University of Alberta

Gertrude Stein's Cubist Brain Maps
by

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A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

Department of Comparative Literature

Fall 2009
Edmonton, Alberta

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Dedication

First and foremost, I dedicate this thesis to the members of my family that literally survived my doctoral program: my father, Louis Leske, and my son, Chad Kippen. The strengths that my father and son demonstrated when they faced serious, medical traumas and life-altering circumstances made my troubles seem insignificant by comparison. No less important during this difficult time was the support of beloved family members, life companions and dear friends, who offered me unconditional love and made it possible for me to conduct this research. To these extraordinary individuals, who have served for me as the best possible examples of human compassion, I also dedicate this manuscript: Rick Kippen, Candace Kippen, Alice Leske, Darryl Leske, Trevor Leske, Clifford Kippen, Olive Kippen, Kathy Kippen, Kelly Brooks and Nicolle McKenna. To Nicolle McKenna, I owe special thanks for helping me understand Gertrude Stein's cubist literature from a queer perspective. Under normal circumstances, the dedication of a manuscript ends with the author's family members and perhaps, if she is lucky, it extends to some of her closest friends, thereby encompassing the individuals that comprise a writer's emotional, physical and spiritual foundations. From the medieval French author Christine de Pizan, I have learned that the existence of a manuscript can involve the interventions of highly learned and courageous individuals, who also happen to embody Reason, Justice and Rectitude (*Droiture*). It turns out that we do not choose our amanuenses; sometimes they choose us for reasons we do not understand at the time. Therefore, I also dedicate this manuscript to the following amanuenses, who made it possible for me to graduate from the doctoral program at the University of Alberta: Hank Stam, Jonathan Hart, Leendert (Leo) Mos, and Murray McGillivray. Without the assistance of these gifted mentors and academic leaders, this dissertation literally would not have existed. These individuals possess special insights into the ways in which great institutions are built from the ephemeral "stuff" of ideas, dreams, visions, beliefs, passions and personal losses.

Abstract

This dissertation explores the connections that exist between Stein's late nineteenth century psychological studies at Harvard University, her fin-de-siècle brain research at the Johns Hopkins Medical School, and her early twentieth century cubist writings. This research is important for literary scholars and neuraesthetic researchers alike, because Stein produced a secret series of cubist brain maps from approximately 1912 to 1935, and then published her first explicit brain map in *The Geographical History of America or the Relation of Human Nature to the Human Mind*, in 1936. The cubist brain maps that Stein produced during this period can be conceptualized as evolving, neuraesthetic writing practices that reflect her scientific insights and artistic associations, in direct and indirect ways. One of the primary differences between Stein's cubist writings and those of her literary contemporaries is that she deploys the cubist portraiture strategies of Pablo Picasso, for the purpose of representing the human central nervous system in creative ways. In addition to exploring the scientific meanings of Stein's multidimensional, performative and introspective cubist puns, this study examines how Stein uses color in her modernist writings, as a means of anticipating the visual effects of future scientific discoveries and connectivity maps, such as the "Brainbow" mapping system, which uses the fluorescent protein from the jellyfish *Aequorea Victoria* to label the central nervous systems of genetically modified mice with distinguishable colors. Also, this project examines how Stein uses color words and other simple devices from the English language to portray the brain's cellular structures, neural networks and neuroanatomical features in her modernist writings. This study's primary aim is to

explore how Stein's dissociative writings function within western culture as *neuraesthetic* modes of masterpiece creation, brain representation and consciousness translation. Through the serial production of cubist brain maps, Stein posed important questions about the modern science of the reading brain. By developing allegorical methods of brain representation, she contributes to the western practice of "neuroesthetics" by foregrounding the roles creative writing can play in the production of imaginary, laboratory practices and imaginative, brain imaging technologies.

Acknowledgements

Many people have done much for me in the course of writing this dissertation. They've asked questions that really matter, provided both formal and informal support at crucial stages, and offered important examples of professional conduct. Linda Hutcheon extended herself not once, but twice, to offer me opportunities for doctoral and post-doctoral supervision at the University of Toronto. Because of her incredible generosity and her professional assistance, I was able to keep important projects and dreams at the forefront of my consciousness. Sincere thanks to Eric Savoy, Jim Black, Jim Ellis, Adrienne Kertzer, Shaobo Xie, bj wray, Pat Clements, Katherine Zelinsky and Peter Midgely for their personal advice, academic support and professional help, over the course of my program. Dr. Ronald Bond, the Emeritus Provost of the University of Calgary, supported me throughout my doctoral program at the University of Alberta, for which I am immensely grateful. I feel that it was a great honor to have worked with Jonathan Hart, my doctoral supervisor. Because of his staggering genius, unwavering support and inspirational direction, I have learned much about the neuraesthetics of humanity. I have the utmost admiration for Leo (Leendert) Mos, who has demonstrated how compassion, scholarship and brilliance can manifest themselves as "ideal forms" within academic settings. Terence Stone and Kim Miller are incredible friends and gifted healers, who deserve enormous praise for their wonderful support. I acknowledge the doctoral scholarship that the Social Sciences and Humanities Research Council awarded me for my research at Department of English and Film Studies, and I thank the English Department for the various grants and awards that I was given during my tenure in their program. I am grateful to the Department of Comparative Literature and to Dr. Jonathan Hart, the Director of Comparative Literature, for welcoming me to the challenging world of interdisciplinary studies. This "brave new world" will inspire my best work, for it reminds me that the neuraesthetic renaissance that is transforming humanism and the human subject, at the present moment, emerges from islands of academic research, not from the "empire burlesque."

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When it gets really difficult you want to disentangle rather
than to cut the knot, at least so anybody feels who is working
with any thread, so anybody feels who is working with any
tool so anybody feels who is working with any sentence or
reading after it has been written.
Gertrude Stein

Heidegger rightly observes that in the phrase, 'Science of the *experience of consciousness*' the genitive is subjective, not objective. 'Science of the *experience of consciousness*' means: consciousness, the new absolute subject, is in its essence a *path* towards science, an experience (*ex*-per-*ientia*, a 'coming from and going through') which is itself science. Thus experience here is simply the name for a basic characteristic of consciousness: its essential negativity, its always being what it has not yet become. Thus dialectic is not something that attaches itself to knowledge from outside. Rather, it shows to what point in the new absolute subject (much further than in the Cartesian I) the essence of knowledge has now become identified with the essence of experience.
Giorgio Agamben[1]

Introduction: Gertrude Stein's "Color Thing": How to Perform Brain Surgery with Cubist Portraits

0.1 Gertrude Stein's "Color Thing"

In this project, my goal is to explore how Gertrude Stein deploys subjectively experienced inner states of consciousness and phenomenal color experiences, for the purposes of constructing literary portraits that explore the brain's neurophysiological entities and its conscious experiences. My primary aim is to explore the ways in which Stein uses color signifiers, color relations, and color experiences to produce cubist brain maps, not to examine why she refuses to speak of her brain mapping experiments and neuron coloring strategies for the better part of her writing career, even if this is an intriguing and often overlooked area of inquiry within modernist studies. In the cubist portraits from *Tender Buttons* and *The Geographical History of America*, Stein uses color words, such as "blue," "yellow" and "green," to represent the way brain looks to a neuroscientist studying its features under a microscope, to represent the ways in which passing states of consciousness feel to the creative mind of modern scientist turned writer/artist, and to connote scientific meanings that may have been or could be associated with the brain's colored matter. Over a half-century, Stein developed *neuraesthetic* writing strategies that enabled her to combine the creative insights from philosophy (i.e. Henri Bergson's intuitive philosophy and William James's philosophy of mind), from psychology (i.e. William James's pragmatist psychology), from medicine (her education at the Johns Hopkins Medical School), from the fine arts (her association in Paris with modern artists, such as Pablo Picasso, Henri Matisse, Georges Braque, Francis Picabia, Juan Gris, Felix Volloton and Salvador Dalí), from biology (through Charles Darwin's evolutionary theories) and from English literature (by way of a broad exposure to canonical English and American literatures from early childhood to late adulthood).[2]

With this conceptual framework, my purpose is to create a brief genealogy of Stein's cubist brain portraiture strategies and to explicate the ways in which Stein developed neuraesthetic writing styles that could accommodate her medical knowledge, neuroscientific epiphanies and artistic perceptions. *Tender Buttons* (1914) is a collection of poems, or a series of literary portraits, that experiment with ways of illustrating and portraying things without naming them directly. In my opinion, this book showcases Stein's first attempts to figuratively paint the brain's neural architecture with simple words from the English language. As a collection of allegorical brain maps, it represents her recent efforts, from the summer of 1912 to the publication of the text in 1914, to privilege the human mind over human nature. In this composition period, Stein made it her prerogative to explore the internal and external realities of phenomenal consciousness from the standpoint of the English language and a dissociative writing style. Given that *Tender Buttons* combines aesthetics and science at the level of its allegorical brain maps, it serves as a modernist precursor to twenty-first century medical textbooks, such as *The Human Brain Coloring Book* and *A Colorful Introduction to the Anatomy of the Human Brain. Tender Buttons* obviously was not meant to serve as a medical textbook or as an instructional handbook, which is the role these other coloring books perform in present-day medical studies and educational contexts; however, if we follow Zeki's definition of "neuroesthetics" in *Inner Vision*, we could say that this book reveals much about brain anatomy and brain function through its literary experiments with cubist writing and radical empiricist psychology; therefore it ought to be defined as "a science," of sorts, that illustrates "something general about the neural organisation of the visual pathways that evoke pleasure (*Inner Vision* 3). By contrast, *The Geographical History of America, or the Relation of Human Nature to the Human Mind* (1936) is one of the late works in Stein's literary corpus. This work is considered by many of Stein's editors and critics to be an 'ur-masterpiece,' because it incorporates a number of Stein's previous writings into its aesthetic purview, in a meditative or "metaphysical" style of writing that examines the relationship between the human mind and human nature from a variety of disciplinary perspectives. William Gass defines *The Geographical History of America* as a "culminating work" (23), in his critical introduction to the 1973 edition, wherein he also argues, "This book is the stylized presentation of the process of meditation itself, with many critical asides. In the manner of her earliest piece, *Q.E.D.*, it demonstrates far more than it proves, and although it is in no sense a volume of philosophy (Gertrude Stein never "argues" anything), it is, philosophically, the most important of her texts" (23-24). In my view, *The Geographical History of America* also contributes to the disciplines of neuroesthetics, brain science, molecular genetics and evolutionary psychology because it advances radical hypotheses about the genetic traits, creative capacities and linguistic abilities of the human mind and then compares these characteristics to the ones that are possessed by human nature, using various ideological viewpoints and disciplinary perspectives. *Tender Buttons* and *The Geographical History of America* both contain cubist portraits that indirectly showcase Stein's previous brain stem research, her psychological experiments with color, and her cubist influences. Through a dissociative writing style, these works reveal a genealogy of cubist portraiture strategies and neuroscientific experiments with nerve tissue stains that inform Stein's neuraesthetic writing experiments with color and her allegorical brain representations with the English language.

Throughout this project, I focus primarily on the legible (and visible) colors in Stein's cubist portraits that normally sighted persons can read or 'see.' It is not my purpose to 'crack the code' of Stein's invisible "color thing," which she defines, in "Portraits and Repetition," as "the relation of color to the words exactly meant but [which] had not [in them] element[s] of description" (*Lectures in America* 191). For most of her literary career, Stein wrote cubist portraits that featured invisible color relations and phenomenal color spaces. It would have been difficult for her readers to detect this "color thing" at work within the second-phase portraits that were written between 1915 and 1926, because the non-descriptive words and enigmatic word combinations that Stein used to describe the colors, sounds, and personality patterns that she envisioned in and with her passing states of consciousness as color relations, color spaces and invisible color inks, often are combined in such a way that they do not denote or connote colors from the visible spectrum. "[L]ike a beautiful discussion of purple," Stein's "color thing" might be defined as a Fauvist/cubist writing experiment, in and through which color, language and other kinds of subjective experiences become translated into neuraesthetic compositions that elucidate the perceptual principles and neural mechanisms of a given, portrait subject. As I propose in chapter two, Stein's fauvist and cubist representations of the human brain function at the level of her non-descriptive, cubist writings as *qualialects*. To use Eco's semiotic terminology, these cubist brain representations operate as consciousness-based, color-coded and language-centered, "aesthetic idiolects" (270-271). From a twenty-first century philosophical perspective that seeks to understand the neural bases of modern art and phenomenal consciousness, Stein's "color thing" could be described as being "just about a color, without itself being colored at all, to use Daniel C. Dennett's words from *Consciousness Explained* (371). Approaching the so-called "qualia problem," or the consciousness problem, from a "heterophenomenological," discursive standpoint that privileges third-person observations, experiences and judgments over first-person accounts of consciousness, Dennett remarks, "This [color enigma] opens up possibilities, but how could an idea be just about a color (e.g., the color red) if nothing anywhere is red?" (*Consciousness Explained* 371). The answers to this question can be found in Stein's neuraesthethic, literary research on the workings of "the Fauvist brain" and the "Cubist brain," to use Zeki's apt expressions. Approaching Dennett's observation about the *idea of color* from the perspectives offered by Stein's shifting neuraesthetic compositional strategies, my response is this: by creating cubist portraits of the Fauvist and Cubist brain with the "color thing" and other non-mimetic modes of consciousness illustration, Stein liberates color from form at the level of language, in order to study the brain's visual pathways, its reading circuits, and its language-processing mechanisms. With these innovative Fauvist and Cubist writing techniques, Stein also performs imaginary brain surgeries that examine the relationship between the visual brain and other brain regions that are responsible for language production, color naming, creative responses to abstract art, and the complex processes of reading.

Neurobiologist Semir Zeki can refer to the human brain as a "Fauvist brain," because early twentieth century Fauvists and Cubists did something that is normally very difficult to achieve at the level of the brain: namely, they liberated colour from form. "This physiological impossibility led the Fauvists to a physiologically unacknowledged solution: invest forms with colors that are not usually associated with them, and thus liberate colour from enslavement to a particular form or group of forms. There are many examples of this in the work of [Henri] Matisse, André Derain, Maurice DeVlaminck, Kees van Dongen and others" (Zeki, *Inner Vision* 197). In *Inner Vision*, Zeki describes the abstract colored landscapes, portrait subjects and seascapes of the Fauvist painters as neurophysiological impossibilities, because their paintings reverse and expose the visual brain's neurobiological operations, making it possible for scientists like Zeki to examine what happens when color and form are separated in abstract art forms. Also, with the use of brain imaging technologies like fMRI, the neuroscientists, who have been conducting neuroesthetic research on abstract art and its relation to brain function, can examine how the brain responds to abstract colored art and its neurophysiological impossibilities. In *Inner Vision*, Zeki stresses that the separation of color and form in the abstract colored paintings of Picasso and his cubist contemporaries are produced in an unconscious fashion, by artists who did not consciously realize what they were doing when they stimulated the visual brain in unconventional ways. By contrast, Stein conducted literary experiments that purposely deployed Fauvist techniques of subject representation, as a means of illustrating the brain's neural architecture and exploring the mind's phenomenal realities. Her neuraesthetic writing experiments, which use Picasso's analytic and synthetic cubist painting strategies in innovative ways, portray the brain's neuroanatomical structures, while examining how language and writing mediate between internal and external, phenomenal realities. The "color thing" that made Stein so anxious during the middle period thus transforms a "neurophysiological impossibility" – the separation of color and form -- into literary brain imaging experiments and into non-invasive, language-based brain "surgeries." The color thing gives Stein a way to examine the visual brain's neural pathways and its sensory-linguistic functions from a number of experimental, neuraesthetic standpoints. By experimenting with cubist writing strategies that utilized this "color thing" for aesthetic and scientific purposes, Stein discovered how to translate the phenomenal color experiences that she was experiencing with her creative imagination, in the form of passing sensations, perceptions, insights and realities, into cubist portraits about the human mind. It is, also in this sense, that she performs imaginary brain surgeries with this color thing, using non-descriptive English phrases, cubist puns and playful language to investigate the effects of the visual brain's interregional, neural pathways and localized, synaptic connections.

The "color thing" comprised a key part of Stein's neuraesthetic compositional strategies for approximately twenty years (1912 to 1932). Though this "color thing" occasionally manifests itself in the form of color signifiers, such as "fuchsia," it generally remains invisible at the level of Stein's dissociative discourse, by virtue of the fact that it exists within, or as, the non-descriptive words and enigmatic phrases that comprise her cubist portraits. Put in qualitative philosophical terms, this color thing could be defined as a set of qualia relations, or as a set of discriminative qualities that accrue meaning in relation to one another within a particular state of consciousness. Taking this definition a step further into the domain of literary neuraesthetics, Stein's "color thing" could be defined as a brain concept and as an artistic practice that functions as a neuraesthetic mode of literary composition, When it is conceptualized as a set of evolving qualia relations that posit neurophysiological impossibilities and examine unusual linguistic conditions, this "color thing" exists in relation to, and at the level of, the non-descriptive words and enigmatic phrases that Stein uses to translate her subjective experiences, especially her color experiences, into cubist portraits that serve, at once, as allegorical brain maps and as neuraesthetic, literary compositions.

Even though my project explores Stein's colorful brain representations (or what I am defining as her Brainbow-like "qualialects") from a literary standpoint, I would be remiss and my research would be incomplete if I did not mention this partly visible or invisible "color thing." Also, I would be neglecting an important area of Stein scholarship, if I did not explain how some critics have treated the "color thing," in their respective analyses of her theatre of the mind, or in her "decadent," literary explorations of phenomenal consciousness. From the little that Stein that reveals about her neuraesthetic compositional practices in "Portraits and Repetition," it appears that the "color thing" originated with her composition of the brain mapping experiments from *Tender Buttons*. In my opinion, her revelations about the "color thing" imply that the non-mimetic writing experiments with cubist brain representation began in the summer of 1912, along with other changes in her cubist portraiture strategies. Subtle changes in Stein's dissociative writing style meant that a shift in focus from the human mind to human nature had occurred, prompting her to archive, explore and recreate the mind's internal and external, phenomenal realities with the English language. Using Foucault's twentieth-century philosophical terminology, I characterize Stein's writing experiments with phenomenal experience as a "qualia-politics" with literary applications. In this introduction, I place some of my "literary" responses to Stein's enigmatic "color thing" in a lengthy endnote, because I focus on the interdisciplinary and interartistic nature of Stein's neuraesthetic writing practices from the standpoint of their color language qualia. I readily admit that I will not be able solve the complex, qualia-problems and brain concepts that correlate with the so-called "color thing in this study, for some of the reasons that I mention in this endnote."[3]

Though it seems that the "color thing" played a crucial role in Stein's neuraesthetic compositional practices for approximately a quarter century, I will not be devising a separate, literary theory, or a new reading strategy, to decipher the neuraesthetic, compositional practices that may be associated with the color thing. However, I suspect that such a theory may be necessary, if critics are to avoid the kinds of ideological misrecognitions and rhetorical catachreses that have become omnipresent in Stein's twentieth-century literary criticism. I am thinking especially of the critical responses that treat Stein's "subjective" approach to literary phenomenology, cubist writing and mind representation as a "private language" and those responses which treat her dissociative writings as the ramblings of a madwoman, schizophrenic, hysteric, or as the linguistic patterns of someone who suffers from "palilalia" (or brain encephalitis).[4] It is not my aim to incorporate this "color thing" into my neuraesthetic readings of Stein's cubist brain maps. However, you will see me foreground this "color thing" in chapters one and two, as a means of clarifying what is meant, or what is not meant, by the phrases "invisible nervous system" and "visible nervous system." In chapter one, I examine the linguistic play that occurs between Stein's invisible and visible representations of the brain in "A Long Dress" from *Tender Buttons*, by making explicit reference to Steven Meyer's neuraesthetic reading practices from *Irresistible Dictation*: *Gertrude Stein and the Correlations of Writing and Science*. In this book, Meyer takes a radical empiricist, 'organicist' approach to the decipherment of Stein's neuraesthetic writing strategies, which I find valuable, as a means of understanding her brain-based epistemology and her literary neuraesthetics.[5]

From approximately 1913 to 1936, Stein produced cubist portraits that illustrated the brain's neural architecture, its neurophysiological mechanisms and its phenomenal experiences with literary devices such as allegory.[6] It is becoming clear to those scholars, who study these cubist writings from a variety of neuraesthetic perspectives, that Stein employed the "language instinct" (Lehrer), language-based nervous system coloration strategies (Kippen), and other literary devices, such as genetic and biological metaphors (Meyer), to construct abstract pictures of the human brain in her dissociative writings. However, it has not yet been established by those working in the field of literary neuraesthetics, if she consistently used the "color thing" to construct her neuroanatomical imaginaries. One of the primary aims of this project is to examine the ways in which Stein experimented with color, as a means of visualizing and representing the brain in historically unprecedented ways. In her cubist writings from the middle period (c. 1912 to 1926), Stein also sought to illustrate the perceived personality patterns or "bottom natures" of her human subjects, "the rhythm of the visible world" and the "problem of the external and the internal," predominantly through the medium of the English language (*The Autobiography of Alice B. Toklas* 130). Through the creation of cubist allegories that served as the conceptual foundations for her neuraesthetic writing experiments, Stein thus was able to pursue contradictory aims with her modernist writings. For example, with the cubist allegories from *Tender Buttons*, Stein was able to portray the brain directly and indirectly, with colors, words and grammatical forms that served to illustrate the brain's synaptic connections, neuroanatomical features and cellular tissues from multiple perspectives simultaneously. These portraits also illustrate the brain-mind-consciousness continuum with experimental portraiture strategies and cutting-edge neuroscientific research.

Potentially, two-thirds of the one hundred and thirty two portraits in Stein's oeuvre offer some kind of allegorical brain representation.[7] Simply by reading Stein's brain portrait from "Part II" of *The Geographical History of America*, it becomes clear that not all of these portraits contain "invisible nervous systems," as Meyer claims in *Irresistible Dictation*. At least one of Stein's 132 portraits contains an explicit, visible nervous system. It may be that some of Stein's dissociative writings were not consciously designed as "neurophysiological imaginaries," but they nevertheless serve as neuraesthetic writing experiments, by virtue of their direct and indirect relationships to the brain studies and laboratory experiments that Stein conducted, designed and observed, while she was an undergraduate student at Radcliffe College and a graduate student at the Johns Hopkins Medical School. In my opinion, the legible and/or visible, nervous systems that Stein produces for her dissociative writings function simultaneously as experimental forms of neuron coloring and as brain imaging strategies. The neuroanatomical imaginaries that Stein creates for her cubist portraits simultaneously caricature medical discoveries from the nineteenth-century and forecast Nobel-winning, neuroscientific discoveries from the twentieth and twenty-first centuries. As well, they demonstrate important neurobiological discoveries from pioneers in the field of nineteenth-century brain research, while interrogating the nature of the brain's visual and reading circuits through the agency of language, discourse and writing.

According to the neuraesthetic research recently conducted by Meyer, Lehrer, Zeki and Ramachandran on literary texts in the past decade, one-third of Stein's literary portraits – especially the first-phase portraits that were written between 1907 and 1911 – contain artistically encrypted, brain representations that operate according to unconscious, brain concepts and instinctive, perceptual principles.[8] In other words, these scientists believe that writers, such as Stein, portray the brain's neurophysiological mechanisms, evolutionary processes and language instincts through their unconscious use of "inherited and acquired, brain concepts" (to use Zeki's terms). However, I am not ruling out the possibility that other kinds of nervous systems, ones that Stein associated with human nature and not with the human mind, could be stimulating the visual brain in unprecedented ways. Because the field of literary neuroesthetics is relatively new, there is much that we do not know about the "neurology of literature." According to Meyer, Stein's imaginary nervous systems function as neurological visualizations and surgical explorations of the human brain; however, Zeki observes that most art forms correspond with unconscious, brain concepts, that the "neurology of art" does not issue from conscious and subconscious, mental processes. If we take these views into account, then this could mean that two-thirds of Stein's cubist portraits represent unconscious and conscious, brain concepts that correspond with certain styles of conscious, cubist brain representation. By implication, one-third of Stein's literary portraits – i.e. the first phase portraits – do not contain consciously-constructed and/or consciousness-based, cubist brain maps; on the contrary, they consciously seek to represent human nature with unconscious brain concepts that not only reveal but work with a range of perceptual principles and aesthetic strategies.[9] In "Portraits and Repetition" (1935), Stein reveals that she achieved her best results with this "color thing" in "Lipschitz" (1926). From this essay, we learn that her writing experiments with sensory synaesthesia culminated in the cubist portraits from *Tender Buttons* and in her opera, *Four Saints in Three Acts*:

> I became more and more excited about how words which were the words that made whatever I looked at look like itself were not the words that had in them any quality of description. And the thing that excited me so very much at that time and still does is that the words or words that make what I looked at be itself were always words that to me very exactly related themselves to that thing the thing at which I was looking, but as often as not had as I say nothing whatsoever to do with what any words would do that described that thing. Those of you that have seen Four Saints in Three Acts must know do know something of what I mean. Of course by the time Four Saints was written I had mastered very much what I was doing then when I wrote Tender Buttons. By the time I wrote the Four Saints I had in hundreds

> of ways related words, then sentences then paragraphs to the thing at which I was looking and I had also come to have happening at the same time looking and listening and talking without any bother about resemblances and remembering. (*Lectures in America* 191)

Describing the creating of the portrait "Lipschitz" as another successful experiment with non-mimetic, cubist portraiture that involves the "color thing," Stein stresses that the 'absence' of color words in this portrait, or conversely, the abundance of non-descriptive English words that do not denote or connote 'real' colors, actually highlights "the relation of color to the words" (192). Through the passage above, Stein reveals that she was dabbling with the "color thing" for a considerable period of time. In "Portraits and Repetition," she further notes that her experiments with the color thing preceded the publication of *Tender Buttons* in 1914 and extended past her composition of *Lipschitz*, with second-phase portraits such as *Van or Twenty Years Later. A Second Portrait of Carl Van Vechten* and *If I Told Him. A Completed Portrait of Pablo Picasso*.

The absence of purposely-designed, cubist brain maps in the first-phrase literary portraits about human nature does not mean that important perceptual and neural principles are not operating within these works at the level of language. Quite the opposite: Stein may have been trying, both consciously and unconsciously, to create different kinds of brain maps with her first-phase portraits; however, I have not included these in this study, because I concentrate on the second- and third-phase cubist portraits. Explaining the significance of the artist's unconscious mind in relation to abstract colored paintings that stimulate the visual brain in specific ways, Zeki notes that painters "have understood something general about the neural organisation of the visual pathways that evoke pleasure, without knowing anything about the details of that neural organisation or indeed knowing that such pathways exist at all" (*Inner Vision* 3). Shakespeare and Wagner ought to be considered "among the greatest of neurologists," Zeki claims, because they "understood something fundamental about the psychological make-up of man which depends ultimately upon the neurological organisation of the brain, even if we are remote from knowing that precise organisation" (2). Building upon Zeki's neuraesthetic hypotheses, it seems likely that Stein unconsciously sought to represent brain concepts with aesthetic principles that corresponded with unknown or little known, visual pathways and neural networks. Also, for every conscious, non-mimetic portrayal of the human mind in the analytic and synthetic, literary portraits, there probably is one or more corresponding unconscious brain concepts that Stein consciously has disavowed at the level of conscious thoughts and literary theories, and that she has failed to recognize as the instinctive and creative forces that inform her dissociative writings.[10] Instead of comparing Zeki's and James's neuraesthetic practices directly, my study examines how Stein's cubist literature reconfigures James's psychological principles and evolutionary hypotheses, so as to create literary brain maps that reflect his radical empiricist brain research and consciousness studies. Having clarified my primary objectives, I would add that Zeki's neuraesthetic research on 'the fauvist brain,' the visual brain, and cubist art provides empirical support, in the form of brain imaging studies and neurobiological evidence, for my arguments about Stein's attempts to represent the complex relations between brain physiology, phenomenal experience and literary creation.[11]

From what Meyer tells us about the connectivity structures and synaptic connections of the "invisible" nervous system in "A Long Dress," I believe that he would have focused on the linguistic communications that occur between the non-colored (i.e. the black) word-neurons in the brain portrait from Detective Story number VII. Because Meyer does not use the cubist brain portrait from *The Geographical History of America* in his book-length study of Stein's neuraesthetic writing practices, we have no way of knowing what his interpretation of this portrait might have been. Based on his reading of "A Long Dress," which shares a colored abstract representation of the brain in common with Detective Story number VII, I believe that he would have completely ignored and then downplayed the significance of the brain's colored matter, because this is what he does with the color signifiers and the colored neurons that comprise "A Long Dress." In his reading of "A Long Dress," he ignores the colors altogether and focuses instead on the sounds and associated meanings of the non-colored word-neurons, which comprise approximately one-half of the portrait's "neurophysiological imaginary." By contrast, I focus on the colored and the non-coloured neural spaces in Stein's cubist brain maps, because I think that the *play* between non-colored and colored neurons, as well as between phenomenal color spaces and colored brain regions, can reveal interesting things about Stein's attitudes toward the clinical practices of histology, neurology and medicine.

For the purposes of this introduction, I would like to draw your attention to Meyer's explanation for the fusion of mind and brain that occurs in Stein's dissociative writings and neuraesthetic compositions from the middle period, especially his explication of the brain/mind fusion that occurs in cubist portraits like "A Long Dress." Meyer approaches the brain-mind continuum and, by extension, the so-called "qualia problem," from a materialist and "organicist," literary/philosophical standpoint that views higher-order phenomenal experiences and creative thought processes as biological and neurophysiological effects. In *Irresistible Dictation*, Meyer explains how the disciplines of genetics, embryology and biology can elucidate Stein's neuraesthetic compositional practices, when he states, "The human mind turns out to be nothing less than the human brain, continually becoming what it is, emerging autopoietically – as occurs most dramatically in neonates and in the course of embryological development" (117; original spelling).[12] In contrast with Meyer's claims about Stein's literary genomics and literary neuraesthetics, my position is that there is room for further debate as to whether or not language can be conceptualized solely as a secondary quality of phenomenal experience and as an "acquired brain concept." To use Zeki's terminology, I believe that language is both an inherited and an acquired, brain concept that plays an important role in Stein's literary neuraesthetics. In the embryonic field of interdisciplinary research that "is" literary neuraesthetics, scholars, such as Lehrer, Meyer and Gass, treat Stein's "literary genome" as a discursive symptom that coincides with the "language instinct" (Lehrer), with this author's interests in embryology and brain science (Meyer), and with bio-political metaphors that partially explicate Stein's repetitive writing style (Gass). If we grant that there is, or there could be, a form of phantasmatic and autopoietic, brain development that occurs in literary texts at the level of language, and if we grant that there is a special kind of literary genetics that corresponds with Stein's neuraesthetic writing practices, then it seems plausible to argue that the brain or mind that "emerg[es] autopoietically" from these texts would not be viable without the proper "econiches," or the proper cultural environments, to support them. To some extent, such environments or econiches are the readers' minds and the readers' experiences. In agreement with the conclusions reached by Simon E. Fisher and his co-researchers at Oxford University regarding the neurodevelopmental, neurogenetic and psycholinguistic effects of *FOXP2*, the so-called "language gene," I propose that we conceptualize language simultaneously as an "inherited brain concept" and as an "acquired brain concept" (to use Zeki's terminology), so as to understand its complex workings within Stein's cubist literature as translations of the brain's elementary and secondary, phenomenal experiences.[13]

In works like *The Geographical History of America*, Gertrude Stein treats playful language as though it were simultaneously an inherited and an acquired brain concept, which has the capacity to pose questions about the neuraesthetic relationships that exist between visual brain, the reading brain and modern literature. In this way, she emulated James's radical empiricist tradition of consciousness analysis, when she produced cubist portraits that studied the brain's neurodevelopmental processes and evolutionary mechanisms, with the aid of color words that served as metaphors for the central nervous system. Throughout this study, I take James's insights about color consciousness and language production into account, when I explore the coextensive domains of cultural production and knowledge production that inform Stein's literary neuraesthetics.

Did Stein purposely make it difficult for her readers to distinguish the brain's operations from the human mind and its passing states of consciousness? Or was she having difficulty achieving her aesthetic vision because her dissociative writings consisted of these neuraesthetic compositions, in addition to other writing 'projects' that worked at cross-purposes with each other at the level of her brain allegories? In "Composition as Explanation," Stein provides some clues about her "inarticulate" formulations of "natural phenomena," which may help us to understand her early conceptions of brain mapping:

> I began doing natural phenomena what I call natural phenomena and natural phenomena naturally everything being alike natural phenomena are making things be naturally simply different. This found its culmination later, in the beginning it began in a center

> confused with lists with series with geography with returning portraits and with particularly often four and three and often with five and four. It is easy to see that in the beginning such a conception as everything being naturally different would be very inarticulate and very slowly it began to emerge and take the form of anything, and then naturally if anything that is simply different is simply different what follows will follow. (222)

To comprehend Stein's efforts to portray natural phenomena with non-mimetic cubist portraiture strategies, we must first appreciate the logic of inevitability that she uses to justify her conceptual methodologies and aesthetic practices: "if lists were inevitable if series were inevitable and the whole of it was inevitable beginning again and again could not trouble me so then with nothing to trouble me I very completely began naturally since everything is alike making it as simply different naturally as simply different as possible" (222). Prior to making this statement, Stein defines the word "natural" as a literary construct that functions in her experimental writings as a mode of comparison, with the best example of this being the natural phenomena that she puts in her portraits "of anybody and anything." According to Stein, "natural phenomena" exist in "confused" forms within her experimental, cubist writings because "everything is used and there is a continuous present and a beginning again and again if it is all so alike it must be simply different and everything simply different was the natural way of creating it then" (*Selections* 221). Like Damon, Meyer, Gass, Ford, Steiner and Ryan, I am interpreting "natural phenomena" as discursive entities that construct confusing, but nonetheless meaningful, images of the body, the soul, the brain and the mind.[14]

With this approach to Stein's literary neuraesthetics, I propose that Stein's dissociative style in *Tender Buttons* creates the illusion of a creative mind, a human mind, and a human brain that share common linguistic, sensory and perceptual properties, like the brain's neural connections. In this book, Stein produces coextensive neural and qualia spaces with non-descriptive English words and enigmatic modernist verses, so as to represent emergent forms of phenomenal experience and brain representation. To be precise, I am suggesting that the human mind and the human brain become neuroanatomical imaginaries in the second-phase portraits, as a result of complex processes of literary interpretation, discursive performativity and reader response. Readers can discover neuraesthetic meanings in a text's "qualialects" (i.e. its color-coded, language-centered and consciousness-based, aesthetic idiolects) by viewing language as a "neural configuration," to use Bryson's words:

> as our new century advances, it becomes increasingly evident that despite this shared thematic of groundlessness that runs through linguistic philosophy – the insistence that what we take to be a reality is only a construction, without foundation is an absolute – what resecures the subject's place in the world is the primacy of the signifier, and the shared semiotic conventions that anchor the subject in the world, giving the world its solidity, coherence, and substantiality. The radicalism of neuroscience consists in its bracketing out the signifier as the force that binds the world together: what makes the apple is not the signifier "apple" (though, this too may play an important role in the process of reality-building) but rather the simultaneous firing of axons and neurons within cellular and organic life. The level of the ground of being, or of the real, shifts from the signifier to the neural configuration, the orchestration of myriad plays of lightning across the ramifying branches of the brain. ("Introduction: The Neural Interface," *Blow-Up* 14)

Following Normal Bryson, I view Stein's language-based, neuroanatomical imaginaries as cubist-inspired and fauvist-colored, "neurobiological collages," the mediate between the real of the brain's neural configurations and the symbolic exchanges that mimic the firing of axons and neurons within cellular elements. I would not characterize her imaginative, brain representations as "nonvitalist" biological organisms, or as "autopoietic," conscious artifacts, as Meyer does in *Irresistible Dictation*, because I believe that these cubist writings are called into critical thought through cultivated, reader responses that acknowledge the ways in which a dissociative writing style portrays the brain's neural networks and cellular tissues, with cubist puns and other experimental, representational strategies.

A text's neuroanatomical imaginaries can offer insights into different kinds of brain mapping, brain modeling, and neuron coloring strategies. However, these can be difficult to understand without the support of psychological theories, scientific illustrations, brain mapping instructions and neuraesthetic research that help us to translate Stein's brain-based epistemologies into culturally intelligible semiotic codes and literary discourses.[15] Over the course of this study, I show how these kinds of scientific methodologies and imaging technologies illuminate Stein's cubist brain maps and their colorful neural architectures. One of the reasons why Stein's brain maps differ from those of her scientific predecessors, or from those of other writers, is because she uses color, in unprecedented ways, to paint the brain's neural architecture. In portraits, such as "Lipschitz," Stein figuratively paints with imagined color relations. That is, she portrays the brain with the consciousness relations that philosophers term "relational qualia," rather than with the color signifiers that represent colors from the visible spectrum, such as "red" or "violet."[16] She does not use words that denote visible colors from the spectrum, but, rather, creates color combinations that might be seen on a painter's canvas, such as the "color of Toulouse Lautrec." In cubist brain portraits from *Tender Buttons* and *The Geographical History of America*, Stein uses words and phrases that connote brain colors and cellular formations that are not found in nature. This practice stems from Stein's history of creating culturally unintelligible, "aesthetic idiolects," one of which is the famous modernist verse, "a rose is a rose is a rose." In *Four in America*, Stein states, "Now listen! I'm no fool. I know that in daily life we don't go around saying 'is a … is a … is a …' Yes, I'm no fool; but I think that in that line the rose is red for the first time in English poetry for a hundred years."[17] To be sure, Stein uses color signifiers sparingly in many of her second-phrase neuroanatomical portraits, as is the case with "A Second Portrait of Carl Van Vechten," wherein she combines words "that very exactly related themselves to that thing the thing at which I was looking, but as often as not had … nothing whatsoever to do with what any words would do that described that thing" (192). In this portrait, her color thing manifests itself at the level of colored and non-colored linguistic signifiers in the non-descriptive phrase, "Not to the future but to the fuchsia" (193). To clarify: the word "fuchsia" appears at the end of a line comprised of words that are not normally associated with colors – e.g., "Not to the future" -- or with words that normally signify colors in a commonsensical way – e.g., "but to the fuchsia." This representational practice suggests that Stein combines invisible color qualia relations with explicit neuron-coloring strategies, in order to produce connectivity maps of the human brain and cubist-style, neuroanatomical portraits.

It has not been established by scholars working in the field of literary neuraesthetics, if Stein began mapping the brain with invisible color relations and then worked her way to designing sophisticated cubist portraits of the human brain with color signifiers, or if there are other factors to take into account when studying the genealogy of her neuraesthetic writing practices. As Normal Bryson points out, "While each artifact may carry a meaning or meanings that belong to the order of cultural symbols, the artifact cannot be derived from these alone. It comes into being through the interaction of a welter of factors that lie beyond the symbolic register. The familiar objects that surround us in daily life are known to us not only as meanings but through sensuous and kinaesthetic handling, the suite of bodily actions that is brought into play whenever we make use of them. Their constellation maps together [constitute] a vast array of "neural signatures" from the myriad registers of experience within which the object appears, only some of which concern the cognitive work of the signifier. Using Bryson's approach to the constellation maps and the neural signatures that can be found in mundane objects, I propose that Stein figuratively paints her neuroanatomical portraits from *Tender Buttons* with invisible color relations and visible color words that function like invisible and visible inks, respectively, on her literary canvases.[18] These portraits await the development of interartistic and interdisciplinary methods of neuraesthetic interpretation, which would permit us to appreciate the ways in which language creates neural maps that interface with other forms of cultural production and human knowledge. For these reasons, I conceptualize Stein's "color thing" as an evolving set of experimental writing praxes that deploy philosophical, psychological and neuroscientific thought experiments, as well as fauvist and cubist representational strategies, for the purposes of visualizing, mapping and expressing the human brain. In *Tender Buttons*, familiar household objects, such s a blue coat, a long dress and a seltzer bottle, contain connectivity maps and neural "signatures" that correspond with Stein's nineteenth-century experimental brain mapping practices and James's radical empiricist, brain research.

Expanding upon Steven Meyer's "neuraesthetic" reading strategies and Wendy Steiner's cubist interpretative methods, I examine how Stein uses color to illustrate the brain, mind and consciousness in her writing experiments. In doing so, I am focusing on an area of "difficulty" that is central to Stein's evolving ideas about masterpiece creation, consciousness translation and neuraesthetic composition. In each chapter of this dissertation, I explore how Stein conceptualizes the creative writing process as a form of literary brain mapping and cubist painting. Also, I examine how she conceives of the invisible color relations and the visible color signifiers that comprised her explicit and non-explicit, allegorical brain portraits. In this way, I follow Betsy Ryan's imperative and that of literary studies, in general, insofar as "Stein's artwork, which contains, in effect, the thing within itself, commands that an audience face it or nothing. There is no object other than the word-object to refer to." If I took my focus off the text and concentrated exclusively on the "color thing" that bedevils and intrigues so many of Stein's critics, then I would no longer be doing what literary critics do, which is to practice 'close reading.' Yet, this is not what I am advocating that neuraesthetic, literary readers do with this "color thing."

To the contrary, I propose that a *microscopic* practice of close reading can help us to analyze the word neurons and neural interfaces that Stein's dissociative writings illustrate in the form of two- and three-dimensional, cubist brain maps. To clarify my purpose: I am suggesting that the practice of 'close reading' be extended metaphorically to include the disciplines of clinical microscopy and connectivity brain studies, as a means of supplementing existing, neuraesthetic reading strategies that incorporate brain-based epistemologies and interpretative strategies from the disciplines of neuroscience, genetics, psychology, the visual arts, literary studies, phenomenology and neuroesthetics. By acknowledging the existence of this "color thing" at the level of Stein's neuraesthetic compositional strategies, we may be able to sharpen our understanding of the psychological principles and neuroscientific insights that this author is representing directly and indirectly, at the level of her non-descriptive, cubist prose. With this "color thing," Stein develops Fauvist and Cubist neuraesthetic compositional practices at the level of individual words and non-descriptive phrases in the second- and third-phase cubist writings. The "color thing" functions as way of understanding the visual brain's neurophysiological mechanisms and their relation to brain regions associated with language-production; therefore, it serves as a conceptual tool that allows her to perform imaginary, brain surgeries and imaginative, neuroimaging strategies. Hence, there is more than the literary text to take into consideration, if we are to grasp what Stein means by "color," and if we are to understand the brain structures, concepts and functions that she explores and illuminates with her "color thing." When Stein employs the "color thing" in relation to the non-descriptive words that she uses to 'paint' her elusive portrait subjects, she is conducting neuroscientific and psychological thought experiments that probe the brain's language-producing regions, its reading circuits and its visual operations.

Before concentrating solely on Stein's legible, color-coded brain mapping practices, I want to foreground some of the studies within twentieth-century literary criticism that frame my discussion of Stein's color thing. I have already suggested that certain practices of close reading, which are encapsulated in the notion that the reader "face [the text] or nothing," prevents us from investigating the possible uses for this "color thing." I believe that the color thing is a neuraesthetic, writing practice that we can study from a third-person perspective that accounts for Stein's subjective phenomenology and her "decadent" aesthetic, using the latest, neuraesthetic methods of textual analysis. Much more can be learned about the kinds of colorful brain maps and brain-based images that Stein produced over the course of her writing career, so this is where I shall focus my efforts.

At this point, I will say a few things about Stein's "intellectual creations," in order to explicate Stein's cubist, interartistic compositions and her neuraesthetic writing practices from a quasi-autobiographical standpoint. With respect to these "intellectual creations," Stein states, "So as everybody has to be a poet, what was there to do. This that I have just described, the creating it without naming it, was what broke the rigid form of the noun the simple noun poetry which was broken. Of course you might say why not invent new names new languages but that cannot be done. It takes a tremendous amount of inner necessity to invent even one word, one can invent imitating movements and emotions in sounds … but [that] has really nothing to do with language" (237-238). Wendy Steiner explains how Gertrude Stein arrived at the practice of representing without naming in the following passage, from *Exact Resemblance to Exact Resemblance*: "in *Tender Buttons* and later in *An Acquaintance with Description* Stein tried "looking at anything until something that was not the name of the thing but was in a way that actual thing would come to be written" (*Exact Resemblance to Exact Resemblance* 166). With the publication of *Tender Buttons* in 1914, Stein produced "intellectual creations" that challenged conventional, writing and linguistic "naming" processes.[19] In *Gertrude Stein and Wallace Stevens: The Performance of Modern Consciousness*, Sara J. Ford argues that

> Stein's affinities to cubism, particularly to synthetic cubism, are important to recognize, for they help to underscore some of the issues that are at stake with her language. … In *Tender Buttons*

> Stein will show that language is much more than the mediating vehicle her readers might have assumed it to be. Language, while referring all the time to its referents, must be reckoned with in its own right. By making art from the parts of language rather than using language to make art from the world of reality, Stein draws our attention to the way language functions as a system of signs. By placing otherwise dissimilar words together in new contexts, she also suggests radically new layers of potential linguistic association. In so doing, Stein challenges language's rigid, deterministic authority and suggests that artistic will can itself impose some degree of challenge to language's most constrictive form. (52)

Confirming Ford's view of Stein's theatrical language and its modernist performance of consciousness, in *The Autobiography of Alice B. Toklas,* Stein recalls that some of her first writing experiments with the phenomenology of consciousness consisted of neologisms and fabrications that were unintelligible to most of her readers. Prior to the composition of *Tender Buttons*, Stein explains that

> she [had] experimented with everything in trying to describe. She tried a bit inventing words but soon gave that up. The English language was her medium and with the English language the task [of representing "the human being"] was to be achieved, the problem solved. The use of fabricated words offended her, it was an escape into imitative emotionalism. No, she stayed with her task, although after her return to Paris [from Granada, Spain] she described objects, described rooms and objects, which joined with her first experiments done in Spain, made the volume Tender Buttons. She always however made her chief study people and therefore the never ending series of portraits. (131)

In *Everybody's Autobiography*, Stein takes this observation about the phenomenology of cubist writing a step further, when she makes the link between her cubist portraiture and Picasso's cubist painting explicit. In this autobiographical work, she tells her readers, "my middle writing was painting" (185). Clarifying the meaning of her metaphor and her statement, she adds that the writing she produced in her "middle period," that is, between 1912 and 1926, "is the painting that everybody is now doing. I do not mean the writing of their poetry but the writing in their painting, it is once more the Oriental thing introducing into the Western the later painting of Picasso [that] is writing (185).

According to Wendy Steiner, the "middle writing" that Stein defines as an Oriental style of cubist painting involves a "process [that] is very much like portraiture where a group of perceptions comes to define or describe a name. But whether the name is present or not the effect of such pieces is a kind of riddle in which associations must be established between the description and the title, or in which the title itself must be discovered. The only feature distinguishing the portrait from the 'poem' in general is the individuality of the portrait subject, as opposed to the class character of the poem's subject (*Exact Resemblance to Exact Resemblance* 167). Thus, with respect to the calligraphic and phenomenological style of 'mind writing' that Picasso created in his analytic and synthetic phase, cubist paintings, Stein explains, "It is necessary to think about the question of calligraphy, it must never be forgotten that the only way Picasso has of speaking, the only way Picasso has of writing is with drawings and paintings. In 1914 and from then on he had a certain way of writing his thoughts, that is to say of seeing things in a way that he knew he was seeing them. And it was in this way that he commenced to write these thoughts with drawings and with painting. Oriental people, the people of America and the people of Spain have never, really never forgotten that it is not necessary to use letters in order to be able to write. Really one can write in another way and Picasso has understood, completely understood this way" (*Picasso By Gertrude Stein* 38-39). See Figure 4, Pablo Picasso's Violon, verre, pipe et ancre (Violin, Wineglass, Pipe and Anchor), and Figure 5, Picasso's 'Ma Jolie': Femme à la guitare ou cithara (Ma Jolie: Woman With Zither or Guitar, for an illustration of the kinds of Oriental-inspired, cubist and hieroglyphic writings that Stein is referring to and thinking about, when she compares her cubist-style literary portraits to analytic and synthetic, cubist works in *Everybody's Autobiography*, *Lectures in America*, and *The Autobiography of Alice B. Toklas*.[20]

Material has been removed from this thesis because of copyright restrictions. The information removed from page 30 is Figure 4. The removed material is a colored photocopy of Pablo Picasso's painting, *Violon, verre, pipe et ancre* (Violin, Wineglass, Pipe and Anchor). Spring 1912. National Gallery, Prague. This work illustrates the kind of cubist and hieroglyphic writings that Stein is referring to in Everybody's Autobiography, The Autobiography of Alice B. Toklas and Lectures in America, when she compares her cubist-style literary portraits to Picasso's analytic and synthetic, cubist portraits. The original source of this material is Plate 128, from Primitivism, Cubism, Abstraction: The Early Twentieth Century. Ed. Charles Harrison et al. New Haven: Yale University P, 1994. 150.

Material has been removed from the thesis because of copyright restrictions. The information removed from page 31 is Figure 5. The removed material is a color photocopy of Pablo Picasso's cubist painting 'Ma Jolie': Femme à la guitare ou cithara ('Ma Jolie': Woman With Zither or Guitar.) Winter 1911-1912. The Museum of Modern Art, New York. Acquired through Lillie P. Bequest. This work illustrates the kind of cubist and hieroglyphic writings that Stein is referring to in Everybody's Autobiography, The Autobiography of Alice B. Toklas and Lectures in America, when she compares her cubist-style literary portraits to Picasso's analytic and synthetic, cubist portraits. The original source of this material is Plate 114, from Primitivism, Cubism, Abstraction: The Early Twentieth Century. Ed. Charles Harrison et al. New Haven: Yale University P, 1994. 136.

0.2 Cubist Brain Surgery

Though I cannot tell you *exactly* how Stein might have been using the "color thing" in her cubist literature to perform imaginary brain surgeries, I can try to explain the neuroscientific significance of her literary phenomenology and her creative uses of color experience below.[21] When it comes to understanding how she 'paints' these color relations (or these qualia relations) with non-descriptive words, it is crucial to keep this anxiety-producing "color thing" in the back of our minds, in case we encounter non-color words amongst color words and we have to decide which words in a given, "neurophysiological imaginary" represent neurons, which words signify axons and their synaptic connections, which words connote and/or create non-neuronal entities, and which words symbolize cellular elements with color signifiers, whose meanings we can interpret by paying close attention to a text's grammar, syntax, style and spacing. When reading for neuraesthetic perceptual principles and neural codes, there may be words, phrases and sentences that represent color language qualia that are not visible, or legible, at the level of language, but which operate in Stein's cubist portraits as Fauvist and Cubist word-objects that produce abstract pictures of the brain's language-producing and color processing, neural pathways.

In Stein's neuroanatomical imaginaries, a color relation is a qualia relation. To use Dennett's expression, there are "color language qualia" in these imaginary nervous systems that correspond with the brain's language-producing and color-experiencing, brain regions. This means that a particular color relation that is being expressed by one or more of the words in any of her literary portraits, be it "crimson to the bud" or "purple," is the equivalent of a "quale." In *A Universe of Consciousness*, Edelman and

Tononi draw upon William James' principles of psychology as a means of defining the meaning of the philosophical term "quale" within the context of their neuroscientific research on human consciousness. In this book, they argue that the quale, which is the smallest unit of phenomenal discrimination, ought to be used by philosophers and scientists to describe the brain's "*N*-dimensional neural [and qualia] space" (162). Because Meyer wants us to think of a text's word-neurons as metaphors for the brain's secondary phenomenal experiences and higher-order thought processes, he does not consider the roles that Stein's "color thing" (which is, at once an elementary and an secondary quality of conscious experience) may be playing in the construction of a given, "neuroanatomical imaginary."[22] In my opinion, a literary text is not the same thing as a human brain, even if the neuroscientific and neuraesthetic metaphors that we use to compare words to neurons reveals surprising connections between brain structure, brain function and human consciousness. Meyer claims, to the contrary, that Stein's dissociative writings ought to be conceptualized as "invisible nervous systems," as "conscious artifacts," as "nonvitalist organisms," and as nonliving biological organisms, with "normally functioning nervous systems" that are "exactly like the human nervous system."

By contrast, I am arguing that the literary qualities of neuroanatomical realism that are communicated to a reader through Stein's dissociative writings do not come to "life" until someone imbues the literary qualia in these works with culturally intelligible meanings and "experiential effects" that transform the formal elements of style, grammar, syntax and genre into neurobiological entities and "felt realities." To an extent, a portrait's neurophysiological entities can be conceptualized as performative speech acts, because these entities instantiate cultural meanings that exceed 'the real' of the human body. Judith Butler points out that the "failure of the mimetic function … has its own political uses, for the production of texts can be one way of reconfiguring what will count as the world. Because texts do not reflect the entirety of their authors or their worlds, they enter a field of reading as partial provocations, not only requiring a set of prior texts in order to gain legibility, but—at best – initiating a set of appropriations and criticisms that call into question their fundamental premises" (*Bodies That Matter* 19). In agreement with Butler's reader response approach to discursive performativity, I submit that Stein's cubist writings generate scientific, biological and neuraesthetic meanings that exceed their immediate, discursive contexts and linguistic significations. This is partly because of audience responses that augment and contest the "fundamental premises" of Stein's abstract illustrations.

It is helpful to understand the generative processes of neuraesthetic, literary composition and audience reception from the standpoint of William James's nineteenth-century psychological research. To do so, one must recognize that the phenomenal experience of the human central nervous system is always already an artificial, mental construct. James explicates the phenomenology of scientific experience in "Necessary Truths and the Effects of Experience," with the following statement: "Even those experiences which are used to prove a scientific truth are for the most part artificial experiences of the laboratory gained after the truth itself has been conjectured. Instead of experiences engendering the 'inner relations,' the inner relations are what engender the experiences here" (*Principles of Psychology II* 638). With this statement, James reveals that the "necessary truths" of nineteenth-century empirical science represent "artificial," phenomenal experiences that correspond with ideologically entrenched, mental realities and institutional biases that have been produced in the laboratory, or reproduced through laboratory-born phenomenal experiences, or conjectured from data that scientists have collected in various, laboratory settings. Using his psychogenetic research on secondary phenomenal experience to buttress his arguments about the brain's plastic, "organic mental structure," James places philosophy, art and science at the same level, within the brain's evolutionary processes. James's psychological study of mental evolution and consciousness discrimination explores the metaphysics of the brain's aesthetic and neuraesthetic feelings, in the following sentence: "Many of the so-called metaphysical principles are at bottom only expressions of aesthetic feeling" (672). When Stein produces dissociative writings to portray scientific realities and recreates the realities of previously experienced, scientific laboratories in her cubist literature, she is using James's psychogenetic principles of brain exploration and consciousness analysis in an indirect fashion. These psychogenetic principles come into play when she writes about the internal and external realities of phenomenal consciousness, using cubist painting strategies to capture passing states of consciousness in "human beings." Stein achieves multifarious, neuraesthetic aims with these writings, even when she posits empirically testable, psychological principles with cubist puns, literary neologisms and playful language. For example, in *The Geographical History of America*, Stein illustrates James's radical empiricist, evolutionary hypotheses with a neuraesthetic, writing strategy that explores phenomenal experiences, such as color vision, tactile sensation, spatial perception, aesthetic feeling, and sexual passion, with language, syntax, grammar, style, genre and poetic form.[23]

Using James's psychogenetic framework, I consider the imaginative acts of brain visualization that Stein produces at the level of her dissociative writings to be discursive symptoms that correspond with the elementary and secondary qualities of phenomenal experience. In James's words,

> The bare existence of a past fact is no ground for our remembering it. Unless we have seen it, or somehow *undergone* it," James argues, we shall never know of its having been. The experiences of the body are thus one of the conditions of the faculty of memory being what it is. And a very small amount of reflection on facts shows that one part of the body, namely, the brain, is the part whose experiences are chiefly concerned. If the nervous communication be cut off between the brain and other parts, the experiences of those other parts are non-existent for the mind. (*Principles of Psychology* I 4; original emphasis).

Because Stein conducted experiments in the Harvard psychology laboratory during her undergraduate studies and performed brain surgeries in the anatomy laboratories of Dr. Franklin Barker and Dr. Lewellys Barker at The Johns Hopkins Medical School during her graduate studies, her bodily experiences serve as templates for the neural architectures in her dissociative writings. Using these scientific experiments as phenomenological blueprints for her imaginary nervous systems, Stein created brain maps that operated simultaneously as *language experiments* and as literary demonstrations of *psychophysiological parallelism*.[24] I submit that Stein subjectively experienced the brain's neural principles, past laboratory experiments and past surgeries, with the agency of her creative imagination and intuitive faculties. By reconfiguring, archiving and re-imagining these subjective experiences in her creative works, Stein discovered new ways of visualizing the brain. In the process of creating new forms of aesthetic consciousness, Stein also mapped out some of the complex, neural connections that exist within the visual cortex, the cerebellum, the midbrain, the brain stem and the retina. As a result of these evolving neuraesthetic compositional practices, she discovered new things about the brain, its neurophenomenological processes, and its creative capacities.

Because of inventive nature of Stein's neuraesthetic writing practices, her abstract brain representations cannot be reduced to nineteenth-century brain-based knowledge. Nor can her abstract brain maps be defined by and limited to common-sense methods of psychological analysis, such as "summation." James explains these summation methods in *The Principles of Psychology*, with specific reference to the language aphasias: "We constantly use the summation of stimuli in our practical appeals. If a car-horse balks, the final way of starting him is by applying a number of customary incitements at once. … If we are striving to remember a lost name or fact, we think of as many 'cues' as possible, so that by their joint action they may recall what no one of them can recall alone. … Aphasia shows many examples of summation. A patient who cannot name an object simply shown him, will name it if he touches as well as sees it, etc." (I 84-85). Through the deployment of cubist representational strategies and innovative brain mapping practices, Stein invites her readers to respond to linguistic signs that generate many semiotic cues and multiple, perceptual perspectives. This neuraesthetic writing practice compares to the way that James and other scientists used summation methods with aphasic patients. In Stein's case, summation operates at the level of language by encouraging the brain to name objects that escape memory, even textual memory, but which may be stimulated through the brain's reading circuits and through motor incitements, such as sensory responses. By the time that *The Geographical History* was published in 1936, Stein had been conducting literary experiments with the phenomenology of consciousness for a quarter of a century. Her dissociative, writing style and phenomenal, language experiments follow in the footsteps of James's radical empiricist consciousness studies, by creatively illustrating his late nineteenth-century hypotheses about consciousness formation, qualia discrimination and brain evolution. [25]

Although Stein never explains how her early literary experiments with the "color thing" and her psychological experiments with color saturation at the Harvard Psychological Laboratory inform her cubist-inspired neuroanatomical portraits, she provides vital clues as to the significance of this invisible "color thing" in "Portraits and Repetition." Her slippery language suggests that she may have been interested in the brain pathologies known as 'color anomias.' For the most part, she considers the human mind's subjectively experienced inner states of consciousness to be most impervious to outside observation and psychological inspection. However, this does not mean that she does not attempt to present her subjective phenomenology, or her views on the phenomenology of consciousness, or a masterpiece's aesthetic consciousness, in her creative and her critical writings from these perspectives. To make matters worse for those interested in tracking these shifting views at the level of her modernist portraits, the only place that Stein explains her "anxious" experiments with the invisible "color thing" is in "Portraits and Repetition." In other words, this is the only information that Stein provides about her enigmatic experiments with color consciousness, though it is not the only place she speak about her tortuous efforts to represent the internal and external realities of phenomenal consciousness.

I believe that it is crucial to account for the invisible "color thing" that informs Stein's portraiture techniques, if one is to discuss Stein's colourful brain maps and her futuristic, neuron coloration strategies in ways that also encompass the author's compositional practices. Yet, as I discuss in chapter three, it may be that Stein's "color thing" serves as a diagnostic tool that allows her to investigate the neural mechanisms of the color anomias and language aphasias arising from Broca's region and Wernicke's area, in ways that we do not yet understand. More research is needed on this subject, before I will be able to say whether she uses the color anomias to create reading deficits, or if she creates color anomias with her brain portraits in order to promote neuraesthetic reading practices. Given Stein's fear of the abnormal and her dislike of the medical practice that she called "pathological psychology," she would have wanted to avoid any direct association between her literary experiments and the brain trauma known as "anomic aphasia." There are different kinds of anomias, such as Wernicke's anomia, Broca's anomia and averbia anomia, but the one I am referring to is "color anomia", where "the patient can distinguish between colors but cannot identify them by name."[26] In Zeki's estimation,

> it is not surprising perhaps to find that the brain has a special center, located close to the color center in the left fusiform gyrus, that is critical in naming colors. Damage to this center results in an inability to name colors, though their perception remains intact, a syndrome known as color anomia. Color is, then, the result of an inherited program or concept that the brain has developed through evolution, which it applies to give sense to the incoming signals and thus gain knowledge about a certain attribute of the world. If the color center in the brain, V4, is destroyed, the concept of taking ratios as described above can no longer be applied and the subject becomes color blind. This is one reason why I have referred to this part of the cortex as the color center. (30-31)

As I propose below, Stein appears to be deploying early twentieth-century neurological principles regarding color constancy and using her medical knowledge about the color anomias when she experimented with the "color thing" in her second-phase cubist portraits. "The importance of understanding that color is a construction of the brain, that it is a visual language used by the brain and it is not a property of the physical world cannot be overemphasized," Zeki stresses. In addition to this detailed description, Zarate and Gellatly note that color anomias result from trauma to "the region of the occipital lobe that specializes in perception of colours" (*Introducing Mind and Brain* 62). In "Constructing the Visual Image," neuroscientists Eric R. Kandel and Robert H. Wurtz describe the color anomias and depth agnosias, from a Freudian neuroscientific perspective:

> The idea that different aspects of visual perception may be handled in separate areas of the brain dates to the end of the nineteenth century, when Sigmund Freud concluded that the inability of certain patients to recognize certain features of the visual world was due not to a sensory deficit but to cortical deficits that affect the ability to combine components of visual impressions into a meaningful pattern. These deficits, which Freud called *agnosias* (loss of knowledge), can be quite specific depending on the area of the cortex damaged. … For example, a patient may have a selective deficit for the perception of depth as a result of a lesion in the visual cortex. One patient with such a *depth agnosia* had an "inability to appreciate depth or thickness of objects seen. … The most corpulent individual might be a moving cardboard figure; everything is perfectly flat." Similarly, a *motion agnosia* can occur after bilateral damage to the middle temporal areas of the cortex (see Chapter 28) and is manifested by an inability to perceive motion without such striking loss of any other perceptual

> abilities. Still other patients lose color vision (*achromatopsia*) because of localized damage to the temporal cortex, while retaining reasonably good perception of form. This color-processing area in the brain can be identified in normal living human subjects using PET scanning. (498-499)

See Table 1, which is a reproduction of Eric R. Kandel and Robert H. Wurtz's Table 25-1, The Visual Agnosias, from "Constructing the Visual Image."

Material has been removed from this thesis because of copyright restrictions. The removed material from page 42 is Table 1, The Visual Agnosias. This table contains information on the agnosia for form and pattern, agnosia for color, and agnosia for depth and movement, citing the deficit and the most probably site in the brain of the lesion causing these agnosias. Listed second in the category for the "agnosia for color" is the "color anomia." Kandel and Wurtz cite the "deficit" as "naming colors" and the "most probably site of the lesion" as "Speech zones or connections from areas 18, 37." This information may help readers under stand the functional neuroanatomy that informs Stein's experiments with the "color thing" in her second-phase cubist writings. The original source of this material is Eric R. Kandel and Robert H. Wurtz's Table 25-9 (Modified from Kolb and Whislaw 1980), from "Constructing the Visual Image," Principles of Neural Science. 500.

In Table 25-1, Kandel and Wurtz observe that the color anomia, which is a form of agnosia for color or loss of knowledge about color, is to be categorized as a deficit that occurs with the naming of colors that occurs in the speech zones or connections from areas 18 and 37 of the brain. See Figure 7, for a view of Brodmann area 18, which is the secondary visual cortex, and of Brodmann area 37, which is the occipital lobe of the cerebral cortex that is involved in processing visual perception.[27] Figure 7 is a photographic reproduction of Figure 21-1, from Korbinian Brodmann's "Contributions to a Histological Localization of the Cerebral Cortex—VI. Communication: The Vision of the Cerebral Cortex": "Lateral (top) and medial (bottom) views of the hemisphere of a human brain with cytoarchitectonic and cortical areas" (*Broca's Region* 335).[28] Also see Figures 8 and 9, for sagittal and mid-sagittal views of Brodmann areas 37 and 18, which the illustrators of these cytoarchitectonic maps have colored, using an arbitrary schema of blue, yellow, red and green colors, to highlight the different sections of Brodmann's cytoarchitectonic, cortical divisions.[29] Stein would have been interested in the language effects produced by color anomias and the transcortical sensory aphasias, because these brain pathologies coincided with psychological research that William James was conducting on language, experience and consciousness in the late nineteenth century. She probably first became interested in the color anomias and the transcortical sensory aphasias when she was conducting psychological experiments with color, attention, reading, writing, and motor automatism in the Harvard psychological laboratory under James' and Münsterberg's supervision. However, her medical studies and brain stem research at Johns Hopkins University at the graduate level provided her the empirical foundations to explore the visual and linguistic effects associated with certain brain diseases from the physiological perspectives that James discusses in *The Principles of Psychology*, in relation to the concepts of "Instinct, the Stream of Thought, Attention, Discrimination, Association, Memory, Aesthetics, and Will" (I 85).

Material has been removed from this thesis because of copyright restrictions. The information removed from page 45 is Figure 7. The material contains the following relevant information: Brodmann cites the 1903 research of Köppen and Löwenstein, which "sought to determine the location of the "visual region" in lissencephalic brains (insectivores and Rodentia), but they arrive at wrong homologues and, in addition, did not give an exact spatial boundary of their so-called "granular cortex" (Brodmann 335). In seeking to correct for Köppen and Löwenstein's homological errors, as well as to build upon "inadequate myelinisation method[s]" by recognizing that "regional differences exist in cell and fiber structures, i.e., in the laminar pattern … of the cross section of the cerebral cortex," in order to account for "cytoarchitectural and myeloarchitectural differences," Brodmann developed a "topological parcellation of the cerebral cortex by using an anatomical-histological method, thereby gaining new guidelines for [the] clinical and physiological localization" of brain function. Using this figure, I drew the reader's attention to areas 18 and area 37, which are the areas believed to be responsible for the production of color anomias in patients with brain lesions. The original source of this information is Korbinian Brodmann, "Contributions to a Histological Localization of the Cerebral Cortex—VI. Communication: The Vision of the Cerebral Cortex." *Broca's Region*. Ed.Yosef Grodzinsky and Katrin Amunts. Oxford: Oxford UP, 2006. 335.

Material has been removed from this thesis because of copyright restrictions. The information removed from page 46 is Figure 8, which is a colored photocopy of the brain, according to a sagittal view that illustrates Korbinian Brodmann's numbered divisions. The information contained in this image is the brain function related to each of the four lobes that constitute the cerebral cortex: i.e. the frontal lobe (in yellow) controls "thinking, planning, & central executive functions; motor execution"; the parietal lobe (in green) controls "somatosensory perception [and the] integration of visual and somatospatial information"; the temporal lobe (in red) controls "language function and auditory perception [and is] involved in long term memory and emotion"; and the occipital lobe (in blue) controls "visual perception and processing." The original source of this information is the following, website address:
<http://www.umich.edu/~cogneuro/jpg/Brodmann.htm>.

Material has been removed from this thesis because of copyright restrictions. The information removed from page 47 is Figure 9, which is a colored photocopy of the brain, according to mid-sagittal view that illustrates Korbinian Brodmann's numbered divisions. The information contained in this illustration consists of a list of the functional areas of the brain, such as vision (primary and secondary), audition (primary and secondary) body sensation (primary and secondary) sensation (tertiary), motor (primary, secondary, eye movement and speech) and motor (tertiary). For each of these functional areas, an arbitrary color scheme has been provided by the creators of this cytoarchitectonic map. The original source of this information is the following, website address:

<http://www.umich.edu/~cogneuro/jpg/Brodmann.htm>.

Stein would have been interested in the language effects produced by color anomias and the transcortical sensory aphasias, because these effects mirror the psycho-physiological research on the brain, language, experience and consciousness that James published in *The Principles of Psychology Volume One*. In chapter two, "The Functions of the Brain," James underscores the evolving and embryonic nature of his psycho-physiological and psychogenetic research, in the following passage: "Both the minute anatomy and the detailed physiology of the brain are achievements of the present generation, or rather we may say (beginning with Meynert) of the past twenty years. Many points are still obscure and subject to controversy; but a general way of conceiving the organ has been reached on all hands which in its main feature seems not unlikely to stand, and which even gives a most plausible scheme of the way in which cerebral and mental operations go hand in hand" (15). Gertrude Stein mostly likely became acquainted with the color anomias and the transcortical sensory aphasias through James's lectures at Harvard University. Explicating the significance of the motor aphasias, in relation to the localization of brain function and speech loss in "The Localization of Functions in the Hemispheres," James writes: "One of the most instructive proofs of motor localization in the cortex is that furnished by the disease now called aphemia, or motor Aphasia. Motor aphasia is neither loss of voice nor paralysis of the tongue or lips. The patient's voice is as strong as ever, and all the innervations of his hypoglossal and facial nerves, except those necessary for speaking, may go on perfectly well. He can laugh and cry, and even sing; but he either is unable to utter any words at all; or a few meaningless stock phrases form his only speech; or else he speaks incoherently and confusedly, mispronouncing, misplacing, and misusing his words in various degrees.

Sometimes his speech is a mere broth of unintelligible syllables. In cases of pure motor aphasia the patient recognizes his mistakes and suffers acutely from them. Now whenever a patient dies in such a condition as this, and an examination of his brain is permitted, it is found that the lowest frontal gyrus (see Fig. 11) is the seat of injury. Broca first noticed this fact in 1861, and since then the gyrus has gone by the name of Broca's convolution″ (37-38). The motor aphasias, color anomias and the sensory homunculus figure prominently in James's discussion of language production and the localization of brain function because, as he notes, "It will be noticed that Broca's region is homologous with the parts ascertained to produce movements of the lips, tongue, and larynx when excited by electric currents in apes (cf. Fig. 6, p. 34). The evidence is therefore as complete as it well can be that the motor incitations to these organs leave the brain by the lower frontal region" (38-39). Though Stein was introduced to Broca's research on the language aphasias in her undergraduate studies, she consolidated her knowledge about the brain's language-centers and its reading circuits over the course of her medical studies at Johns Hopkins University. Her anatomical studies with human and mammalian brain specimens, in the laboratories of Dr. Lewellys Barker and Dr. Franklin Mall, provided her with the clinical experiences and the empirical tools that made it possible for her to devise complex, neuroscientific experiments with her cubist writings. As we are just discovering, her neuraesthetic compositions interrogate the complex relations that exist between brain anatomy, brain function, speech production, language production, the genetics of language, and artistic creation, using metaphor, genre, style and playful language.

Using language as a surgical tool, of sorts, to examine the relation between neuroanatomy, brain function and phenomenal experience in her second- and third-phase cubist portraits, Stein creatively redeployed some of the psycho-physiological methodologies that James explicates in *The Principles of Psychology*, as a means of exploring "Instinct, the Stream of Thought, Attention, Discrimination, Association, Memory, Aesthetics, and Will" (I 85). According to Meyer, Stein's dissociative writings assimilate James's physiological psychology into their conceptual purview, as a means of illustrating a literary style of "descriptive neurology" that operates, in a figurative sense, like present-day brain imaging technologies. As he argues in *Irresistible Dictation*,

> Clearly, the challenge for a physiological psychology like James's lay in devising experiments that could build on the results of descriptive neurology without requiring invasive brain surgery; and it was exactly this sort of training that Stein acquired in her work at the Harvard Psychological Laboratory, as her 1896 and 1898 studies of character and automatic writing demonstrate. … The further challenge, which James did not address but which came to concern Stein more and more, was how any physiological psychology could ultimately be distinguished from pathological psychology, given that the basis for the physiology was so unavoidably pathological. Today, at the outset of the twenty-first century, it has perhaps finally become possible, both conceptually and technologically, to extend James's speculations concerning neurological self-education *after* birth into the sphere of prenatal development, as well as to view the brains of ostensibly normal, healthy persons through techniques of brain imaging. A hundred years ago this was inconceivable. Yet this is the only kind of physiological psychology that could possibly have satisfied Stein; and one may argue that in her most experimental writing she aims to record the characteristic brain activity of individuals who haven't

> been slated for surgery. She also models her writing on neurological self-education, which is most pronounced at the embryological and neonatal stages. (113)

With this hypothesis, Meyer interprets Stein's experimental form of physiological psychology, in works like "An American and France" and "What are Master-Pieces," as a neuraesthetic writing practice, emphasizing "those aspects of her writing that removed it from the dictates, respectively of place and time" (114). Through these works, Meyer argues, "Stein substitutes a duality of function for the Cartesian dualism of substance. Writing, no less than the human mind – or any entity for that matter – is an activity, not a substance; accordingly, it is made, in James's phrasing, of the same *non*substantial—neither substantial nor insubstantial – "stuff as things are" (114). For Meyer, the fact that, in "Mildred's Thoughts," words metaphorically "serve as bread" and act as "the staff of life" also means "combinations of words, come to life, functioning on their own terms … as a means to a determinate end. This is *life* understood on the model of the nervous system" (114; original emphasis). That is, Meyer finds in Stein's fragmentary word combinations a radical empiricist psychological model that makes sense of a text's oxymoronic, life force and discovers its invisible nervous system. In other words, he uses James's speculations about the brain's embryological development and his laboratory experiments with motor automatism to make sense of Stein's dissociative writing practices. Working closely with James's radical empiricist hypotheses and experiments from the late nineteenth-century, he proposes that a number (perhaps all) of Stein's dissociative writings possess invisible nervous systems with oxymoronic, phenomenal qualities that make them culturally intelligible as "*non*substantial, neither substantial nor insubstantial," biological entities with artificial intelligences, or as non-vitalist organisms with aesthetic consciousnesses. [30]

Meyer's argument about James's "descriptive neurology" and Stein's literary brain mapping strategies relies upon the respective contributions of Hughlings Jackson and Theodor Meynert to nineteenth-century brain science and "The Education of the Hemispheres." In the section of *The Principles of Psychology* that bears this title, James addresses the "most stirring controversy in nerve-physiology which the present generation has seen" – the "*cerebral localization* of the various sorts of elementary sorts of idea" or the "*localization-question*" – by proposing to understand sensory experience from the coextensive perspectives of brain anatomy and brain function: "If, then, we grant that motor and sensory ideas variously associated are the materials of the mind, all we need to do to get a complete diagram of the mind's and brain's relations should be to ascertain which sensory idea corresponds to which sensational surface of projection, and which motor idea to which muscular surface of projection. The associations would then correspond to the fibrous connections between the various surfaces. This distinct *cerebral localization* … has been treated as a 'postulate' by many physiologists (e.g. Munk)" (30; original emphasis). In the next section – "The Localization of Functions in the Hemispheres" – James introduces Flourens' neuroanatomical experiments with pigeons and emphasizes their importance with respect to human language function: "namely that the different functions of the hemispheres were not locally separated, but carried on each by the aid of the whole organ" (30-31). Stein's obscure, multiple references to pigeons in Detective Story number VII from *The Geographical History of America* appear to be indirect references to Flourens' scientific research and to James's psychological study of the brain's cortical irritations, ablations, and localizations. To be more precise, the pigeons and bird references serve as cubist brain hieroglyphs that have been interspersed amongst the detective stories leading up to Detective Story number VII. This detective story contains, or rather "is," the only explicit cubist portrait of a brain-like human mind in Stein's literary corpus. Based on the existence of this cubist brain portrait, I disagree with Irene Small's assertion that "[i]n 1938, Stein could not have anticipated the brilliant red lithographic illuminations Picasso would contribute to Pierre Reverdy's book of poems *Le chant des morts*, published in 1948. But this book, perhaps more than any other, demonstrates Picasso's "calligraphy" in Stein's double sense of the word" ("*Le chant des mort (The Song of the Dead)*: Pierre Reverdy," *Picasso and the Allure of Language* 162). Seeing how Stein characterizes Picasso's cubist poetry and her own cubist literature as hieroglyphic writings in *Everybody's Autobiography*, I feel, to the contrary, that Stein predicted Picasso's colorful hieroglyphics and she also felt the need to create a visual rhetoric that "evoke[d] both the practices of rubrication (the highlighting of letters or phrases in red) and illumination (the pictorial decoration of the margins of a page)" (Small 164). In chapter two, I explain how Stein adapts Matisse's Fauvist techniques and Picasso's cubist portraiture strategies, as a means of producing the color-coded and qualia-based, neuroanatomical portrait in Detective story number VII, a portrait whose brain hieroglyphs come from Picasso's calligraphic writing practices, as well as ancient Egyptian and modern European, medical discourses.

Though Thornton Wilder found the bird images from the detective stories in Part II of *The Geographical History of America* to be ineffable, another example of Stein's "private language" at work, I believe, to the contrary, the bird images operate as sly, literary references to the brain. Like the colorful, cubist puns that Stein uses in Detective Story number VII to construct a brain portrait, these bird images elliptically refer to a number of medical discourses and neurological references, through a unique form of iconic-indexical, cubist representation. Through discursive and grammatical forms of "play" that Steiner and others have defined as the "beloved mistake," or the cubist pun, the detective stories from "Part II" function as modernist hieroglyphs, as sorts, that encrypt as well as reconfigure the brain hieroglyphs from *The Edwin Smith Surgical Papyrus*, the various bird-brain experiments that James cites in *The Principles of Psychology*, and the comparative neuroanatomy studies that Barker dissects with his medical knowledge in *The Nervous System and its Constituent Neurones*. In my opinion, the pigeons and birds in the detective stories from "Part II" function as cubist puns and as modernist hieroglyphs, to the extent that they incorporate knowledge from ancient and modern, medical treatises, so as to conduct literary, brain experiments and to construct cubist, connectivity maps.

Throughout *The Geographical History of America*, Stein expresses her interest in the kinds of disconnections that can occur between writing, speaking, thinking, seeing, reading and remembering within the purview of phenomenal consciousness. We find that James's description of "motor aphasia" and "agraphia," in *The Principles of Psychology*, similarly emphasizes the disconnections that occur between cognitive, sensory, motor and visual brain functions because of hemispheric differentiation and different kinds of brain pathology:

> Victims of motor aphasia generally have other disorders. One which interests us in this connection has been called *agraphia*: they have lost the power to *write*. They can read writing and understand it; but either cannot use the pen at all or make egregious mistakes with it. … The symptom may exist when there is little or no

> disability in the hand for other uses. If it does not get well, the patient usually educates his right hemisphere, i.e. learns to write with his left hand. In other cases of which we shall say more a few pages late on, the patient can write both spontaneously and at dictation, but cannot *read* even what he has himself written! All these phenomena are now quite clearly explained by separate brain-centres for the various feelings and movements and tracts for associating these together. But their minute association belongs to medicine rather than to general psychology, I can only use them here to illustrate the principles of motor localization. Under the heads of sight and hearing I shall have a little more to say. (I 40)

Toward the end of this section on the localization of brain function in the hemispheres, James also draws our attention to "a number of cases of mental blindness, especially for written language, coupled with hemianopsia, usually of the rightward field of view" (51). He explicates the significance of these cases, in the section about hearing, with the aim of connecting these brain disorders with associated, sensory experiences and with the epistemic regimes that he defines as the "period of Broca, the period of Wernicke, and the period of Charcot":

> These are all explicable by the breaking down, through disease, of the *connecting tracts* between the occipital lobes and other parts of the brain, especially those which go to the centres for speech in the frontal and temporal regions of the left hemisphere [such as Broca's Region and Wernicke's Area, as given in James's Figure 11, "Schematic Profile of Left Hemisphere…"]. They are to be classed among disturbances of *conduction* or of *association*; and nowhere can I find any fact which should force us to believe that optical images need be lost in mental blindness, or that the cerebral centres for such

> images are locally distinct from those for direct sensations from the eyes. Where an object fails to be recognized by sight, it often happens that the patient will recognize and name it as soon as he touches it with his hand. This shows in an interesting way how numerous the associative paths are which all end by running out of the brain through the channel of speech. The hand-path is open, though the eye-path is closed. (I 51-52)

For James, "There is no 'center of Speech' in the brain any more than there is a faculty of Speech in the mind. The entire brain, more or less, is at work in a man who uses language" (I 56). Twenty-first century neuroscientists, such as Wolf, Edelman, Tononi and Fisher, have confirmed James's thesis, though they disagree as to the scientific methodologies, interpretative practices and interdisciplinary tools that elucidate the brain's neurophysiological mechanisms, its states of consciousness, and its epigenetic or genetic developmental processes.[31] Stein also confirms James's hypotheses about the localization of brain function, the language aphasias and the education of the hemispheres, when she produces neuraesthetic representations of the human brain that troubles the faculties of sight, sound, and sense at the level of language, without losing sight of the brain functions and concepts that produce artistic masterpieces.

Clearly, Stein did not want her readers to think that she was trying to represent the loss of color names that occurs when there is damage to the very posterior section of the left temporal lobe when she was experimenting with the color thing, even if she was fascinated with recreating these neural principles in her literary portraiture through the foreclosure of color names from her visual field. She avoids all discussion of her literary experiments with the color thing until late in her literary career and then only briefly mentions her interest in the relationship between color, language and phenomenology. For Stein, such thought experiments may have yielded insights about the brain's coextensive, neural and qualia spaces (Edelman and Tononi, *A Universe of Consciousness* 164). It may be that she wished to explore the unusual linguistic qualities of the color anomias and language aphasias by creating an imaginary "qualia space" that corresponded with the non-descriptive words in this portrait through a special kind of invisible color mapping. Dan Drai agrees that a "sensible strategy for studying the fundamental role of a brain area is to analyze the performance deficits of people affected by a lesion of that area. The hope, of course, is that the performances of the affected subjects will show a differential pattern. Ideally, some function will be isolated such that the performance of a task requiring it is abnormal for affected subjects, while the performance of those tasks not requiring it is normal. Broca's area is not an exception in this respect, and there is a rather large body of data on the linguistic performance of subjects with a lesion in Broca's area" ("Evaluating Deficit Patterns of Broca's Aphasics in the Presence of Intersubject Variability" 108). Recent research on Broca's region, published by Shapiro, Thompson, Fadiga, Craighero, Roy, Arbib, and Friederici, suggest promising directions for the study of Stein's "color thing" as a linguistic, artistic and phenomenological experiment that investigates the performance of color anomias and linguistic aphasias at the level of a masterpiece's non-descriptive language.[32]

0.3 Stein's Literary Psychogenesis and Cubist Portraiture

The question I am pursuing in this project as a whole can be phrased as follows: did Stein imagine that the brain's neurons, axons and cellular tissues could be stained, painted and/or reconfigured in ways that would render them knowable, legible and visible from multiple perspectives at once? To answer this question, I will be examining the discursive historicity, the color systematicity and the literary methodologies that Stein used to construct her allegorical brain maps. In chapter one, I analyze the ways in which cubist puns function as neuraesthetic portraiture strategies. I focus predominantly on "A Long Dress" from *Tender Buttons*, because it serves as the prototype for the explicit, cubist brain portrait from "Detective Story number VII" in *The Geographical History of America*. In chapter one, I examine the extent to which Stein's cubist portraiture of the human mind and the human brain is representational and mimetic, and conversely, the extent to which it is meant to be non-representational and non-mimetic, using Meyer's neuraesthetic reading strategies, Barker's medical research and Cajal's neurobiological methods of nerve tissue analysis.

Stein's cubist portrayal of the brain can be characterized as a representational and mimetic form of neuraesthetic art, because she deploys color signifiers to represent the brain's colored matter and its colored neurons in ways that are comparable to nature's structural organization of these biological elements. Also, Stein's cubist portrayals of the brain can be described as mimetic and quasi-realistic forms of neuraesthetic representation, because the color signifiers and cubist puns that comprise the brain's colored matter in these portraits follow medical protocols, such as the ones that nineteenth-century neurologists used when they examined brain tissue in surgical settings and they analyzed brain matter under a microscope with innovative, histological methods. In addition, Stein's cubist portrayals of the brain can be defined as non-mimetic, or as non-representational, forms of neuraesthetic literary composition, because she uses the English language to recreate the appearance of neuronal networks, neuroanatomical features and synaptic connections, through interartistic and interdisciplinary means that may be ineffable to some readers.

At this point, I believe it is crucial to debate the extent to which Stein's non-mimetic forms of cubist brain representation emerged from seemingly logical, mimetic and previously intelligible, portraiture strategies. To explain the evolution of her neuroanatomical portraiture strategies, I use twenty-first century brain mapping strategies and other means of neuraesthetic literary analysis. By contrast, Wendy Steiner argues that the logical, second-phase (analytic) cubist portraits evolved into "overextended," unintelligible forms of experimental cubist expression, in *Exact Resemblance to Exact Resemblance*:

> [Stein] approached the problem of the literary portrait in a very conscious and rational manner, and yet had ended up in a logical contradiction – non-representational portraiture. The explanation of this paradox does not lie in some failing of Stein's logic or in her inability to realize its demand in prose. Rather, the problem arose from her overextension of her medium. For we should remember that the most significant force in generating the development of Steinian portraiture was the indexical-iconic definition of the portrait derived from painting, and that Stein's activity may be looked upon as an attempt to accommodate a set of visual norms to a set of literary ones. (*Exact Resemblance to Exact Resemblance* 13).

To a large extent, I agree with Steiner about the communicative constraints of the non-representational (or non-mimetic) literary portraiture that Stein produced between 1912 and 1926. However, I disagree that Stein's neuroanatomical portraiture became less intelligible as time passed. As her synthetic cubist portraits became more extreme and apparently less intelligible to many of her literary readers, I find that the neuroanatomical imaginaries within the third-phase portraits emerge as complex, but nonetheless clear and immediately recognizable, cubist portrayals of the central nervous system. As Steiner underscores, even in the most abstract, second- and third-phase cubist writings from Stein's corpus, we find "the presence of small units of color which could not be directly related to any element of the represented object." Whereas I emphasize the neuraesthetic and scientific meanings of these "small units of color" in relation to other quasi-objects and quasi-subjects within these cubist portraits, Steiner claims that the color signifiers, or the color units, from these works ought to be interpreted as "elementary units borrowed from Cézanne, who had, according to Loran, invented the system of modulating a volume from its cool, dark side to its light, warm parts in chromatic nuances – that is, a series of steps or planes. The volumes attain by means of these tiny overlapping color planes a solidity different from that attained through mere dark-to-light modeling; it is a solidity based on the protruding character of warm color and the receding tendency of cool … [p. 25]" (Steiner, *Exact Resemblance* 145). From a neuraesthetic standpoint (whether it be Zeki's or Ramachandran's neuraesthetic research on color consciousness and the unconscious, artistic articulation of brain concepts), there is no "logical contradiction" between Steiner's theoretical position and my neuraesthetic reading. I am saying Stein used these units of color to create dimensions, structures, nuances and meanings for her neuroanatomical imaginaries, whereas Steiner is arguing that these color units function in the same way as Cézanne's "elementary units," by creating color oppositions and chromatic nuances that operate like the geometric planes, angles and lines in impressionist paintings. Though, in *Exact Resemblance*, Steiner does not say why Stein would put these color elements into her cubist writings, she notes that they serve as architectural elements that constitute some sort of picture, that they correspond to William James's language-based theater of the human mind.

In chapter one, I propose that one of the reasons why the color units and the color signifiers in these cubist portraits seem to be (or are partially) disconnected from other non-colored signifiers and the non-descriptive phrases is because Stein meant for them to signify neurogenesis, or the process of neuron regeneration. In other words, these color units appear to be functioning as newborn neurons within her neuroanatomical imaginaries, as "cellular neophytes" that have not yet been wired completely into the brain's complex, connectivity maps. The precise role that these colored neurons play in her neuroanatomical imaginaries remains uncertain because, in their role as "cellular neophytes," they may represent spontaneous variations and other evolutionary processes that alter the brain's organic, mental structures.

With this theoretical framework in place, I contend that Stein's cubist brain maps consist of brain, mind and consciousness representations that can be traced to three main areas of experimental activity in western science and art that occurred in the late nineteenth century and the early twentieth century: (1) Stein's nineteenth-century psychological experiments and studies at Harvard University with William James, (2) her fin-de-siècle brain stem research at Johns Hopkins Medical School with Franklin Mall and Lewellys Barker, and (3) her twentieth century literary experiments with cubist portraiture that reveal the artistic influences of her friends Pablo Picasso, Paul Cézanne, Francis Picabia, Georges Braque, Henri Matisse, Juan Gris and Jacques Lipchitz upon her conceptual methodologies and modernist aesthetic.[33] In "Color, Consciousness, and the Isomorphism Constraint," Stephen Palmer observes, "color is perhaps the most tractable, best understood aspect of mental life from a scientific standpoint. It demonstrates better than any other topic how a mental phenomenon can be more fully understood by integrating knowledge from many different disciplines (Kay & Daniel, 1978; Thompson, 1995; Palmer, in press). Within the western philosophical tradition dating back to John Locke, Palmer also observes, "relations among consciousness, brain, behavior, and scientific explanation are [best] explored within the domain of color perception" (1; original spelling). Using color words that signal the phenomenal properties of conscious experience as well as the philosophy of color consciousness, Stein contributes to the western philosophical tradition by using her literary experiments as a platform to illustrate the ineffable relations that exist between the creative mind's phenomenal experience, the brain's neurophysiological mechanisms and modern science's empirical methods of exploring the brain-mind-consciousness continuum.

In keeping with Meyer's neuraesthetic reading practices, I hold that Stein's experimental writings and compositional practices indirectly "reflect" western experimental scientific practices of the late nineteenth-century and early twentieth-century, to the extent that Stein's creative writing, "Instead of being modeled on scientific experimentation, … turns out to be a form of experimental science itself. It is not just that her ideas about writing were influenced by science; she configured science as writing and performed scientific experiments in writing" (*Irresistible Dictation* xxi). Finding this method of reading to be a productive way of deciphering encrypted scientific experiments and neurophysiological meanings at the level of a text's cubist puns and figurative language, I believe that Stein's dissociative writings can be read, and, perhaps in many circumstances, ought to be read as allegories for the "properly functioning human nervous system" (*Irresistible Dictation* 111).

With recent advances in brain mapping technologies and neuraesthetic reading practices, those who are interested in learning more about Stein's cubist brain mapping strategies can utilize these methods, as a means of contributing to the western practice of "neuroesthetics." "At first glance," Jonah Lehrer remarks, "the premise of neuroaesthetics seems bizarre: Scientists are using artists to learn about the mind. They're looking for objective facts in the most subjective of places, using paintings and sculptures as sources of experimental data. … But neuroaesthetics is also trying to bring precision to the study of art. Unlike traditional approaches, which treat the artwork as a product of historical and cultural forces, neuroaesthetics looks at art through the lens of neuroscience" ("Unlocking the Mysteries of the Artistic Mind" 74-75). According to the online dictionary *Wikipedia,*

> [Neuroesthetics] is a relatively recent subdiscipline of empirical aesthetics. Empirical aesthetics … take[s] a scientific approach to the study of aesthetic perceptions of art and music. Neuroesthetics uses the techniques of neuroscience in order to explain and understand the esthetic experiences at the neurological level. The field was pioneered and named by Semir Zeki, who runs the Institute of Neuroesthetics at University College London. Zeki suggests that "...the artist is in a sense, a neuroscientist, exploring the potentials and capacities of the brain, though with different tools. How such creations can arouse aesthetic experiences can only be fully understood in neural terms. Such an understanding is now well within our reach." Neuroesthetics investigates the structure and activity of the brain in response to experiences of esthetic phenomena. Steady advances in neuroimaging tools such as functional magnetic resonance imaging (fMRI) and in genetic analysis have contributed to advances in neuroesthetic

> knowledge. For example, one neuroesthetic study showed that humans prefer images of faces when the gaze is directed towards the viewer (Kampe et al, 2001). Since 2005 the notion of bridging brain science and the visual arts has blossomed into a field of increasing international interest. In his 2008 book, Neuroarthistory: from Aristotle and Pliny to Baxandall, Professor John Onians of the University of East Anglia positions himself in the forefront of the field of neural scientific biased art historical research. Contemporary artists like Mark S. Smith (William Campbell Gallery, USA) and others have developed extensive bodies of work mapping the convergence of brain science and painting. Smith's work explores fundamental visual analogies between neural function and self-expression in abstract art.
> (<http://en.wikipedia.org/wiki/Neuroesthetics>.)

Stein's literary brain maps belong to the practice of "neuroesthetics," by virtue of the fact that she uses the following principles to study the relation between brain function and artistic production: "peak shift," "grouping," "balance," "contrast," "isolation," "perceptual problem solving," "symmetry," "repetition, rhythm, orderliness," "generic perspective" and "metaphor" (Lehrer 77). Jonah Lehrer, in "Unlocking the Mysteries of the Artistic Mind," characterizes the abovementioned, "ten perceptual principles of great art" as "your brain on Picasso." These are the principles that neuroscientists and neuroaestheticians, such as Zeki, Ramachandrandran, and Lehrer, use to study the masterpieces of Picasso, Stein, Cézanne, Mondrian, Malevich, Matisse and other modern artists. "The sly connection between the instincts of baby gulls and abstract art is the work of V.S. Ramachandran, neuroscientist and director of the Center for Brain and Cognition at the University of California at San Diego," Lehrer observes. "Ramachandran believes that the peak-shift effect explains a wide variety of art, from abstract expressionist paintings to ancient religious sculptures like a 12th-century Indian sculpture of the goddess Parvathi with exaggerated feminine features. These creatures are all examples of the "deliberate hyperbole" that defines the artistic process, says Ramachandran. In this sense, the job of an artist is to take mundane forms of reality – whether a facial expression or a bowl of fruit – and make those forms irresistible to the human brain. As Ramachandran puts it, "If herring gulls had an art gallery, they would hang a long stick with three red strips on the wall; they would worship it, pay millions of dollars for it, call it a Picasso, but not understand why they are mesmerized by it. That's all any art lover is doing when buying contemporary art: behaving exactly like those gulls chicks" ("Unlocking the Mysteries of the Artistic Mind" 74). At one or more levels of consciousness, artists employ one or more of the perceptual principles when creating works of art that map out the convergence between brain processes and cultural production.

Gertrude Stein utilizes the peak shift perceptual principle in her cubist portraits, when she distorts the features of her portrait subjects with experimental writing strategies, such as literary synaesthesia and the "color thing." For example, she deploys the "peak shift" principle when she caricatures Picasso, Matisse, Juan Gris and other artist friends in her first- and second-phase cubist portraits with non-descriptive literary phrases, the "color thing," and other representational strategies. According to Lehrer's "peak shift" definition, "we find deliberate distortions of a stimulus even more exciting than the stimulus itself – which is why cartoon caricatures grab our attention" (74). To take another example: Stein employs the perceptual principle of "grouping," when she uses color signifiers and color units to create cubist brain maps; Lehrer defines "grouping" as the feeling that arises when the brain finds patterns and forms amidst random signals and other kinds of “noise” (74). When Stein juxtaposes non-colored and colored neuron-words in the neuroanatomical imaginaries from *Tender Buttons* and *The Geographical History of America*, in order to produce innovative, literary neuroimaging and brain mapping strategies, she is consciously manipulating the principle of “contrast,” even though she does not reveal her neuraesthetic aims and her authorial intent. Lehrer defines “contrast” as the pleasure the visual cortex of the brain receives from “gaz[ing] at images rich in contrast, like thick black outlines or sharp angles – or, as in the geometric art of Mondrian, both at once” (77). When Stein portrays neurobiological functions, synaptic connections and neuroanatomical features in structurally realistic ways with the English language in her cubist literature, she is deploying the principle of “isolation.” According to Lehrer, isolation occurs when an artist “reduc[es] reality to its most essential features” (Lehrer 74). [T]hink [of] a Matisse that’s all bright color and sharp silhouettes,” Lehrer suggests, because, in his fauvist and impressionist paintings, Matisse “amplif[ied] the sensory signals we normally have to search for” (74).

Stein’s neuraesthetic, literary compositions reveal the “essence” of the brain’s cellular elements with fauvist and cubist representational strategies by generating multiple meanings, perspectives and images for brain elements and concepts, with their playful uses of the English language. What interests me about Stein’s literary neuraesthetics is that it combines a number of perceptual principles simultaneously. In the second-phase cubist portraits, this causes confusion for readers regarding the nature of Stein’s neuraesthetic compositional practices; whereas, in the third-phase portraits, this author’s interdisciplinary and interartistic methodologies create innovative brain mapping practices that may not be recognizable from a single, disciplinary perspective (such as English studies proper). For example, when Stein combines the perceptual principle of "isolation" with cubist and fauvist writing principles, she produces brain portraits that act simultaneously as performative speech acts and as acquired, brain concepts. By virtue of the fact that her cubist brain portraits display the accumulated effects of combined perceptual principles, these works serve multiple purposes for her readers, which include new ways of understanding how literature represents the visual brain, the linguistic brain and the reading brain. Also, Gertrude Stein demonstrates how "perceptual problem solving" can be conducted with the aid of cubist and fauvist-inspired, discursive representations of neuroanatomical structures, when she uses color language qualia to examine the phenomenal and neurophysiological properties of the brain's colored matter. Lehrer suggests that "perceptual problem solving" occurs every time that "we "solve" abstract paintings such as cubist still lifes or Cézanne landscapes" (77): the brain likes to find solutions to many different kinds of puzzles, perhaps especially the ones that are posed by abstract, colored paintings and cubist writings. "The perceptual principles of "repetition, rhythm, and orderliness" serve as the linguistic, semiotic and poetic foundations for Stein's neuraesthetic compositional practices. As Lehrer explains, "Beauty is inseparable from the appearance of order. Consider the garden paintings of Monet. Pictures filled with patterns, be it subtle color repetitions or formal rhythms, appear more elegant and composed" (77). Coded as color words and as cubist puns, Stein uses color repetition to shape perceptual principles into the cubist brain map from *The Geographical History of America*. By reworking the cubist puns of Picasso and other cubist painters to form neural networks, Stein develops multidimensional, "generic perspectives," which serve unprecedented, brain representation purposes. In defining the generic perceptual principle for his twenty-first century readers, Lehrer points out that this perceptual principle is not generic in the sense that it creates static forms of knowledge about the world and its multifarious objects. To the contrary, he points out, "We prefer things that can be observed from multiple viewpoints, such as still lifes and pastoral landscapes, to the fragmentary perspective of a single person. They contain more information, making it easier for the brain to deduce what is going on" (77). In the cubist brain maps from *Tender Buttons* and *The Geographical History of America*, Stein uses color words and cubist puns, along with other representational strategies and linguistic devices, to generate multiple viewpoints and plural meanings for the brain's cellular elements and its neuronal network architecture. This allows her to portray the central nervous system from multiple viewpoints, while permitting her readers to experience the subjective phenomenology of the human mind as a fragmentary perspective of a single person, as a literary phenomenology that has the capacity to explore the brain in a complex, neuraesthetic fashion, precisely because of its linguistic plasticity and its literary playfulness.

As I explain below, it can be difficult to read Stein's neuroanatomical imaginaries, because they do not offer panoramic views of the human brain, as occurs with abstract paintings of pastoral landscapes and with cubist paintings of human subjects. Rather, these neuroanatomical imaginaries provide us with fragmentary perspectives of passing states of consciousness and their phenomenal qualities, and these perspectives may or may not comprise a "finished" work of art, let alone a completed picture or map of the human brain. In my opinion, Stein uses the perceptual principle of "balance" to represent microscopic and macroscopic views of the brain's neural networks, thereby demonstrating how perceptual principles and aesthetic principles can function together as neural principles at the level of her neuraesthetic compositions.

Last but not least, Stein finds innovative ways of using figurative language in her dissociative writings and neuraesthetic compositions. Through the use of "metaphysical metaphors," for instance, Stein not only represents the central nervous system according to unconscious perceptual principles and conscious neural precepts, but she also explores the "literary genome" (as Lehrer calls the modernist representation of human DNA), through her discursive explorations of the metaphysical relations that exist between "human nature" and the "human mind." As Lehrer points out from a neuraesthetic standpoint, "Metaphor encourages us to see the world in a new way: Two unrelated objects are directly compared, giving birth to a new idea. Picasso did this all the time – he portrayed the bombing of Guernica, for example, with the imagery of a bull, a horse, and a lightbulb" (77; original spelling).

With these principles serving as the invisible framework for my study of Stein's cubist literature, I will be supplementing Zeki's neurobiological definitions of "neuroesthetics" with Meyer's neuraesthetic research. Specifically, I will be focusing on how recent, scientific discoveries in the field of genetic brain mapping and the visualization of the brain's neural circuitry compare with Stein's brain mapping strategies. Transgenic strategies of nervous system coloration, such as the "Brainbow mapping system," can contribute to our understanding of Stein's literary, neuron coloration and brain representation schemes, by illustrating some of the commonalities that exist between different kinds of connectivity mapping.

With the cubist brain portraits from *Tender Buttons*, for example, she signals her conceptual departures from her scientific predecessors, by discretely illustrating new methods of neuron coloring, brain mapping and neurobiological description. In these portraits, Stein's cerebral allegories incorporate and transfigure neuroscientific findings by nineteenth-century brain researchers, such as Cajal, Golgi, Kollicker, Sherrington, Barker, Mall and His, so as to offer complex representations of the central nervous system, which compress disparate scientific, cultural and biological meanings into layers of colored and non-colored signifiers that form a "neurobiological collage," to use Neidich's term, or into an "neurophysiological imaginary," to use Meyer's expression.

When Stein uses the English language to illustrate the brain's synaptic connections and neural circuitry, her neuraesthetic compositions avoid the trap of scientific reductionism, by virtue of their referential and performative, linguistic qualities. Because we are not talking about human beings or living organisms, but literary works that showcase a "creative metaphysics" (to use Wilder's term) and a phenomenology of consciousness, in the service of exploring the brain's creative evolution and subjective phenomenology, we may take Stein's medical knowledge of the human brain and her previous psychological experiments with color consciousness, attention and motor automatism to be a few of the possible *traces* that constitute a text's aesthetic consciousness. In the 1930s, Stein conceives of a text's phenomenal consciousness, or its aesthetic consciousness, as a discursive entity that lacks identity, memory, human nature and psychology. In her lecture, "What Are Master-Pieces and Why Are There So Few Of Them," Stein stresses that the conceptual groupings of identity-memory-human nature and the human mind-entity function as universal features of her literary masterpieces about the human mind. According to Stein, a literary "master-piece's" triangulation of the act(s) of creation, its represented subjects, and its aesthetic means of communication (and/or its theatrical modes of incarnation, embodiment and cultural transmission) implies a shifting relation between "the relation of human nature to the human mind." This is why literary readers and cultural spectators sometimes find it difficult to comprehend the perceptual principles and neuraesthetic compositional practices that inform the conceptual foundations of modern "master-pieces." Stein explicates and recognizes this "difficulty," in the following passage:

> It is very difficult, so difficult that it always has been difficult but even more difficult now to know what is the relation of human nature to the human mind because one has to know what is the relation of the act of creation to the subject the creator uses to create that thing. There is a great deal of nonsense talked about the subject of anything. After all there is always the same subject there are things you see and there are human beings and animal beings and everybody you might say since the beginning of time knows practically commencing at the beginning and going to the end everything about these things. After all any woman in any village or men either if you like or even children know as much of human psychology as any writer that ever lived. After all there are things you do know each one in his or her way knows all of them and it is not his knowledge that makes master-pieces. (85)

For Stein, dramatic and non-dramatic literary texts that have been deemed "masterpieces" by the members of a given society function as non-identificatory, non-mnemonic, non-psychological and non-pathological, discursive symptoms that illustrate non-essential aspects of the creative mind's subjective nature.

In "What is English Literature," Stein explains that what makes her dissociative writing style similar to Chaucer's poetry, Shakespeare's dramas, and other canonical English literatures is its "disembodied way of disconnecting something from anything and anything from something" (53). According to this essay, Stein's dissociative writing style follows an American tradition, whose disembodied and disconnected way of representing a national consciousness and ways of "daily living has nothing to do with psychological or social repression (53). In her words, "Some say it is repression but no it is not repression it is a lack of connection, of there being no connection with living and daily living because there is none, that makes American writing what it always has been and what it will continue to become" (54). Linking her dissociative style to the American and English canonical traditions in this fashion, Stein conceptualizes her modernist aesthetic as a literary phenomenology of consciousness that represents the ways in which a national literature, an ideological discourse and a set of disembodied ideas feels inside of her: "I am not trying to give to myself but to you a feeling of the way English literature feels inside me" (17). For Stein, it is vital that her cubist writings indirectly communicate this "aesthetic feeling," as James calls these secondary forms of phenomenal experience, through a disconnected and disembodied literary prose that links the human mind's creative processes with the brain's "organic mental structure" (James, *Principles of Psychology* II 619). The year that she passed away (1946), Stein held a transatlantic phone interview with Robert Haas, in which she offered the following explanation for her dissociative style and her emergent, cubist aesthetic:

> Something happened. I mean I felt a need. I had thought this thing out and felt a need of breaking it down and forcing it into little pieces. I felt that I had lost contact with the words in building up these Beethovian passages [in the *Making of Americans*]. I began to play with words then. Picasso was painting my portrait at that time and I

> used to talk this thing over endlessly. At this time he had just begun on cubism. And I felt that the thing I got from Cezanne was not the last composition. You had to recognize words had lost their value in the nineteenth century particularly towards the end, they had lost most of their variety and I felt that I could not go on, that I had to capture the value of the individual word, find out what it meant and act within it… All through that middle period the interest was with that largely, ending up with *Tender Buttons*. In this I think there are some of the best uses of words that there are. The movement is simple and holds by little words. I had at the same time a new interest in portraiture. I began then to want to make a more complete picture of each word, and that is when the portrait business started. I wait until each word can intimate some part of each little mannerism. In each of them, I was not satisfied until the whole thing was formed, and it is very difficult to put it down, to explain, in words.
> (*What Are Masterpieces* 100-101)

Stein's literary portraits from *Tender Buttons* enabled her to branch off into the art of neuroanatomical portraiture proper, because the words in these portraits operated like theatrical entities and multidimensional qualitative characters, even though she admitted, in her critical writings from the 1930s, that her attempts to represent "natural phenomena" through non-mimetic, cubist representational strategies failed to achieve the results she desired. If my hunch is correct, then it was probably when she was writing the cubist portraits from *Tender Buttons* that she experienced a series of epiphanies regarding the neuraesthetic qualities of her dissociative writing style, perhaps recognizing for the first time that each metaphorical neuron-word creates microscopic pictures of the brain's neural architecture. By the same token, each color signifier representing a colored neuron from a particular neuronal grouping or neural network helped her to visualize the brain's synaptic connections and its complex neural circuitry, precisely because of its performative, theatrical, and multivalent, linguistic meanings.

Stein also assimilated James's hypotheses about the relation that exists between the brain's molecular processes and consciousness's secondary qualities into her neuraesthetic writing practices. She seems to have accepted James's proposition that "Metaphysics should take heart from the example of physics, simply confessing that hers is the longer task. Nature *may* be remodeled, nay, certainly will be remodeled, far beyond the point at present reached. Just how far? -- is a question which only the whole history of Science and Philosophy can answer.* Psychology, we cannot even cross the threshold of that larger problem" (II 671; original emphasis).[34] In chapter twenty-eight of *The Principles, Volume Two,* James describes the difficult task of explaining the connections between the brain's neurophysiological mechanisms and consciousness's subjectively experienced, phenomenal qualities as a "god effect" in nineteenth-century experimental psychology, as an endeavour that invoked religious ideology as a fallback position, because, as an emergent science of the mind, psychology did not possess the knowledge and the technological abilities to produce verifiable, scientific results (671). Based on Darwin's evolutionary hypotheses about natural selection, James was able to imagine a time when scientists would be able to study the relationship between the brain's molecular mechanisms and consciousness's secondary qualities, while accounting for the evolutionary processes that shaped the brain's neurodevelopmental processes and its "organic mental structure" (619).

As James's student, Stein had no difficulty believing that her literary masterpieces could serve as modernist archives of phenomenal consciousness, as hieroglyphic records of the brain's "spontaneous variations," and as literary brain maps. James did not believe that flashes of insight, which were inscribed in poetic works and philosophical treatises, ought to be verified by scientific and empirical methods of analysis, as neuraesthetic researchers now do with brain imaging technologies and experimental brain mapping devices. As he puts it, "whereas the poetry and wit (like the science of the ancients) are their 'own excuse for being,' and have to run the gauntlet of no farther test, the 'scientific' conceptions must prove their worth by being 'verified.' This test, however, is the cause of their preservation, not that of their production; and one might as well account for the origin of Artemus Ward's jokes by the 'cohesion' of subjects with predicates in proportion to the 'persistence of the outer relations' to which they 'correspond' as to treat the genesis of scientific conceptions in the same ponderously unreal way" (636). By focusing on how Stein produces cubist brain maps that feature James's radical empirical psychological principles and her past medical knowledge, I am treating the "genesis of scientific conceptions" from a twenty-first century neuraesthetic perspective, which holds that it is possible to understand what transforms a series of dots, or a mass of brushstrokes, or a disconnected set of words and phrases, into literary and artistic masterpieces. As Lehrer suggests, "It's possible, after all, that art has no universal definition: Perhaps each work of art activates the brain in its own peculiar way. Perhaps there is no lowest common denominator of aesthetic experience that can be detected in an *f*MRI machine. The poet John Keats worried that Newton's investigations into color had "unwoven the rainbow," that scientist had destroyed the beauty of light by investigating it. But beauty is not so fragile. Neuraesthetics doesn't diminish the impact of art or puncture the power of the imagination. Instead, it leaves us with an even more profound appreciation for the intuitive wisdom of great artists" ("Unlocking the Mysteries of the Artistic

Mind" 77). In "What Are Master-Pieces" and other academic lectures from the 1930s, Stein upholds James's radical empiricist viewpoint about the scientific preservation of the brain's spontaneous variations and its creative processes, when she argues that a masterpiece is an end in itself; it is an unnecessary artefact that "exists in and for itself" (311). Opposed to action, human nature and the necessities of existence, "a master-piece has essentially not to be necessary," Stein claims, "it has to be that is it has to exist but it does not have to be necessary it is not in response to necessity as action is because the minute it is necessary it has in it no possibility of going on" (311).

If we examine Stein's neuraesthetic compositions closely, we find that many of them illustrate neurobiological impossibilities, such as multicolored neuronal formations, and they portray what was impossible to achieve in the laboratories of early twentieth-century medical schools and research clinics: namely, a variegated, three-dimensional, multicolored, "neuronal network architecture" that resembles the Brainbow-mapped, nervous systems that Harvard scientists Lichtman and Sanes produced with "transgenic strategies," neurobiological research and fluorescent microscopy, in 2007 (Livet et alia, "Transgenic Strategies" 56). These Harvard scientists and their co-researchers were able to generate as many as 90 distinguishable colors in the nervous systems of genetically modified animals, with the "Brainbow system" that consists of *Brainbow-1* and *Brainbow-2* genetic constructs (Livet et alia, "Transgenic Strategies" 56).

With the "Objects" from *Tender Buttons*, Stein seems to be experimenting, for the first time, with the creative act of color-staining the individual word-neurons of her neuroanatomical portraits with different colors. Having conducted brain research at the Johns Hopkins Medical School from 1897 to 1901, Stein knew that neuroscientists had not yet developed the nerve tissue staining techniques that would allow them to stain individual neurons with distinguishable colors. Ironically, the empirical reality tests for Stein's color-based, neuroimaging strategies and neuroanatomical portraiture techniques come from the anachronistic, Brainbow photographic images and connectivity maps. In the *Nature* article, "Transgenic strategies for combinatorial expression of fluorescent proteins in the nervous system," Livet et alia show how the brain's "neural network architecture" appears when its neurons, axons and glial cells are genetically labelled with as many as ninety different colors. They explain that they have designed not one but two "genetic strategies, called "Brainbow," for [the] stochastic expression of multiple fluorescent proteins from a single transgene. *Brainbow-1* uses Cre-mediated excision between pairs of incompatible *lox* sites, alternated to create mutually exclusive recombination events. [Whereas,] in *Brainbow-2*, Cre inverts DNA segments delimited by loxP sites in opposite orientation, positioned in tandem to generate several recombination outcomes. The differential expression of multiple copies of these constructs generates XFP mixtures, allowing the labelling of individual neurons and glia with as many as 90 distinguishable colours" ("Transgenic Strategies" 56). In the late nineteenth-century when Stein was studying the human brain at Johns Hopkins Medical School, scientists could not distinguish between neurons, axons and glial cells with multiple color stains. With the cubist brain portrait that she created in "Detective Story number VII," however, Stein reconceptualizes the brain's neural architecture, by labelling its neurons and its neural networks with distinguishable colors, in much the same way that Lichtman and Sanes deploy the Brainbow system *to paint* the nervous systems of their transgenic mice. *The Geographical History of America* thus playfully showcases James's phenomenology of consciousness and Stein's neuroscientific knowledge, when the omniscient narrator calls attention to the human mind's subjectively experienced, neuroanatomical landscape. In Detective Story number VII, Stein's dissociative rhetoric examines the phenomenological properties, the literary qualities, and the neurophysiological values that comprise the human mind's neuroanatomical landscape.

Although Stein's practice of conscious, neuroanatomical portraiture seems to have originated with the cubist portraits from *Tender Buttons*, Detective Story number VII proves itself to be the most versatile, pluralistic, and mimetic form of synthetic phase, neuroanatomical portraiture in her literary corpus. By developing cubist styles of brain representation that feature James's psychological principles at the level of color, while encrypting esoteric forms of medical knowledge and neurobiological possibility at the level of syntax, language and grammar, Stein contributes to western society's practice of literary neuraesthetics. Focusing his efforts on the "neurology of [visual] art," Zeki argues in *Inner Vision*, "It is almost impossible to say anything beyond the most general about the relationship between brain physiology and the perception of some of the most complex, narrative and representational works, which is why I say less about them" (2). With her cubist literature, Stein challenges Zeki's assessment of the "neurology of [literary] art" from *Inner Vision*, by proving that it is possible to explore neuroanatomy and consciousness with language, especially with her color language qualia.

The Geographical History of America's cubist brain portrait proves that at least one of Stein's neuraesthetic compositions consciously serves as an exercise in perceptual problem solving and color-coded brain mapping. In this sense, Stein's third-phase cubist portraiture opposes Zeki's claim about the neuraesthetic satisfaction of unconscious brain concepts, which is a version of the claim that artists "are in some sense neurologists, studying the brain with techniques that are unique to them, but studying unknowingly the brain and its organisation nevertheless" (*Inner Vision* 10). A decade later, in *Splendors and Miseries of the Brain* (2009), Zeki returned to some of the arguments that he posed, in *Inner Vision*, about the neurobiology of modern art, with the aim of explaining some of the connections that exist between brain function and art function, using a selection of literary and artistic works from the western canon. In *Splendors*, Zeki illustrates his scientific hypotheses about the brain's futile search for perfection, with examples from French modern literature. For example, in chapter fourteen of this book, "Unfinished Art in Literature," Zeki points out that color was used by Cézanne as well as by Balzac's protagonist, Frenhofer, from *The Unknown Masterpiece*, to render form and to satisfy synthetic brain concepts or ideals that are "capable of forever evolving" (112). In the preceding chapter, "Paul Cézanne and the Unfinished," Zeki writes,

> In surveying his work, one cannot help but notice an evolution toward the unfinished, towards objectively empty patches of canvas that somehow do not give the impression of emptiness. … In addition, the objects that he painted have themselves a certain unfinished quality, and again become absorbed by the viewer to such an extent that they look finished. The series of drawings of the mountain outside Aix-en-Provence known as *Montagne Sainte Victoire* … begin with naturalistic renderings and become increasingly more abstract, with the fields, houses, and trees merely hinted at by brilliant brush-strokes of different color. Often the entire canvas consists of nothing more than a series of patches, rectangular in shape, some finished, others not, the whole assembled together in such a way as to give the perceiver much flexibility. Cézanne was a

> meticulous painter, deliberating at length over each detail. He also felt unsatisfied with much, perhaps all, of his work and destroyed many of his canvases. It is perhaps because of this that he was commonly considered to be irresolute and simply incapable of finishing his work. Yet a closer look at Cézanne's work shows that nothing was left unfinished in haste, and nothing was left to chance. Though knowing nothing about the visual brain[,] … [Cézanne] was nevertheless remarkably insightful into its workings, and had also been influenced by literary works that have been a central theme to this book – the difficulty of representing the synthetic brain concept or ideal, and the advantages of leaving much to the mind. It is not surprising therefore that a large body of his work has, on an objective analysis, an unfinished aspect. This engages the viewer imaginatively and gives him different possibilities, although the viewer may not be aware of it. (*Splendors and Miseries of the Brain* 111-112)

As Zeki notes, Cézanne's water colors draw the perceiver's attention to the unfinished qualities of the painted work and, in doing so, they link the perceiver's visual brain with the artist's neuraesthetic, compositional practices by unconsciously and/or subconsciously drawing the perceiver's focus to synthetic brain concepts that inhere within the art form, concepts that also unfold in the perceiver's imagination, as a result of the 'play' that occurs between the canvas's empty spaces and its colored signs. Describing his compositional process as one that strives for unity, Cézanne observes, "Only from their sum, their relation and their interaction, do the objects they define themselves reveal themselves to the viewer" (Zeki 117). Based on this statement, Zeki argues, "The precise formal content is not specified. Moreover, by leaving so much of it apparently unfinished, he leaves open the possibility that the paintings themselves could have been developed in a number of ways, both for the painter and the viewer. How it is integrated and developed depends on the viewer, or rather on the brain of the viewer, and may change from one viewing to the other" (117-118). Following Zeki's observations about Cézanne's unfinished masterpieces, I find striking parallels between Cézanne's painting techniques and Stein's neuraesthetic writing practices. Like Cézanne, Stein used the imperfect, incomplete and ambiguous qualities of her abstract, modernist art to represent the complexity of the visual brain in the simplest of domestic objects and personality patterns.

Lacking the benefits of Zeki's neurobiological research and today's neuraesthetic methodologies, most early 20th-century literary critics were unable able to see a mirror image of their neuraesthetic incomprehension, in Balzac's *The Unknown Masterpiece*. Reading Balzac's novel from a neuraesthetic perspective, Zeki remarks, "Poussin and Porbus are astonished when they view the painting that Frenhofer had been toiling at secretly for ten years. They see nothing but "a mass of confused colors contained within a multitude of bizarre lines which formed a wall of painting." The whole canvas is vastly overworked, save for a divinely painted foot, a mere fragment. They remain "petrified in admiration before this fragment that had escaped an unbelievable, slow and progressive destruction." The next day, Frenhofer is found dead and his painting destroyed, perhaps having realized, like von Aschenbach, that beauty – the concept in the brain – cannot be easily experienced. Sometimes it may even be impossible to experience it in a work of art" (*Splendors and Miseries of the Brain* 122). Stein's cubist portraits have evoked responses from twentieth-century critics that are comparable to the responses that Balzac attributes to Poussin and Porbus, in that these portraits are often seen as being highly repetitive and fragmentary. Consider the following description of Stein's dissociative writings by Meyer, who interprets the "vibrating lines and portmanteau sentences" of these writings as neural networks and "reentrant connections":

> Seventy-five years earlier Stein too sought to generate "intellectual recreations" that were not just representations of her subjects but "highly connected, layered local structures with massively reentrant connections," composed, in her case of words and their interactions ([Edelman] BABF, p. 117). When Edelman asks, "Is it possible to construct a conscious artifact?" and answers in the affirmative, one may perhaps be excused for wondering whether Stein beat him to the punch, providing an alternative manner of visualizing the brain's reentrant signaling with the vibrating lines and portmanteau sentences of her equally "impossible" project (p. 188)." The crucial thing to recognize in this context is that visualization is not limited to the objectifications of *sight* but includes necessarily proprioceptive and neuraesthetic aspects as well. (*Irresistible Dictation* 325)

In Meyer's opinion, Stein translated "brain concepts" into "portmanteau sentences" and "vibrating lines," with the assistance of James's psychophysiological, brain research and his neuraesthetic vision.[35]

James's psychological principles and brain research inform Stein's experimental brain mapping practices in ways that can seem invisible or incomprehensible to non-specialist readers. Yet, as Meyer points out, it is possible to historicize Stein's neuraesthetic writing practices. By demonstrating how her cubist literature assimilates James's research into its modernist aesthetic and its conceptual purview, my aim is elucidate the unconscious, brain concepts and the conscious, phenomenal experiences that correspond with James's conception of the brain's "organic mental structure" (*Principles of Psychology II* 619). Consider the following third-person statement from *The Autobiography of Alice B. Toklas*: “William James delighted her. His personality and his teaching and his way of amusing himself with himself and his students all pleased her. Keep your mind open, he used to say, and when some one objected, but Professor James, this I say is true. Yes, said James, it is abjectly true” (87). In this autobiography, she also remarks, “The important person in Gertrude Stein’s Radcliffe life was William James … the really lasting impression of her Radcliffe life came through William James” (87). Not only does Stein call attention to her close association with James and with his psychological research, but she also she recalls, for the benefit of her readers, that he was the one who encouraged her to attend medical school. Alice B. Toklas recounts the exchange between James and Stein, as it were happening partly in the present tense and partly in the past tense: “for psychology you must have a medical education, a medical education opens all doors, as Oliver Wendell Holmes told me and as I tell you. Gertrude Stein had been interested in both biology and chemistry so medical school presented no difficulties. There were no difficulties except that Gertrude Stein had never passed more than half of her entrance examinations for Radcliffe, never having intended to take a degree. However with considerable struggle and enough tutoring that was accomplished and Gertrude Stein entered Johns Hopkins Medical School” (88). In a transatlantic telephone interview that Stein held with Robert Haas during the final year of her life, Stein credited James for instilling an open-minded approach in his psychology students and for expanding her mind, by encouraging her to simplify her conceptual schemes, while opening herself up to the world of ideas. He also advanced her thinking, by allowing her to design experiments in his Harvard psychology laboratory, under the supervision of her colleagues and doctoral students, on research subjects that included color saturation, attention and automatism. With these laboratory experiences and psychological studies, Stein was better equipped than most to understand the coextensive operations of phenomenal consciousness, the visual brain and the brain stem. Finding James's instructions about designing psychological experiments to be valuable to her experimental writing practices, Stein tells Haas:

> I like a thing simple but it must be simple through complication. Everything must come into your scheme, otherwise you cannot achieve real simplicity. A great deal of this I owe to a great teacher William James. He said, "Never reject anything. Nothing has been proved. If you reject anything, that is the beginning of the end as an intellectual." He was my big influence when I was at college. He was a man who always said "complicate your life as much as you please, it has got to simplify. (*What Are Masterpieces* 104)

Like James, Stein was interested in exploring the relationship that exists between the brain's neurophysiological mechanisms and the mind's secondary phenomenal experiences. As a sign of this interest, *The Geographical History of America or the Relation of Human Nature to the Human Mind* features a cubist-style literary portrait of the human mind's neuroanatomical landscape that permits readers to study the neural correlates of phenomenal experience from a literary standpoint.

Using James's psychogenetic methods of qualia discrimination, discourse analysis and evolutionary science, this book predicts neuroscientific discoveries, inventions and methodologies of the twenty-first century, such as Lichtman and Sanes's transgenic strategies of nervous system coloration. I believe that Stein's dissociative, modernist style functions as aesthetic form of radical empiricism, and I am not alone in this belief, for other literary scholars, such as Meyer, Ryan, Steiner, Brockman, Stewart, Bloom and Ford, have advanced similar arguments about Stein's radical empiricist, literary experiments with phenomenal consciousness. Taken one step further, I hold that one of the aims of Stein's "dissociative rhetoric" is to stage the creative mind and its phenomenal states of consciousness in ways that can reveal the brain's evolutionary processes at the level of the brain's neurophysiological mechanisms and its creative insights.[36] In other words, I plan to use James's hypotheses about the mind's creative evolution and its qualitative discriminations of conscious experience in my neuraesthetic readings of Stein's literary masterpieces. In other words, I propose that these masterpieces contain important clues about the evolution of phenomenal consciousness and its qualitative, literary characters from the interdisciplinary perspectives that are engendered by Stein's neuraesthetic practices.

By developing neuraesthetic practices that adapted themselves to a range of interdisciplinary aims, Stein was able to present highly speculative and clinically unproven, neuroscientific insights to her readers in a playful, non-threatening and unexposed manner. With her synthetic style of cubist literature, she developed a performative, speculative, creative and introspective model of neuraesthetic inquiry that was unprecedented in American literature. In my opinion, Eric Kandel's comments about the kind of revolutionary, scientific theories that would be needed for us to be able to correlate neural activities with subjective experiences accurately reflect Stein's partially realized, neuraesthetic aims:

> We do not know how the firing of specific neurons leads to conscious perception even in the … [simplest] case. In fact, according to Searle, we completely lack an adequate theoretical model of how an *objective* phenomenon – electrical signals in a person's brain – can cause a *subjective* experience such as pain. Because consciousness is

irreducibly subjective, it lies beyond the reach of science as we currently practice it. Since science, as we currently practice it, is essentially a reductionist approach to events, it cannot, according to Nagel, address consciousness without a significant change in method, one that would allow the demonstration and analysis of the *elements* of subjective experience. These elements are likely to be basic components of brain function much as atoms and molecules are basic components of matter. According to Nagel, object-to-object relations are not problematic because we understand, at least in principle, how the properties of a given type of matter arise from the molecules of which it is made. What we lack in a science of consciousness are rules for extrapolating subjective properties (consciousness) from the properties of objects (interconnected nerve cells). Nagel argues that our complete lack of insight into the elements of subjective experience should not prevent us from discovering rules that relate conscious phenomena with cellular processes in the brain. In fact, it is only through the accumulation of cell-biological information that we will have the data necessary to think intelligently about a more fundamental type of reduction, from the physical to the subjective. It is only after we have developed a theory that supports this more fundamental reduction that we will be able to tackle the problem of relating specific neural activity to specific subjective experiences. To arrive at that theory, we will have to discover the elementary components of subjective consciousness. This discovery, Nagel argues, will be of enormous magnitude and implication and one that may require a revolution in biology and most likely a complete transformation of scientific thought. (“From Nerve Cells to Cognition: The Internal Cellular Representation Required For Perception and

Action" 397-398; original emphasis)

In chapter one, I introduce some of the key concepts belonging to James's 'psychogenetic' theory of mind evolution, qualia discrimination and brain development that Stein incorporated into her creative representations of the human mind and the human brain. This conceptual framework hopefully will provide my readers with a sense of the "elementary components of subjective consciousness, for Kandel underscores that these components must be grasped, before a theory can be devised that "relate[s] conscious phenomena with cellular processes in the brain."[37] In this project, I have focused on James's influence upon Stein's conception of the symptomatic, discursive subjectivity that results from her artistic translation of the mind's subjective experiences of its inner states of consciousness and their external realities. Psychogenesis was one of the scientific discourses that Stein manipulated, so as to probe the cellular processes of the brain's visual pathways and the phenomenal qualities of the higher-order thought processes associated with color vision, spatial orientation, ego mapping, tactile sensation and proper sexual functioning. By deploying "metaphysical metaphors" that expressed the relation between human nature and the human mind in multifarious ways within a given work, Stein interrogates the neural principles of conscious experience through the perceptual principles of metaphor. As I demonstrate in chapter three, Stein's metaphysical tropes do not work in isolation from other perceptual principles. For instance, in the cubist brain portrait from *The Geographical History of America*, a metaphysical metaphor highlights the perceptual principles known as peak shift, grouping, metaphor, repetition, rhythm, orderliness, generic perspective, isolation, symmetry and contrast, through its comparison of human nature and the human mind. Stein's neuraesthetic, literary compositions thus function paradoxically as "necessary truths," because of their deliberate and accidental distortions. To cite Picasso, "Art is the lie that reveals the truth" (as cited in Lehrer, "Unlocking the Mysteries of the Artistic Mind" 77). Through the distorting lenses of these perceptual principles, Stein translated Picasso's cubist representational strategies into neuraesthetic writing practices that literally reinvented the western practice of brain mapping, consciousness representation and mind reading.

Stein's avid interest in evolutionary science and its speculative solutions led her to investigate the genetics of language, mental evolution and human creativity in *The Geographical History of America or the Relation of Human Nature to the Human Mind.* Researched during Stein's lecture tour of the United States in 1934 and 1935 and published in 1936, this book employs a humorous literary approach to explore the human mind's "creative evolution" (to use Henri Bergson's term). Stein's friend, Thornton Wilder, defines Stein's humorous style of quasi-philosophical, literary prophecy as a "creative metaphysics" that is comparable to the prophecies of Plato, Blake and Keats. For the past seventy years or so, critics have neglected this aspect of Stein's aesthetic. With a renewed focus on peak shift perceptual principles in their respective, research project, Semir Zeki and V.S. Ramachandran show us that brain abstractions (or brain concepts) can take the form of cubist puns and modernist parodies. As Lehrer points out, "Studies show that we're able to recognise visual parodies of people – like a cartoon portrait of Richard Nixon – faster than an actual photograph. The fusiform gyrus, an area of the brain involved in facial recognition, responds more eagerly to caricatures than to real faces, since the cartoons emphasize the very features that we use to distinguish one face from another. In other words, the abstractions are like a peak-shift effect, turning the work of art or the political cartoon into a "super-stimulus" ("Unlocking the Mysteries of the Artistic Mind" 74). For these reasons, I believe that it is crucial to take Stein's humour into account when evaluating her contributions to literary modernism and to western science, particularly when these contributions and their emergent forms of qualia-knowledge overlap in her neuraesthetic compositions.

With the cubist portraits that were created between 1914 and 1926, Stein sought to understand how the discriminative properties and relational qualities of phenomenal color experience could be used for imaginary brain surgeries, experimental laboratory procedures and neuroscientific thought experiments. The "color thing" may have appeared to Stein's conscious mind, to her passing states of consciousness, as linguistically encrypted color spaces and as linguistically colored neural networks, which she then translated with linguistic symbols into the color-coded brain maps that we find in *Tender Buttons* and other second-phase cubist writings. However, in second-phase portraits like "Lipschitz," "If I Told Him: A Completed Portrait of Picasso," and "A Second Portrait of Carl Van Vechten," the "color thing" may have assumed other purposes and meanings for Stein; perhaps it even corresponded, in her creative imagination, with the brain's "*N*-dimensional neural space" and the mind's "*N*-dimensional qualia space" (Edelman and Tononi, *A Universe of Consciousness* 164).

At first, Stein's neuraesthetic compositions may seem to be "irreducibly subjective." However, these compositions consist of literal and figurative dimensions of contradictory, disconnected and complementary meanings, which serve as comparative structures and as comparative anatomies that permit us to derive neuraesthetic principles from the subjective experiences that correlate with the brain's abstractly represented, cellular elements and neurobiological processes. To re-emphasize Kandel's point, "What we lack in a science of consciousness are rules for extrapolating subjective properties (consciousness) from the properties of objects (interconnected nerve cells). Nagel argues that our lack of insight into the elements of subjective experience should not prevent us from discovering rules that relate conscious phenomena with cellular processes in the brain." The discipline of empirical aesthetics, or neuraesthetics as it is alternatively called, contributes to the scientific study of brain physiology and phenomenal consciousness by illuminating the language instinct and its creative forces.

With her neuraesthetic compositions, Stein honours the teachings of her favourite university professors and quarrels with the pathological mindset of nineteenth-century brain science. By opposing the "anatomo-politics," "bio-politics" and "memoro-politics" of nineteenth-century western science, Stein rewrites the mind's passing states of consciousness as a literary "qualia-politics," or as a politics of consciousness, to use Foucault's philosophical coinage. In the cubist portraits from *Tender Buttons* and *The Geographical History of America*, this qualia-politics expresses itself as a mode of neuraesthetic inquiry that is indistinguishable from the brain's neuroanatomical features and its brainbow-like "qualialects."

One thing I have learned in a long life: that all
our science, measured against reality, is primitive
and childlike—and yet it is the most precious thing
we have. Albert Einstein

[A] science of language must recover the *natural*—
that is, the simple and original – relationships between
speech and writing, that is, between an inside and an
outside. It must restore its absolute youth, and the purity
of its origin, short of a history and fall which would have
perverted the relationships between outside and inside.
Jacques Derrida

Individuality is founded in feeling; and the recesses of
only places in the world in which we catch real fact in
the making, and directly perceive how events happen,
and how work is actually done. Compared with this
world of living individualized feelings, the world of
generalized objects which the intellect contemplates
is without solidity or life. William James [38]

Gertrude Stein's Colored Brain Maps

1.1 Gertrude Stein's Literary Neuroesthetics

The American author, Gertrude Stein (1874-1946), is famous for her association with the visual arts and for her friendships with modern artists. After abandoning her medical studies at Johns Hopkins University in 1902, Stein moved to Paris in 1903 and befriended painters, such as Pablo Picasso, Henri Matisse, Georges Braque, Francis Picabia, Juan Gris, Felix Volloton and Salvador Dalí. Stein's literary neuraesthetics encompasses this rich aesthetic, scientific and cultural background, which includes the performance arts, sculptural design and the cinema. There are many reasons why little critical attention has been given to Stein's neuraesthetic writing practices in the past century or so. For example, the scientific technologies and the interdisciplinary knowledge did not exist that would have made it possible for her literary readers to decipher her cubist brain maps. But also, as neuraesthetic researchers Semir Zeki, V.S. Ramachandran, Jonah Lehrer, John Onians, Norman Bryson and Warren Neidich point out, the "neurology of art" derives from unconscious, brain activities that artists express through different kinds of media, without fully knowing or understanding the brain concepts that motivate them to produce abstract, perceptual representations. In the case of Stein and other literary artists, such as H.D., Henry James, George Eliot, Walt Whitman, Ralph Emerson, Djuna Barnes and Virginia Woolf, the practice of neuraesthetics occurs just as frequently through the conscious mind, which seeks to articulate complex brain concepts, perceptual principles and neural principles through a wide range of writing practices, styles, genres and forms.[39] Even though Stein viewed writing as painting, and painting as way of visualizing and articulating the brain's neural architecture when she composed cubist portraits about the human mind, she did not confuse linguistic realities with phenomenal experiences. Through her narrator in *The Geographical History of America*, she stresses, "Any word can say something but really that has nothing to do with the human mind" (*GH* 55; 1936). With this statement, Stein separates meaning production and the human mind in a fundamental way: we could say that her metaphysical inquiries about the colors that comprise the human mind's neuroanatomical landscape serve as ways for her to examine the ineffable relation that exists between the brain's organic matter and consciousness's phenomenal experiences. I argue that she examines this relation from a set of radical empiricist, psychological perspectives that explore how the creative, human mind evolves alongside, and in relation to, the interdisciplinary practice of neuraesthetics.

By probing the "generic perspective" perceptual principles that Stein employs in her cubist writings, my aim is to show how Stein's literary neuraesthetics emerges from these discursive inquiries into the relations that exist between human nature and the human mind, and how it defines itself as a configuration of this abstract, conceptual relation. If you recall, Stein considers the relationship between human nature and the human mind to be a function of "relation of the act of creation to the subject the creator uses to create that thing" ("What Are Master-Pieces" 85). I propose that we view the triangulated relationship between the act of creation, a text's represented subjects, and the aesthetic means of transmission, as Stein's modernist expression of neuroaesthetic, perceptual principles.

Through these triangulated relations, Stein provides us with new ways of visualizing and conceptualizing the brain's colored matter. From this neuraesthetic standpoint, I consider the brain portrait from *The Geographical History of America* to be a useful conceptual tool, because it allegorizes what I consider to be two of the most abstract things about Stein's dissociative style of consciousness representation and brain mapping. Namely, it treats the mysterious relation that exists between the brain's molecular processes and consciousness's secondary qualities, and the ineffable relation that exists between the brain's neural structures and consciousness's phenomenal experiences, as coextensive domains of literary inquiry that reconfigure the brain's metaphysical realities. This portrait achieves this difficult task by interrogating the relationship that exists between human nature and the human mind, at the level of the brain's colored organic matter. The relationship that exists between human nature and the human mind also happens to be the theme of *The Geographical History of America*. My goal, in chapter three especially, is to show how Stein manipulates the relationship between mind and nature through the "relation of the act of creation to the subject the creator uses to create that thing," in order to provide her readers with new ways of visualizing the brain's colored matter and its neural architecture ("What Are Master-pieces" 85).

The neuraesthetic compositions that I will be examining in this chapter, from the perspectives of James's radical empiricist psychological research and Stein's brain stem research, are *Tender Buttons* and *The Geographical History of America*. For the most part, I focus on how "A Seltzer Bottle," "A Long Dress," "A Red Hat," and "A Blue Coat" from *Tender Buttons* produce qualia-knowledge, brain-based images, and scientific meanings from language-based, neuraesthetic principles. Serving as the conceptual foundation for this dissertation, this chapter explores some of the links that exist between Stein's late nineteenth-century psychological studies at Harvard University, her fin-de-siècle brain research at the Johns Hopkins Medical School, and her early twentieth-century cubist writings. Meyer has explored some of these connections in his book, *Irresistible Dictation*, but it is important to continue this research, because it appears that Stein produced a secret series of cubist brain maps from approximately 1912 to 1935, beginning with *Tender Buttons*. After twenty-three years of producing non-explicit, neuraesthetic compositions and brain portraits, she published her first explicit, brain portrait in Part II of *The Geographical History of America or the Relation of Human Nature to the Human Mind*, in the form of Detective Story number VII. One of the key differences between Stein's literary brain maps and the brain maps of her scientific predecessors is that she deploys Picasso's cubist portraiture techniques and the artistic representational strategies of other contemporary artists, as a means of representing the human central nervous system. Like Picasso, she uses color signifiers in her cubist writings to portray the creative mind's perceptions, sensations and experiences. In synthetic-style cubist portraits, like Detective Story number VII, Stein configures the English language into neural networks and cellular formations, so as to generate neuron coloration strategies and brain imaging strategies that resemble the visual effects of twenty-first century brain maps, such as the Brainbow connectivity maps. Jeff Lichtman and Joshua Sanes genetically engineered transgenic animals and these connectivity maps in his Harvard laboratory, as a means of producing rainbow-colored nervous systems.

My project examines how Stein uses color words and other simple devices from the English language to portray the brain's cellular structures, neural networks and neuroanatomical features in late works from the 1930s, such as *The Geographical History of America*. Detective Story number VII, from this book, showcases a number of neuraesthetic, perceptual principles through Stein's deft manipulation of cubist representational strategies and other literary devices, such as grammatical parataxis, rhetorical tropes and poetic form. Through these perceptual principles and literary methods, this detective story explores macroanatomical and microanatomical views of the brain's colored matter, from the standpoint of unusual, phenomenal experiences and esoteric forms of scientific knowledge. In these precise ways, Stein's cubist writings function within western culture as neuraesthetic modes of masterpiece creation, brain representation, and consciousness translation. Zeki's recent "Statement on Neuroesthetics" provides a strong, conceptual framework for understanding Stein's experimental, brain mapping strategies:

> [T]he feelings aroused by his Pietã are no doubt experienced in different ways, and in varying intensity, by different brains but the inestimable value of variable subjective experiences should not distract from the fact that, in executing his work, Michelangelo instinctively understood the common visual and emotional organization and workings of the brain. That understanding allowed him to exploit our common visual organization and arouse shared experiences beyond [t]he reach of words. It is for this reason that the artist is[,] in a sense, a neuroscientist, exploring the potentials and capacities of the brain, though with different tools. How such creations can arouse aesthetic experiences can only be fully understood in neural terms. Such an understanding is now within our reach. The first step is to understand better the common organization of our visual and emotional brains, before we can even proceed to enquire into the determinants of neural variability. But there is little reason to doubt that a study of variability, of how a common visual activation can arouse disparate emotional states, will constitute the next giant step in experimental studies of the visual brain. In such a study, neuroscientists would do well to exploit what artists who have explored the potentials and capacities of the visual brain with their own methods, have to tell us in their own works. Because all art obeys the laws of the visual brain, it is not uncommon for art to reveal these laws to us, often surprising us with the visually unexpected. Paul Klee was right when he said, "Art does not represent the visual world, it makes things visible." We hope that [given] the enormous international enthusiasm that a study of neural

> basis of aesthetic experience will prove an effective catalyst in encouraging the neural study of other human activities that may seem remote from the general discipline of neurobiology. It is only by understanding the neural laws that dictate human activity in all spheres – in law, morality, religion and even economics and politics, no less than in art – that we can ever hope to achieve a more proper understanding of the nature of man.
> (<http://neuroesthetics.org/statement-on.neuroesthetics.php>)

Expanding upon Zeki's neuraesthetic principles, I examine how Stein manipulated the elements of her conscious experiences, in order to produce cubist maps of the human brain. With Zeki's observations about the neural laws that shape human activity in the sphere of artistic production, I also explore how Stein reconfigures medical, neuroscientific and psychological studies from the late nineteenth-century, in order to caricature the nervous system coloration techniques of her medical professors and scientific peers. By exposing the neural principles of conscious thought and illustrating the brain's visual, emotional and sensory operations with the English language, Stein was able to transform herself into a budding neuroscientist once again, though she would perform this role, the second time around, as a modernist writer, playwright and librettist, who was "explor[ing] the potentials and capacities of the brain" with the surgical tools provided by figurative language, consciousness and art, a set of radically different tools than the ones she used to examine the human brain in medical school. Through her literary brain maps, Stein incarnated Zeki's neuraesthetic vision of the artist turned neuroscientist. To a certain extent, she achieves this by "exploit[ing] our common visual organization" through the cubist portraiture strategies that she featured in her experimental writings. She actualizes Zeki's neuraesthetic vision and substantiates his neurobiological findings, by creating experimental writings that translate scientific experiences into "neural interface[s]" (to use Bryson's phrase) and neurobiological collage[s]" (to use Neidich's apt term). For example, in *The Geographical History of America*, Stein showcases James's psychogenetic hypotheses about inherited and acquired, brain processes by creating a brain-like "human mind" that subjectively experiences its neuroanatomical landscape with a dissociative rhetoric that uses the color words from the English language to probe the brain's neural architecture. For Stein, the practice of "neuroesthetics," or "neuraesthetics" as it is alternatively called, operates as a novel form of scientific reinvention and as a special kind of artistic reincarnation: it is a matter of this budding neuroscientist transforming herself into a "writer-god" and then reinventing herself as a literary neurologist, or as a neuraesthetic practitioner, through her cubist writings about the "human mind." In the process of visualizing the brain's neural architecture with colors, lines and perspectives that mimic the ones that Matisse, Cézanne and Picasso create in their paintings, Stein challenges the scientific status quo by interrogating the histological, clinical and neurological practices of her medical professors and her neuroscientific peers. The color words and the linguistic signifiers that comprise the "neurophysiological imaginaries" of her cubist writings, thus indirectly reflect her rich, scientific experiences and her keen, psychological insights.

The midbrain and brain stem regions that Stein researched at the end of the nineteenth-century at Johns Hopkins Medical School under the direction of Dr. Lewellys Barker and Dr. Franklin Mall are believed by today's neuroscientists to be responsible for directing visual attention to perceived objects and conducting information between different brain regions and neural networks. According to Meyer, the nucleus of Darkshewitch facilitates the neurophysiological processes that are involved in the acts of "slow" and "close" reading. When Stein's dissociative writings are studied from the perspective of the brain's functional neuroanatomy, the nucleus of Darkschewitch plays a key role in this author's neuraesthetic production, because this brain nucleus also happens to serve as the basis of her medical knowledge about the brain's reading circuits and its somatosensory pathways. To use Zeki's terminology, the nucleus of Darkschewitch and surrounding midbrain region operate as "synthetic brain concepts" within her dissociative writings, because these brain structures facilitate her literary exploration of conscious and unconscious, brain-based epistemologies. That is, this brain nucleus provides a knowledge base, a "brain-based epistemology" (to use Edelman's phrase), and a special kind of qualia-knowledge, with which Stein produced neuraesthetic compositions that explored the relationship between art, literature, psychology, the brain and mental evolution. Through the serial production of cubist brain maps that featured mostly non-mimetic neurophysiological entities, Stein posed vital questions about the science of the reading brain. With these maps, she investigated the relationship between the nucleus of Darkschewitch and other brain regions that twenty-first century scientists have come to associate with the functions of language, vision, hearing, memory and reading. With her "strange art forms," as her anatomy professor (Lewellys Barker) called her experimental writings, Stein encouraged her readers to ask tough questions about the reading *of* science and the science of the reading brain. With these neuraesthetic compositions, Stein forces readers to interrogate the institutionalized reading practices that they may have used to comprehend her experimental writings, often with limited success.

Building upon Meyer's observations in *Irresistible Dictation: Gertrude Stein and the Correlations of Writing and Science,* I explore the neuraesthetic writing strategies that Stein developed over a thirty-year period, as a means of visualizing, illustrating and rearticulating the brain's "neuronal network architecture" in innovative ways. In his study, Meyer claims,

> Stein is thinking autopoeitically, and neuraesthetically, in the course of "thinking about" the relations that emerge when the words are "join[ed] together in functional multi-word units." … This "sense of the volume of words, reiterated more than twenty years later, suggests that she conceived of words, like cells, as existing in three-dimensional space rather than two-dimensionally on the page or the microscope slide. Stein's writing practice may thus be viewed as a form of laboratory science, descending, by way of the psychological and anatomical laboratories at Harvard and Johns Hopkins, from the medical laboratory described by Claude Bernard in his *Introduction to the Study of Experimental Medicine*. (81-82)

I disagree with Meyer's argument on a number of counts, but especially with his claim that she tries to free her neurophysiological entities from the "external constraints" of physical reality. In my view, Stein achieves a degree of neurobiological realism with the brain portraits from *Tender Buttons* and *The Geographical History of America,* when she recreates the cellular tissues and neural networks of the human cerebellum using color words, grammatical parataxis, poetic form and simple syntax. With a preference or a bias towards creating a form of structural neurobiological realism, Stein reproduces certain biological structures, like the triple-layered nerve tissue formations that are found in the cerebellum's concentric lobes and retina's nerve tissue, with color words from the English language and non-descriptive modes of cubist representation. I submit that her neuraesthetic literary compositions indirectly reflect the scientific discoveries of Nobel laureates Santiago Ramón y Cajal and Camillo Golgi, when her cubist writings feature the cellular structures, neural networks and synaptic connections that are proper to the midbrain, cerebellum and retina. Stein was introduced to the neurobiological studies and histological findings of Cajal, Golgi and other nineteenth-century neurologists by her anatomy professor, Lewellys Barker, at the Johns Hopkins Medical School. In her cubist portrayals of multi-layered and color-variegated neuronal groupings, she appears to be drawing from Barker's medical references, rather than from Cajal and Golgi's 1906 Nobel Lectures. Barker writes at-length about Cajal's method of reduced silver method of neuron staining and Golgi's reduced silver nerve tissue stains in *The Nervous System and its Constituent Neurones* (1899). Connecting Cajal and Golgi's neurobiological research with the findings of other brain pioneers from the nineteenth-century, he also publishes Stein's research on the nucleus of Darkschewitch and the surrounding midbrain region, in this medical textbook.

In my study of Stein's abstract neuraesthetic compositions, I also concur with many of Meyer's neuraesthetic readings. For example, I agree that Stein creatively visualizes and discursively represents the brain's neurophysiological entities within her dissociative writings from the middle period, in ways that enable her to partially liberate her neurophysiological entities from their metaphysical limitations and their biological constraints. In *The Geographical History of America*, Stein achieves this goal by turning her colorful neurophysiological entities into neuraesthetic inquiries that generate performative meanings and visual effects that do not necessarily correspond with known, historical scientific practices and recognizable, physical realities.[40] In *Tender Buttons* and *The Geographical History of America,* she creates a balance between neurobiological realism and creative anachronism, by imagining the brain's neural architecture in a rainbow of colors. With these neuraesthetic writing practices, Stein subconsciously anticipates the stunning visual effects generated by future neuron coloration strategies, such as the "Brainbow system." By adapting Picasso's cubist painting strategies for a wide range of neuraesthetic aims and effects, Stein was able to predict the Brainbow connectivity maps that Jeff Lichtman and Joshua Sanes were able to produce in the nervous systems of transgenic mice nearly a century later, with cutting-edge neurobiological research, advanced genetic technologies and confocal microscopy. See Figure 11 (Combinatorial XFP Expression Results From Tandem Copy Integration), Figure 12 (Brainbow-mapped Cerebral Cortex) and Figure 13 (Brainbow-mapped Hippocampus).

Material has been removed from this thesis because of copyright restrictions. The material removed from page 103 is Figure 11, Combinatorial XFP Expression Results From Tandem Copy Integration, [A Brainbow-mapped Dentate Gyrus]. Figure 11 is a magnified, color photograph of a Brainbow-mapped dentate gyrus. ('Brainbow' is the neologism that Jeff Lichtman coined to describe the mosaic expression of fluorescent proteins in the nervous systems of transgenic animals).[41] The information contained in this material concerns the ways in which scientists can now produce "connectivity maps in which multiple, or even all, neuronal, connections are rendered. Building such 'connectomic' maps would be more straightforward with the equivalent of a multicolour Golgi stain that would allow many neurons within a single sample to be individually identified by virtue of a large number of cell-specific labels. … Multiple spectral variants of fluorescent proteins now exist and are ideal labels for this purpose" (Livet et alia, ""Transgenic Strategies For Combinatorial Expression of Fluorescent Proteins in the Nervous System" 56). The original source of this material is Figure 4c, from Livet et al, "Transgenic Strategies For Combinatorial Expression of Fluorescent Proteins in the Nervous System. Nature. November 1, 2007. 59.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 104 is Figure 12, which is a color photocopy of a Brainbow-mapped cerebral cortex, from the cover of Nature, November 1, 2007. © Jeff Lichtman, Harvard University. The information contained in this material concerns the ways in which scientists produce "connectivity maps in which multiple, or even all, neuronal, connections are rendered. Building such 'connectomic' maps would be more straightforward with the equivalent of a multicolour Golgi stain that would allow many neurons within a single sample to be individually identified by virtue of a large number of cell-specific labels. … Multiple spectral variants of fluorescent proteins now exist and are ideal labels for this purpose" (Livet et al, "Transgenic Strategies For Combinatorial Expression of Fluorescent Proteins in the Nervous System" 56). The original source of this material is Figure 4-c, from Livet et al, "Transgenic Strategies For Combinatorial Expression of Fluorescent Proteins in the Nervous System." Nature. November 1, 2007. 59.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 105 is Figure 13, Brainbow-mapped Hippocampus, from the cover of Nature, November 1, 2007. © Jeff Lichtman, Harvard University. The information contained in this material concerns the ways in which scientists can now produce "connectivity maps in which multiple, or even all, neuronal, connections are rendered. Building such 'connectomic' maps would be more straightforward with the equivalent of a multicolour Golgi stain that would allow many neurons within a single sample to be individually identified by virtue of a large number of cell-specific labels. … Multiple spectral variants of fluorescent proteins now exist and are ideal labels for this purpose" (Livet et al, "Transgenic Strategies For Combinatorial Expression of Fluorescent Proteins in the Nervous System" 56). The original source of this material is the cover design of Nature, which corresponds with Figure 4-c, from Livet et al, "Transgenic Strategies For Combinatorial Expression of Fluorescent Proteins in the Nervous System." Nature. November 1, 2007. 59. Confocal microscopy by Jean Livet.

1 February 2009 <http://news.bbc.co.uk12/hi/health/7070672.stm>.

1 February 2009 <http://news.bbc.co.uk.BBCNews/Inpictures; The future of brain imaging>. (#2)

"By activating multiple fluorescent proteins in neurons, Steve Bradt writes, "neuroscientists at Harvard University are imaging the brain and nervous system as never before, rendering their cells in a riotous spray of colors dubbed a "Brainbow." In "Transgenic strategies for combinatorial expression of fluorescent proteins in the nervous system," Jean Livet, Tamily A. Weissman, Hyuno Kang, Ryan W. Draft, Ju Lu, Robyn A. Bennis, Joshua R. Sanes and Jeff W. Lichtman explain how they developed "Brainbow transgenes" by manipulating the "widely used Cre/*lox* recombination system, which can switch on gene expression by DNA excision, inversion, or interchromosomal recombination" (56).[42] In "Transgenic strategies for combinatorial expression of fluorescent proteins in the nervous system," Livet et alia explicate the genetic engineering strategies that they used to produce colored neurons, axons, and glial cells in their 'Brainbow mice':

> Integration of tandem *Brainbow* copies in transgenic mice yielded combinatorial XFP expression, and thus many colours, thereby providing a way to distinguish adjacent neurons and visualize other cellular interactions. As a demonstration, we reconstructed hundreds of neighboring axons and multiple synaptic contacts in one small volume of a cerebellar lobe exhibiting approximately 90 colours. The ability of the Brainbow system to label uniquely many individual cells within a population may facilitate the analysis of neuronal circuitry on a large scale. (56; original emphasis and spelling).

See Figure 14, <u>Cerebellar Circuit Tracing and Colour Analysis</u> [Brainbow-mapped Mossy Nerve Cells Cerebellum], from Livet et al, "Transgenic Strategies for Combinatorial Expression of Fluorescent Proteins in the Nervous System" (59).

Material has been removed from this thesis because of copyright restrictions. The material removed from page 107 is Figure 14, Cerebellar Circuit Tracing and Colour Analysis [Brainbow-mapped Mossy Nerve Cells Cerebellum]. This image illustrates the “numerous synaptic interactions between mossy fibres and granule cell dendrites, identified by their characteristic claw-like morphology” (Livet et alia, “Transgenic Strategies For Combinatorial Expression of Fluorescent Proteins in the Nervous System” 60). The original source of this material is Figure 5a, from Livet et al, “Transgenic Strategies For Combinatorial Expression of Fluorescent Proteins in the Nervous System.” Nature. November 1, 2007. 59. Confocal microscopy by Tamily A. Weissman. Presented image in thesis comes from the following website address: <http:www.guardian.co.uk/ science/gallery/2007/nov/01/brainbow?pict…>.

Based on experiments that tested the color constancy of the Brainbow system in the central nervous systems of their transgenic mice with *in vivo* tracking techniques available through confocal microscopy, these Harvard scientists report,

> Potentially, colour might be used to verify the identity of all the processes arising from an individual neuron without necessarily tracing back to the proximal branch points of the soma. This approach would require that the colour profile of a neuronal process remain constant over long distances. In order to study color constancy, we sampled consecutive mossy fibre rosettes along individual axons and compared their RGB values (Supplementary Fig. 5a, b). The colour profiles obtained for distant regions of a mossy fibre axon (rosettes more than 100 μm apart along a given axon) were largely similar (Fig. 5d). Moreover, axons and dendrites belonging to the same neuron also exhibited similar colour profiles (Supplementary Fig. 6). Given the colour constancy within a cell, colour differences provide a way to distinguish between neurons and thus could be useful for detailed circuit analysis, such as to count the number of neurons that innervate a postsynaptic cell. We found that individual granule cells were typically innervated by multiple axons that expressed different colours (Fig. 5e, f). Hence, more than one presynaptic neuron innervated each postsynaptic neuron (Fig. 5f). In one case, a granule cell was contacted by two presynaptic terminals from a single mossy fibre (Fig. 5g), but it also received inputs from at least one additional (unlabelled) mossy fibre. These data are consistent with the idea that cerebellar granule cells are polyneurally innervated by mossy fibres. ("Transgenic Strategies for Combinatorial Expression of Fluorescent Proteins in the Nervous

System" 60).

See Figure 15, Cerebellar Circuit Tracing and Colour Analysis [Brainbow-mapped Reconstructed Granule Cells from the Cerebellum], which is an enhanced image of the cerebellar granule cells that Livet et alia mention in their article, with specific reference to Figures 5e, 5f and 5g.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 110 is Figure 15, Cerebellar Circuit Tracing and Colour Analysis [Brainbow-mapped Reconstructed Granule Cells from the Cerebellum]. Figure 15 contains information about neural connectivity patterns that can be studied with the use of genetic labelling and distinguishable color. As Livet et alia observe, "The usefulness of the Brainbow system to analyse complex connectivity depends on the number of distinguishable colours expressed by neurons. To determine this number, we analysed the distribution of colour profiles in the reconstructed volume from line H above (eight transgene copies). The population of axons exhibited many different colour profiles (Fig. 5c); the mean colour values calculated for the different axons varied greatly in hue and saturation and filled a large portion of colour space (Supplementary Fig. 5c). Using a visual colour discrimination test, we found that 98.9% of randomly selected rosette pairs expressed colours distinct enough to discriminate (see Methods). This degree of colour variation is equivalent to having approximately 89 distinct colours (that is, if 98.9% of axon pairs appear different, then the remaining 1.1% or 1 out of 88.7 pairs are too similar to discriminate). An alternative computer-based colour analysis of hippocampal neuron cell bodies from Brainbow 1.0 line L (see Fig. 4c) gave an estimated 166 colours. This large number of colours should be useful in resolving individual components of many neural circuits" (60). The source of this material comes from Figures 4c, 5c, 5e and 5f, in Livet, et al, "Transgenic Strategies for Combinatorial Expression of Fluorescent Proteins in the Nervous System." Nature, November 1, 2007. 59. Confocal microscopy is by Tamily A. Weissman of Harvard University.

Stein's color-coded, language-centered and consciousness-based, literary portraits assume new significance, given what the Brainbow system has enabled us to discover about the brain's synaptic circuitry and given what it visually demonstrates about the mapping of the central nervous system with distinguishable colors.

I propose that Stein created embryonic versions of the *Brainbow aesthetic* in *Tender Buttons* and *The Geographical History of America* with cubist representational strategies. These cubist brain maps contribute to the neuraesthetic study of the brain's "cytoarchitectonics," "myeloarchitectonics" and "chemoarchitectonics," by generating new ways of reading the symbols that comprise these neuroanatomical imaginaries. For example, "A Long Dress" and "Detective Story number VII" consist of color signifiers that express Stein's desire for advanced neuroimaging techniques and scientific technologies. By layering color words, such as "blue," 'yellow," and "green" into poetic formations that resemble cellular tissues, Stein calls attention to the process of myelination that occurs within the brain's white matter during certain periods of the brain's development. Thus, with the formal structures of language and with simple poetic devices, she draws attention to the brain's basic anatomy and its functional anatomy. Much of this is achieved with color signifiers and common words from the English language. Stein's strategic use of color words produces different kinds of neural structures and brain features in "A Long Dress" and "Detective Story number VII." From Picasso and other cubist painters, Stein learned how to craft cubist puns into ambiguous literary phrases that generate multiple meanings and create innumerable referents for their subjects, which include the visual brain and its neural pathways.

To be sure, there are vast differences between the Brainbow connectivity maps and Stein's cubist brain maps. To begin with, Stein visualizes the brain's neuroanatomical features, neuronal networks, synaptic connections and cellular tissues with the English language. In the brain maps that Stein produces in *Tender Buttons* and *The Geographical History of America*, color is arguably the most noticeable feature, next to the dissociative style of writing that Stein deploys in order to picture the human mind's subjective phenomenology and its neuroanatomical landscape. Stein's allegorical brain maps may have been inspired by Picasso's cubist poems and paintings, but these works are unique to the western practice of "neuroesthetics," because she uses the English language to visualize the complex neurophysiological entities, experiences and relationships that constitute the brain's "*N*-dimensional qualia space" (Edelman and Tononi, *A Universe of Consciousness* 164). In my opinion, Stein's 'neuroanatomical imaginaries' can be linked to empirical laboratory practices in nineteenth century histology, anatomy, psychology and evolutionary science. Yet, also in striking ways, her imaginary constructions resemble the fluorescent brain maps that scientists that have been able to produce with twenty-first century brain research. Stein may have been schooled in nineteenth-century experimental neuroscientific and psychological practices, but it appears that she overcame her personal aversion to certain laboratory procedures and brain modeling protocols by recreating the brain's neural structures anew in her imagination. In resisting the pathological mindset of her scientific contemporaries, she was able to forecast the visual effects of Nobel winning, brain mapping strategies with her cubist literature.[43] Also, she may have been able to shape the twenty-first century literary practice of "neuroesthetics," in ways that we are just beginning to appreciate and understand. By developing allegorical methods of brain representation that generated multiple, perceptual perspectives and demonstrated complex neuroscientific theories, Stein contributes to the western practice of "neuroesthetics" by showing how creative writing can represent imaginary, laboratory practices and produce imaginative, brain imaging technologies.

Rhawn Joseph, editor of *Neurotheology: Brain, Science, Spirituality, Religious Experience*, conceptualizes the brain, according to the Renaissance and Christian traditions of religious portraiture, for the cover design of his collection as special kind of cerebral afterlife. The "God" who emerges from the brain's organic matter and from his corporeal entwinement in the heavenly hosts is revealed as a neurotheological entity, as a figment of the human imagination that derives from neurobiological processes and organic matter. See Figure 16, The Brain, from Rhawn Joseph's book cover design for Neurotheology: Brain, Science, Spirituality, Religious Experience. © 2002.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 114 is Figure 16, which is a magnified and cropped, color photocopy of the brain image that appears on Rhawn Joseph's book cover for Neurotheology: Brain, Science, Spirituality, Religious Experience. According to Joseph's neurotheological discourse, the brain image that appears on this cover could be conceptualized as quantum theory's "multiverse." In his words, "According to quantum theory, our universe is only a single tiny facet of an incredibly large multiverse. By definition, the theoretical multiverse is a highly structured continuum containing many universes and these many universes are side by side, or inside one another, or are mirrors of or identical copies of each other, such that everything that exists in this universe has its counterpart, or rather, counterparts in at last of few of these other universes. … The theory of the multiverse could thus be used to explain the experience of life after death, the existence of heaven or hell, or the presence or experience of what some have interpreted to be demons, angels, and even gods" ("The Myth of the Big Bang," Neurotheology 23). In this thesis, I interpret the brain image on the cover of *Neurotheology* as a caricature of Christian, late medieval and early renaissance notions of spiritual transcendence. By virtue of quantum theory's multiverse conception of the universe, I also view this brain image as a substantiation of Renaissance pictorial principles and some of its neuraesthetic, perceptual principles (i.e., grouping, balance, contrast, isolation, symmetry and metaphor). The original source of this material is Neurotheology: Brain, Science, Spirituality. Ed. R. Joseph. San Jose: U of California P, 2002. © Rhawn Joseph, 2002.

You will never "see" a realistic, brain portrait like the one that Joseph has created for his book's cover design in any Stein's cubist portraits. Wendy Steiner explains why this is this case, from the perspective of Stein's cubist writings and Cézanne's analytic cubism, in *The Colors of Rhetoric: Problems in the Relation Between Modern Literature and Painting*:

> Proponents of the cubist analogy usually begin with cubism's disruption of the Renaissance norms of linear perspective, chiaroscuro, and other means of suggesting three-dimensionality on a two-dimensional medium. The flatness of the picture plane is stressed in the noniconic patches in Cézanne, in the geometric faceting of analytic cubism, and in the pastings and totally two-dimensional 'bodies' found in synthetic cubism. The integrity of objects is violated, the laws of gravity and directionality of light defied, and the premise that the canvas presents one atemporal moment of vision by a perceiver standing in a fixed position is exploded by the multiple views of a single object simultaneously present on the picture plane. The size the position of objects are not dependent upon their distance from the viewer, but upon their conceptual or formal importance. Thus, objects are broken up and reassembled according to a conceptual logic that functions after the fact of the physical laws of appearance. (180)

In comparing Stein's analytic and synthetic cubist portraiture with the cubist writings of Robbe-Grillet, Williams, Joyce and Eliot, Steiner explicates that the "literary methods of punning, contradiction, parody and word play create a similar state of ambiguity in modern writing, both in terms of multiple reference of words and the multiple levels of reference – to the world, the text, or language in general. All the writers termed "cubist" saturate their work with such ambiguities—as indeed do almost any writers of the last hundred years or so (and ultimately all writers, if one concurs with William Empson). It is the amount of play that is unusual" (182). Concurring with Steiner's definitions for cubist writing and its playful qualities, I would add that the color signifiers that Stein uses in her cubist portraits to represent the human central nervous system operate as puns, parodies and ambiguous modes of semiotic reference. The "play" that occurs in and between these modes of cubist representation can make it difficult for readers to decipher the scientific meanings of Stein's colorful neuroanatomical imaginaries, because, of course, these imaginaries function as "aesthetic enclaves" and as "aesthetic idiolects," to use Umberto Eco's semiotic expressions (*A Theory of Semiotics* 270-271). Because these "idiolects" serve as neuraesthetic modes of semiotic expression that indirectly reflect the author's subjective experiences through the text's symptomatic discursive subjectivity, I propose that we call these consciousness-based, language-centered and color-coded idiolects "qualialects," for short. Stein's modernist verses, or her *qualialects*, reveal perceptual principles, such as "repetition, rhythm and orderliness," and "generic perspectives," such the multiple viewpoints generated by a portrait's cubist word-objects, that resemble rainbows, spectrums and prisms. In *A Theory of Semiotics*, Eco argues that Stein's famous verse, "A rose is a rose is a rose," can be conceptualized as a literary prism, of sorts, through which a spectrum of ambiguous meanings and semiotic redundancies fragment into a imaginary rainbow of colors. These metaphorical colors produce a set of enigmatic messages and cultural meanings that can enrich, as well as frustrate, a reader's attempts to understand Stein's experimental prose. In Eco's opinion, a verse's "surplus of expression" and "surplus of content" creates a prismatic effect, whereby the word /rose/ acquires a kind of deviational status within its contextual framework, so that every time the word /rose/ is uttered, the reader no longer accepts the repetition as normal. According to Eco, the reader views these mundane repetitions as special kinds of "uninformative statement[s]" (270). In his expert opinion, the sentence, "Rose is a rose is a rose is a rose," recreates physical realities and semiotic possibilities that exceed their mundane utterances, by virtue of their discursively encrypted "surplus of expression" and "surplus of content." Following Eco's cue, I suggest that we visualize these rainbow-like qualialects as neurophysiological entities, in the second- and third-phase portraits, when we read color experience (i.e. color language qualia) at the level of a work's color signifiers and non-descriptive, literary phrases.

Rhawn Joseph nicely captures Stein's practice of neuraesthetic practitioner turned modern author, when he illustrates the human brain as the seat of neurotheology and as the imaginative place where a god-like figure emerges from the brain's organic matter. What we encounter in Stein's cubist portraits are not realistic depictions of the human brain; on the contrary, her brain portraits are, to repeat Warren Neidich's apt phrase, "neurobiological collages" that are comprised primarily of language. To the best of my knowledge, no one has written about the colorful brain in *The Geographical History of America* since Stein composed it, in 1933 or 1934. (Random House published *The Geographical History of America or the Relation of Human Nature to the Human Mind* in 1936.) I believe that this brain portrait makes a unique contribution to western society's literary neuraesthetics, because it features the Cubist Brain in an unparalleled fashion: as a form of psychogenetic, brain evolution.[44]

1.2 "Neurogenesis" in Stein's Colored Brain Maps

My primary aim, in this chapter, is to explain how Stein developed cubist methods of brain representation, using William James's psychological principles and her previous medical knowledge. It is true that Stein prefers to keep many of the connections that exist between her psychological studies with William James, her neuroanatomical research with Franklin Mall and Lewellys Barker, and her modernist masterpieces about the human mind private, or even secret. For the most part, she says little about the colors that she uses to create her cubist neuroanatomical portraits, preferring to let her readers do the empirical detective work that would give these colors culturally intelligible meanings, both within experimental scientific practices of the late nineteenth century and within the experimental aesthetic practices of the early twentieth century. Because of the reader's knowledge, imagination and input, these neuraesthetic entities possess performative meanings and cultural associations beyond Stein's historical imagining. We know little about her cubist brain mapping strategies, except for the bits of information that she shared with her readers about her psychological laboratory experiments at the Harvard Psychological Laboratory from 1893 to1896, and what we know or what she says about her brain research at the Johns Hopkins Medical School from 1897-1901. Without a concrete sense of how Stein's intuitive, neuroscientific vision operates within *The Geographical History of America*'s dissociative discourse for creative literary purposes, as well as for experimental scientific aims and for philosophical reasons, we might conclude prematurely that Stein produces 'cubist puns' and adopts Picasso's cubist painting techniques for humorous purposes. That is, we might assume that this author is removed from the physical realities of the scientific laboratory, and she has forsaken biological realism, or the realities of the brain's neurobiological processes, in order to pursue her eccentric, neuraesthetic aims. However, I do not believe this is the case, with her portrait of the brain-like human mind. By combining a phenomenology of consciousness with a creative form of neurological description, Stein was able to examine the brain's colorful neurophysiological entities and neuroanatomical features from a set of obscure, microanatomical and macroanatomical perspectives that instantiated multiple meanings for these colors through a representational strategy that is known as "cubist punning.' Through the agency of the reader's scientific knowledge and aesthetic imagination, Stein creates a cubist brain portrait that serves as a neuraesthetic laboratory, as the scene of neuron births, and as a brain-mapping device. To be sure, the Brainbow-like neural imagery and the Brainbow-like aesthetic that we find in "A Long Dress" and "Detective Story number VII" derive partially from Stein's knowledge of histology, microscopy and neurology. When Stein uses color signifiers to distinguish between macroanatomical and microanatomical, neural structures in her cubist brain representations, her literary brain modeling and brain imaging practices reveal that unconscious brain activities, in the form of spontaneous variations and creative insights, may be partially responsible for the unusual, rainbow-like colors in the brain's organic matter.

Given these insights, I believe it is possible to generate some ideas about the morphological functions and 'connectomic' relations that exist between the "brain" colors in this cubist portrait. I also think that it is possible for literary theorists to use the Brainbow maps to generate some ideas about the cellular elements, neuronal networks and brain parts that a text's colored word-neurons could be representing at the level of language. With such "detective work," one can advance some educated guesses about the kinds of the neurophenomenological experiences these word-neurons might be representing at the level of the human mind's subjectively experienced, neuroanatomical imaginary.

Perhaps what we are seeing when we look at Stein's portrait is the birth of new color neuron-words forming on the periphery of the mind's "white and grey" cortical landscape. If this is the case, then R. Douglas Fields' point about the potential roles that new hippocampus neurons play in the execution of declarative and spatial memory may be the metaphysical joke that Stein is trying to make, with her colorful inquiries into the relation that exists between human nature and the human mind. That is, with her brainbow-like *qualialect*, she may be gesturing toward the inefficacy of "memory" by creating a visual display of color neuron words, whose implied neurobiological functions, as mere "cellular neophytes," may be uncertain and ambiguous in terms of this neuroanatomical portrait, but very specific in terms of how she conceptualizes memory, identity and human nature from a modernist perspective, in terms of her theories and "master-pieces" about the human mind. With respect to Stein's creative neuron coloring strategies, the Brainbow photographs can offer valuable clues as to the morphological functions that the color neuron words may be playing in her neuroanatomical imaginaries. With the aid of these photographs, we can speculate about the morphological functions of the colored neuron-words in her cubist portraits, by comparing the brainbow-mapped neurons in these images to the non-colored word-entities that comprise the human mind's subjectively experienced, neuroanatomical landscape from Detective Story number VII. While the Brainbow-mapped nervous systems of transgenic mice are by no means the first, or the only, color images of fluorescent mouse brain neurons, to have been published in scientific journals, they are only the ones that have caught the public's attention and imagination so completely. In “New Brain Cells Go To Work,” R. Douglas Fields confirms that new brain neurons are being generated in the human brain, indeed, that “neurogenesis” seems to be occurring in “the most hallowed of all brain regions, the hippocampus, the seat of declarative and spatial memory” (32). By injecting the fluorescent marker ‘bromodeoxyuridine into the nuclei of mouse hippocampal neurons,’ Fields reports that Nohjin Kee, Cátia M. Teixeira and their colleagues at the University of Toronto were able to prove that “certain “memory” genes known as *c-fos* and arc were turned on in many of the new neurons” (33-34). “To make memories stick,” Fields explains,

> neurons must turn on genes to manufacture proteins that will cement more strongly the synapses shared among them. The molecules that establish current flow around synapses, as with the proteins in the body, degenerate and are replaced constantly over a period of hours or days. Scientists have known since the sixties that turning on genes was somehow involved in making memories permanent, because genes tell cells to produce proteins, and new proteins must be synthesized in the neural networks within minutes of an experience for it to be coded in memory. (33)

There is an acrimonious debate that is taking place about whether neurogenesis occurs outside of the hippocampus in the human brain. Gesturing to this ongoing debate in the neurosciences, Fields observes, “Skeptical scientists, however, have met this news with an important question: What use are new neurons if they do not somehow wire themselves into the existing circuitry of the brain—and how are these inexperienced neurons going to do that? The difficulty of incorporating new cells into the intricate, tightly woven fabric of neural connections in the grown-up brain was always one of the stronger arguments against the existence of new neurons in the first place. What good are these cellular neophytes is they merely become passive bystanders?" (32; original spelling).

Thus she may be envisioning the brain's evolutionary processes and spontaneous variations occurring at the level of her portrait's colored neurons and its linguistic signifiers. In his introduction to the 1936 edition of *The Geographical History of America*, Thornton Wilder explicates the different forms that these "metaphysical metaphors" can take at the level of Stein's dissociative discourse and briefly explains how these tropes exemplify her modernist views about the ways in which artists sublimate the human mind and entity over human nature, identity and memory when creating their modernist masterpieces. Defining her catachrestic practice of metaphysical writing as a "creative metaphysics," he states,

> *Now the relation of human nature to the human mind is this. Human nature cannot know this. But the human mind can*. [It can know this] (Human nature, hugging identity-survival cannot realize a non-self situation. The Human Mind, knowing no time and identity in itself, can realize this as an objective fact of experience.) Similarly, further down we come upon the question: "What is the use of being a little boy if you are growing up to be a man?" (Since the Human Mind, existing, does not feel its past as relevant, why does succession in identity have any importance? What is the purpose of living in time? One cannot realize what one was like four seconds ago, four months ago, twenty years ago. "Only when I look in the mirror," said Picasso's mother, "do I realize that I am the mother of a grown-up man." ("Introduction" 9)

These examples do not do justice to some of the "non-self situation[s]" that Stein represents in this book as "objective fact[s] of [phenomenal] experience." The human mind's subjective view gives the impression, however illusory, that there is a functioning, "core consciousness" that can provide the reader with a sense of how it deploys its subjectively experienced, phenomenal realities and literary qualities to create colorful, neuroanatomical structures. With respect to Stein's neuraesthetic writing strategies, the *Brainbow* photographs can offer valuable clues as to the brain morphologies and functions that the color neuron-words might be performing in a given work's neuroanatomical imaginary. Sporns, Tononi and Kötter have defined connectivity maps like the one that find in *The Geographical History* as the "human connectome." As signifiers that exemplify the generic perspective perceptual principle, the color words in this portrait represent a range of neuroscientific meanings, scientific perspectives, and evolutionary creative processes that vaguely resemble Lichtman and Sanes's Brainbow-mapped neural structures. Because of the uncanny resemblances that exist between this brain portrait and the transgenic, connectivity maps from the twenty-first century, Stein's color words and their performative, neuroscientific meanings accrue additional, scientific meanings associated with the concepts of human evolution and the human subject that could fundamentally change the way we read her portraits, plays and "detective stories."[45] If Zeki is correct about the kinds of unconscious brain concepts that express themselves through abstract colored paintings and modern literature, then we may have to consider the possibility that writers, such as Stein, may not be entirely aware of the extent to which certain evolutionary processes are expressing themselves through the brain's creative insights, so as to bring new ideas and emergent forms of cultural knowledge to readers through mundane phrases and color units in these neuraesthetic compositions. Yet, there is also a conscious aspect to the evolution of human knowledge, for the medical knowledge that Stein possessed about the brain's neuronal network architecture can be read at the level of her colorful, literary qualialects as a special kind of qualia-knowledge that functions as an emergent form of cultural production.

1.3 Gertrude Stein and the "Qualialect"

Stein's language-centered, color-coded and consciousness based (qualia based) "aesthetic idiolects," or her *qualialects*, discursively represent her specialized medical knowledge of the brain's colored brain nuclei and its neural structures. These *qualialects* also metaphorically represent the ways in Stein transforms experience into a work's aesthetic consciousness, which indirectly caricatures the nerve tissue staining techniques and the medical discoveries of her scientific contemporaries.

With the strategic use of color words that connote the scientific promise of certain kinds of neuron coloring strategies and indirectly interrogate the efficacy of nineteenth-century nerve staining practices and laboratory procedures, Stein created cubist allegories that function in three ways at once. First and foremost, they portray the brain's neural networks and synaptic connections with color signifiers and simple stylistic conventions that call to mind laboratory experiments that she conducted at Harvard University, as an undergraduate psychology student, and at Johns Hopkins University, as a graduate level medical student. Secondly, these allegorical representations serve as neuroanatomical imaginaries that posit ingenious neuron coloring strategies, microscopic imaging techniques and connectivity mapping devices. Thirdly, they operate as colored brain maps that illustrate the neuronal configurations and synaptic connections within certain brain regions, through the creative use of color words, grammatical parataxis, common syntax and poetic form. Not only do these brain maps represent historical medical research and scientific discoveries, but they also create new perspectives and new meanings for the "human connectome," which is another term for the brain's "connectivity maps" (Sporns et alia, "The Human Connectome" 1; Livet et alia, "Transgenic Strategies" 56). Fourth, these neuroanatomical portraits present scientific problems that can only be solved with the creative imagination, especially with regard to the relationships that exist between the brain's "neural space" and its "qualia space" (Edelman and Tononi, *A Universe of Consciousness* 164). In these ways, Stein's language-centered, color-coded and consciousness based (qualia based) "aesthetic idiolects," or her *qualialects*, discursively represent medical knowledge about the human brain and its various functions. These *qualialects* also metaphorically represent the ways in Stein transforms conscious experience into an aesthetic consciousness, and this aesthetic consciousness indirectly caricatures the nerve tissue staining techniques and the medical discoveries of Stein's scientific contemporaries with its discursively encrypted, perceptual principles. To view how Edelman and Tononi conceptualize the human brain's *N*-dimensional qualia space, see Figure 17, Qualia Space.

Material has been removed from this thesis because of copyright restrictions. The information removed from page 126 is Figure 17, which is a black-and-white, magnified image of Gerald Edelman and Giulio Tononi's "Qualia Space." The information contained in this image can be summed up by the caption that Edelman and Tononi provide for their *N*-dimensional model of the "neural reference space" for conscious experience: "QUALIA SPACE. The figure depicts an *N*-dimensional neural space corresponding to the dynamic core. *N* is the number of neuronal groups that, at any given time, are part of the dynamic core, where *N* is a large number (only a minimal number of dimensions is plotted). Some of these dimensions correspond to neuronal groups that are color selective and exhibit color constancy (exactly as in figure 13.1). However, a large number of other dimensions is represented in the dynamic core [sic], as indicated by the axes corresponding to the activity of neuronal groups specialized for visual form or visual motion, for auditory or somatosensory inputs, for proprioceptive inputs, for body schemas, and so forth. The appropriate neural reference space for the conscious experience corresponding to the quale "pure red" would correspond to a discriminable point in this space (crossed circle)" (164). The original source of the removed, thesis material is Figure 13.2 from *A Universe of Consciousness: How Matter Becomes Imagination.*164.

I imagine that there are a considerable number of readers, both in academia and in the public sphere, who have not heard about Stein's cubist-style neuroanatomical portraits. Indeed, there is no reason why anyone should know about these portraits and their "invisible" brain maps. Perhaps if one had been reading Meyer's neuraesthetic literary criticism, or if one had been thinking about Stein's cubist allegories from a neuroscientific perspective, then it would make sense to view Stein's dissociative writings as innovative forms of neuraesthetic research. If it were not for the persuasive arguments that Meyer advances in *Irresistible Dictation*, I might have concluded erroneously and prematurely that she did not produce any neuraesthetic compositions and *explicit* neuroanatomical portraits during the course of her writing career. However, the cubist brain portrait from *The Geographical History of America* proves that Stein was capable of producing an explicit neuroanatomical landscape that is not an indecipherable hieroglyph. If it were not for this explicit brain portrait and for Meyer's scholarship, I might have believed that it was impossible to make important connections between Stein's cubist brain maps and twentieth-century medical studies, and that it would be difficult to find ways of comparing her literary brain maps with twenty-first century neurobiological research. However, Zeki's three books on the subject of neuroaesthetics, the first of which includes the innovative study of Cubist and Fauvist brain concepts, demonstrate that Stein was working in an emergent area of cultural knowledge that twenty-first century neurobiologists and neuroaestheticians find to be challenging, fascinating and feasible. That field of human knowledge and brain knowledge is "neuroesthetics." My study builds upon Meyer's insights regarding Stein's early twentieth-century neuraesthetic writing practices, by posing different kinds of questions about the literary artists' visual brain and its symptomatic subjectivity. In particular, I explore how she deploys brainbow-like qualialects in order to create new scientific paradigms and to spur imaginative, interdisciplinary thinking on the part of her readers. Also, I examine how she *paints* with these qualialects, in order to portray the brain's neuronal network architecture and its organic matter with the English language. If one is trying to determine the phenomenological, neuroanatomical and neuroscientific meanings of the color signifiers in her cubist brain portraits, this is a difficult task to achieve, because one must first account for the ambiguous, linguistic qualities of the perceived, brain concepts and brain structures at each of these levels, before proceeding with the task of explaining why Stein condenses experiential meaning into cubist puns, metaphysical metaphors and non-descriptive phrases, as part of her cubist brain portraiture strategies. (Zeki calls this problem the "stability of perceptual instability" (84). In *Splendors and Miseries of the Brain*, he explicates this concept as follows, "The extent to which the machinery of the brain is programmed to allow of different interpretations, and the seeming poverty of "top-down" influences, can be demonstrated by showing that it is not easy to disambiguate … ambiguous figures" (84). Even if Stein thought that she was accurately representing the brain's neuronal network architecture and its *N*-dimensional qualia space, her readers might not agree because, as Zeki notes, the "brain retains the option of interpreting it in two ways. This suggests that the brain does not have much choice in the multi-interpretations that its organization makes possible. *The ambiguity, in other words, is stable*. The stability of multi-interpretations is also, in a sense, an inherited brain concept applied to certain categories of incoming signals" (84-85). Below, I argue that Stein's strategic deployment of color words to create neural connectivity maps can be conceptualized as an illustration of James's psychogenetic principles. By illustrating James's psychogenetic hypotheses about phenomenal experience and its evolutionary forces, Stein indirectly exemplifies Zeki's "stability of perceptual instability," with her cubist literature. Even though many of her cubist portraits are designed to be deliberately ambiguous, by featuring non-mimetic strategies of consciousness representation, they also showcase neurobiological entities and scientific meanings that are comprehensible and legible, for those who care to decipher and read them.

Put another way, the unnaturally and naturally colored, neuron-words in Stein's cubist portraits illustrate some of the elementary and secondary, phenomenal experiences that form a "neural interface" with the brain's neurophysiological mechanisms and its cellular elements. Serving multidimensional purposes at the level of language, the colored word-neurons illustrate the neural architecture of the visual brain through their ambiguous semiotic and linguistic interactions, in addition to other brain regions that currently are, or previously have been, associated with sensation, perception, memory, the imagination, language production, and reading. These color signifiers also index artistically imagined and medically researched, neurophysiological mechanisms, which Stein has translated into English verse and transformed into cubist brain maps. Norman Bryson calls this re-configuration of sign and neuron "The Neural Interface." In his introduction to Warren Niedich's book, *Blow-Up: Photography, Cinema and the Brain*, Bryon argues,

> The level of the ground of being, or of the real, shifts from the signifier to the neural configuration, the orchestration of myriad plays of lightning across the ramifying branches of the brain. From this shift to a cortical or neural model of subjectivity follow a number of consequences that can be taken as distinct advantages which the "neural turn" possesses over the broad family of accounts of the real

that are based on the primacy of the signifier. The first is the resolution of a classic difficulty faced by poststructuralist thought in relation to the breadth of experience that it is able to describe; for by concentrating on the signifier as the basic unit of description, the analysis commits itself to an intensely *cognitive* point of view. Feeling, emotion, intuition, sensation – the creatural life of the body and of embodied experience – tend to fall away, their place taken by an essentially *clerical* outlook that centers on the written text. The signifier rules over a set of terms whose functions are primarily textual in scope: the analysis of ordinary language (Wittgenstein); of the circulation of meaning within the literary text (deconstructive criticism); of the disruptions of the symbolic order that indicate the advent of unconscious fear and desire in the analysand's speech or in the discourse of the work of art (psychoanalysis). While the family of terms that owe their allegiance to the signifier – *text, discourse, code, meaning* – is brilliantly adept at dealing with questions of signification, it encounters a notable limit when the area that it seeks to understand exceeds the sphere of textual meaning. Though semiotics is often at pains to point out that the signifier belongs to the sensory order, it is difficult to modulate the term so as to include a full range of sensuous and emotional experience, the affective, the physical, and the kinesthetic. Yet, as Niedich's essays indicate, the pathways of association and combination that constitute the "secondary repertoire" are immensely variable in their range of operation: their configuration pass not only through the discursive arena in which semiotics specializes, but sensory, memory, affective resonance, and habits of touch and movement that belong to the motor and kinesthetic regions of the

> body's experience of the world. (14-15; original spelling and emphasis)

By examining how Stein manipulates the English language as a means of exposing the brain's neural principles, I follow Meyer's example, by observing that her cubist writings figuratively portray the "shifts from the signifier to the neural configuration." Whereas Meyer places more emphasis on "the orchestration of myriad plays of lightning across the ramifying branches of the brain," to use Bryson's words, I am interested in creating a brief genealogy of the neuraesthetic compositional practices that enact the "shift [from a linguistic, clerical model] to a cortical or neural model of subjectivity." By examining the cortical and neural models of modern subjectivity that Stein creates for the human mind in her cubist writings, I oppose Meyer's "clerical approach" and follow Bryson's directive "to include a full range of sensuous and emotional experience, the affective, the physical, and the kinaesthetic." In this chapter, I use William James's radical empiricist psychological principles to show how Stein's expresses her symptomatic discursive subjectivity at the level of her cubist writings with a wide range of phenomenal experiences, while also illustrating the brain's neural architecture and exploring its evolutionary processes through inherited and acquired, brain concepts.

Through James's psychogenetic principles, I address the ways in which Stein's cubist writings marshal ambiguous and incomplete, brain images for the purposes of neuraesthetic, brain simulation and creative, brain representation. In chapter eighteen of *Inner Vision*, Zeki writes, "Of all branches of visual science, none has been more fiercely debated and more eloquently defended than that of colour vision. It is a subject that has interested philosophers and poets, no less than scientists, and artists have of course used it to great effect throughout the ages. Perhaps the most daring have been the Fauvists, who in a way tried to defy physiology and naturally failed – for no one defies physiology successfully. But their failure had an interesting consequence, which has inspired physiological experiments that have provided, in turn, interesting insights into how the brain handles colour" (183).[46]

Stein's dissociative writings convert primary sensations and inherited brain concepts into abstract brain images that exude "primal vividness" at the level of their multidimensional, neurobiological and neurophenomenological representations. (Zeki, *Splendors and Miseries of the Brain* 36, 118). Meyer, by contrast, describes Stein's neuraesthetic, literary compositions as experimental writings that mimic the biological mechanisms of the central nervous system through their secondary, phenomenal properties. According to Meyer, these compositions function simultaneously as Jamesian-influenced radical empiricist, literary creations and as modernist, brain mapping practices. With respect to establishing the conceptual provenance and the scientific logic of Stein's 'neurophysiological imaginaries,' Meyer claims that Stein's dissociative writings have an epistemological and neurological history that originates with her medical studies and brain research at the Johns Hopkins Medical School. To be precise, he contends that the provenance of Stein's dissociative writing style ought to be linked to the research that she conducted on the nucleus of Darkschewitch and the surrounding brain stem region in 1897 and 1898, when she was working with Dr. Franklin Mall and Dr. Lewellys Barker at Johns Hopkins on their respective medulla projects. Barker subsequently published this research in his textbook, *The Nervous System and it Constituent Neurones* (1899). At the end of his discussion about Stein's research on the nucleus of Darkschewitch and the midbrain region, Meyer poses the following question about Stein's neuraesthetic writing practices: "The principal question I shall address here is how to construe the relation between these two facets of Stein's career, her early neuroanatomical training and her subsequent literary practice. Is it possible to understand the latter as *building* upon the former, rather than as either *divorced* from it, as Stein herself tended to suggest, or as *dictated* by it, merely a set of procedures and a perspective inherited from her scientific training?" (54; original emphasis). Following Meyer's cue, I believe that Stein's dissociative writing style reflects her specialized knowledge of the mind's "quasi-objects" and "quasi-subjects."[47] That is, I agree that Stein sought to represent the mental-physiological phenomena that William James referred to as "extraordinary mental states" in his Gifford lectures of 1901-02 (*Irresistible Dictation* 55). In this project thus far, I have introduced some of the neuraesthetic writing strategies and perceptual principles that Stein used to create her cubist brain maps; these include literary synaesthesia, the color thing, psychogenesis, the generic perspective, and the cubist puns that function as abstract brain maps and as neuroanatomical imaginaries. These writing strategies *supplement* Stein's nineteenth-century psychological studies and brain research, by forming discursive supplements that serve as emergent forms of cultural knowledge and creative expression.

Though numerous essays have been written about Stein's cubist literary portraits over the past century, only Meyer has written extensively about Stein's literary, brain mapping experiments.[48] To the best of my knowledge, he is the only critic that has written about Stein's "neurophysiological imaginaries," from the dual perspectives of late nineteenth-century neuroscience and late twentieth-century neuroscience. In *Irresistible Dictation*, he claims that these invisible nervous systems exist in *Tender Buttons*, "Old and Old," and *Bee Time Vine*. In chapter two, "Beyond

Organic Form: Gertrude Stein and Johns Hopkins Neuroanatomy," Meyer explains his "neuraesthetic," critical approach, as follows: "In describing "A Long Dress" in this way, as a collection of words that functions after the manner of a collection of neurons in the brain, I have actually appropriated Jane Maienschein's characterization of biological research of the last half-century on cellular organization, merely substituting the term *word* for *cell*. "The most serious weakness of the cell theory," Maienschein writes, is its inability in itself to explain cell-to-cell interaction or [the] organisation of many cells … Especially since the Second World War[,] … studies of exchanges at cell junctions and across cell membranes have begun to show the ways in which cells join together into functional multi-cellular units. ("Cell Theory," p. 370)" (Meyer 80). Looking to Maienschein's late twentieth-century biological research for inspiration, Meyer thus establishes the scientific rationale for "cell to cell" or "word to word" interactions in Stein's "neurophysiological imaginaries." He admits that he gets his inspiration from Maienschein's twentieth-century research, not from Barker's nineteenth-century medical descriptions of the different types of neurons that are found in the central nervous system in *The Nervous System and its Constituent Neurones*, or from other neuraesthetic studies of the brain, such as Zeki and Onian's respective, scientific contributions to the disciplines of "neuroesthetics" and "neuroarthistory."

By sidestepping Barker's accounts of the experimental nerve tissue staining techniques developed by his contemporaries, Meyer allows his readers to forget that histology – the medical discipline where scientists study the structure, properties and effects of neurons and non-neuronal brain structures using chemical stains and cutting-edge clinical technologies -- does not treat the central nervous system as an invisible entity, or as gray matter, or as a literary text that is comprised of black and white neuron-words. From a histological standpoint, the human central nervous system is always already a visible field that is comprised of naturally pigmented brain matter and artificially stained brain slices. According to Meyer, "Writing like this [i.e., the cubist writing that we find in "A Long Dress"] might be characterized, in properly radical empiricist fashion, as *studies of exchanges at word junctions and across word membranes*, designed *to show the ways in which words join together into functional multi-word units*" (80; original emphasis). With respect to Maienschein's biological research, Meyer contends, "I could just as well have cited Stein directly, in remarks concerning the composition of *Tender Buttons* which she made in an interview shortly before her death in 1946. "I took individual words," she noted, "and thought about them until I got their weight and volume complete and put them next to another word, and at this time I found out very soon that there is no such thing as putting them together without sense. I made innumerable efforts to make words write without sense and found it impossible. Any human being putting down words had to make sense out of them" (TI, p. 18)" (Meyer 80). Following James, who states in *The Principles of Psychology*, that "*subjectively*, any collocation of words may make sense – even the wildest words in a dream – if one does not doubt their belonging together," Meyer makes sense of Stein's dissociative prose by conceptualizing her fragmented, nonsensical writings as *neurophysiological imaginaries* that function as "conscious artifacts" and as nonliving, biological entities (81; original emphasis). Though Meyer does not credit Donald Sutherland with making a similar observation in *Gertrude Stein: A Biography of Her Work*, both of these critics approach Stein's dissociative writings with an associative, critical stance and philosophical logic. In his biography of Stein, Sutherland writes, "it is perfectly possible that the first half of this century, in which everything has been wildly disconnected and at the same time everything is made to connect with anything else, may find its most exact meaning in the word 'steinesque" (85). In his "steinesque" reading of "A Long Dress," Meyer proposes that Stein "conceived of words, like [nerve] cells, as existing in three-dimensional space rather than two-dimensionally on the page or the microscope slide. Stein's writing practice may thus be viewed as a form of laboratory science, descending, by the way of the psychological and anatomical laboratories at Harvard and Johns Hopkins, from the medical laboratory described several decades earlier by Claude Bernard in his *Introduction to the Study of Experimental Medicine*. In *her* laboratory she experimented with words in an attempt to articulate their sense of life" (81-82; original emphasis).

Turning to Barker's chapter on the fasciculus longitudinalis medialis in *The Nervous System and its Constituent Neurones*, we find that Stein's neuroanatomy professor, Lewellys Barker, conceptualizes the nucleus of Darkschewitch and the midbrain region surrounding this nucleus as a three-dimensional space. That is, even when these brain structures have been studied in the laboratory from a two-dimensional histological perspective, using perhaps Cajal or Golgi's methods of silver nitrate staining to elucidate the finer neuronal structures and cellular elements of the nucleus of Darkschewitch and its nerve tracts, Barker views these structures from a three-dimensional, neurological standpoint. Though admittedly incomplete and imperfect, Barker's three-dimensional, medical view of the nucleus of Darkschewitch and the surrounding midbrain region elucidates some of the problems that Stein faced when she was trying to comprehend the precise function of this brain nucleus in relation to the visual brain (i.e., to V4 of the cerebral cortex) and in relation to the brain's memory centers (i.e., to the hypothalamus and the thalamus). Stein's assigned task, as Barker and

Mall's research assistant on the brain stem project, was to study the finer neuronal network connections that comprised these midbrain neural structures under the microscope, so as to reconstruct the neural network architectures that comprised the nucleus of Darkschewitch and surrounding region. Also, her task was to discover any neural pathways between this brain nucleus and other interregional neural networks that might be responsible for the processes of vision, reading, attention, learning and memory. If Stein acquired the habit of conceptualizing the neuron-words in her cubist writings as three-dimensional entities, then she largely derived this neuraesthetic reading practice from Barker and Mall, who taught her how to examine the brain from two-dimensional histological and microscopic perspectives, as a means of constructing three-dimensional brain models and neurological theories. Revealing the neurological protocols that were followed in their comparative studies of infant and adult brain stem structures in his laboratory, Barker concludes his book chapter on the fasciculus longitudinalis medialis, which also presents Stein's research findings on the nucleus of Darkschewitch and the surrounding region of the upper medulla, with the following observations:

> The upward continuations of the fasciculus longitudinalis medialis, which could be looked upon as being concerned in the conduction of sensory impulses toward the somaesthetic area of the cortex, are not at well understood. So far as we can find in serial sections through the baby's brain cut in all three dimensions of space, it is not possible to follow any direct upward continuations far into the hypothalamic region, and if the fasciculus longitudinalis medialis is to be regarded as one of the paths mediating sensory impulses on their way to the cerebral cortex, this path is almost certainly interrupted in the hypothalamus or thalamus. (726)

From this statement, we know that Barker directed Stein and Sabin, his senior graduate student, to follow the nerve bundles into all "three dimensions of space," in order to find a possible route of conduction from the fasciculus longitudinalis medialis toward the hypothalamus and the cortex's somaesthetic, neural networks.

Using "A Long Dress" to support his argument about Stein's nonpathological literary representations of James's "physiological psychology," Meyer argues, "An automobile may not actually be a living organism but it nonetheless catches the spirit of the thing, as the very name *automobile*, "self-moving," suggests. Stein seeks the engine's movement in her portraiture, "the current that makes the machinery crackle," as she puts it in "A Long Dress": what is it that is "inside any one, and by any one I mean every one" is "intrinsically exciting" (p. 183). It is this internal movement that, like Bernard's internal milieu in the living organism, distinguishes the functioning of language from "external factors," and makes controlled experiments of individual neuraesthetic experience possible, at least in a milieu composed of words" (115). In proposing that we read Stein's word "machinery" in this object description as a synonym for the word "automobile," Meyer sets up a chain of associations that are non-pathological from the standpoint of James's "physiological psychology." It appears that Meyer is referring to Stein's concept of genius, in "Portraits and Repetition," when he uses the engine trope and the automobile metaphor to describe the workings of the "invisible" nervous system that he finds to be operative in "A Long Dress":

> One may really indeed say that that is the essence of genius, of being most intensely alive, that is being one who is at the same time talking and listening … it is necessary to be at once … doing both things, not as if they were one thing, not as if they were

> two things, but doing them, well if you like, like a motor going inside and the car moving, they are part of the same thing … This is what we mean by life and in my way I have tried to make portraits of this thing always have tried to always may try to make portraits of this thing. ("Portraits and Repetition" 170)

From what Stein says about her attempts to capture movement at the level of language in her cubist portraits, Meyer's neuraesthetic reading offers a legitimate way of reading Stein's portraits. However, it leaves out the visual dimension completely and it neglects other allegorical dimensions of meaning production that are pertinent to the decipherment of a portrait's "neurophysiological imaginary." Here is the complete text of "A Long Dress," as it appears in the Dover edition:

> What is the current that makes machinery, that makes it crackle, what is the current that presents a long line and a necessary waist. What is this current.
>
> What is the wind, what is it.
>
> Where is the serene length, it is there and a dark place is not a dark place, only a white and red are black, only a yellow and green are blue, a pink is scarlet, a bow is every color. A line distinguishes it. A line just distinguishes it. (8)

Through an associative neuraesthetic logic, Meyer arrives at the conclusion that "A Long Dress" functions as a paradigmatic instance of how Stein creates an invisible nervous system for this work that is "exactly like the brain or nervous system in one's body" (117).

Basing his "neuraesthetic" reading of the non-explicit neuroanatomical portraits in Stein's literary oeuvre, Meyer asserts that Stein creates invisible nervous systems for her modernist masterpieces that are based on her own "normally functioning nervous system." According to Meyer, the reason why Stein secretly constructs these invisible nervous systems for her dissociative writings is that she views the central nervous system as a machine or engine that controls important bodily functions and thereby remains invisible until such time as it becomes diseased or disordered. This would be an elegant explanation for Stein's closeted neuroscientific writing practices, but for the fact that some of the more interesting "neurophysiological imaginaries" in Stein's literary corpus, "A Long Dress" included, consist of vibrant, unexpected and bold colors that represent Stein's evolving scientific insights about the brain's neural architecture and her attempts to visualize this architecture with color words from the English language. This is one of the primary areas where I disagree with Meyer's neuraesthetic, critical approach; specifically, I disagree with him as to what constitutes a neuraesthetic writing practice that either conforms to, or can be defined as, a discourse that exemplifies James's "properly radical empiricist fashion." I believe that color serves as the royal road to conceptualizing, understanding and visualizing the relationship that exists between the brain's neural connections and consciousness' phenomenal experiences, both for Stein and her cubist writings. In *Picasso*, Stein observes, "The color Picasso used was always important, so important that his periods were named after the color that he was using" (44). I am proposing that the similar kind of observation can be made of the colors that Stein uses in her cubist brain maps: namely, that these colors can help us to understand Stein's imaginative brain mapping strategies, her unusual neuroimaging techniques and her prescient neuron coloration schemes. The colors in Stein's second and third phase literary portraits (especially the ones composed between 1914 and 1936) may be as vital to understanding Stein's evolving neuroscientific insights and her neuroanatomical portraiture strategies, as the colors in Picasso's cubist portraits are to understanding his cubist aesthetic, subjective phenomenology and modernist vision. In the allegorical brain maps that Stein produces in *Tender Buttons* and *The Geographical History of America*, color is arguably the most noticeable feature, next to the dissociative style of writing that Stein deploys as a means of picturing the human mind's subjective phenomenology and neuroanatomical imaginary. Stein's literary brain maps may have been inspired by Picasso's cubist poems and paintings, but these maps are unique to the western practice of "neuroesthetics," because Stein uses the English language to visualize the complex neurophysiological entities, experiences and relationships that constitute the mind's "*N*-dimensional qualia space." Following Meyer's classification of Stein's dissociative writings as 'brain maps' and as 'neurophysiological imaginaries,' I am defining Stein's cubist allegories in *Tender Buttons* as brain-based 'connectivity maps' and her detective stories in *The Geographical History of America* as explicit modes of neuroanatomical portraiture and consciousness portrayal.

With "A Long Dress," "A Red Hat" and "A Seltzer Bottle" from *Tender Buttons*, Stein appears to be experimenting, for the first time, with the creative act of color-staining the individual word-neurons of her neuroanatomical portrait with distinguishable colors. Because of her experimental brain research and laboratory work with Lewellys Barker at Johns Hopkins, Stein knew that contemporary scientists had not yet developed the nerve tissue staining techniques and reached the level of neurobiological research that would allow them to stain individual neurons from a brain section with different colors, so as to study the brain's neural networks and synaptic connections under a microscope. In her embryological brain experiments and comparative anatomical studies with Barker, Stein was introduced to von Gerlach, Golgi, Dogiel, and Cajal's nervous system staining techniques, as well as to their hand-drawn illustrations of neurons and to their respective theories about the neuron doctrine and the reticular formation. This medical knowledge provided her with some of the conceptual tools that would be needed to understand the relationship that exists between neural structure, brain function and phenomenal experience.

Assuming that a reader possesses this scientific knowledge, the “sight and sound and meaning” of a portrait’s allegorical nervous system must be interpreted by someone that is aware of Stein’s secret, neuroanatomical designs. Secondly, the sights, sounds and meanings of a masterpiece’s allegorical nervous system need to put into context by a reader who has accepted that there may be secretive, neuroanatomical designs, as well as subconscious neuroscientific meanings in a given work, someone who is perhaps willing to use the “neuron doctrine,” or another form of neuron analysis, to decipher the synaptic connections and neuronal relations that are being posited by a text’s enigmatic word-neurons. That person must be willing to address the commonalities and differences that exist between the living human brain and a text’s human mind, as well as the similarities and differences that exist between the living human brain and a text’s brain-like human mind, and so forth. It is especially crucial that such readers remain alert to the fact that Stein’s colored word-neurons draw implicit, comparative analogies between artificially stained nerve tissues and naturally pigmented nerve tissues, as well as between microscopic views of individually colored neurons and macroscopic views of colored brain regions and neuronal groupings. In certain portraits, Stein’s language draws indirect comparisons between two-dimensional, laboratory prepared brain sections and three-dimensional, imaginatively construed brain images.

For some reason, Meyer only reads the first four lines of this portrait and invests a considerable amount of time to the analysis of these four lines in his monograph study, but then ignores the rest of the poem. Though Meyer turns to this portrait to illustrate different aspects of Stein's neuraesthetic compositional practices, he never mentions the second half of this portrait (i.e. the last four lines); not once does he mention the vibrant colors that comprise this nervous system's "neurophysiological imaginary." I can find several ways to explain why the colors in this portrait could be invisible to certain readers, and I am sure that Meyer also could have found ways to explain why reading color is not seeing color, although Zeki stresses that the relation between seeing and understanding is negligible when it comes to the visual brain and its multifarious functions.[49] In the section below, I offer some theories as to why Meyer does not "see" the colors in the masterpiece's "invisible" nervous system and why, conversely, Stein may not have put colored word-neurons in the first half (i.e. the first four lines) of "A Long Dress." As a means of supplementing Meyer's neuraesthetic readings and compensating for possible blind spots in his critical approach, I devote my efforts to reading the colors and the color signifiers in Stein's neuroanatomical portraits. By focusing on "A Long Dress," I explore how Stein's laboratory experiences from the Harvard psychological laboratory become transfigured by her literary cubism into neuraesthetic creations that anticipate radical changes to nineteenth-century, nervous system coloration and examination practices.

Even if you did not know that you were looking at artificially stained or naturally pigmented colored neurons from the human brain, the vibrant colors and zany color combinations that Stein uses to describe the enigmatic objects in this piece likely would capture your attention: "it is there and a dark place is not a dark place, only a white and red are black, only a yellow and green are blue, a pink is scarlet, a bow is every color" (8). Even if you did not know that you were reading metaphorical word-neurons that comprised a text's imaginary nervous system, you likely would notice that only half of this portrait contains color signifiers and that the other half seems to be a colorful garden of "buzzing blooming confusion," as James describes the sensory confusion experienced by infants whose developing brains do not yet distinguish between internal sensory experiences and external percepts. I am not the only one to find the unusual color combinations and nonsensical color mixtures in the cubist portraits from *Tender Buttons* to be fascinating 'studies in description.'[50] However, I am one of the first to discuss these color neuron-words from a twenty-first century, neuraesthetic perspective. Following Meyer, I view these literary experiments as radical empiricist discursive constructions that express a phenomenology of consciousness, which derives its brain-based knowledge and conceptual framework from Stein's laboratory experiences at Harvard University, as well as from her clinical research at the Johns Hopkins Medical School.

1.4 Stein's Color Experiments at Harvard University and Their Literary Traces

In this section, I examine the ways in, and the extent to which, Stein's neuraesthetic practices indirectly reference her experiments with the saturation of colors in the Harvard Psychological Laboratory. I propose that "A Long Dress" and other cubist brain portraits from *Tender Buttons* showcase the subjective qualities of conscious experience that correspond with Stein's previous laboratory experiments at Harvard University and Johns Hopkins Medical School. Using James's psychological observations about color consciousness and mental evolution, I explore the neuroscientific implications of Stein's sensation-based, radical empiricist literary practices, by showing how they relate to Stein's nineteenth-century brain research at Johns Hopkins. From a radical empiricist literary standpoint, my aim is to consider the extent to which, and the ways in which, Stein's dissociative writing practices operate as culturally intelligible, "neurophysiological imaginaries," for this century's neuraesthetic readers.

From the outset, let me stress that it is not my goal to solve the difficult, neuraesthetic problems that Meyer raises in his book concerning Zeki's empirical readings of modern literature; nor is it my aim to rehearse Meyer's complex views on Zeki's twenty-first century, radical empiricist approaches to phenomenal consciousness and the visual brain. Rather, my aim is to explore how Stein portrays color experience in her cubist writings, as a means of visualizing the brain and producing cubist brain maps. Based on James's evolutionary research on the brain and the mind in *The Principles of Psychology Volume Two*, I believe that her color-coded brain maps illustrate different sources of creative insight at the level of consciousness's elementary and secondary, phenomenal qualities.[51] Stein's allegorical brain representations showcase the human mind's creative *qualialects* and *qualia-politics* and *qualia spaces*. I have coined the first two terms, *qualialects* and *qualia-politics*, to describe the ways in which Stein's modernist writings represent the human brain and central nervous system, using the literary, aesthetic and linguistic qualities of phenomenal consciousness, which William James first classified as "aesthetic ideas," under the general heading of the elementary qualities of conscious experience. I take the scientific term, "qualia space," from Edelman and Tononi's *A Universe of Consciousness,* where they use it to describe the "*N*-dimensional consciousness space" that corresponds with the brain's "*N*-dimensional neural space" (164). Instead of pursuing a vision of the brain's neural architecture and its synaptic connections that explicitly follows Cajal's neuroscientific illustrations and his theoretical conclusions about neuron regeneration and the neuron doctrine, Stein creates a palimpsest of colored word-neurons in "A Long Dress," which playfully represents and discursively reconfigures her laboratory-born, subjectively experienced, inner states of consciousness.

In an embryonic way, I am trying to answer the following question: can literary works express the genetic codes and evolutionary processes of the creative, human mind and its passing states of consciousness with colors that simultaneously represent the brain's neurophysiological entities and its neuroanatomical features? This question can be difficult to answer, because one must be able to visualize and theorize the connections that exist between a text's colorful neurophysiological entities and its psychogenetic processes of literary composition. For the better part of her writing career, Stein sought to efface the conceptual connections and the color relations that would make it possible for her readers 'to see' these important forces at work within her literary compositions.

One of the reasons why Meyer does not mention colored neurons or colored brain matter in his analysis of "A Long Dress" is because he largely defines his neuraesthetic model of literary interpretation, through James's philosophy of mind, as a radical "empiricism that is divorced from the idea of the primacy of sense-data" (13). My study expands upon the neuraesthetic reading practices advanced by Meyer in *Irresistible Dictation: Gertrude Stein and the Correlation of Writing and Science,* in a number of important ways. For example, we both agree that his radical empiricist psychological approach to the study of consciousness greatly influenced her modernist writing experiments with language, dissociation, phenomenology, creativity and cognition. Yet, there are fundamental differences between Meyer's neuraesthetic/organicist approach to Stein's dissociative writings and my neuraesthetic/critical approach, the primary one being that we disagree about how to read the elementary and secondary qualities of conscious experience at the level of a text's dissociative discourse. For example, Meyer places far less emphasis upon "sense-data," or what James defines as the elementary qualities of phenomenal experience, when he reads Stein's experimental writings. On the contrary, I believe that it is crucial to account for both the elementary and secondary qualities of conscious experience, if we are to appreciate how Stein translates sensory experiences into dramatic writings and cubist masterpieces, which serve purposes other than the creative representation of the artist's subjective nature and her embodied experiences. That is, I do not believe that the plays, operas, portraits, detective stories and other experimental writings in Stein's corpus merely seek to represent the subjective phenomenology of their creator's "human mind." In most cases, they exceed this purview by virtue of their dramatic and performative nature, not to mention the fact that they incarnate the neural and perceptual principles of great art. Though I mostly limit my analyses of Stein's neuroanatomical portraiture strategies to the cubist portraits from *Tender Buttons* and *The Geographical History of America*, I believe that the dramatic texts in her literary corpus were meant to be linguistically staged, musically incarnated and physically embodied, in front of live audiences.[52]

In this project, my aim is to examine Stein's non-explicit and explicit, neuroanatomical portraiture strategies for what they reveal about the "elementary components of subjective consciousness" (Kandel 398). If you recall, Kandel calls for scientific theories that allow researchers to be able to "relate conscious phenomena with cellular processes in the brain" (397). Following this scientific logic, Edelman and Tononi approach the problem of correlating conscious experience with neural mechanisms, the so-called "qualia problem," from the standpoint of linguistic translation, scientific description and philosophical explanation, with the following passage:

> Consciousness poses a special problem that is not encountered in other domains of science. In physics and chemistry, we are used to explaining certain entities in terms of other entities and laws. We can describe water with ordinary language, but we can also describe water, at least in principle, in terms of atoms and the laws of quantum mechanics. What we are really doing is connecting two levels of description of the same external entity – a commonplace one and a scientific one that is enormously powerful and predictive. … When we come to consciousness, however, we encounter an asymmetry. What we are trying to do is not just to understand how the behavior or cognitive operations of another human being can be explained in terms of the working of his or her brain, however daunting that task may be. We are not just trying to connect a description of something out there with a more sophisticated scientific description. Instead, we are trying to connect a description of something out there – the brain -- with something in here – an experience, our own experience, that is occurring to us as conscious observers … We know what it is like to be us, but we would like to explain why we are conscious at all, why there is "something" it is like to be us – to explain how subjective, experiential qualities are generated. (10-11; original spelling)

Based on this passage, I wonder if there is a particular reason why we would expect Stein to describe her conscious experiences of the human brain with "ordinary language," if, indeed, she is "trying to connect a description of something out there – the brain – with something in here – an experience, our own experience, that is occurring to us as conscious observers"? By the same token, I wonder if we ought to expect this writer to have translated her conscious experiences of previous laboratory experiments and past brain surgeries into "ordinary language" and intelligible English verse, if, as these scientists stress, "What we are really doing, [when we describe consciousness,] is connecting two levels of description of the same external entity – a commonplace one and a scientific one that is enormously powerful and predictive"? If it was the case that Stein produced literary works that indirectly illustrated her conscious, laboratory experiences with a dissociative writing style that uses the English language in unexpected ways, and if some of these experiences were of a scientific nature that encompassed insights, intuitions and findings from past laboratory experiments and empirical studies, then is it really so hard to believe that she also might try to translate some of experiences into a series of neuraesthetic literary experiments that address a number of scientific problems? With varying degrees of success, I think that she created neuraesthetic writing styles that accommodated the descriptions of emergent forms of scientific knowledge. In part, I base my arguments on Edelman and Tononi's neuroscientific research, which stresses that most forms of scientific notation and discursive description fail to explain the "subjective, experiential qualities [that are [being] generated by [consciousness]."[53] With her cubist literature, Stein not only captured emergent forms of aesthetic consciousness, but also preserved the special kinds of scientific insight and knowledge that came from her passing states of phenomenal consciousness. Following James, Edelman and Tononi, I am defining this special kind of consciousness-based, neuraesthetic mode of inquiry as "qualia knowledge."

Based on Edelman and Tononi's statements, it seems reasonable to ask if there may have been a special reason why Stein would have wanted to preserve the cognitive operations of her subjectively experienced inner states of consciousness in culturally intelligible literary verses, when, in her unique position as a budding brain researcher and experimental psychologist, these recorded experiences derive, in part, from laboratory experiments and brain surgeries that she conducted during her undergraduate and graduate studies. For example, in the psychological experiments on the saturation of colors, motor automatism and attention that she helped Leon Solomons design and execute at William James Harvard laboratory, Stein experienced sensations, perceptions, and realities that were related directed to the brain and its passing states of consciousness. Placed in the position of being simultaneously the research subject and the scientific researcher during her psychological experiments with the saturation of colors, Stein reports, through the published research of Leon Solomons, that she experienced her "consciousness" as coextensive domains of conflicting, external and internal phenomenal realities, which coincided with her subjective, but nonetheless clinical and decidedly objective, experiences of the colored objects that were being presented to her by Solomons, within the Harvard laboratory.

Based on these recorded experiences and what they reveal about Stein's ability to analyze the subjective elements of her phenomenal color perceptions from a radical empiricist perspective, I propose that her creative processes of consciousness translation, mind evolution, brain representation, and masterpiece creation reflect James's hypotheses about the conscious mind, from chapter twenty-eight of *The Principles of Psychology*. In this chapter, which is entitled "Necessary Truths and the Effects of Experience," James defines the elementary qualities of phenomenal consciousness, as follows: "The first thing I have to say is that all schools (however otherwise they may differ) must allow that the *elementary qualities* of cold, heat, pleasure, pain, red, blue, sound, silence, etc., are original, innate, or *a priori* properties of our subjective nature, even though they should require the touch of experience to awaken them into actual consciousness, and should slumber, to all eternity, without it" (II 618; original emphasis). In the section that is entitled "Two Modes of Origin of Brain Structure," he further dissects the elementary qualities of conscious experience into a hierarchy of sensations, experiences, feelings, ideas and judgments. Using Darwin's evolutionary theories as a basis for his psychogenetic categorization of conscious experience, James says, "We find:

1. Elementary sorts of sensation, and feelings of personal activity;
2. Emotions; desires; instincts; ideas of worth; aesthetic ideas;
3. Ideas of time and space and number;
4. Ideas of difference and resemblance, and of their degrees.
5. Ideas of causal dependence among events; and of end and means; of subject and attribute.
6. Judgments affirming, denying, doubting, supposing any of the above ideas.
7. Judgments that the former judgments logically involve, or are indifferent to, each other. (II 629)

As this list reveals, James classifies the elementary and secondary qualities of phenomenal experience into seven main categories and twenty subcategories. Contrary to what Meyer states in *Irresistible Dictation*, James's radical empiricist psychological practice does indeed "decompose" emotional experience into clear and distinct elements, as Darwin did" (26). Because Meyer reads James's analysis of conscious experience primarily from the perspective of his psycho-physiological research in *The Principles*, he thereby misses this important classification of phenomenal consciousness that applies to Stein's neuraesthetic writing practices.

As a result of his critical leanings, Meyer ignores how James elevates the elementary qualities of phenomenal experience to the status of evolutionary by-products and processes, and thus he fails to see how Stein's radical empiricist forms of literary experimentation follow James's cue, by *not* treating these discriminative qualities as "dumb way[s] of acquaintance without *knowledge-about*" (James, PR, p. 217). In Meyer's opinion, "Radical empiricism demonstrates that ordinary empiricism's notion of experience is itself, inevitably, an abstraction" (13). To support his arguments about the superior status of the secondary order of phenomenal experiences in James's radical empiricist psychology and Stein's dissociative writings, he states,

> Although James was certainly no slouch in the production of all manner of theses, and the Harvard Psychological Laboratory he founded in 1875 actually preceded Wundt's famous laboratory at Leipzig by several years, the account of introspective theory in *The Embodied Mind* caricatures his practice. Despite distinguishing among several forms of sensation, he does not "decompose" emotional experience into clear and distinct elements, as Darwin did; nor is his perspective that of "detached, unemotional, exact, intellectual scrutiny of one's condition, conducted in the way a scientist would conduct a piece of research," to cite Martha Nussbaum on the pursuit of "knowledge of the heart by intellectual scrutiny" (p. 262). (26)

As we saw with the passage above from "Necessary Truths," James does categorize conscious experience "into clear and distinct elements," contrary to what Meyer argues in the passage above. Also, in volume two of *The Principles*, James does *not* treat the elementary qualities of conscious experience as indistinguishable elements and as "dumb" sensations. To the contrary, he refers to these elementary qualities as "original, innate, or *a priori* properties of our subjective nature, even though they should require the touch of experience to awaken them into actual consciousness." Making the relationship between Darwin's biological science and his radical empiricism explicit in this chapter about phenomenal consciousness, brain evolution and "psychogenesis," James argues, "In zoological evolution we have two modes in which an animal race may grow to be a better match for its environment. First, the so-called way of 'adaptation' in which the environment may itself modify its inhabitant by exercising, hardening, and habituating him to certain sequences, and these habits may, it is often maintained, become hereditary. Second, the way of 'accidental variation,' as Mr. Darwin termed it, in which certain young are born with peculiarities that help them and their progeny to survive. That variations of *this* sort tend to become hereditary, no one doubts. The first mode is called by Mr. Spencer direct, the second indirect, equilibration. Both equilibrations must of course be natural and physical processes, but they belong to entirely different physical spheres. The direct influences are obvious and accessible things. The causes of variation in the young are, on the other hand, molecular and hidden" (II 626-627).

While it is important for me to prove that James assimilates Darwin's evolutionary science into his psychological discourse, as a means of supporting his hypotheses about "psychogenesis" and its "knowing objects (II 629)," I do not want to lose the thread of my argument, which is to challenge Meyer's point about radical empiricism's absolute stress upon "the decisive role of processes and procedures, of conjunctive as well as disjunctive relations, in the composition of experience" (*Irresistible Dictation* 13). In "Does Consciousness Exist," James emphasizes, "To be radical, an empiricism must neither admit into its constructions any element that is not directly experienced, nor exclude from them any element that is directly experienced" (42). Stein's laboratory experiments with color conform to James's definition of the practice of radical empiricism because she does not admit into her literary constructions of the human brain "any element that is not directly experienced, nor exclude from them any element that is directly experienced" (James 42). By asking us to exclude the elementary qualities of conscious experience from consideration, Meyer chooses not to include the crucial tenet of radical empiricism's operational methodology: namely, the first part where James cautions his followers and readers not to exclude anything from their analyses and their studies that is not directly experienced, sensed and perceived by the conscious mind.

Looking at the list above, Meyer probably would draw the line between category three ("ideas of time and space and number") and category four ("ideas of causal dependence among events, and of end and means; of subject and attribute"), if he was determining what comprises an elementary experience and what comprises a secondary experience in Stein's radical empiricist compositional practices.[54] Yet, James treats all of the seven categories above as "elementary mental categories," reserving the term "secondary qualities" for those "subjective duplicates of outer objects" that "are not supposed by any educated person to even resemble the [outer] objects" perceived by the brain (II 631). In other words, James defines the secondary qualities of conscious experience as the "abstract system of hypothetical data and laws" (II 635), the "scientific algebra" that "little resembles the reality given to us, [but which] turns out (strangely enough to be) applicable to it" (II 636). In addition to the secondary qualities, James adds, there are both “front-door” and “back-door” methods that allow the “original elements of consciousness, sensation, time, space, resemblance, difference and other relations, to become actualized ‘brain-processes.’ Many of the secondary qualities of conscious experience come into being by these so-called back-door processes, he argues. In James’s view, back-door evolutionary processes that manifest themselves through spontaneous variations at the level of the brain’s organic matter “form secondary combinations such as the *forms of judgment*, which, taken *per se*, are not congruent either with the forms in which reality exists or in those in which experiences befall us, but which may nevertheless be explained by the way in which experiences befall in a mind gifted with memory, expectation, and the possibility of feeling doubt, curiosity, belief, and denial. The idea of one term will then engender a fixed, a wavering, or a negative expectation of another, giving affirmative, the hypothetical, disjunctive, interrogative, and negative judgments, and judgments of actuality and possibility about certain things” (II 633).

James also points out that many of “the features of our organic mental structure cannot be explained at all by our conscious intercourse with the outer environment, but must rather be understood as congenital variations, “accidental’* in the first instance, but then transmitted as fixed features of the race” (II 618). By the phrase “inner nature,” James means the “natural objects and processes (in the ovum, in the blood, etc.), which equally modify the brain, but mould it to no cognition of *themselves.* The *tinnitus aurium* discloses no properties of the quinine; the musical endowment teaches no embryology; the morbid dread (of solitude perhaps) no brain-pathology; but the ways in which a dirty sunset and rainy morrow hang together in the mind copies and teaches the sequences of sunsets and rainfall in the outer world” (II 626). Taking the relation between the brain’s molecular processes and the mind's secondary qualities into account when he theorizes the origins of scientific insight and the creation of other forms of knowledge at the level of phenomenal experience, James observes:

> No one can successfully treat of psychogenesis, or the factors of mental evolution, without distinguishing between these two ways [direct and indirect] in which the mind is assailed. The way of experience proper is the front door, the door of the five senses. The agents which affect the brain in this way immediately become the mind's *objects*. The other agents do not. It would be silly to say of two men with perhaps equal effective skill in drawing, one an untaught natural genius, the other a mere obstinate plodder in the studio, that both alike owe their skill to their 'experience.' The reasons of their several skills lie in wholly disparate natural cycles of causation. (II 628)

This psychological theory is important because it helps to explain how Stein conceptualizes her subjective nature within her brain mapping experiments, as well as how she conceived of her subjective experiences at the level of her laboratory experiments at Harvard University, when she was being supervised by James. In addition, James's psychological explanations for the neural and evolutional mechanisms of conscious experience help to ground our understanding of Stein's artistic limitations and her conceptual gifts. Here is a fine example of how this operates in Stein's autobiographical writings: after recounting how, as a young girl, she was unable to draw simple household items like "a pretty cup and saucer" for a school project, ultimately relying on her older brothers to do the drawings for her, Stein admits that she has little natural talent for drawing and for conceptualizing three-dimensional objects. Nevertheless, she asserts, "it is a good thing to have no sense of how it is done in the things that amuse you.

You should have one absorbing occupation and as for the other things in life for enjoyment you should only contemplate results. In this way you are bound to feel more about it than those who know a little of how it is done. She is passionately addicted to what the french call métier and she contends that one can only have one métier as one can only have one language. Her métier is writing and her language is english" (*The Autobiography of Alice B. Toklas*, 84-85; original spelling). With these childhood reveries, Stein draws attention to the difficulty she had with three-dimensional brain modeling during the final stage of her medical studies at Johns Hopkins. Yet, as she points out, these limitations do not prevent her from using other artists' portraiture strategies and conceptual schemas, to portray the human mind in her compositions. Her autobiographical reflections thus support James's argument about "psychogenesis, or the factors of mental evolution," to the extent that she considers herself an "untaught natural genius" in the discipline of English literature, but "a mere obstinate plodder" in the field of fine art. By making the distinction between the two things, Stein indicates that she understands the neural and genetic bases of artistic creation from a psychogenetic standpoint, which is one of the things that James theorizes in "Necessary Truths and the Effects of Experience."

Speaking, in a similar capacity, about the ability of certain "biological empiricists," such as Semir Zeki and Gerald Edelman, to be able to evaluate the phenomenal qualities of their scientific vision and their laboratory experiences, Meyer argues that the "difference between Edelman's and Zeki's perspectives, then – like Whitehead's and Russell's, and Stein's and Eliot's – comes down to "that slightest change in tone" that, in "Whitehead's formulation, "yet makes all the difference" (SMW, p.2)" (20-21). I do not agree that the difference is so slight between Stein and Eliot's scientific insights or between their neuraesthetic compositions that a critic must rely upon intonation as a means of deciphering the neural and perceptual principles that inform their respective works. On the contrary, I think that vision plays a larger role that Meyer is willing to admit in Stein's neuraesthetic writing practices. Hence, my counterargument to Meyer's color-challenged, radical empiricist reading of Stein's "neurophysiological imaginaries" begins with this proposal: Stein's cubist brain maps use performative speech acts and cubist puns to represent the brain in unprecedented ways, so there is no need to fear the kinds of scientific reductionism that take the form of the "interval," which Meyer defines, through Pater's writings, as any "neuraesthetic perspective" that would reduce a text or a representation to a basic anatomical level, such as "the passage of the blood, the wasting and repairing of the lenses of the eye, [and] the modification of the tissues of the brain by every ray of light and sound" (Walter Pater, *The Renaissance* 150; Meyer 59). When speaking about the different kinds of qualitative discriminations that a scientist can identify within the realm of conscious experience, James observes that scientists may "postulate at the outset that all these forms of thought have a natural origin, if we could only get at it. That assumption must be made at the outset of every scientific investigation, or there is no temptation to proceed" (II 629). If these conscious experiences are considered to be environmental influences that act upon the brain's "organic mental structure," a paradox can arise in the scientist's thinking process if one is not careful: it is precisely because "these mental affections are ways of knowing objects," James notes, that scientists should not be quick to assume that all physical processes or metaphysical properties are knowable, for there are also "back door [evolutionary] methods" and "secondary [phenomenal] qualities" that "lie more in the sphere of morphological accident, of inward summation of effects, than in that of the 'sensible presence' of objects" (II 629, 631). In "Necessary Truths," James explains, "I think we must admit that the origin of the various elementary feelings is a recondite history, even after some sort of neural tissue is there for the outer world to begin its work on. The mere existence of things to be known is even now not, as a rule, sufficient- to bring about a knowledge of them" (II 630).

Note that James is arguing for the comprehension of the genetic, molecular and evolutionary processes of the "various elementary feelings" as a "recondite history." He is not suggesting that the elementary feelings ought to be conceptualized as the mind's profound, hidden or obscure history, as Meyer claims is the case with the "elementary emotions" in *Irresistible Dictation*. Referring to James's distinction between the 'knowledge of acquaintance' and 'knowledge about' as the foundation for his neuraesthetic readings of Stein's modernist texts, Meyer concedes that feeling is important to James's introspective psychology, yet it is a form of knowledge and acquaintance with phenomenal objects that is "necessarily "dumb" and "incommunicable":

> No thought exists without feeling, not any human feeling without some kind of thought. By the same token, all description requires "an acquaintance with description," and, conversely, all knowledge of acquaintance involves some degree of knowledge-about, at least for any creature capable of descriptive knowledge. It is the recognition of this co-implication of knowledge of acquaintance and knowledge-about that marks radical empiricism in both its poetic and its more straightforwardly scientific forms. James, in distinguishing knowledge of acquaintance and knowledge about, suggested that "words *feeling* and *thought* give voice to the antithesis. Through feelings we become acquainted with things, but only by our thoughts do we know them."

> All “elementary natures,” he added, “as well as “the kinds of relation that subsist between them,” either are not “known at all, or known in this dumb way of acquaintance without *knowledge-about*.” Stein refused to concede that such acquaintance was necessarily “dumb” or incommunicable: that, as James put it, at most, I can say to my friends, Go to certain places and act in certain ways, and these objects will probably come” (PR, p. 217). (16)

However, I agree with Meyer’s following claim,” “Writing, ordinarily treated in science as a means whereby experiments are reported and analyzed becomes the medium for experimentation in these writers’ hands. As a result, the hybrid nature of scientific practice, which in fact always combines knowledge of acquaintance and knowledge-about, albeit in different proportions and different relations, is rendered explicit in a way that protocols of scientific writing actively discourage” (21). In Stein’s able hands, the writing process literally transforms the elementary qualities into secondary qualities at the level of her neuroanatomical landscapes. When she uses color words to create “neurophysiological imaginaries” in her cubist portraits and detective stories, there is certainly a sense in which the color experiences these words signify are always already secondary order phenomenal experiences, as Meyer correctly observes in his analyses of Stein’s literary compositions. However, there is also a sense in which a portrait’s color words signify the elementary qualities of conscious experience that correspond with Stein’s embodied experiences of previous, laboratory conditions and clinical experiences. In Stein’s special case, the subjective domain of phenomenal experience includes laboratory experiments that studied motor automatism, color saturation and color consciousness.

If, as I believe, these color words indirectly signify the brain's colored matter, its phenomenal color experiences and the neurophysiological mechanisms that are associated with the brain's color vision and color consciousness, then Meyer has failed to examine his own critical vision as well as that of Stein's, when he chooses not to read the second half of "A Long Dress." In so doing, he fails to account for how this portrait's colored word-neurons *oxymoronically* comprise its *invisible* "neurophysiological imaginary." With respect to accounting for experience within the practice of biological empiricism, Meyer claims, "For Edelman, knowledge-about and knowledge of acquaintance proceed in a necessarily conjunctive relation. Science, as he conceives it, remains unable to "describe individual or historical experience adequately," since ordinary experience, as a function of knowledge of acquaintance, cannot be described in terms of knowledge-about in a non-reductive manner; nevertheless science "does provide a satisfactory (indeed, the best) description of the *constraints* on experience" ([Edelman] BABF, p.163)" (20). On this issue, William James draws the reader's attention to "a rather intricate system of necessary and rather immutable *ideal truths of comparison*, a system applicable to terms *experienced* in any order of sequence or frequency, or even to terms never experienced or to be experienced, such as the mind's imaginary constructions would be" (646). He adds,

> These truths of comparison result in *Classifications*. It is, for some unknown reason, a great aesthetic delight for the mind to break the order of experience, and class its materials in serial orders, proceeding from step to step of difference, and to contemplate untiringly the crossings and inosculations of the series among themselves. The first steps in most of the sciences are purely classificatory. Where facts fall easily into rich and intricate series (as

> plants and animals and chemical compounds do), the mere sight of the series fill the mind with a satisfaction *sui generis*; and a world whose *real* materials naturally lend themselves to serial classifications is *pro tanto* a more rational world, a world with which the mind will feel more intimate, than with a world in which they do not. (II 646-647; original emphasis)

James summarizes his evolutionary theory about the 'necessary truths" that comprise the human mind's mental objects and their discriminative qualities as the result of the "consciousness of series." "The essential condition for the formation of all these sciences [classification, logic and mathematics]," he proposes, "is that should have grown capable of apprehending series as such and of distinguishing them as homogeneous and heterogeneous, and as possessing definite directions of what I have called 'increase.' This consciousness of series is a human perfection which has been gradually evolved, and which varies amazingly from one man to another. No accounting for it as a result of habitual associations, so we must simply ascribe it to the factors, whatever they may be, of inward cerebral growth" (II 659). In addition to this observation, James adds this crucial point: "Once this consciousness is attained to, however, mediate thought becomes possible; with our very awareness of a series may go an awareness that dropping terms out of it will leave identical relations between the terms that remain; and thus arises a perception of relations between things so naturally separate that we should otherwise never have compared them at all. The axiom of skipped intermediaries applies, however, only to certain particular series, and among them to those which we have considered, in which the recurring relation is either of difference, of likeness, of kind, of numerical addition, or of prolongation in the same linear or plane direction" (II 659-660).

By comparing the colors in Stein's cubist brain maps to her previous experimental laboratory practices at Harvard University, I will show how these colors illustrate James's observations about "the axiom of skipped intermediaries," the "consciousness of series," and the "law of dissociation." The subjective phenomenology underlying the literary construction of these colored brain maps remains somewhat inaccessible, despite the author's autobiographical and critical reflections regarding her subjective processes of 'masterpiece creation." Hence, this reconstructive process is one that requires painstaking, scientific proofs and careful, literary analysis. In "Necessary Truths," James further stresses,

> All skipping of intermediaries and transfer of relations occurs within homogeneous series. But not all homogeneous series allow of intermediaries being skipped and relations transferred. It depends on which series they are, on what relations they contain. Let it not be said that it a mere matter of verbal association, due to the fact that language sometimes permits us to transfer the name of a relation of skipped intermediaries, and sometimes does not; as where we call men 'progenitors' of their remote as well as of their immediate posterity, but refuse to call them 'fathers' thereof. There are relations which *are intrinsically* transferable, while others are not. The relation of *condition*, e.g., is intrinsically transferable. What conditions a condition conditions what it conditions—"cause of cause is cause of effect." The relations of negation and *frustration*, on the other hand, are not transferable: what frustrates a frustration does not frustrate what it frustrates. No changes of terminology would annul the intimate difference between these two cases. (II 660)

To understand how "the axiom of skipped intermediaries and the transfer of relations" functions at the level of Stein's creative writing processes and brain mapping strategies, it is necessary to review what this author says about her non-identificatory, non-mnemonic and non-psychological methods of 'masterpiece creation' in "What Are Master-Pieces and Why Are There So Few Of Them."

Following James's teachings and principles, Stein often combined the elementary qualities and secondary qualities of phenomenal experience at the level of her textual discourse, so as to explore new methods of neuroanatomical portraiture, mind evolution and consciousness representation. For example, in *Reread Another :A Play*, an unidentified character (one that is most likely an anthropomorphic persona called 'First Mountain') enunciates or perhaps thinks to itself (himself or herself), "I am told that words are used in the sense in which they are felt. I am persuaded of nothing else. Can you effect trees. Yes by gasoline and what is the result. The leaves fall. A great many people are married. How can flowers sweat. The dear little thing it just gets hot" (124). James utters a sentiment that is similar to the one expressed by this play's anthropomorphic entity, when he proposes, "Different feelings may coexist in us without assuming any particular order. The sound of the brook near which I write, the odor of the cedars, the comfort with which my breakfast has filled me, and my interest in this paragraph, all lie distinct in my consciousness, but in no sense outside or alongside of each other. Their spaces are interfused and at most fill the same vaguely objective world. Even where the qualities are far less disparate, we may have something similar" (*Principles of Psychology* II 146). At the level of emotion and feeling, there needn't be a particular order in which the creative mind senses, evaluates and synthesizes the literary qualia that contribute to its sense of the "objective world" that has been transformed by bodily sensations and subjective realities. In *The Principles*

James argues for the scientific validation of sensory experience in experiments with consciousness:

> Conceptual systems which neither began nor left off in sensations would be like bridges without piers. Systems about fact must plunge themselves into sensation as bridges plunge their piers into rock. Sensations are the stable rock, the *terminus a quo* and the *terminus ad quem* of thought. To find such termini is our aim with all our theories -- to conceive first when and where a certain sensation may be had, and then to have it. Finding it stops discussion. Failure to find it kills the false conceit of knowledge. Only when you deduce a possible sensation for me from your theory, and give it to me when and where the theory requires, do I begin to be sure that your thought has anything to do with truth. (I 7)

Largely because of James's supervision and mentorship at Harvard University, Gertrude Stein and Leon Solomons learned to deduce "possible sensations" from their psychological theories and empirical experiments, in order to provide him with the "necessary truths" of human knowledge.

The phenomenology of color consciousness, or the "subjective aspect of color theory," as Solomons terms it, turns out to be a crucial part of Stein's psychological training at Harvard University. The laboratory experiment that Stein helped Leon Solomons design, as a means of testing the saturation of colors against Weber's law of 'least perceptible differences,' provided her with an embryonic, but vital, understanding of the "psychological classifications" that experimental psychologists scientists used to explore the "different subjective effects[,] which a colored object produces." Thus, *this* experiment functioned for her, not only as a form of cognitive experience, or as an institutional history that was "divorced from the idea of the primacy of sense-data" (13), as Meyer claims, but as a series of elementary experiences that comprised her subjective nature.

Placed in the position of being the research subject and the clinical researcher, at the same time, with these laboratory experiments on the saturation of colors, Stein was required to experience the colors first-hand and then to objectively analyze the significance of the data that emerged as a result of their experiments. Both the objective experiments with color and the subjective experiences of color could be defined, using Meyer's words, as "intimately experienced investigative procedures" that consisted of embodied, subjective perceptions, sensations and feelings that were directly related to the qualitative discrimination of different colors within the elementary and secondary orders of phenomenal consciousness.

The psychological and phenomenological experience of one's own failed investigative procedures was a crucial part of Stein's laboratory experiments on the saturation of colors in the Harvard Psychological Laboratory, which her partner, Leon Solomons, explains, in scientific language, in the following passage:

> when the rations of color to white are equal the ratios of color to white + color or any proportion thereof, as white +1/2 color, are also equal. Calling S the saturation,
> we have the general formula $S = \frac{c}{w+ac}$ satisfying the law of equality of saturation for all values of a. We have seen that for constant saturation the saturation increment corresponding for a L.P.D varied inversely as the intensity – for the actual color increment being constant, the saturation increment corresponding to it will vary inversely as the total quantity of light. Assuming it to vary directly as the saturation,

> we should have the formula $[\Delta]S = \frac{[\Delta]c}{W+ac} \infty \frac{c}{W+ac} \frac{I}{I}$, I being the intensity, that is, the increment of color, $[\Delta]c$, varies directly as the ratio of color to intensity. Since the result is independent of the quantity W+ac it might seem preferable to give the law the simple, verifiable formulation $[\Delta]c \infty \frac{c}{I}$, and from a physical standpoint this would of course be preferable. But psychologically it is bad because the quantity c has no psychological equivalent. The psychical fact, intensity of coloration, depends on a
> physical ratio $\frac{c}{W+ac}$ If we are to keep to psychical fact we must use the quantities saturation and intensity. Remembering therefore that $\Delta c \infty c$ is the best expression of the observed physical fact it is yet well, I think, to retain the somewhat hypothetical formula $\Delta S \infty S$, as more suggestive from the psychological point of view. (52)

With this Weberian-style analysis, Solomons manages to tease out the "least perceptible differences" that he perceived as existing between differing psychological points of view, psychical facts and physical facts. He finds that the intensity of coloration, which is given the quantitative value c, in Weber's law "has no psychological equivalent."

This means that Stein and Solomons had no way of measuring a color's qualitative value at the physical level, because of the inexplicable, subjective variations that occurred in their recorded observations of the colored objects that could only be explained psychologically, or at the psychological level. As a means of explaining the subjective phenomenologies that factored into their psychological experiments with Weber's law of least perceptible differences and with the saturation of colors, Solomons reports their disappointing findings about Weber's law but, also, their revealing discoveries about the subjective nature of color experience, in the following passage:

> *Place a white disk in a weak light, and a black and white in a strong light. It is not possible, by varying the proportion of black and white in the well-lit disk to get the two to look alike.* It is possible to get them of the same general light intensity, or of the same shade of gray, but not together. When the light-intensity is the same the well-lit disk is a very dark gray and the other a white, dimly seen. When of the same shade, the well-lit disk is very much more intense. It is the same with colors. A blue disk is seen distinctly as a pure blue, even when the light is so feeble as to make it scarcely visible, while a blue and black disk appears as a dark navy blue, no matter how strong the light. There is much individual difference here. A white disk in weak light appeared much more like a gray to Miss Stein than to me, but in no way could either of us get equality between the strong and weak light wheels. It should perhaps be stated that these experiments were first carried out with the object of really securing such an equality, and our inability to do so was a serious inconvenience; so that the result was anything but desired by us. We made every effort to see the disks alike. ... The conclusions are obvious. Intensity as such does not affect color quality *at all*. It remains a separate and distinct element in every color presentation. Blackness cannot be regarded as the inverse of intensity, nor as a sensational element at all. For it depends not upon the character of the light coming from the given body, but upon its relation to the immediate field of view. It must be regarded as an element added to every presentation by some reflect process, and giving the relation of the object to its immediate field of view—or to the incident

> light. It is not a mere question of comparison with other objects, for in all the above experiments there were two objects seen, yet the most intense disk was also the blackest. Nor was it simply a question of seeing objects 'as we know them to be,' instead of as they appear. For in our efforts to obtain equality all sorts of variations were made in the proportion of black and white and color of the two disks, of which the subject was unaware; yet it was not possible to get equality as long as the two disks were seen in different backgrounds. The teleological significance of the law is obvious. It makes blackness a 'body property,' independent of the intensity of the illumination. This compels us to adopt a four-fold, instead of the usual three-fold, representations of colored objects. They can vary in four independent ways: 1. color quality, or tone; 2. saturation; 3. intensity; 4. blackness. Any one of these may be made to vary while the others remain constant. This is a purely psychological classification of course, giving the different subjective effects which a colored object produces. That color quality may vary, the other elements remaining constant, is clear theoretically, though to actually compare the saturation of different colors is difficult. … The general result of this, it will be noticed, is to accentuate the subjective aspect of color theory. (54-55; original emphasis)

To grasp how Stein translated her laboratory-born color experiences into literary brain maps, this experiment reveals it could have taken place through the "axiom of skipped intermediaries." As James puts it, "Nothing but the clear sight of the ideas themselves shows whether the axiom of skipped intermediaries applies to them or not. Their connections, immediate and remote, flow from their inward natures. … The question whether there are or are not inward and essential connections between conceived objects as such, really is the same thing as the question whether we can get any new perception from mentally coupling them together, or pass from one to another by a mental operation which gives a result."

In the second half of "A Long Dress," I call your attention to the phrase "only a white a red are black." Instead of representing the neural networks of certain brain regions, such as the medulla oblongata or the cerebral cortex, in a direct fashion, Stein uses unusual color mixtures that obliquely reflect her laboratory experiments with the saturation of colors at Harvard University to "question whether there are or are not inward and essential connections between conceived objects as such" (James 661). Part of the color saturation experiment at Harvard involved the mixing of colors, as Solomons notes:

> The result of a long series of observations showed that the saturation of a mixture of color and white is entirely independent of the intensity, and of the actual quantity of color, and depends only on the ratio of the color to the white. [Weber's] law is perfectly obeyed within the limits of experimental error (a few degrees). The equality point was always determined by the method of least observable difference, though it was not long before the judgment of the equality point became more accurate than in most judgments, being nearly always placed in the same position, for movements in both directions. The colors used were red and blue. (51)

It is not obvious that Stein may have been trying to reproduce her laboratory experiment on the saturation of colors from the Harvard University, if proof of this experiment resides with the phrase, "only a white and red are black." Here is the complete text of "A Long Dress," as it appears in the 1997 Dover Publication:[55] What is the current that makes machinery, that makes it crackle,

> What is the current that presents a long line and a necessary waist.
> What is this current.
> What is the wind, what is it.
> Where is the serene length, it is there and a dark place is not a dark place, only a white and red are black, only a yellow and green are blue, a pink is scarlet, a bow is every color. A line distinguishes it. A line just distinguishes it. (8)

With respect to color mixtures and their symbolic traces within phenomenal consciousness, James points out, "Where a result comes [for the axiom of skipped intermediaries], it is due exclusively to the *nature* of the ideas and of the operation. Take blueness and yellowness, for example. We can operate on them in some ways, but not in other ways. We can compare them; but we cannot add one to or subtract it from the other. We can refer them to a common kind, color; but we cannot make one a kind of the other, or infer one from the other. This has nothing to do with experience. For we can add blue *pigment* to yellow *pigment*, and subtract it again, and get a result both times. Only we know perfectly that this is no addition or subtraction of the blue and yellow qualities of natures themselves" (II 661). (In the footnote following these observations, James refers his readers to Locke's *Essay*, book two, chapter XVII, p. 6.) One of the reasons why Stein may have chose to contrast a nonsensical color mixture with a physically established color mixture is to call attention to her creative processes of brain representation and her powers of qualitative discrimination. With these color combinations, she contrasts the "sciences" of consciousness that James describes as "intuitive" science versus the science that creates "a priori bodies of truth" (662). In the sixth line of "A Long Dress," Stein advances two propositions about the properties of colors that are mixed, one that is *untrue* and one that is *true*, according to the laws of physics: "only a white and red are black, only a yellow and green are blue" (8). These are small but significant clues that Stein began to mix colors, to play with former laboratory experiences and to reformulate her subjective experiences, so as to create colored brain maps that functioned, not as mirrors of her past selves or her previous laboratory experiments, but as creative templates for the neuraesthetic exploration of the brain's neural architecture and mind's phenomenal experiences.

Stein's friend and editor, Thornton Wilder, left it to future critics to explain the kinds of scientific visions, literary prophecies and philosophical intuitions that Stein was producing with her "creative metaphysics," when he proposed that Stein was following in the steps of Plato, Blake and Keats by "writing metaphysics" in a modernist literary fashion, in his introduction to the 1936 edition of *The Geographical History of America*. In his words, "The highest intuitions toward a theory of time, of knowledge or of the creative act have always passed beyond the realm of "text-book" exposition. When the metaphysician is combined with the poet we get such unusual modes of expression as the myths in Plato, the prophetic books of Blake, and the highly figured phrases in Keats's letters. Miss Stein's style in this book might be described as a succession of "metaphysical metaphors" (9-10). By viewing the relations and non-relations that exist between human nature and the human mind through the lens of Picasso's cubist paintings as colorful brain maps and as genomic landscapes, Stein foresaw some of important, genetic discoveries of the twentieth- and twenty-first centuries.[56] By incorporating unusual perspectives of the visible world and natural phenomena into her writings, she stumbled onto an important area of genetics research and brain mapping in the twenty-first century: the "Brainbow transgene." Through the creation of neuroanatomical imaginaries with cubist coloration techniques, modernist poetic devices and brain-based 'metaphysical metaphors,' Stein thus anticipated the fluorescent brain mapping strategies of the twentieth century and the 'brainbow mapping' strategies of the twenty-first century. While this is a significant achievement, one that I spend a considerable amount of time exploring in this thesis, it is not her only contribution to the practice of neuroesthetics, and it is probably not her greatest contribution to American literature.

With these neuraesthetic writing strategies, Stein envisioned a literary science of the reading brain that indirectly critiqued western society's "anatomo-politics," "bio-politics," and "memoro-politics." In other words, her dissociative writings advance James's radical empiricist approach to the ideological critique of western society's socially regulatory scientific regimes, by instantiating his "qualia-politics" at the level of her dissociative rhetoric. In *Rewriting the Soul*: *Multiple Personality and the Sciences of Memory*, Ian Hacking observes, "we can say that the program of localization of brain function, marked by Broca's identification of the motor control of speech, was a late appearance at the anatomo-pole. Experimental psychology may have begun in the physiology laboratory, once again part of the anatomo-knowledge, but with Ebbinghaus, when it became a statistical science, it no longer concerned itself with individual events or beings but with averages and deviations. It was part of the generalized bio-pole (a generalization that makes free with Foucault's own use of the "bio," but which in fact captures the essence of his "regulatory controls")" (215). With *The Principles of Psychology*, James transformed the localization of brain function into an experimental psychology that translated "anatomo-knowledge" and "bio-knowledge," that is, the scientific epistemes that Foucault identified as western science's socially regulatory "anatomo-politics" and "bio-politics," into a "qualia-politics" that would become intelligible to scientists, philosophers and psychologists at the end of the twentieth-century as the empirical study of consciousness. In *The Race for Consciousness*, John G. Taylor defines the politics of consciousness that I am defining as a "qualia-politics," using Foucault's philosophical nomenclature, Hacking's neuroscientific definitions, James's psychological research and Stein's cubist brain allegories, as "the race to be the first to understand it scientifically" (10). It is not my intention to make this *qualia-politics* the centerpiece of my argument; as I suggested above, this "qualia-knowledge" supplies cultural intelligibility for Stein's quasi-scientific, literary experiments with color saturation, attention, consciousness, language, phenomenology and dissociation.[57] Instead, I wish to flag some of the ways in which Stein's creative representations of the brain participate in an emergent qualia-politics, one that James was instrumental in shaping and producing at the end of the nineteenth century, with his analysis of the localization of brain function and its relation to experimental psychology, evolutionary science and the biological sciences in the late-nineteenth century. In conjunction with other artistic and cultural movements that were associated with avant-garde western modernism in the early twentieth century, Stein's literary texts and her dramatic plays inaugurated a form of "qualia-knowledge" that was associated with James's consciousness research, at precisely the time when the empirical sciences (i.e., the memory sciences) lost interest in consciousness as a direct object of study.[58]

Stein's secrecy about her neuraesthetic practices does not mean that her cubist brain mapping strategies do not belong to recognizable scientific traditions and ideological regimes, such as western society's "memoro-politics" and "qualia-politics." By 1936, the year Random House published *The Geographical History of America*, Stein's neuroanatomical portraiture had achieved its final stage of cubist evolution: namely, the "third phase," or the phase that Wendy Steiner defines as a synthetic style of cubist writing that simulated the synthetic, cubist paintings that Picasso and other cubist artists produced between 1912 and 1919. By "totally excluding the mode of signifying of her medium, Stein prevented her works from signifying altogether, reducing them to the status of "numinous" objects," Steiner argues in *Exact Resemblance to Exact Resemblance*. "However, she adds, "the creation of this fragmented, lexical language brought Stein's work very close in a technical sense to the synthetic cubists, with their isolated or disarranged forms. In fact, the similarities between the second- and third-phase techniques and those of the synthetic cubists are quite remarkable" (156). In Steiner's view, the literary portraits in Stein's corpus can be categorized according to three distinct phrases, which are the first, the second and third phases of literary portraiture that reflect the ways in which, and the degree to which, she employed the principles of analytic and synthetic cubism in her cubist writings. According to Steiner's classificatory schema, *Tender Buttons* contains second-phase or analytic cubist portraits and *The Geographical History of America* contains third-phase, or synthetic cubist portraits. Steiner also emphasizes, "portraiture was the most permanent of the genres, extending almost from the beginning to the end of Stein's career; … its vicissitudes marked, if not determined, the emergence and disappearance of other genres; and finally, after approximately 1922 this dominance shifted to other genres" (164). Near the end of her monograph study on Stein's cubist portraits, Steiner remarks, "It is reasonable to ask "whether the apparent dead end that Stein reached was peculiar to her portraiture alone, or whether all of her writing met a similar fate" (161). Though I oppose Steiner's conclusions about the "apparent dead end" that Stein's cubist portraiture reached in the 1930s, by analyzing the allegorical brain maps in *Tender Buttons* and *The Geographical History of America* from a variety of neuroscientific and psychological perspectives, I support her views about the performative meanings that these works produce through their “cubist puns” and “beloved mistakes.”

In my contrary opinion, Stein’s cubist portraiture does not become less intelligible to scientific-minded, literary readers because it takes the idea of hieroglyphic, cubist writing *too seriously*. For example, the cubist brain portrait from *The Geographical History of America* invites readers to consider the “hot” topic of neuroanatomical portraiture from multiple perspectives, which are presented by metaphors, puns and phrases that represent the human mind’s coextensive “neural” and “qualia” spaces (Edelman and Tononi, *A Universe of Consciousness* 164). In contradistinction with Steiner’s reading, I propose that this brain portrait anticipates scientific inventions and neurobiological discoveries, such the Brainbow “connectivity maps” that Harvard scientists Jeff Lichtman and Joshua Sanes perfected in 2007. In other words, I believe that the hypothetical “dead end” that Stein’ reached with her synthetic cubist portraiture in the 1930s does not exist, as such, that, this cubist portrait functions as the Rosetta Stone that permits readers to correlate Stein’s analytic and synthetic styles of brain representation with established, scientific practices of brain modeling, consciousness analysis and mind examination from the past three centuries. In my view, the brain portrait that Stein created for the “human mind” in *The Geographical History of America*, using James’s psychological principles and her subjective experiences of previous laboratory experiences, ought to be conceptualized as a cubist allegory and as a brain hieroglyph that has scientific value and culturally intelligible meanings.

Recent neuroscientific inventions, such as the Brainbow system, have made it possible for us to visualize the literal and allegorical dimensions of Stein’s cubist portraits as colored brain maps consisting of neurons, axons, glial cells and non-neuronal elements. With the empirical scientific knowledge and the visual aids that the Brainbow system provides, I interpret the allegorical brain representations in *Tender Buttons* and *The Geographical History of America* as ‘brainbow-like’ creations that exemplify James’s psychological principles, particularly his ideas about “psychogenesis,” or “mental evolution.” By “psychogenesis,” James means not only the evolutionary processes that reconstitute the human mind by transforming its “organic mental structure” and its passing states of consciousness, but also the theoretical process of trying “to ascertain just how far the connections of things in the outward environment can account for our tendency to think of, and to react upon, certain things in certain ways and in no others, even though we personally have had of the things in question no experience, or almost no experience, at all” (II 619, 617). Though James discusses the concept of psychogenesis throughout *The Principles of Psychology*, in “Necessary Truths” he uses a parallelogram metaphor to explicate the internal and external forces that act upon the conscious mind and the human brain, in their coextensive evolutionary processes:

> It is a familiar truth that some propositions are *necessary*. We *must* attach the predicate ‘equal’ to the subject ‘opposite sides of a parallelogram’ if we think those terms together at all, whereas we need not in any such way attach the predicate ‘rainy,’ for example, to the subject ‘to-morrow.’ The dubious sort of coupling of terms is universally admitted to be due to ‘experience’; the certain sort is ascribed to the ‘organic structure’ of the mind. This structure is in turn supposed by the so-called *apriorists* to be of transcendental origin, or at any rate not to be explicable by experience; whilst by evolutionary empiricists it is supposed to be also due to experience, not only to the

> experience of the individual, but to that of his ancestors as far back as one may please to go. Our emotional and instinctive tendencies, our irresistible impulses to couple certain movements with the perception or thought of certain things, are also features of our connate mental structure, and like the necessary judgments, are interpreted by the apriorists and empiricists in the same warring ways. (II 617; original emphasis)

With this parallelogram figure, James positions his radical empiricist, evolutionary psychology in relation to the nineteenth-century "evolutionary empiricists" and the "a priori transcendentalists," with whom he shares common ground in creating a "qualia-politics" that can be defined as the fourth side of an ideological parallelogram that hitherto had been comprised of the triangulated, socially regulatory scientific regimes defined by Foucault and Hacking as an "anatomo-politics," a "bio-politics," and a "memoro-politics."[59]

The opposing discourses of the "evolutionary empiricists" and "a priori transcendentalists" thus function as conceptual "poles" in James's evolutionary reasoning, in much the same way that Foucault conceives of the "*anatomo-politics of the human body"* as one "pole of development linked together by a whole intermediary cluster of relations" and the *"bio-politics of the population*,*"* as another pole whose "supervision was effected through an entire series of interventions and *regulatory controls*" (139; original emphasis). James's psychogenetic discourse serves as an ideological intervention into the scientific discourses of the "empiricists" and "apriorists," by showcasing the philosophical wars and scientific feuds previously defined the metaphysical properties, neurophysiological mechanisms and evolutionary adaptations that once were deemed by experts to constitute "mind stuff." In *The Principles of Psychology,* James sought to convince his readers to explore the spatial dimensions and sensory qualities of phenomenal consciousness, using psychogenesis, by asking the following questions (II 619): "What does it ["mind stuff"] consist in? What is its inner nature? Of what sort of mind-stuff is it composed? Second, the way of history: What are its conditions of production, and its connection with other facts? Into the first way we cannot go very far. *In its inner nature, belief, or the sense of reality, is a sort of feeling more allied to the emotions than to anything else*" (II 283; original emphasis). Using Darwin's evolutionary science to reinforce his pragmatist views about the brain's evolutionary possibilities and the mind's creative capacities, James takes a historical and analytical style of psychological inquiry into the domain of psychogenesis proper, when he asks whether or not the brain's "contents are arranged from the start, or perhaps if … "the arrangement they may possess [is] simply due to the shuffling of them by experience in an absolutely plastic bed" (II 619). At this point in his discourse, the concept of "psychogenesis" becomes synonymous with biological, molecular and evolutionary processes of brain regeneration that Darwin associated with natural selection and its molecular mechanisms of "spontaneous variation," in *The Descent of Man* and *On the Origin of the Species*. Edelman and Tononi have since redefined psychogenesis, using James's consciousness research and Darwin's evolutionary principles, as "Neural Darwinism," which is the term they use to describe the neurodevelopmental, epigenetic and adaptive processes of brain regeneration that have been broadly defined as "neurogenesis." James's parallelogram figure and his psycho-physiological psychology thus contribute to a "qualia-politics" that greatly influenced Stein's literary experiments with phenomenal consciousness and brain representation.

Though Stein refuses to use James's psychological terminology and classificatory schemas to describe the internal and external forces of conscious thought as psychogenesis proper, it is clear from her autobiographical writings that she has assimilated his research, in order to envision the brain's evolutionary processes and its spontaneous variations. The first time Stein speaks candidly and openly about her literary experiments with phenomenal consciousness is in *The Autobiography of Alice B. Toklas* (1933). Narrating her literary history and her college experiences from the third-person perspective of her lover, Alice Toklas, Stein recalls, in "Chapter Five 1907-1914," that it was during their trip to Granada, in the summer of 1912, that she began focusing on the phenomenology of consciousness and its literary vicissitudes: "We enjoyed Granada, we met many amusing people english and spanish and it was there and at that time that Gertrude Stein's style gradually changed. She says hitherto she had been interested only in the insides of people, their character and what went on inside them, it was during that summer that she first felt a desire to express the rhythm of the visible world" (130). Following this statement, Stein identifies the evolving conceptual nature, the aesthetic functions, and the discursive effects of her literary experiments with phenomenal experience as a "long tormenting process" that would consume her intellectual and creative energies for the rest of her writing career:

> It was a long, tormenting process, she looked, she listened and described. She always was, she always is, tormented by the problem of the external and internal. One of the things that always worries her about painting is the difficulty the artist feels and which sends him to painting still-lifes, that after all a human being essentially is not paintable. Once again and very recently she has thought that a painter has added something to the solution. She [Gertrude Stein] is interested

> in Picabia in whom hitherto she has never been interested because he at least knows that if you do not solve your painting problem in painting human beings you do not solve it at all. There is also a follower of Picabia's, who is facing the problem, but will he solve it. Perhaps not. Well anyway it is that of which she is always talking and now her own long struggle with it was to begin. These were the days in which she wrote Susie Asado and Preciocilla and Gypsies in Spain. She experimented with everything in trying to describe. She tried a bit inventing words but soon she gave that up. The English language was her medium and with the English language the task was to be achieved, the problem solved. The use of fabricated words offended her, it was an escape into imitative emotionalism. No, she stayed with her task, although after her return to Paris she described objects, she described rooms and objects, which joined with her first experiments done in Spain, made the volume Tender Buttons. She always however made her chief study people and therefore the never ending series of portraits. (130-131)

Using these statements to frame Stein's phenomenology of consciousness, I conceive of her cubist aesthetic, in *Tender Buttons*, as a neuraesthetic writing practice and as an aesthetic form of consciousness. I understand why Steiner proposes the following about Stein's cubist writings, but I disagree with her prophetic logic and phenomenological assumptions: "When we consider that Stein's ideas about language, her bracketing-off of various factors in order to concentrate on only one, and her intricate analysis of time have led critics to wonder if she might not have been well acquainted with writings of the phenomenologists, one begins to feel that she may indeed have grasped some essential structure of the modern which was capable of generating any of the phenomena of the twentieth century"

(54). By foregrounding this statement, I also interrogate the premises and possibilities of Stein's phenomenological writing practices. However, I do not believe that Stein created things *ex nihilo*. Her cubist writings offer fleeting images of future scientific discoveries, such as the Brainbow connectivity maps, precisely because she possessed the medical knowledge, which would have allowed her to predict these kinds of neuroscientific innovations. This, I would say, is the neuraesthetic secret that underlies her artistic genius.

1.5 Gertrude Stein and the Johns Hopkins Experiments

In the course of producing her cubist portraits, Stein deployed special representational techniques from the cubist painters and comparative anatomists of the early twentieth century. With her advanced knowledge of comparative neuroanatomy, neurological histology and clinical microscopy, she was able to invent new ways of coloring the brain's neural architecture and presenting the mind's elementary and secondary phenomenal experiences through her cubist literature. Reminiscing about her neuroanatomical studies of the human brain at Johns Hopkins, Stein recalls, "The first two years of the medical school were alright. They were purely laboratory work and Gertrude Stein under Llewelyn Barker immediately betook herself to research work. She began a study of all the brain tracts, the beginning of a comparative study. All this was embodied in Llewelyn Barker's book. She delighted in Doctor Mall, Professor of anatomy, who directed her work" (89). At Johns Hopkins, Doctor Franklin Mall provided the kind of supervision that she needed to develop her own dissection techniques and neuroanatomy skills: "Doctor Mall believed in everybody developing their technique. He also remarked, nobody teaches anybody anything, at first every student's scalpel is dull and then later every student's scalpel is sharp, and nobody has taught anybody anything" (90). Because of Mall's supervisory skills, "These first two years at the medical school Gertrude liked well enough" (90). Underscoring the difference between the first two years of medical study where she mostly conducted brain research in the laboratory and the last two years of medical study where she practiced general medicine, Stein recalls,

> The last two years at the medical school she was bored, frankly openly bored. There was a good deal of intrigue and struggle among the students, that she liked, but the practice and theory of medicine did not interest her at all. It was fairly well known among all her teachers that she was bored, but as her first two years of scientific work had given her a reputation, everybody gave her the necessary credits and the end of her last year was approaching. It was then that she had to take her turn in the delivering of babies and it was at that time that she noticed the negroes and the places that she afterwards used in the second of the Three Lives stories, Melanctha Herbert, the story that was the beginning of her revolutionary work. As she always says of herself, she has a great deal of inertia and once started keeps going until she starts going some where else. As the graduation examinations drew near some of her professors were getting angry. The big men like Halstead, Osler etcetera knowing her reputation for original scientific work made the medical examinations merely a matter of form and passed her. But there were others who were not so amiable. Gertrude Stein always laughed and this was difficult. (90-91)

As Stein recounts this narrative from the perspective of her lover, Alice Toklas, thirty years after she abandoned her medical studies at Johns

Hopkins, one is given the impression that the institutional politics and her boredom led to the "end of the medical education of Gertrude Stein" (91). Formally, what Stein is saying is true; but, in actuality, this was not the full story. Though Stein failed to graduate from her medical studies in June of 1902 with the rest of her class, she was willing to return to Baltimore several weeks later to finish her research and program requirements. "Recently," Meyer notes, "Brenda Wineapple has clarified Stein's aim in pursuing the [medical] degree [after her failure to graduate]. The previous year she had made arrangements to do postgraduate work with Adolf Meyer, at the time chief neuropathologist at the Massachusetts State Hospital for the Insane and subsequently professor of psychiatry at Johns Hopkins and director of the Henry Phipps Psychiatric Clinic there" (Meyer 88). Wineapple concludes that Stein's "implication was clear: in due course she would have [had] her degree" (pp. 143-144; Meyer 88), which Meyer points out, is "Exactly as Stein proposed thirty years later [in *The Autobiography of Alice B. Toklas*], she would then have gone on, if not "to the practice of medicine, … at any rate to pathological psychology" (91; Meyer, *Irresistible Dictation* 88).

This institutional and personal history reveals that Stein was dedicated to her brain research, even after she suffered some setbacks at the Johns Hopkins Medical School with her coursework and her three-dimensional brain model of the medulla oblongata. Through Alice Toklas, Stein tells her readers,

> The professor who had flunked her asked her to come to see him. She did. He said, of course, Miss Stein all you have to do is take a summer course and in the fall naturally you will take your degree. But not at all, said Gertrude Stein, you have no idea how grateful I am to you. I have so much inertia and so little initiative that very

> possibly if you had not kept me from taking my degree I would have, well, not taken to the practice of medicine, but at any rate to pathological psychology and you don't know how little I like pathological psychology, and how all medicine bores me. The professor was completely taken aback and that was the end of the medical education of Gertrude Stein. (91)

Using Barker's medical textbook and autobiography, it is possible to prove that Stein used different kinds of color-based, nervous system staining practices and brain modeling protocols in her laboratory experiments at Johns Hopkins. With the first neuroanatomical portraits in *Tender Buttons* (1914), Stein appears to be caricaturing the brain stem research that she conducted at the Johns Hopkins Medical School. In a footnote that is dedicated to the remarks that Stein's brother, Leo, made to Albert Barnes about his sister, Meyer observes, "Leo Stein, in a letter to Albert Barnes dated October 20, 1934, recalled that his sister "made fun" of "her research" work at medical school[,] saying that the women who were at Johns Hopkins for the first time fell in with Mall's hobby for making models of the brain tracts, to show how interested they were; that the men wouldn't waste their time on it." "She told me," he added, "that she didn't mind doing it, as it was purely mechanical work and rather restful" (*Journey Into the Self*, p. 148)" (*Irresistible Dictation* 347). In my opinion, Stein's colorful brain mapping experiments in *Tender Buttons* suggest a level of detachment and abstraction that coincided with her interests in cubism. If she was producing caricatures of the brain, and of certain laboratory procedures, and/or of certain neuroscientific findings with her colored brain maps, then it was through these detached, fully conscious, almost clinical, methods of cubist parody and non-mimetic literary portraiture.

In her anatomical experiments and medical studies with Dr. Lewellys Barker, Stein was introduced to Nissl, von Gerlach, Golgi, Dogiel, and Cajal's nervous system staining techniques, as well as to their hand-drawn illustrations of neurons and to their respective theories about the neuron doctrine and the reticular formation. Stein's familiarity with different kinds of nineteenth-century neuron coloration practices can be established, by referring to Barker's book, *The Nervous System and its Constituent Neurones* (1899), and to her references about this book in *The Autobiography of Alice B. Toklas*. Barker mentions these nervous system staining practices in relation to Stein's research on the nucleus of Darkschewitch in the chapter on the fasciculus longitudinalis medialis, so we can assume (by Barker's many pedagogical comments and medical references) that he taught Stein and his other medical students about the different staining practices that would yield promising results for the study of the fasciculus longitudinalis medialis, the brain stem, the midbrain and the medulla. Barker also discusses his medical pedagogy with Stein and her fellow medical students at Johns Hopkins in his memoir, *Time and Physician*. If further evidence is needed to support the connections between Barker's book and Stein's participation in his laboratory research, such proof can be found in *The Autobiography of Alice B. Toklas*, wherein Stein writes about her "original" contributions to Barker's comparative studies of the central nervous system. At various places within *The Nervous System and its Constituent Neurones*, Barker reveals that he used the methylene blue method of neuron, sometimes in conjunction with other tissue dyes such as Golgi's and Cajal's silver nitrate methods, the Weigert-Pal purplish-silver staining method and von Gerlach's gold chloride dye, as a means of studying the neurons, axons, glia and non-neuronal elements of mammalian nervous systems.

Using this medical textbook and Barker's medical memoir, *Time and the Physician*, it is possible to prove that Stein used many of these neuron coloration methods in her laboratory experiments at Johns Hopkins. Throughout his medical textbook, Barker emphasizes that certain axons and neurons do not stain well, so scientists must experiment with different stains and procedures in order to achieve the best results. For example, in "The Internal Morphology of Neurones," he observes,

> The axone itself, unlike the dendrites, is entirely free from the stainable substance of Nissl, as is also the portion of the cell body immediately adjacent, known as the axone hillock. This hillock is marked off with a tolerably sharp curved plane from the granular protoplasm of the cell body, and shows it at its margin not infrequently a layer of especially fine granules. With Kronthal's method, the axone and axone hillock stains intensely in methylene blue, very much as in the vital staining of Ehrlich. But Benda found that when the specimens thus prepared were cleared in creosote the axone and axone hillock lost their color, and only the stainable substance of Nissl retained the dye in the cell body and the dendrites. Benda makes one exception to this statement. In the basal axones of the pyramidal cells of the cerebrum, especially of those known as the giant pyramid cells of Betz, the collaterals which come off at right angles are visible when the preparations are stained by Benda's methylene-blue method. Just at the beginning of the collateral, a small wedge-shaped granule, in the section triangular, takes up the methylene blue, the axone itself remaining quite unstainable. I have met with this observation nowhere else in the bibliography. (111-112; original spelling)

Note, for example, how, in Figure 18 (Barker's Figure 64), one of the axons from a motor ganglion cell from the ventral horn of an ox's spinal cord shows no stain absorption whatsoever. This figure supports Nissl's claim and Barker's observation that the neuron's cell body and its dendrites retain chemical stains that are necessary for scientific study and connectivity mapping, in brain regions where the granule cells largely comprise a given neuronal grouping.

Material has been removed from this thesis because of copyright restrictions. The image removed from page 189 this thesis is Figure 18, Large motor ganglion cell from the ox showing clear spaces (*Vacuolen*). This figure supports Nissl's neurological findings and Barker's subsequent, medical observations, to the effect that the neuron's cell body and its dendrites retain chemical stains and the color constancy that are necessary for connectivity mapping in brain regions where granule cells largely comprise a particular, neuronal network architecture. The source of this image is Figure 64, Lewellys Barker's *The Nervous System and its Constituent Neurones* (112). New York: D. Appleton and Company, 1899. 112.

"Chromophobia" is one of the nerve tissue coloration dilemmas that Barker discusses in his study, with respect to various staining methods and different comparative studies. This neuronal form of color phobia may be the kind of problem that Stein had in mind and subsequently 'solved' with her variegated, neuron coloring literary experiments from "A Long Dress" and "Detective Story number VII." In his study, Meyer contends, "The sense of a whole, the overarching sense of acquaintance displayed in Stein's dissociative practices, may not correspond to any particular anatomical, or subanatomical, structure, yet it is itself a function of a properly functioning nervous system" (111). This assertion does not address the problem of how readers ought to account for the neural content of the neuron-words that comprise a portrait's "properly functioning, nervous system." On the one hand, Meyer wants us to think of "A Long Dress" invisible nervous system as conscious artifact that resembles Stein's normally functioning, nervous system; and, yet on the other hand, he prefers that we disregard the question of whether her dissociative writing practices correspond to "any particular anatomical or subanatomical [brain] structure." As Joseph Levine would say, there is a "thickness," or opacity, to his oxymoronic, neuraesthetic logic, since the "explanatory gap" that exists between a text's neurophysiological entities and its phenomenal realities may be a normative function of the brain's functional roles. Yet, nevertheless, there is a performative breach and an epistemic rupture that occurs when Meyer claims that there is no correlation whatsoever between Stein's dissociative writing practices, the brain's anatomical structures and the brain's neuraesthetic productions.[60]

By approaching "A Long Dress's" imaginary neuroanatomical structures from the perspective of Stein's psychological studies with James, her fin-de-siècle brain stem research with Barker and Mall, and her artistic associations with Picasso and Matisse, I view the allegorical nervous system in this work as a literary caricature of Cajal's scientific illustrations of the cerebellum and retina. According to this reading, Stein would not be trying to represent her own nervous system, but may have been trying to expand the boundaries of what the human central nervous system looks like and qualifies as, in the early twentieth-century. In other words, I disagree with Meyer's claim that Stein tried to free her neurophysiological entities from the "external constraints" of physical reality. I find, to the contrary, that she achieves a degree of neurobiological realism with her brain portraits in *Tender Buttons* and *The Geographical History of America,* when she recreates the cellular tissues and neural networks of the human cerebellum, retina and spinal cord, using color words, grammatical parataxis, poetic form and simple syntax. From the structural similarities that I find between her neuraesthetic compositions and certain brain structures, it appears that she may have been trying to represent the triple-layered nerve tissue formations exist in the cerebellum's concentric lobes and in the retina's nerve tissue. For Stein, this neurobiological realism allows her to create comparative neuroanatomical architectures at the level of language within her neuraesthetic compositions. Though linguistic and literary in nature, these comparative, neuroanatomical structures nonetheless parallel the ones she reproduced in laboratory conditions, under Barker's supervision, by describing the brain's neural networks and cellular elements with cubist representational strategies. Whereas the comparative, neural anatomies that Cajal describes in his 1906 Nobel lecture come from a range of animal and human specimens, Stein leaves her comparative literary studies of the brain's neural structures as open-ended interpretative possibilities for her readers. That is, Stein creates as neural network architectures out of language that produce worlds of meaning and possibility.

In this section, I interpret what Stein means by the phrase "out of the eye comes research," using Cajal's neurobiological research. Put simply, I aim to show how Stein portrays the human brain with color words, enigmatic phrases, grammatical parataxis and conventional poetic forms. If research "comes out of the eye," as Stein writes in *Tender Buttons*, we might assume that this is a way of saying that scientific research comes from secondary processes such as cognition, disputation, observation and experimentation. However, Stein also may mean this phrase literally in the case of "A Long Dress." The turn of speech, "out of the eye," might explain where Stein derived her idea for the neuraesthetic composition that consists of phenomenological, literary experiments with color signifiers that exhibit unusual color mixtures, least perceptible differences, and triple-layered, neural groupings. It may be that Stein contrived her cubist poem about "a long dress," knowing that the long oculomotor axons that connect the retina to the midbrain and the nucleus of Darkschewitch literally come "out of the eye." With "A Long Dress," "A Red Hat" and "A Seltzer Bottle," Stein appears to be experimenting for the first time, with the creative act of staining the metaphorical neurons of her neuroanatomical portrait with distinguishable colors. Yet, her figurative language also betrays these experimental aims by creating ambiguous relationships between the brain's neural structure and the mind's phenomenal experiences, relationships that might be explicated along the lines of Weber's law of least perceptible differences, but for the fact that they obey the subjective phenomenology and discursive vicissitudes of a work's aesthetic consciousness. Because of her brain research and laboratory work with Lewellys Barker and Franklin Mall at Johns Hopkins Medical School, Stein knew that medical researchers had not yet developed the nerve tissue staining techniques and scientific knowledge that would allow them to stain individual neurons from a brain section, or a brain slice, with different colors, in order to study the brain's neural networks and synaptic connections with a microscope. If it was her aim to render the brain's neuronal network architecture culturally intelligible from the perspective of her color signifiers and their three-dimensional cubist puns, then she managed to do so with the playful use of color signifiers, which displayed her medical knowledge and achieved her neuraesthetic goals.

Tender Buttons, in this respect, functions as a modernist precursor to neuroanatomy textbooks, such as *The Human Brain Coloring Book* and *A Colorful Introduction to the Anatomy of the Human Brain*, because of its coloring precepts. Unlike these textbooks, *Tender Buttons* does not overtly provide "a means of learning about the structure and function of the human brain through a process of coloring-by-directions (directed coloring)," as *The Human Brain Coloring Book* states its purpose to be on its cover-jacket. To the contrary, *Tender Buttons* creatively represents the brain-mind continuum through its innovative, cubist writing strategies, some of which brilliantly forecast the color based, brain-mapping strategies from the twenty-first century, such as the "Brainbow system." In *A Universe of Consciousness*, Edelman and Tononi state, "if someone pointed a gun at us and threatened oblivion if we did not say the single word most significant for understanding the brain, we would say *neuroanatomy*. If we could only untangle its intricate connections fully, the brain would certain qualify as the biological object with the most stunning morphology ever seen. And in biology, morphology is almost always the royal road to function" (42; original emphasis). To grasp how Stein may have arrived at certain neuroscientific insights and neuroanatomical discoveries, a dozen or so years after she abandoned her brain research at Johns Hopkins, we need to understand how cubism helped her to see the brain in different ways. Also, we need to explore how cubism enabled her to re-envision neuroscience as the modernist, literary practice of neuraesthetics.

In chapter three, I discuss the 'brainbow-like' mapping techniques that Stein features in *The Geographical History of America*, using photographs that were taken by a confocal microscope, as a means of elucidating the nineteenth-century laboratory practices and neurobiological research conducted by Stein, her medical professors and other neuroscientific pioneers. In this chapter, by contrast, my purpose is to examine the neurobiological accuracy of Stein's literary descriptions and her neuraesthetic writing strategies in "A Long Dress." I will show that, even though Stein has taken artistic liberties with the practice of neuron coloration in the pursuit of creating cubist puns with multiple scientific, linguistic and neurophysiological referents, her descriptions of the brain's neural networks remain true to physical reality and scientific fact. Even though she uses non-descriptive English phrases and syntactical structures to illustrate these neurobiological structures and cellular mechanisms, it is possible to 'see' the differentiated neurons and layers of neurons at the level of this portrait's conjunctions, words and empty spaces.

In "A Long Dress," the color signifiers highlight the linguistic meanings, phenomenal qualities and neural connections that comprise this portrait's neuroanatomical imaginary. At the level of color signification and cubist portraiture, these color words signify the "cellular elements of neural circuits" with the English language, in much the way that Cajal describes the cerebellum and retina's neural networks, using ordinary language, hand-drawn diagrams and medical terminology. For example, in his 1906 Nobel lecture, "The Structure and Connexions of Neurons," Cajal observes,

> the "sensory corpuscles" (or the nerve cells) … divide into two branches: one external branch which leads to the periphery to end

> in the skin, or in the mucous membranes; another internal branch which penetrates the sensory or posterior root to end in the dorsal column of the spinal cord. This last branch, from my observation in birds, reptiles and mammals (confirmed by a large number of scientists such as Kölliker, von Lenhossék, Retzius, Van Gehuchten, Sala, Athias, etc.), does not penetrate the grey matter straight away, as some writers had supposed, but divides in the thickness of the posterior column in such a way as to give one ascending branch and one descending branch. (223)

Having closely examined the spinal column and brain stem regions of human infants and embryos at Johns Hopkins, Stein could verify Cajal's findings, and she knew, from first-hand experience, that the upper region of the medulla oblongata contained white matter that consisted of "medullated" axons from the fasciculus longitudinalis medialis, that the lower regions of the medulla oblongata contained periaqueductal gray matter, and that a mixture of white and gray matter could be found in the spinal cord nerve tissue and cerebellum's concentric lobes.[61]

In "A Long Dress," color represents the retina's nerve structures and their neural pathways to the midbrain, and it functions as the 'royal road,' so to speak, for understanding the complex neural circuitry of the brain's visual systems, its reading mechanisms and its attention-producing structures. Most likely, Stein sought to represent the parts of the visual brain, where she previously conducted research on the nucleus of Darkschewitch and the fasciculus longitudinalis medialis. Having been introduced to Cajal's neurobiological discoveries through Barker's academic lectures and medical writings, Stein may have wished to portray the separation of neurons and grey matter in her cubist portraits, in order to support Cajal's theories about the neuron doctrine and neurogenesis, while advancing a creative, neuroscientific vision of the brain's multicolored neurons and neural networks that challenged his views of nervous system coloration practices. Stein, however, does not describe the three rows of *colored* neurons in *The Geographical History* with the medical terminology and the directional vocabulary that she used in her published, brain research from Johns Hopkins. By describing the cellular tissues and neural networks of the "human mind's" anatomy in ways that accurately resemble Cajal's hand-drawn illustrations of brain anatomy, Stein created realistic, biological structures for her cubist brain maps. Though crafted from language, these cubist brain representations accommodate her latest neuroscientific insights about variegated and multicolored nerve staining techniques, which she does not theorize about in her literary essays, but which scientists from the twentieth- and the twenty-first centuries have developed into important, neurological and genetic brain imaging tools.

By focusing on color and its structural significance within the brain mapping practices of Cajal, I will analyze the triple-layered, cellular tissues that Stein has created in "A Long Dress." By comparing Cajal's illustrations of retinal nerve tissue with Stein's neuraesthetic writing style, I will explore how Stein uses language, structure, spacing and color to portray abstract, neural architectures. In "A Long Dress" and Detective Story number VII, she recreates the retina and the cerebellum's triple-layered nerve formations, when she layers words and combines colors to form language-based, neural network architectures. Here is the text, again, for "A Long Dress," so that you may see these neuraesthetic writing strategies at work in the final four lines:

> What is the current that makes machinery, that makes it crackle, what is the current that presents a long line and a necessary waist. What is this current.

What is the wind, what is it.

Where is the serene length, it is there and a dark place is not a dark place, only a white and red are black, only a yellow and green are blue, a pink is scarlet, a bow is every color. A line distinguishes it. A line just distinguishes it. (8)

Although I will be focusing on the last four lines of this text, I direct your attention to the construction of color units and to the lines of color that repeat themselves in this neuroanatomical imaginary. Also, I ask that you consider the "lines" within lines seven and eight that appear as singular, but also repetitive, neural formations for this colorful, brain portrait. The first thing I wish to point out is that, even though there are four black lines that appear near at the bottom of Cajal's neuroanatomical drawing that represent the retina's nerve tissues, there are actually three layers of nerves in the retina proper. Using this hand-drawn illustration, Cajal explicates why scientists ought to view the neurons and the interneuronal relationships in the first three layers of retina nerve tissue as granular, bipolar and ganglionic neurons that possess differentiated and complex functions, whereas the fourth layer of nerve tissue leads from the triple-layered, retinal nerve tissue into the brain and represents the optic nerve, in the form of a single, black line:

> The interneuronal relationships are shown with an admirable clarity and simplicity in this object of study. In spite of its great complication, the retina can be considered as a nerve ganglion formed by three rows of neurons or nerve corpuscles: the first row encloses the rods and cones with their descending prolongations forming the external granular layer (a and b in Fig. 3); the second is made up of the bipolar cells (c and d) and the third contains the ganglionic neurons (e); the three series of nerve corpuscles interconnect at

> the level of the said molecular or plexiform layers, internal and external. Note that the external plexiform layer (C in Fig. 3) encloses a multiple connexion of which the elements are: externally, the terminal spheres of the rod fibres and the conical feet of the descending prolongations of the cones, equipped with filamentous attachments; internally, the external processes of the bipolar cells of which, as we have shown, there are two varieties: bipolar cells with flattened processes going to the cones (d in Fig. 3) and robust bi-polar cells with ascending dendritic processes going to the rods (c in Fig. 3), and finally there are the protoplasmic branches and nerve arborizations of the horizontal cells of the internal granular layer. The internal plexiform layer has even more complicated connexions which can be divided into three, or even many more, stages. The essential factors are represented, externally by the terminal processes of the descending prolongation of the bipolar cells and the terminal ramifications of the inferior expansions of the spongioblasts; internally by the flattened protoplasmic arborization of the neurons of the ganglionic layer. (225)

See Figure 19, The connections of the visual fibres and the cells of the retina, from Figure 3 in Santiago Ramón y Cajal’s The Structure and Connexions of Neurons (238), for a view of the three rows of neurons (or the nerve corpuscles) that form the retina’s nerve ganglion and its interneuronal relationships.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 199 is Figure 19, The connections of the visual fibres and the cells of the retina. This image is a black-and-white photocopy of Figure 3, from Santiago Ramón y Cajal's The Structure and Connexions of Neurons (238). This figure illustrates how the retina's "internal plexiform layer has even more complicated connexions which can be divided into three, or even many more, stages. The essential factor are represented, externally by the terminal processes of the descending prolongation of the bipolar cells and the terminal ramifications of the inferior expansions of the spongioblasts; internally by the flattened protoplasmic arborization of the neurons of the ganglionic layer" (225). The information contained in this image pertains to my thesis argument, by showing how Stein uses Cajal's nineteenth-century neurobiological research to represent the "human mind's" neuroanatomical landscape with poetic form, color signifiers and the English language. The source of this material is Figure 3, The connections of the visual fibres and the cells of the retina, from Santiago Ramón y Cajal's The Structure and Connexions of Neurons. 238. NobelPrize.org. Website address: <http://nobelprize.org/nobel_prizes/medicine/laureates/1906/cajallecture.pdf>.

By comparison, “A Long Dress” explicitly mentions two *lines* and calls attention to the lines of words that could be representing individual axons, the process of neuronal arborisation, the appearance of the neurons within the cerebellum’s ganglionic layer, and/or the retina’s triple-layered nerve tissue. We see this pattern of neuronal coloration and cellular differentiation with the following sentences: “Where is the serene length,” “A line distinguishes it,” and “A line just distinguishes it.” If we compare Stein’s neuraesthetic composition style with Cajal’s hand-drawn illustrations of the retina and cerebellum, then it seems plausible there is a special kind of neurobiological realism and structural reference that Stein has created with her neuraesthetic compositional strategies, by virtue of her portrait’s “generic perspective,” perceptual principles, which create multiple meanings and perspectives for the brain’s neural networks through their structural relations, linguistic meanings and figurative associations.

If we read this cubist portrait neuraesthetically, with an emphasis upon its neural structures and “neurobiological collage,” then the last four “lines” function as special modes of neurobiological reference and iconic-indexical portraiture. Stein portrays the nerve tissue of the human brain with analytic style, or second-phase, non-mimetic styles of cubist portraiture and color signification, in order to create semiotic ambiguities that serve simultaneously as neurobiological perspectives and as perceptual principles. In his Nobel lecture, Cajal explains how the optic nerve connects with the midbrain, but I would point out that Stein also researched the midbrain region as a medical student at Johns Hopkins, especially the portion of the midbrain that contains the nucleus of Darkschewitch, which is sometimes known by its German name, “*oberer Oculomotoriuskern* of Darkschewitsch.” The German name designates the nucleus of Darkschewitch’s brain function as a visual tracking center and as a bundle of motor nerves that are located near the red nucleus. Concerning the neural pathways between the retina, the lateral geniculate nucleus, and the midbrain that are joined by motor neurons and axons, like the nerve fibres found in the fasciculus longitudinalis medialis and the nucleus of Darkschewitch, Cajal writes:

> In following the axons of the neurons of the ganglionic layer the length of the optic nerve, we will find in the *mid-brain* and the *intermediary brain* yet a third connexion brought to light, primarily by our researches on the optic lobe of birds and the mid-brain of mammals, and then by very interesting observations by my brother *(lateral geniculate body* of mammals, *optic lobe* of birds, reptiles and fishes), and by Van Gehuchten, Kölliker, Sala, Tello, etc. As we know, certain axis-cylinders of the optic tract go forward, ending by free, very complicated, ramifications into the depths of the lateral geniculate body; others, going backward, become large ascending arborizations in the cortex of the anterior quadrigeminal body. It is here that the visual *reflexo-motor* pathway originates (g in Fig. 3). Finally, these observations in mammals and in children have demonstrated to us the fourth and last connexion of the optic conductors, that is to say, of the central optic pathway, the original neurons of which are in the lateral geniculate body. This interesting terminal connexion, verified by the important anatomo-pathological work of Henschen, is in the calcarine fissure at the level of the 4th and 5th cortical zone in which are found two very compact layers of astrocytes (g in Fig. 7). (225-227)

If we analyze Cajal's drawing of the retina and then compare this drawing to Stein's neuraesthetic composition from *Tender Buttons*, (in our Figure 19, his Figure 3), then we can study the common structures that link the two brain representations. Even if we have trouble visualizing how the axon-cylinders of the optic nerve connect with the neurons of the lateral geniculate body, the midbrain nuclei, the nucleus of Darkschewitch and the cerebellum in Stein's cubist illustration and in the human brain, it is possible to make sense of Stein's neuraesthetic representations of the human brain at the structural level. By focusing on the structural elements of this neuroanatomical imaginary, we can see how Stein deploys generic perspective perceptual principles and nineteenth-century neurobiological findings to create neural networks with realistic, synaptic connections and cellular elements. For example, in "A Long Dress," there are four lines of words that represent the neural networks of the cerebellum and retina; yet, significantly, there are only three lines that contain colored neuron-words. (By contrast, Cajal draws four distinct lines, whereby one leads away from the retina's three layers of nerve tissue). In this way, her neuraesthetic writing praxes remain faithful to Cajal's neurobiological findings, by portraying three rows of neurons and by keeping the fourth line *as a line* that will serve allegorically, as an optic nerve. In this cubist portrait, color words recreate the literal appearance of nerve cells within the triple-layered nerve tissues that are also found in the retina and cerebellum, thereby calling the reader's attention to the structural formations and the interneuronal connections that comprise the visual brain's "concept formation," neural pathways.

While the retina's nerve formation exists as a biological template for Stein's neuroanatomical portraiture, it is not the only one, since the cerebellum serves equally well as a referential candidate for the colorful neural networks in "A Long Dress" and "Detective Story number VII." In his Nobel lecture, Cajal stresses, "the connexions established between these two types of conductors [i.e. "the long or motor nervous prolongations" and the “afferent nerve fibres”] and the cells of the cerebellar cortex are very interesting theoretically. They have contributed greatly to persuading us of the truth of the neuronal doctrine. We have confirmed the connexions even more plainly with the Ehrlich reduced silver nitrate method, than was revealed in the first place by the Golgi method” (229-230).[62] As a result of his neuroanatomical investigations and histological experiments, Cajal advocated for the neuron doctrine and demonstrated its value in terms of advancing the latest scientific methods. Like Cajal, Stein does not limit her illustration of the neurons and axons, in “A Long Dress,” to silver or black colors. Cajal used many different kinds of chemical stains, before settling with the reduced silver method and the gold method. The silver nitrate method that Golgi developed in the late nineteenth-century was more widely known to nineteenth-century neurologists, so this may be one of the reasons why Stein uses the color “silver” sparingly in her neuroanatomical portraits; that is, because it was so commonly used and widely advocated by her contemporaries, the color silver, when used by Stein within a descriptive study like “A Seltzer Bottle” to characterize certain kinds of clinical procedures, obliquely refers to the discoveries being made in neurobiological research by these brain pioneers. Silver and lead colors serve as fairly obvious, scientific references and semiotic codes within the context of Stein’s neuraesthetic modes of literary composition, perhaps even highlighting the difference between a descriptive study and a neuroanatomical portrait proper, in the shifting mix of literary subgenres that comprise the evolving practice of literary neuraesthetics.

For knowledgeable neuraesthetic readers, the color silver likely would trigger associations between her neurological descriptive methods and Cajal’s neurological illustrations. In his detailed description of the cerebellum's three types of neurons and their distinctive cellular elements, Cajal observes,

> The first, or plexiform layer, is formed principally by small star-shaped cells (or *basket cells* according to some authors; the second, or intermediary, is made of up Purkinje cell bodies. The third and last is the result of granular reunion. The layering of the astrocytes, Purkinje cells and granule nerve cells within the cerebellar tissue creates the appearance of "medullation," or striation. With respect to the "intrinsic connexion" between the Purkinje neurons and the axons of the astrocytes or star-shaped neurons, Cajal comments on what he finds to be an "interesting connexion by contact which is established in this way by two orders of neurons has been confirmed by Dogiel and by us, using the methylene-blue method. (229)

If Stein was thinking of Cajal's nerve tissue staining methods and neuroanatomical descriptions when she was composing her cubist brain maps, then it could be that she was referencing Dogiel's and Cajal's methylene-blue methods with the word "blue," rather than trying to represent the melanin-pigmented neurons of the locus coeruleus (which is also known as the 'blue spot'). This would make sense, since she also uses the color "yellow" along with the "blue," in her neuraesthetic composition, most likely for the purpose of representing the Purkinje neurons, as well as Purkinje's discovery of the largest neurons in the cerebellar lamella. By using the colors "green," "yellow" and "blue" in a sequence to distinguish between the word neurons in her connectivity maps, Stein demarcates her conceptual departure from Cajal's staining techniques, particularly Cajal's use of Ehrlich's reduced silver nitrate method to study the cerebral cortex's surface cells and his use of Ehrlich's "methylene-blue method" to examine the synaptic relations that exist between the cerebellum's Purkinje neurons, the granule cells, recurrent collaterals, and "parallel fibres" (230, 229).

Without the color signifiers and non-descriptive phrases that generate semiotic ambiguities and multiple meanings for this neuroanatomical imaginary, some readers might assume that the colors 'silver' and 'lead' automatically signify Stein's past research on the nucleus of Darkschewitch, since she used the reduced silver method and the Weigert-Pal stain (which is purplish-silver in color), to discern the axons of the fasciculus longitudinalis medialis and the neurons of the nucleus of Darkschewitch. By historical and figurative association, we could also link the color "silver" to Stein's previous research on the reticular formation in the medulla oblongata, where she used Golgi's silver nitrate method and his reticularist theories as referential templates for Barker's brain research. In my opinion, Stein mixed colors to produce unnatural effects and deployed color units in unprecedented ways, in order to distinguish the word neurons that comprised her imaginary nervous systems from the late nineteenth-century, scientific practices of her professors, contemporaries and peers.

"A Seltzer Bottle," by contrast, operates as a descriptive study, in the proper sense of the word, because it portrays twentieth-century brain mapping practices and familiar household objects with silver and lead colors, as a means of producing a descriptive, qualia-based and brain-based form of neuraesthetic, literary representation. For Stein, the budding neuroscientific researcher, it was not simply a matter of "differentiat[ing] … the adult protoplasmic reticulum" through the use of staining techniques that transparently dyed the nerve cells one solid color, as it had been for Cajal in his study of the reticular formation (233). To the contrary, her aim in this portrait seems to have been the interrogation of the laboratory techniques and quasi-objects that were produced through nineteenth-century experimental procedures and medical protocols, which is why she employs performative and playful language to evoke a wide range of sensory, perceptual and imaginative experiences. From the combined neuraesthetic, neurological and histological perspectives that are generated by her portrait's ambiguous color units and phrases, Stein indirectly invokes the procedures and practices of nineteenth-century clinical microscopy; however, she does not follow the established scientific status quo, as we have seen, and she deviates from the brain-based epistemologies of the period by creating a "neurophysiological imaginary" that is unique in its presentation of the brain's neuronal network architecture.

If we interpret "A Long Dress" though the neuraesthetic lens of nineteenth-century experimental histological and laboratory practices, then the phrase, "a pink is scarlet," could be referring to the way in which a sample of nerve tissue from the red nucleus looks when it is still fresh (8). Though it appears to be pink-colored to the human eye when it is still fresh, the red nucleus contains an iron-containing pigment that is described as a red or as a scarlet color, in many medical journals. From these medical textbooks and Stein's published research, we know that the red nucleus is situated above the nucleus of Darkschewitch and surrounding structures in the midbrain region. If the color red is missing from the human mind's neuroanatomical landscape in *The Geographical History of America*, then I believe there must a good reason for its exclusion from Stein's neuraesthetic color palette, because, in other cubist portraits from *Tender Buttons*, the color red features prominently. For example, "A Red Hat" presents the absence of red as a monstrosity, even when it implies it normative presence within the grey matter and/or structures that comprise its neuroanatomical imaginary. As Stein's dissociative discourse states, "A dark grey, a very dark grey, a quite dark grey is monstrous ordinarily, it is so monstrous because there is no red in it. If red is in everything it is not necessary. Is that not an argument for any use of it and even so is there any place that is better, is there any place that has so much stretched out" (8). Using non-mimetic cubist portraiture techniques, Stein neuraesthetically portrays the place that the red nucleus occupies within the dark grey organic matter of the midbrain region. We see a similar kind of abstract colored, cubist portraiture function as a neuraesthetic composition, when she describes the locus coeruleus, or some other blue-colored brain matter, with the following enigmatic phrases and color signifiers, from "A Blue Coat: "A blue coat is guided away, guided and guided away, that is the particular color that is used for that length and not any width not even more than a shadow" (*Tender Buttons* 9). For the record, the locus coeruleus is a "nucleus in the brain stem responsible for physiological responses to stress and pain" that Stein also examined when she was in medical school, as part of the comparative study of the brain stem tracts that she completed for her anatomy professors, Dr. Franklin Mall and Dr. Lewellys Barker. If we accept that Stein deploys the generic perspective perceptual principle at the level of her color signifiers and cubist representational strategies, then it could be that this portrait also represents the colored neurons that have been stained with blue chemicals in a laboratory setting, such as the methylene-blue stained neurons and brain tissue that Barker discusses, at some length, in *The Nervous System and Its Constituent Neurons.* See Figure 20, Plexus of varicose nerve fibrils in close relation to the characteristic muscle fibers of the sino-auricular node of the pig (stained with methylene-blue), from B.S. Oppenheimer, M.D. and Adele Oppenheimer's "Nerve Fibrils in the Sino-Auricular Node," Fig. 2, Plate 66, for a view of how methylene blue stained nerve tissue appears to the naked eye, when presented in a Petri dish.

If Stein had wanted to provide a more realistic representation of the pigmented neurons that comprise the locus coeruleus' blue color, then she could have restricted her color range to only blue words, or she could have added adjectives that would modify the color blue to give it the depth and hue associated with a three-dimensional brain region. Following Picasso's example from the cubist portraits, she might have composed something like this: There is cobalt blue bright blue and pale blue inky navy dark blue and light blue, and so forth. Because Stein excludes the colors red, black, and brown from her description of the human mind's neuroanatomical landscape in this portrait or, rather, because she alludes to their presence by virtue of their monstrous absence, this leads me to believe that she was not interested in visualizing the neurons from the locus coeruleus, the substantia nigra, and the red nucleus in these portraits, despite the fact that these were the brain regions where she had focused her research, at Johns Hopkins. During her medical studies, Stein closely examined the brain regions that contain the 'red nucleus,' the 'substantia nigra' (the black stuff) and the 'locus coeruleus' (the blue spot). From her laboratory experiments and brain modeling assignment, she understood that there were colors in the brain other than gray and white.[63] For her, the human brain contained a palette of colors that could be mixed with other colors, such as the scientifically-produced nerve tissue stains from the laboratory, in order to produce modernist 'brainbows' in her non-mimetic, cubist portraits.

Despite the embryonic nature of Stein's brain research at Johns Hopkins Medical School, in comparison with today's sophisticated medical knowledge and scientific technologies, her anatomy professors, Dr. Franklin Mall and Dr. Lewellys Barker, considered her intellectual contributions to the disciplines of neuroanatomy and neurology to be important and original. Impressed by Stein's research abilities, Barker deferred to her expert judgment and published her description of the nucleus of Darkschewitch, along with other scholarly contributions to the field of medicine, in his textbook, *The Nervous System and Its Constituent Neurones* (1899):

> The nucleus is more or less conical in shape. It lies dorso-medial from the red nucleus, being about as thick in a dorso-ventrical direction as is the dorso capsule of the red nucleus in which it lies.[1] At this period of medullation the commissural posterior cerebri, considered simply topographically (that is, as a medullated fibre-mass without particular reference to the course of the fibres), appears as a dorso-ventral bundle, solid in the middle, subdivided dorsally into an anterior (proximal) portion and a posterior (distal) portion, while ventrally it expands in the form of a hollow pyramid, which rests directly upon the nucleus of Darkschewitsch. (725)

Stein mentions the red nucleus twice in her description of the nucleus of Darkschewitch and the surrounding midbrain region. If there is an "argument" that Stein is using about the neuraesthetic significance of the color red in her neuroanatomical portraits, then perhaps it her choices around nervous system coloration exceed the epistemological purview of her brain research at Johns Hopkins. Taken literally, the color red signifies the red nucleus, in addition to other objects and subjects within her neuroanatomical imaginary. Figuratively speaking, "red" symbolizes her research on the nucleus of Darkschewitch at Johns Hopkins. Viewed allegorically and neuraesthetically, the presence of the color red within a given neuroanatomical landscape implies the operation of ordinary memory and the construction of a subjective phenomenology that deploys color language qualia to link identity, memory, time, human nature and the human mind in a quasi-intelligible, neuraesthetic fashion. From an allegorical and neuraesthetic standpoint, it seems likely that the signifier "red" occupies a position within a portrait's neuroanatomical imaginary, even if it is as a disavowed, foreclosed, or excluded presence that informs the meaning of other colors and other potential brain structures.

Though it appears that Stein uses color in "A Long Dress" to paint the brain's neural architecture in an unprecedented fashion, this does not mean that she never uses the color "silver" to paint word-neurons in other neuroanatomical portraits. Nor does it mean that she never uses the signifier "silver" as a descriptive strategy that indirectly parodies the neuron coloration practices of her neuroscientific contemporaries. Indeed, I would argue this is the case with the phrases, "lead in color" and "discolor in silver," from "A Seltzer Bottle." "Silver" is a color that appears in *Tender Buttons* four times, but only once in "A Seltzer Bottle," where it features prominently in relation to a set of practices (that go unnamed, of course), where Stein mentions the month of August, "a dress," and some sort of "elegant settlement" that is "not final and sufficient and substituted" (8). The sentence, "Any neglect of many particles to a cracking, any neglect of this makes around it what is lead in color and certain discolor in silver," could be a creative way of illustrating the traumatized "neurofibrils" that Cajal describes in his Nobel lecture. Alternatively, this sentence could be portraying the silver-stained nerve tissue of the retina, thereby fulfilling the generic perspective, perceptual principle from the brain-based epistemological and neuraesthetic standpoints that are being presented by Stein's analytical (non-mimetic), literary cubism (235, 237). See Figure 21, Crushed portion of a [cat's] nerve, from Cajal's Nobel lecture, "The Structure and Connexion of Neurons" (Fig. 13).

Material has been removed from this thesis because of copyright restrictions. The material removed from page 212 is Figure 21, Crushed portion of a [cat's] nerve, which comes from Santiago Ramón y Cajal's "The Structure and Connexions of Neurons," Figure 13. (238). The information contained in this figure concerns Cajal's representation of neuronal degeneration and Stein's possible representation of this process in descriptive studies, such as "A Seltzer Bottle," from *Tender Buttons*. The source of this material is Figure 21, from Santiago Ramón y Cajal's Nobel lecture,

"The Structure and Connexions of Neurons" (238). 1 February 2009. <http://nobelprize.org/nobel_Prizes/Medicine/laureates/1906/
cajallecture/pdf>.

By viewing this "descriptive study" from the perspectives offered by the laboratory sciences of histology and microscopy, it seems plausible that the *slivering* and *silvering* of damaged neurons could be what Stein was envisioning when she wrote "A Seltzer Bottle." Armed with knowledge from these scientific disciplines, I am making a case for viewing the silver and lead colors that appear in "A Seltzer Bottle" as metaphors for the silver nitrate dyes that Cajal and Golgi used in their respective, neuroanatomical investigations and laboratory experiments. In "A Seltzer Bottle," Stein writes, "The use of this is manifold. Supposing a certain time selected is assured, suppose it is even necessary, suppose no other extract is permitted and no more handling is needed, suppose the rest of the message is mixed with a very long slender needle and even if it could be any black border, supposing all this together made a dress and suppose it was actual, suppose the mean way to state it was occasional" (8). With this playful and colorful language, Stein figuratively recreates the laboratory conditions in which scientists perform brain examinations, chemical nerve staining techniques and microscopic investigations on stained specimens. The silver and lead colors, as well as the phrases, "a very long slender needle" and "no more handling" – imply that scientific procedures are being performed on a neurological specimen of some sort. The implied, clinical procedures within this portrait/study operate, in an allegorical sense, to associate the "dress" that is mentioned in the following phrase with the human brain, or rather, with a scientific conception of the human brain: "supposing all this together made a dress and suppose it was actual, suppose the mean way to state it was occasional" (8). The next portrait to appear in *Tender Buttons*, "A Long Dress," substantiates this reading by featuring the human brain as a colorful and yet invisible, neuroanatomical imaginary. If Meyer is correct about Stein's neuraesthetic compositional strategies in "A Long Dress," then it may be that the dress serves as a metaphor for the brain's neuronal network architecture and the words in the portrait illustrate the brain's synaptic circuitry. Nonetheless, I find it interesting and noteworthy that "A Seltzer Bottle" opposes the Brainbow-like aesthetic of "A Long Dress" with its stark, silver- and black-toned, color palette: "Any neglect of many particles to a cracking, any neglect of this makes around it what is lead in color and certainly discolor in silver" (8).

As noted above, it was through her experimental brain research and laboratory work with Lewellys Barker and Franklin Mall at Johns Hopkins that Stein became acquainted with cutting-edge, histological and neurological, examination methods. As a result of her medical studies and laboratory experiments, Stein learned that contemporary scientists had not yet developed the nerve tissue staining techniques that would permit them to stain individual neurons from a brain section with different colors, in order to study the brain's neural networks and synaptic connections under a microscope. Despite these epistemological and conceptual limitations, Stein experimented with literary, brain imaging strategies and neuron coloration techniques in her cubist literature for approximately twenty-five years, so as to hone the portrayal of important, brain concepts and corresponding, perceptual principles. Although Stein did not achieve the full range of visual effects that twenty-first century geneticists and brain researchers produced with advanced, scientific technologies, she was able to create multidimensional, "neurobiological collages" with the English language, which paralleled the unconscious, neurological experiments that Pablo Picasso and Henri Matisse conducted with their cubist and fauvist paintings. This depth of her neuraesthetic expression derives partially from her embryological brain experiments and comparative anatomical studies with Barker. Though him, she was introduced to the nervous system staining methods of Nissl, von Gerlach, Golgi, Dogiel, and Cajal, in addition to the brain modeling protocols and neurological descriptive methods of other pioneers in the emergent fields of neuroanatomy. Through Barker's medical publications, lectures and mentorship, Stein was introduced to the hand-drawn illustrations of neurons and axons by these brain scientists, and Barker likely schooled her about contradictory, theoretical positions that Cajal and Golgi held about the neuron doctrine and the reticular formation. It is easy to prove her familiarity with the neuron coloration practices of these brain pioneers, because they are reflected in Barker's medical textbook, *The Nervous System and its Constituent Neurones* (1899). The connection that I am making here between Stein's medical studies and her literary creations pertains to the genealogy of Stein's cubist modes of neuraesthetic production. To understand this genealogy, we must appreciate the historical medical discourses that inform Stein's literary neuraesthetics, like the fact that Barker publishes Stein's research on the nucleus of Darkschewitch and the surrounding midbrain regions in his medical textbook; also, he recollects the details of his medical pedagogy with Stein and her peers from graduate school, in his medical/autobiographical memoir, *Time and Physician*. In addition to this, Stein writes glowingly about her "original" contribution to Barker's comparative study of the nervous system in *The Autobiography of Alice B. Toklas*. In his medical textbook, *The Nervous System and its Constituent Neurones*, Barker reveals that he was using the methylene-blue method of neuron staining in Mall's laboratory at Johns Hopkins, sometimes in conjunction with Golgi's and Cajal's silver nitrate methods and sometimes with Gerlach's gold chloride method, as a means of studying the neurons, axons, glia and non-neuronal elements of the mammalian nervous system. Taken together, these autobiographical references and medical discourses form a symptomatic ideological history and an experiential base, from which Stein draws her brain-based knowledge and forms her ideological resistances to the socially regulatory, scientific regimes of the nineteenth-century.

Using Barker's medical textbook and his medical memoir to support the link between Stein's brain portraiture and her brain research at Johns Hopkins in this study, my aim is to show that Stein's medical studies and brain research allowed her to conceived of the human nervous system in truly innovative ways, not only as the neural interface between language and the brain, but also as an evolving cascade of indeterminate meaning, endless connection and vibrant color. In a section that addresses Nissl's classification of the nerve cells according to their degree of stain absorption, Barker reports,

> Nissl early pointed out that single types of nerve cells may under certain circumstances show different staining relations; the individual members of a given group of cells belonging to one type may be paley, moderately, or intensely stained. These differences appear to depend upon the concentration of the stainable substance in the cell body. Nissl consequently designates the extremely darkly stained cells as *pyknomorphous* cells, or cells in which the stainable portions are arranged relatively most closely … while the very feebly stained cells he names *apyknomorphous*—that is, cells in which it is characteristic of the staining that the stainable masses are not arranged close to one another, but are tolerably widely separated by the non-stainable constituents of the cell-body. Intermediate stages Nissl groups as *parapyknomorphous*. Flesch described these appearances, speaking of *chromophilic* cells and *chromophobic* cells as well as transition forms, and attributed the differences to variations in the internal chemistry of the cells, which depended in part, he

> thought, upon differences in the development [and], in part upon differences in metabolism or of function. (123; original emphasis)

While it is easy to prove Stein's familiarity with the neuron coloration practices of the nineteenth-century medical profession*,* it is not a simple matter to explain why some of the word-neurons in her neuroanatomical portraits are colored and why some are not.

Barker's neurological lessons offer important clues as to why Stein may have alternated between color-coded, neuroanatomical features and invisible, neural networks in her cubist writings. From a nineteenth-century histological perspective, Stein's *parapyknomorphous* and *apyknomorphous* neuroanatomical portraiture makes sense as a representational strategy and as a special kind of visual rhetoric that reveals, in Zeki's words, "the modularity of the visual brain and … the modularity of visual aesthetics" (*Inner Vision* 205). It is also possible, Zeki points out,

> [to] "relate some aspects of some schools of art, for example Fauvist art, to specific pathways in the brain. I think that we can generalise even more than that: we can perhaps speak of the neurology of abstract art and that of representational art and narrative art. Some may consider this to be obvious in light of what I have already written. If so, I am surprised that no one has so far uttered the obvious. Abstraction, by which I mean non-iconic abstraction (i.e. art which does not represent or symbolise objects) has been a very dominant tendency in modern art. Through it artists like Mondrian, Malevich and many others have tried to reduce the many features in the visual world to their common elements. In this, abstract art differs from the more pervasive representational and narrative art. … Abstract coloured paintings, as in the examples provided by Mondrian, Malevich, Ben Nicholson and others, activate only a part

> of the pathways in the brain dealing with colour, the parts of the pathway dealing with colour in an abstract sense, where there is no 'right' or 'wrong' colour because the colours do not belong to objects associated with particular colours. Coloured representational art activates areas beyond V4, as does Fauvist art, but the two kinds of art activate different parts of the colour pathway beyond V4. (*Inner Vision* 205-206)

Stein's non-mimetic, cubist brain portraiture validates Zeki's research on the "neurology of art," by generating colorful, modernist illustrations of the visual brain's modularity and by showing how abstract brain concepts indirectly manifest themselves at the level of her cubist writings, through her knowledgeable representation of the brain's artificially- and naturally-colored, neurons and axons. If Stein was looking for ways to expand upon her nineteenth-century brain research, particularly with respect to exploring the neural pathways that exist between the brain stem, the thalamus and the cerebral cortex, then her cubist writings may have provided her with the intellectual forum and the creative means to do so. Following Zeki's cue, I would say that she attempted to portray the visual brain from multiple, vantage points, which include its synaptic connections, its responses to abstract colored art/writing, and its language-related, parallel processing systems in closely associated, cerebral areas.

In this section, I have stressed that Stein knew a great deal about the brain's naturally pigmented neuronal groupings from her brain stem research at Johns Hopkins, and that it is likely she sought to represent some of these neural networks and brain nuclei with color signifiers and other literary methods in her second- and third-phase cubist writings. William A. Beresford, Professor of Anatomy for West Virginia University, observes that what is "[f]undamental to an understanding of nerve cell histology is the knowledge: (a) that most neurons' processes are so extensive that only part of the cell is present in a 8 µm-thick section; (b) that different parts of the neuron contain different elements, and staining for one of these elements reveals only the part of the cell containing it. For example, a basic stain like toluidine blue will stain only nuclei of nerve and glial cells and Nissl bodies of nerve cells, leaving the large areas of surrounding tissue pale and apparently structureless, although other stains reveal that these areas of neuropil are packed with dendrites, axons, and processes of glial cells. Supporting Beresford’s observation about the chromophilic and chromophobic qualities of neurons from the perspective of Nissl’s nineteenth-century findings, Barker observes, “A curious and puzzling phenomenon is met with in the so-called chromophile nerve cells. One sees often, along with the other nerve cells, single cells or small groups of cells in which the stainable substance appears to be evenly diffused throughout the cell body, so that it is impossible to distinguish a stainable from an unstainable constituent in the cell. The explanation of these forms if as yet not entirely satisfactory” (123-124). Following this, he remarks, “A curious and puzzling phenomenon is met with in the so-called chromophile nerve cells. See Figure 22, Nerve cell from the spinal cord of the dog in the so-called “chromophile” condition, which comes from Figure 73, in Lewellys Barker’s The Nervous System and its Constituent Neurones (124).

Material has been removed from this thesis because of copyright restrictions. The material removed from page 220 is Figure 22, Nerve cell from the spinal cord of the dog in the so-called "chromophile" condition, which comes from Lewellys Barker's The Nervous System and its Constituent Neurones (124), Figure 73. This figure contains information about nerve cells that do not stain properly, "chromophobe" neurons that follow Nissl's nineteenth-century classifications. Gertrude Stein's anatomy professor, Lewellys Barker, features these classifications in his medical textbook and discusses the relevance of cutting-edge histological techniques to the study of the brain. The source of the material for Figure 22 is Lewellys Barker, The Nervous System and its Constituent Neurones. Figure 73. New York: D. Appleton and Company, 1899. 124.

One sees often, along with the other nerve cells, single cells or small groups of cells in which the stainable substance appears to be evenly diffused throughout the cell body, so that it is impossible to distinguish a stainable from an unstainable constituent in the cell. The explanation of these forms if as yet not entirely satisfactory" (123-124).]

One way to explain why it is that half of the word-neurons in "A Long Dress" are colorless and the other half are colored is to employ Nissl's "chromophobe" and "chromophile" theory, in our neuraesthetic reading of Stein's cubist portrait. Put simply, Stein seems to be representing Nissl's "chromophobe" and "chromophile" neurons in her neuraesthetic composition; but perhaps she had another vision of the brain's neural network architecture in mind, when she construed a brain map with a dark background and points of color streaking across it, or dotting its cellular landscape, that is, when she used figurative language and color signifiers to construct the brain's neuroanatomical imaginary in this fantastical way. I am thinking of Ryan Draft's brainbow-mapped motor neurons, which are illustrated in Figure 23.[64] It seems plausible to me that Stein envisioned the cranial cavity as a "dark place"; such a conception would not have been a stretch of her scientific and literary imagination; however, it could be that this dark place is special for reasons that remain unclear to us at this point in time, because of their creative nature; this may be where she perhaps "discovered" her first Brainbow, even though she had been the one to produce this neuroanatomical imaginary from color units and non-descriptive English phrases, knowing fully that its aesthetic resembles the Pointillist, Fauvist and Cubist paintings of her close friends and artistic peers. In *Inner Vision*, Zeki draws some interesting conclusions about "the Fauvist brain" that may be relevant to our understanding of Stein's avant-garde, brain mapping strategies from *Tender Buttons*. He argues, "I suspect that works of art which, in general, conflict with one's experience of the visual world – for example, the works of Magritte, or De Chirico or Max Ernst – will strongly activate the parts of the frontal lobe which are activated by Fauvist paintings. There is in these works a conflict to resolve – the conflict of the immediate view with the record of past experiences, and the frontal lobe seems to be implicated in the resolution of such conflicts. Whatever the outcome of the experiments, once they are performed, it is important to realise that we have now advanced sufficiently to be able to formulate hypotheses about the neural pathways that are active when we view different schools of art" (*Inner Vision* 208). If Zeki is correct about the role that the fusiform gyrus plays in re-arranging abstract colors, motions and forms to create a picture in the brain that corresponds with the unnaturally colored objects and the wild scenes from Fauvist paintings, then it could be that Stein instinctively used her neuroanatomical cubist portraits activate the fusiform gyrus. These brain portraits would be valuable to her, because they would allow her to resolve intellectual disputes that she had with past professors, as well as to showcase the lingering doubts that she harboured about previous laboratory experiments. Also, her cubist brain representations could be used to question her unfounded, scientific intuitions and philosophical insights in a playful fashion. With the cubist portraits from *Tender Buttons*, she examined the neurophysiology of the visual brain and produced a visual rhetoric that condensed brain-based knowledge into truly innovative, brain maps, without raising the hackles or the suspicions of her literary enemies. See Figure 23, Brainbow-mapped Oculomotor Axons, which is a photograph taken by Ryan Draft of Harvard University, using confocal microscopy, of the motor axons leading from and going to the brain stem.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 223 is Figure 23, which is a color photocopy of Ryan W. Draft's picture of oculomotor axons that was produced with confocal microscopy, which is entitled Brainbow-mapped Oculomotor Axons. The information presented in this image, at the level of the colored motor axons offers a plausible explanation, from a twenty-first century neurobiological perspective, a nineteenth-century histological perspective and a twentieth-century neuroesthetic perspective, as to why some of the neurons in Stein's portraits may be colored and why others are not. A version of Draft's confocal microscopic research on the oculomotor axons can be found in Figure 4-b ("Oculomotor axons of *Thy1—Brainbow-1.0* line H (recombination with CreErT2)"), from "Transgenic Strategies for Combinatorial Expression of Fluorescent Proteins in the Nervous System," p. 59. The website source of the material for Figure 23 is <http://www.guardian.co.uk/science/gallery/2007/nov/01/brainbow?picture=331136099>. The original source of this material is Livet et al, "Transgenic Strategies for Combinatorial Expression of Fluorescent Proteins in the Nervous System." Nature November 1, 2007. 59. Confocal microscopy is by Ryan Draft. 1 November 2007.

In my opinion, Stein's aim in the cubist portraits from *Tender Buttons* and *The Geographical History of America* was to explore *future* methods of neuron staining, brain imaging and microscopic analysis with representational strategies, such as the cubist pun, as well as to caricature past methods of nervous system coloration with her creative language, neuroscientific insights and medical knowledge. Following Meyer's classification of Stein's dissociative writings 'neurophysiological imaginaries,' I define Stein's cubist allegories as brain-based 'connectivity maps' and her detective stories as explicit and non-explicit modes of neuroanatomical portraiture and consciousness research. For reasons that I have already discussed, Meyer has overlooked the colored word-neurons that comprise the imaginary nervous systems of these cubist works. As a result of this oversight, he fails to recognize the significance of the laboratory-created neuron stains and the laboratory-born, phenomenal color experiences that serve as structural elements in Stein's cubist portraits. My study, serving as a as a supplement to Meyer's ground-breaking research, focuses primarily on nervous system coloration strategies and the conceptual roles they play within Stein's cubist writings, as metaphysical metaphors, as neuroanatomical imaginaries and as perceptual principles. Thus far, I have approached her cubist literature from the triangulated perspective of her psychological studies with William James, her brain stem research at Johns Hopkins, and her cubist writing experiments from the middle and late periods, in order to create a brief genealogy of her neuraesthetic compositional practices. In what follows below, I expand upon these coextensive areas of knowledge and examine the aesthetic logic behind Stein's cubist brain mapping strategies.

[Philosophers] seem to have no idea whatever of an act
which might be entirely new (at least inwardly) and which
in no way would exist, not in the form of the purely possible,
prior to its realization. But this is the very nature of a free act.
To perceive it thus, as indeed we must do with any creation,
novelty or unpredictable occurrence whatsoever, we have to
get back into pure duration. Henri Bergson

Hence it comes to pass for consciousness that what it previously
took to be the in-itself is not an in-itself, or that it was only an
in-itself for consciousness. Since consciousness thus finds that its
knowledge does not correspond to its object, the object itself
does not stand the test; in other words, the criterion for testing
is altered when that for which it was to have been the criterion
thus fails to pass the test; and the testing is not only a testing of
what we know, but also a testing of what knowing is.
G.W.F. Hegel

It requires a greater detachment to know how to speak
with drawings and with color than to speak with sculpture
in cubes or in round … Gertrude Stein

Who knows what a portrait is because he makes and is them.
Gertrude Stein [65]

Gertrude Stein's Cubist Brain Allegories and Detective Stories

2.1 Picasso's Sweet Dreams and Stein's Waking Nightmare

In Gertrude Stein's able hands, the detective story serves as a modernist investigative practice and as a prophetic form of neuroanatomical portraiture. When this detective story considers the disjunctive relations and the possible connections that exist between objects that are perceived by passing states of consciousness, it functions as an aesthetic consciousness whose primary role is to provide information about the elementary and secondary qualities of the human mind's subjective experiences. Hence, the key role of the detective story as an aesthetic consciousness is to examine the implied, neurophysiological mechanisms and organic processes occurring within the brain that bring these subjective experiences "to life" within the masterpiece at the level of its dissociative prose. By incorporating unexpected neuroscientific, psychological and artistic perspectives into her literary masterpieces, such as the microscopic view of the brain's individually colored neurons that we can see in Detective Story number VII and the aerial view of the earth's surface that Stein sees in the cubist painting techniques of Braque, Masson and Picasso, Stein reconfigures Picasso's early twentieth-century cubist portraiture techniques and interrogates the premises of late nineteenth-century nerve tissue staining practices, at the level of her neuraesthetic writings and phenomenological inquiries.

In this chapter, I explore how Stein represents the literal level of brain, mind and consciousness representation in her cubist brain maps, from *Tender Buttons* and *The Geographical History of America.* In the course of doing so, I analyze how Thornton Wilder, Steven Meyer and Wendy Steiner have approached Stein's modernist writings, and I offer an interpretation of her cubist portraits' allegorical means of neuroanatomical portraiture, using the Brainbow research, literary criticism and Dennett's philosophical musings about the literal and metaphorical truths of conscious man. In short, I explore the ways in which Stein's cubist allegories, her neuraesthetic writing practices and her brain mapping strategies can be supplemented with twenty-first century brain research, as a means of understanding her detective stories and their brain hieroglyphs. By reading Stein's literary portraits microscopically and macroscopically, from a metaphorical standpoint that examines the function of single word-neurons and interregional connectivity patterns in their neural connectivity maps, I expand upon Meyer's neuraesthetic reading strategies and thus contribute to the interdisciplinary practice of "neuroesthetics." My purpose is twofold: first, I will explain how Stein's neuroanatomical portraiture strategies first appear as non-mimetic, Fauvist and Cubist forms of brain representation, in works like *Tender Buttons*. Secondly, I will explicate how Stein's analytic-style, cubist brain maps master the generic perspective perceptual principle and its multiple abstract viewpoints, after a quarter century of literary experimentation and neuraesthetic composition, so that obscure, color patterns and linguistic, connectivity maps function as innovative forms of cubist brain mapping.

In *Sweet Dreams*, Daniel Dennett claims that Saul Steinberg's "pointillist rendering of conscious man" from the October 16, 1969 cover print of the *New Yorker* serves as the "metaphorical truth" about consciousness. He then poses the following question: "If this is the metaphorical truth about consciousness, what is the literal truth?" (1). Before I discuss Stein's relation to cubism and cubism's relation to the Brainbow aesthetic, I want to comment briefly on Dennett's book cover, because this will help me explain why Stein wished to create "master-pieces" that not only caricatured contemporary theories of consciousness, such as Freud's theories about the unconscious, but also investigated future forms of brain research from the perspective of her nineteenth-century brain research at Johns Hopkins University. In the center of a yellow-coloured page is a large thought-bubble that contains a fragmented series of words that look like they correspond with a spectator's impressions of a modernist painting. The words on the first four lines read as follows: "Braque, baroque, barrack, bark, poodle, Suzanne R., 68th Street? Regent 7-12..?, Butterfield 8, Algonquin 4, ELdorado 5, ElMorocoo, Mogador, Mogadigcio, Abys-sina, 1936! Vittorio Emmanuele III: Re d'Italia e di Albania Imperatore d'Etiopia, George V, Louis XIV, Louis XVII, Louis XXXIX, Paris XIV[e], N.Y. 21, 22, 28, 17, 5, Monte Carlo, Monte Cristo" (original spelling). I believe that it is helpful to compare Stein's cubist portraits and descriptive studies from *Tender Buttons* to Steinberg's pointillist cartoon, and to place these studies in relation to what Stein says about Picasso's synthetic and analytic cubist painting and writing styles in *Everybody's Autobiography* and *Picasso by Gertrude Stein*, because only then will it be possible for us to understand how an artist transubstantiates conscious thought into works of art that resemble the brain's neuronal network architecture and its organic cellular structures. In chapter one, "The Zombic Hunch: Extinction of an Intuition?," Dennett proposes, "the Steinberg cartoon on the cover shows one good way of looking at the problem of consciousness. If this is the metaphorical truth about consciousness, what is its literal truth? What is going on in the world (largely in this chap's brain, presumably) that makes it the case that this gorgeous metaphor is so apt?" (1). In partial answer to this question, Dennett claims that "heterophenomenology's resolutely third-person treatment of belief attribution squares perfectly with standard scientific method: when we assess the attributions of belief relied on by experimenters (in preparing and debriefing subjects, for instance) we use the principles of the intentional stance to settle what is reasonable to postulate regarding the subjects' beliefs and desires. … Heterophenomenology allows us to proceed with our catalog[ue] of a subject's beliefs leaving it open whether any or all of them are Chalmers-style phenomenological beliefs or mere zombie-beliefs. … In fact, heterophenomenology permits science to get on with the business of accounting for the patterns in all these subjective beliefs without stopping to consider this imponderable issue" (*Sweet Dreams* 46). I use Dennett's book cover and Steinberg's cartoon to examine the ways in which Stein views the metaphorical rendering of conscious experience in Picasso's cubist writings from 1935 to 1937. More specifically, I analyze how Stein views the translation of cubist painting into cubist writing, through Picasso's melancholic expression of Matisse's color palette and her disavowal of unconscious brain concepts and neuraesthetic perceptual principles. See Figure 24, Saul Steinberg's Pointillist Rendering of Conscious Experience, which is the cover Design for Daniel C. Dennett's book, Sweet Dreams: Philosophical Obstacles to a Science of Consciousness.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 230 is Figure 24, which is a color photocopy of the book cover of Daniel C. Dennett's book, Sweet Dreams: Philosophical Obstacles to a Science of Consciousness. Cambridge, Mass.: MIT P, 2006. This book's cover design is a reproduction of Saul Steinberg's cartoon, which served as the cover design for the New Yorker, on April 18, 1969. The information contained in this image is the translation of cubist painting into a subjective phenomenology, or stream of conscious thought, that resembles the dissociative writing style of Gertrude Stein. The source for Figure 24 comes from Daniel C. Dennett, Sweet Dreams: Philosophical Obstacles to a Science of Consciousness. Cambridge, Mass.: MIT P, 2006. Cover design. N. pag. (The original source of this image is Saul Steinberg's cartoon and cover design for the New Yorker, April 18, 1969). N. pag.

The descriptive study that Stein presents in the "Food" section of *Tender Buttons* will suffice as a demonstration of a metaphorical representation of conscious man, which parallels Steinberg's pointillist cartoon: "Roastbeef Mutton Breakfast Sugar Cranberries Milk Eggs Apple Tails Lunch Cups Rhubarb Single Fish Cake Custard Potatoes Asparagus Butter End of Summer …" (*Selections* 143). With studies such as this one, Stein transcribes her subjective experiences of modern paintings and other visible objects into cubist writings that read like lists of word-objects and object-relations.

However, her more complicated experiments with phenomenal consciousness, in "Lipschitz" and "If I Told Him: A Completed Portrait of Pablo Picasso," also consist of the anxiety-causing process that she defines as her "color thing." Matisse admitted to using a similar technique in his fauvist painting, "Woman With a Hat," whereby he envisioned unnatural colors on his wife and comprised her portrait of "wild" colors that were not actually there. The Museum of Modern Art in San Francisco relates the following background about Matisse's painting, "Woman with a Hat," and describes the relationship that Gertrude and Leo Stein had with this painting, over the course of its early history:

> First exhibited at the 1905 Salon d' Automne in Paris, this work was at the center of the controversy that led to the christening of the first modern art movement of the twentieth century — Fauvism. The term fauve ("wild beast"), coined by an art critic, became forever associated with the artists who exhibited their brightly colored canvases in the central gallery (dubbed the cage centrale) of the Grand Palais. Femme au chapeau marked a stylistic change from the regulated brushstrokes of Matisse's earlier work to a more expressive individual style. His use of non-naturalistic colors and

> loose brushwork, which contributed to a sketchy or "unfinished" quality, seemed shocking to the viewers of the day. The artist's wife, Amélie, posed for this half-length portrait. She is depicted in an elaborate outfit with classic attributes of the French bourgeoisie: a gloved arm holding a fan and an elaborate hat perched atop her head. Her costume's vibrant hues are purely expressive, however; when asked about the hue of the dress Madame Matisse was actually wearing when she posed for the portrait, the artist allegedly replied, "Black, of course." The expatriate Stein family (Michael, Sarah, Leo, and Gertrude) bought the painting soon after its initial showing. Although Leo characterized the work as "the nastiest smear of paint I had ever seen," the Steins recognized its importance and began a long-lasting patronage of the French artist. Sarah and Michael Stein subsequently brought the painting to San Francisco where it was bought in the 1950s by the Haas family. In 1990 Elise S. Haas bequeathed to the Museum thirty-seven paintings, sculptures, and works on paper by modernist masters, among them Femme au chapeau.
>
> ("Description," MOMA, <http://www.sfmoma.org/artwork/213>)

Supplementing this account with intimate details about the aesthetic provenance of her cubist writings in *The Autobiography*, Stein compares her writings with Matisse's Pointillist and Fauvist paintings, whereby she characterizes herself as a misunderstood, Fauvist/Cubist writer. When Stein first befriended Matisse, Picasso and other modern painters like Gris and Picabia, she had just begun to compose literary portraits about human nature, using Cézanne's abstract painting strategies to depict the perceived, personality patterns, or "bottom natures," of her portrait subjects. As early as 1905, however, Stein was employing the fauvist, pointillist, and cubist painting techniques of her artist friends, in her cubist literature, for neuraesthetic and literary aims that we are only beginning to discover and comprehend. In *The Autobiography* Stein tells "the story of the buying of La Femme au Chapeau by the buyers," meaning, by this phrase, that she and her brother, Leo, had purchased Matisse's painting at the Salon d' Automne, in 1905, saving it from the destruction it would have faced at the hands of enraged, gallery viewers:

> People were roaring with laughter at the picture and scratching at it. Gertrude Stein could not understand why, the picture seemed to her perfectly natural. The Cézanne portrait had not seemed natural it had taken some time to feel that it was natural but this picture by Matisse seemed perfectly natural and she could not understand why it infuriated everybody. Her brother was less attracted but all the same he agreed and they bought it. She then went back to look at it and it upset her to see them all mocking it. It bothered her and angered her because she did not understand why because to her it was so alright, just as later she did not understand why since the writing was so clear and natural they mocked at and were enraged by her work. (40)

Based on this passage, we can see Stein identifies with Matisse's position as an artist and considers herself to be a Fauve, by virtue of the fact that her cubist literature seemed to her to be "so clear and natural," even though many of her critics "mocked at and were enraged by her work." Taking this a step further, I propose that there are other commonalities to be found between Matisse's Fauvist style of subject portraiture and Stein's Fauvist/Cubist style of neuraesthetic composition. In chapter two, "My Arrival in Paris," Stein refers to Matisse's "*Bonheur de Vivre*" as "his first big composition which gave him the name of a fauve or a zoo. It was the moment Max Jacob has since called the heroic age of cubism. I remember not long ago Picasso and Gertrude Stein talking about various things that had happened at that time, one of them said but all that could not have happened in that one year, oh said the other, my dear you forget we were young then and we did a great deal in a year" (10).

For Stein, the formal distinction between Fauvism and Cubism was an arbitrary one that derived from Max Jacob's performative speech act; so, too, is the distinction between neuraesthetic composition and Cubist/Fauvist subject portraiture a performative construct and an arbitrary, critical designation. According to her narrative recollections in *The Autobiography*, Fauvism became Cubism the moment that Max Jacob declared the former to be the latter. One might infer from Stein's narrative about the Fauves and the Cubists that she uses color in ways, within her neuraesthetic compositions, that is similar to the Fauves, in general, and to Matisse, in particular; which is to say, she prides herself on using color signifiers and the English language in ways that seem natural to her, but which her readers consider to be "unnatural," "wild," and "infuriating." This is perhaps especially the case when she stresses to her readers that she composes cubist literature in ways that emulate the Cubist/Fauvist styles of her friends, Picasso and Matisse.

With her cubist brain maps, Stein employs a number of neuraesthetic, perceptual principles and compositional styles that Zeki has explained particularly well in *Inner Vision*. Concerning the enigmatic, neurobiological workings of "The Fauvist Brain," Zeki states,

> [U]nless we understand how the brain solves the problem of 'binding' two parts of a line," Zeki claims, "we shall find it hard to understand how it binds together the results of the piece-meal processing when we view a painting like Velasquez's Toilet of Venus, for example. …

> The problem is rendered more emphatic when we view pointillist paintings or a painting such as Matisse's *Luxe, Calme, et Volupte*. Here the brain must combine and group together discontinuous elements and separate them from other such discontinuous elements, through a process about which we know nothing. Nor is this process encountered solely with static pictures; we do not understand how the brain solves the problem in kinetic situations. How does the brain know, for example, that a line is sufficiently long to fall onto the receptive fields of several cells, say in one of Tinguely's *MétaMalevichs*, is in fact the same line? Or how does it know that many of the elements constituting one of Calder's mobiles belong to the same mobile? How, in fact, does it know that an object at point X in time *t* is the same object that was at point Y in time *t* – 1? (*Inner Vision* 130) [66]

In contrast with Zeki's neuraesthetic aims, my goal is to explore the extent to which, and the ways in which, Stein deployed Pointillist, Fauvist and Cubist painting strategies in her cubist writings, as a means of depicting the brain's neural architecture and envisioning how colored word-neurons might be used for, and as, innovative, brain mapping strategies. See Figure 25, which is a color photocopy of Henri Matisse's *Femme au Chapeau*, in order to see the Fauvist painting techniques that Stein claims she identifies with, in *The Autobiography of Alice B. Toklas*, not only part of her personal history, but also as the aesthetic foundation for her cubist historiography and the conceptual framework that defines her cubist writings as "natural" expressions of the creative mind and as interartistic, writing experiments with "natural phenomena." Also see Figure 26, which is a color photocopy of Matisse's pointillist beach scene, *Luxe, calme et volupté* (*Luxuriance, Calm and Sensuality* 1904-05), which illustrates the early twentieth-century pointillist aesthetic that blends landscape painting with erotica. Also consider Figure 27, which is André Derain's *La Danse* (*The Dance*), for an example of the "wild" and "primitive" Fauvist aesthetic that Stein sought to recreate in her cubist writings, as a result of her association with Derain, Matisse, Picasso and other members of the Parisian, art community.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 237 is Figure 25, which is a colored photocopy of Henri Matisse's Femme au Chapeau (Woman with a Hat), 1906. The information contained in this image concerns the Fauvist expression of the portrait subject through Henri Matisse's abstract colored painting techniques. The source of the photocopied material is Museum of Modern Art, San Francisco: <http://www.sfmoma.org/artwork/213>. Information pertaining to the source material: Henri Matisse, Femme au chapeau (Woman with a Hat). 1905. 31 3/4 in. x 23 1/2 in. (80.65 cm x 59.69 cm. Acquired 1991. San Francisco Museum of Modern Art, Bequest of Elise S. Haas. © Succession H. Matisse, Paris/ Artists Rights Society (ARS), New York. 161.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 238 is Figure 26, which is a colored photocopy of Henri Matisse's pointillist painting, Luxe, calme et volupté (Luxuriance, Calm and Sensuality). The figure contains information about the pointillist painting techniques used by Henri Matisse and "the pointillist rendering of consciousness" in Stein's second-phase literary portraits from the middle period (c. 1912-1916). The source of the material for Figure 26 is Plate 41 from Primitivism, Cubism, Abstraction: The Early Twentieth Century. Ed. Charles Harrison, et al. New Haven: Yale UP, 1993. 50. Primitivism, Cubism, Abstraction gives the following information about Matisse's Luxe, calme et volupté (Luxuriance, Calm and Sensuality): 1904-05, oil on canvas, 99 x 118 cm. Musée d'Orsay, Paris. Photo: Réunion des Musées Nationaux Documentation Photographique. © Succession H. Matisse/ DACS 1993. 50.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 239 is Figure 27, which is a color photocopy of André Derain's Fauvist painting, La Danse (1906), oil on canvas, 185 x 209 cm. The information contained in this figure is the illustration of a "primitive" or "wild" use of color that was defined, or "redefined according to a Western avant-garde artistic code" (Harrison, et alia, Primitivism, Cubism, Abstraction 56). Steve Bradt, the spokesperson for the Department of Molecular Biology and Brain Science at Harvard University, defines Fauvism as one of the art movements that influenced the "Brainbow aesthetic." The original source of the material for Figure 27 is Plate 46 from Primitivism, Cubism, Abstraction: The Early Twentieth Century. Ed. Charles Harrison, et al. New Haven: Yale UP, 1993. 53. Primitivism, Cubism, Abstraction: The Early Twentieth Century gives the following holdings and copyright information about André Derain's La Danse (The Dance): Courtesy of the Fridart Foundation. Photo: John Webb. © ADAGP, Paris and DACS, London, 1993.

Gertrude Stein does not describe her compositional methods as philosophical experiments with relational qualia; however, when she uses her imagination to envision the elementary and secondary qualities of color experience as neuraesthetic modes of brain mapping that produce invisible inks and color spaces on her literary canvases, she uses relational qualia to conduct neuropsychological, thought experiments and imaginary, brain surgeries without the knowledge of her readers. A similar observation can be made about her neuraesthetic writing practices, for, even though she does not define her experiments with the representation of the visual brain and phenomenal color experience as her "color thing," according to the definitions used by philosophers Dennett, Levine and Chalmers and neuroscientists Edelman, Tononi, and Zeki, she is conducting research into how the brain binds discontinuous elements within consciousness to form intelligible pictures and images. In my opinion, Stein assimilates Cézanne's impressionist style, Matisse's Fauvist aesthetic, and Picasso's cubist vision into her neuraesthetic compositions, as a means of creating literary maps of the brain's multidimensional, "neural and qualia spaces." Using James's spatial model of phenomenal consciousness and his radical empiricist hypotheses about the brain's neural principles, Stein indirectly tackles the mysteries of "submodality binding" within neural space and phenomenal consciousness (*A Universe of Consciousness* 164). This is a significant move because, as Zeki points out, "no one has really approached satisfactorily the problem of how the brain binds different submodalities. We are thus still left with the mystery of how the brain assembles things together, one of the most exciting problems in neurophysiology and critical in providing us with insights into the neurology of art" (131). For the abovementioned reasons, I do not think that Stein was creating a conscious zombie, or a "conscious artifact," when she experimented with new ways of representing the human brain in her cubist portraits. If I did, I would have to embrace Dennett's argument about the literal truth of the pointillist cartoon about consciousness and translate his philosophical "truth" about the unconscious nature of conscious experience into Stein's neuraesthetic writing practices. Instead, I think the literal truth about conscious man consists of unconscious and conscious brain concepts that become translated into dissociative, cubist writing and literary portraiture by writers, such as Stein, through complex processes of artistic melancholia, cultural production, creative expression and scientific translation.

Though I do not accept Dennett's argument in its entirety, I find merit his philosophical approach to understanding the neural basis for conscious experience through pointillist (i.e. cubist literary) art. Though Dennett fails to account for neural variability and individual subjectivity in his theory about the pointillist rendering of conscious experience, he makes valid points out the kinds of "philosophical obstacles" that prevent us from reaching or devising a science of consciousness in the humanities.[67] Interestingly, the pointillist male subject from Steinberg's cartoon, who translates a modern painting into words and other symbols within his conscious mind, also happens to be a pointillist rendering of modern, male subjectivity. The pointillist gentleman's conscious thought patterns, to the extent that they mirror or reflect the perceived, aesthetic content of the abstract painting that faces him, paradoxically reflect his shadowy and pointillist, bodily configuration. As it turns out, the conscious experiences (or the color language qualia) of the pointillist gentleman operate in relation to the imago of the cubist, abstract painting, and, in turn, the pointillist gentleman's insubstantial body reflects the dissociative nature of his conscious thoughts by expressing them through a corporeal pattern of black, somewhat disconnected, dots. With regard to the pointillist, zombie thinker that supposedly stands for the metaphorical truth about consciousness, Dennett contends,

> Consider once again our *pointillist* gentleman and ask if we can tell from the picture if he's a genuinely conscious being or a zombie – a philosopher's zombie that is behaviorally indistinguishable from a normal human being but is utterly lacking in consciousness. Even the zombie version of this chap would have a head full of dynamically interacting data-structures, with links of association bringing their sequels online, suggesting new calls to memory, composing on the fly new structures with new meanings and powers. Why? Because only a being with a system of internal operations and activities could nonmiraculously maintain the complex set of behaviours this man would no doubt exhibit if we put him to various tests. According to Chalmers, where normal people have a stream of consciousness, zombies have a stream of unconsciousness, and he has argued persuasively that whatever explained the *purely informational competence* of one (which includes every transition, every association depicted in this thought balloon) would explain the same competence in the other. Since the literal truth about the mechanisms responsible for all the sworls and eddies in the stream, as well as the informational contents of the items passing by, is, -ex hypothesi – utterly unaffected by whether or not the stream is conscious or unconscious, a brilliant metaphorical rendering of consciousness, is exactly as good a metaphorical rendering of what is going on inside a zombie. (12-13; original spelling and emphasis)

Assuming, for the sake of argument, that a person hadn't read *Everybody's Autobiography* and *Picasso by Gertrude Stein,* this person might have made the mistake of thinking that Stein, like the pointillist gentleman, processes

Picasso's cubist painting in her stream of consciousness in ways that are self-identical each time. Or, conversely, that Stein processes the cubist paintings of Picasso in ways that are identical with other spectators of Picasso's paintings, or in ways that are identical with Picasso's personal views of his analytic and synthetic, cubist paintings. Possibly, this person also might believe that Stein composed her pointillist/cubist/fauvist portraits in ways that were identical with Picasso's cubist portraiture strategies, since these artists shared many common beliefs about cubism, about its relation to western science and about its contributions to modern society. As far as Dennett is concerned, such pointillist renderings of conscious experience are "exactly as good a metaphorical rendering of what is going on inside a zombie." I oppose this view, on the grounds that Stein believes there is a subtle difference, as to whether or not cubist writings derive from conscious or unconscious streams of thought. Coming at this problem from the innovative perspectives of cubist melancholia and cubist historiography, Stein makes sense of Picasso's colorful, cubist writing strategies by constructing a biographical narrative that contains incorrect information about Picasso's professional activities during a difficult time in his life, which is more revealing about her own disavowed and unconsciously produced, brain mapping practices. Even though Stein's cubist historiography contains significant errors about Picasso's activities from 1935 to 1937, the melancholic, cubist historiography that she produces, in her book *Picasso by Gertrude Stein* serves as a means of illumination about Stein's conscious and unconscious, brain mapping practices.

From a qualitative phenomenological perspective, we could say that Stein did not see things as Picasso painted them in his cubist portraits; I propose that her conscious experience of cubist art and her cubist renderings of conscious experience ought to be evaluated from a third-person, heterophenomenological standpoint that accounts for her discursively reconstructed, subjective phenomenology. I think that it is important to see her cubist discourses as screen memories, of sorts, whether her symptomatic discursive subjectivity appears in the guise of a melancholic, cubist historiography about another artist, such as Picasso, or if it expresses itself through, and manifests itself as, an autobiographical narrative that contains historical inaccuracies and exaggerated scenes. I further propose that Stein sought to illustrate "brain concepts" that were similar to the ones that Picasso portrayed with his cubist paintings and writings; however, there is a difference between her "cubist brain" and his "cubist brain," in that her unconscious, brain concepts assume neuraesthetic (literary) meanings, as a result of her laboratory-acquired, phenomenological experiences and her previous, brain research. Because of her scientific training, her "Cubist brain" consciously seeks to portray the cubist brain and the human brain in ways that Picasso and his "Cubist brain" do not try to achieve consciously, namely, with color language qualia and encrypted scientific discourse. Speaking about the melancholia and the trauma experience that informs Picasso's cubist art, "Picasso was the only one in painting who saw the twentieth century with his eyes and saw his reality and consequently his struggle was terrifying, terrifying for himself and for others, because he had nothing to help him, the past did not help him, nor the present, he had to do it all alone and, as in spite of much strength he is often very weak, he consoled himself and allowed himself to be seduced by other things which led him more or less astray" (*Picasso* 22). In this passage, Stein reveals that she conceives of Picasso's color-based melancholia and his artistic zombism as a literary re-incarnation of instincts, drives and unconscious force that operate by reviving the "naïve" and "exotic," coloration schemes of Matisse's Fauvist paintings, at the level of his conscious thoughts and artistic expressions. When discussing the “infinite variety” of color in Picasso’s “grey period” and in his calligraphic figures, Stein thereby defines Picasso’s internal struggle, that is, his interminable mourning (or his melancholia) as the “normative” expression of wild color schemes and as the non-normative (i.e. gifted artist’s) view of human beings and the visible world. Stein explicates Picasso’s fauvist expressions of color melancholia, in the following passage: “between 1927 and 1935 Picasso had a tendency to console himself with Matisse’s conception of color, this was when he was most despairful that this commenced and this ended when he ceased to paint in 1935. It is extraordinary that one ceases to do what one has done all one’s life but that can happen. It is always astonishing that Shakespeare never put his hand to his pen once he ceased to write and one knows other cases, things happen that destroy everything which forced the person to exist and the identity which was dependent upon the things that were done, does it still exist, yes or no ” (*Picasso* 45-46).

To grasp how a cubist brain portrait’s color words contribute to the “pointillist rendering of conscious experience,” one must appreciate what the vibrant colors in Picasso’s cubist poems do and do not represent for Stein. In *Picasso,* Stein describes Picasso’s cubist *writings* as form of spiritual automatism and as kind of literary zombism, whereby Picasso’s “real” writing – i.e., his cubist poetry -- becomes replaced by a form of automatic writing that symptomatizes his inability to express things on canvas as he used to see, feel, and experience them prior to his melancholia, during which state of mind Picasso “commenced to write poems but his writing was never his writing” (46). Conceptualizing the difference between cubist writing and cubist painting as a matter of distinguishable, ego experiences, Stein stresses, “the egoism of a painter is not at all the egoism of a writer, there is noting to say about it, it is not” (46). According to her melancholic interpretation of Picasso's cubist historiography, Picasso's "real" form of artistic expression coincides with his colorful expression of "the faces, the heads, the bodies of human beings" through the medium of analytic and synthetic cubist portraiture (47). This characteristic, ego-centered form of cubist expression, which ultimately defines the way that Picasso uses color, empties himself of emotions, and explores his subjective phenomenology for new creative visions, becomes "subjugated by a vision which was not his own vision" during the period of personal struggle that occurred from 1935 to 1937.

According to Stein, Picasso's subjective nature, as well as his analytic and synthetic cubist portraiture, becomes suspended in a melancholic state of literary zombism that resembles the "moments in life when one is neither dead nor alive" (46). As she reports:

> Two years of not working. In a way Picasso liked it, it was responsibility the less, it is nice not having responsibilities, it is like the soldiers during a war, a war is terrible, they said, but during a war one has no responsibility, neither for death, nor for life. So these two years were like that for Picasso, he did not work, it was not for him to decide every moment what he saw, no, poetry for him was something to be made during rather bitter meditations, but agreeably enough, in a café. This was his life for two years, of course he who could write, write so well with drawings and with colors, knew very well that to write with words was, for him, not to write at all.
> Of course he understood that but he did not wish to allow himself to be awakened, there are moments in life when one is neither dead nor alive and for two years Picasso was neither dead nor alive, it was not an agreeable period for him, but a period of rest, he, who all his life needed to empty himself and to empty himself, during two years

> he did not empty himself, that is to say not actively, actually he really emptied himself completely, emptied himself of many things and above all of being subjugated by a vision which was not his own vision. (46-47)

With cubist poetry supposedly serving as a way for Picasso to express his unconscious personal losses and traumatic war experiences, he enters into seemingly "normal" streams of half-consciousness, or "half-mourning," as melancholia is sometimes called, or into the stream of (aesthetic) unconsciousness that Dennett has defined as philosophical zombism.

In these states of creative automatism, Picasso conducts many of the daily actions and characteristic behaviours that Stein attributes to the cubist painter and her close friend, "Picasso," even though he lacks the emotions, feelings and subjective qualities of the individual that Stein sees as the "real" artist that supposedly "is" the true Pablo Picasso: that is, she views the cubist writer/melancholic subject as the artistic zombie and the "real" Pablo Picasso as an artist who does not normally write cubist poems, but creates exquisite portraits of the faces, heads and bodies of human beings, "as they have existed since the existence of the human race" (47). According to Stein's cubist historiography, Picasso fits the profile of the melancholic subject that Freud depicts in "Mourning and Melancholia." As Freud puts it, "the melancholic seems puzzling to us because we cannot see what it is that is absorbing him so entirely. The melancholic displays something else besides which is lacking in mourning – an extraordinary diminution in his self-regard, an impoverishment of his ego on a grand scale. … He is not of the opinion that a change has taken place in him, but extends his self-criticism back over the past; he declares that he was never any better" (584). Pursuing the contrary viewpoint for rhetorical purposes, Freud also points out that the melancholic exhibits the "almost opposite trait of insistent communicativeness which finds satisfaction in self-exposure" (585). Because Stein describes Picasso's state of 'artistic zombism' as the literary and affective expression of unconsciousness losses that express themselves through his cubist writings and his poetic adventures in the Parisian and London café scenes, this is the kind of zombism that coincides with Dennett's description of philosophical zombies in *Sweet Dreams*. Citing Chalmers, Dennett claims "where normal people have a stream of consciousness, zombies have a stream of unconsciousness." By contrast with this description, Picasso exhibits the narcissistic tendencies common to melancholic subjects that have been subjected to traumatic, war and life experiences. In other words, his automatism and zombism does not derive from the artistic experience per se, from the shock value of modern art or the nihilism of modern subjectivity, but it is expressed through the aesthetic imago that is contained in the images, words and colors of his cubist portraits and poems.

In order to create persuasive arguments about Picasso's poetic misadventures, perhaps as a way of masking her artistic insecurities and personal jealousies, Stein tells fabulous (that is, partially inaccurate) stories about Picasso's colors and their meanings.[68] In the process of doing so, she forecloses upon the stories that she could have told about her cubist-inspired literary experiments with neuron coloration and brain representation. This is another example of how Stein uses the narrative practice of cubist historiography to foreclose upon the subject of her literary brain mapping activities. Taking a unique (if somewhat distorted), scientific approach to the subject of cubist historiography and Picasso's color melancholia in *Picasso*, Stein clarifies that it is not scientific progress per se that early twentieth-century cubist painters and writers found to be troubling or disconcerting, but the fact that scientific progress implies a lack of imagination on the part of its trained practitioners. In her view, it was a *particular* image of scientific progress that analytic and synthetic cubism wished to distance itself from: namely, an image of science as a progressive movement (an episteme) that increasingly defined itself in terms of its empirical modes of discovery.

Stein believed that that cubism could account for the perceptual and neural principles that informed a scientist's creative thinking and an artist's pointillist rendering of consciousness, as opposed to nineteenth-century western science. Her main point about cubism's contribution to human knowledge, amidst the violent splendour of the twentieth-century, is that "nothing changes in people from one generation to another except the way of seeing and of being seen." This cubist principle also applies to the colorful, literary representation of the human brain and the central nervous system. In *Picasso*, Stein further notes that cubist painters produced unprecedented images of the visible world and their portrait subjects without having any models in front of them; for example, Picasso mostly drew without models after his analytic cubist phase, as did many of his artistic peers. As a result of the cubist movement, the basis for new perceptions was no longer what the eyes saw, but what the mind created anew, as a result of its phenomenological interactions with the visible world. Cubist painters could grasp abstract scientific truths and phenomenal realities because their perceptions no longer depended upon the observation of known realities and laboratory-produced, quasi-objects and quasi-subjects. In Stein's estimation, the second, cubist principle ought to be characterized in the following way: "Secondly, the faith in what the eyes were seeing, that is to say the belief in the reality of science, commenced to diminish," Stein contends. "To be sure science had discovered many things, she would continue to discover many things, but the principle which was the basis of all this was completely understood, the joy of discovery was almost over" (12). With this second tenet, Stein stresses how the creative imagination and its intuitive powers recreate the tangible qualities of the conscious, phenomenal experiences that have come to define cubism in the early twentieth-century. But she also reveals how the phenomenal qualities of the human mind in cubist writing can be compared to the practices of the nineteenth-century, biological and pure sciences.

As far as Gertrude Stein was concerned, cubism achieved four significant things in the twentieth-century: it mourned, incorporated, preserved and reincarnated western science's "joy of discovery" for its own, vicarious purposes. Also, it sublimated the scientific creation of new phenomenal and physical realities, even unconscious neuraesthetic realities, by serving as a supplement to empirical science's descriptive modes of knowledge production. "Thirdly," Stein adds, "cubism is responsible for "the framing of life, the need that a picture exist in its frame, remain in its frame was over. A picture remaining in its frame was a thing that always had existed and now pictures commenced to want to leave their frames and this also created the necessity for cubism" (12).

With this third tenet, Stein underlines her belief about cubist portraiture blending into science, life becoming art, and reality blurring into fiction. However, she does so in a fashion here that only indirectly reinforces her neuraesthetic hypotheses about the non-identificatory, non-mnemonic and non-human qualities of literary "master-pieces." As Wendy Steiner argues in *The Colors of Rhetoric*, "The cubist interaction with the past makes a simultaneity of it, a system whose elements are altered not in substance but in context. Cubism thus tells us to think of history in a new way, not as a plotted narrative moving toward a resolution, but as a cubist painting whose elements maintain their heterogeneity – objects, people; things, signs; the banal, the dramatic; the contemporaneous, the anachronous – in an aestheticized structure of interrelations" (*Color of Things* 191).

As I make the shift from cubist historiography to neuraesthetic literary criticism, it is crucial to keep Steiner's remark in mind, lest we forget the heterogeneous and fragmentary nature of Stein's neuroanatomical imaginaries and the unprecedented nature of her nervous system coloration schemes. First and foremost, they are "intellectual creations," which serve as emergent forms of neuraesthetic composition and interdisciplinary exploration.

Instead of speaking about her color-coded brain mapping activities in *Everybody's Autobiography*, Stein sidesteps the issue of cubism's scientific legacy by telling another fabulous tale about the hieroglyphic future of the English language. Then she relates this prophetic etymology to Picasso's cubist poetry and her cubist literature. With these creative acts of cubist historiography and linguistic prognostication, Stein secures a notion of first-person autobiography as a special kind of melancholic text that enables her to explore and articulate the losses associated with her cubist brain mapping activities.[69] For Stein, the metaphysical relation that exists between human nature and the human mind serves as one of the things that causes an interminable form of mourning (or the pathological condition that is known as melancholia), in artists from different cultures and historical epochs. If a writer or artist cannot compose in his "proper" medium, then Stein believes that this writer or artist essentially loses his or her artistic identity, as well as the source of his or her "natural" creativity. This aesthetic philosophy implies that on some level of consciousness, and in some sphere of artistic production, the melancholic writer-artist will mourn unconscious losses and traumatic experiences through the expression of color, but particularly through the expression of another artist's color palette and aesthetic singularity.[70] By not speaking about her neuraesthetic compositional practices directly, Stein participates in a special kind of cubist, melancholic historiography. However, there is also a conscious element to her cubist brain mapping activities and her cubist historiography, which makes it difficult for me to define her cubist writing practices as philosophical "zombism," or as the "metaphorical truth about conscious man."

Stein's sins of omission and literary fallacies thus prevent me viewing her pointillist expressions of cubist art as literary zombism, and her cubist renderings of conscious experiences as the metaphorical and literal truths about consciousness. In *Everybody's Autobiography*, Stein foresees an evolutionary path for the English language that privileges sight over hearing, "I think what is going to happen is that a written language is going to be existing like it did in old civilizations where it is read with the eyes and then another language which only says what everybody knows and therefore is not interesting which is read with the ears" (18). In the late 30s, most likely because of her past silence about her cubist brain mapping experiments, Stein begins to fear that Picasso has encroached upon and will conquer her perceived territory as a cubist writer.

If Zeki is correct about Picasso's production of unconscious brain concepts, then, in certain respects, Stein's fears were founded, because Picasso was always already acting as a neurologist in his creation of cubist paintings.[71] At some point before she wrote *Everybody's Autobiography* and *Picasso*, Stein realized that most readers would not discover major differences between Picasso's cubist writings and her cubist creations. In this respect, there is credence to Dennett's philosophical arguments about the pointillist rendering of conscious man, because, until recently, very few critics tried to distinguish between the different genres, subgenres and styles of cubist writing. Given Stein's harsh reviews of Picasso's cubist writings and her belittling treatment of him as a poet in *Everybody's Autobiography*, her jealous behavior suggests, on the surface, that she fears Picasso's popularity with the European literati. On a deeper level, she seems to fear that the readers, who adore Picasso's cubist paintings and drawings, will prefer his colorful, cubist writings to her obscure, cubist portraits, because it is difficult for readers to distinguish between their modernist qualialects. In contrast with Stein's description of Picasso's cubist poetry in *Picasso* and *Everybody's Autobiography*, I find his cubist prose and poetry to be colorful, even exuberantly so. To put this in slightly different terms, his cubist writing conveys striking, even violent, images of the mind's phenomenal realities.

In my opinion, Picasso's 'painterly' cubist writing functions as a special kind of neuraesthetic literary expression, which differs from Stein's literary neuraesthetics in a number of significant ways. Consider the following passage from his prose work, "In the Corner A Violet Sword": "Listen in your childhood to the hour which white in blue memory borders white in his eyes very blue and indigo spot of silver sky the white looks cobalt pierce the white paper which the blue ink tears out bluish his ultramarine descends which white enjoys repose blue stirred in the dark green green wall which his pleasure writes light green rain which swims yellow green in light oblivion" (*Surrealist Painters and Poets* 347). With these colorful images, he is able to evoke in his readers' imaginations clear and powerful, childhood memories by deploying color signifiers, such as "green," "blue," "cobalt," "ultramarine," "indigo," "white," and "yellow," to create distinguishable hues, intensities, lines, qualities, shades and meanings for his abstractly represented, portrait subjects. In his cubist writings, Picasso uses grammatical conventions in a dissociative manner, like Stein; however, his dissociative images make sense to visually-oriented readers. This is because Picasso chooses adjectives and nouns for their evocative, sensory associations and visceral power. He does not experiment with grammar, syntax and punctuation to the extent that Stein does in her analytic-style cubist portraits and middle writings; nor does he purposely strive to destroy meaning by effacing his portrait subjects and evacuating their culturally intelligible, denotative and connotative meanings. Picasso's readers thus can visualize the connections that exist between the violet sword, white paper, blue ink and green wall in his cubist prose poem, "In the Corner: A Violet Sword."

Because of the negative emotions that color Stein's perceptions of Picasso's cubist poetry, she does not view his cubist writings as colorful, poetic and neuraesthetic renderings of unconscious, brain concepts and conscious, perceptual principles. Somewhat ironically, it was only after he gave up writing that she credited him with the gift of creating beautiful colors in his cubist paintings and writings. In *Picasso*, she describes his post-melancholic and post-traumatic, artistic renaissance, as follows: "The color of his pictures he paints now in 1937 are bright colors, light colors but which have the qualities of the colors which until now only existed in his greys, the colors can oppose the drawing, they can do what they want, it is not that they can agree or not with the drawing that they are there, they are there only to exist, certainly Picasso has found his color, his real color in 1937" (*Picasso* 48). In other words, Stein claims that it was only after Picasso gave up writing completely and resumed his normal, painting and drawing activities that he was able to find "himself" and his "real color." In *Everybody's Autobiography*, Stein openly admits she felt jealous when she found out that Picasso was writing cubist poetry. As she recounts,

> When I first heard that he [Picasso] was writing poetry I had a funny feeling. It was Henry Kahnweiler the dealer who first told me about

> it. What kind of poetry is it I said, why poetry he said you know poetry like everybody writes. Oh I said. Well as I say when I first heard he was writing I had a funny feeling one does you know. Things belong to you and writing belonged to me, there is no doubt that writing belonged to me. I know writing belongs to me, I am quite certain and nobody no matter how certain you are about anything about anything belonging to you if you hear that somebody says it belongs to them it gives you a funny feeling. … So that was the kind of feeling that I had when I heard that Picasso was writing and that was the feeling I had when I went over to listen. (16)

This narrative serves to remind us that there are strong emotions and personal feelings that inform Stein's neuraesthetic, literary compositions. Clearly, she feels possessive about her cubist portraits, but perhaps this is also because she has taken the 'science' of neuron coloring, brain representation and consciousness creation into completely new directions. Stein's legacy, as a cubist writer and a neuraesthetic composer, comes from the modernist hieroglyphs and cerebral allegories that she produces for her readers.

The social drama, personal insecurities and artistic jealousies that Stein reveals in *Everybody's Autobiography* throw her cubist brain portraiture and evolutionary theories into bold relief, thereby demonstrating that there is more at stake for Stein, than just losing some hard-won public support in the small, but competitive (some might say, incestuous) world of cubist, literary expression. The reading public might hold a dim view of her whimsical experiments with imaginary brains, "bottom natures," and phenomenal realities. They also might disagree that the English language was a hieroglyphic form of symbolic expression because of its interartistic, assimilatory activities. Perhaps, then, it goes without saying that Gertrude

Stein felt passionate about her literary brain maps and their uncertain legacy within English literature, because she had focused so much energy on their conscious creation and her defence of cubist writing strategies. Precisely because of this theoretical concentration and her obsession with Picasso's poetic fame, Stein failed to recognize the neuraesthetic significance of Picasso's cubist writings. In *Everybody's Autobiography*, Stein recalls how she confronted Picasso about the allegedly underwhelming, literary qualities of his cubist poems:

> I asked Pablo what he had been doing and he said he was not painting he was leading a poet's life and here he was with Braque who was still painting. Well I said and Picasso said well you did see Dali, sure I said but you did not come no said Pablo you see I knew you would tell him what I thought of my poetry and you would not tell me. Sure I did I said and that was easy, why said he, why I said because you see one discusses things with stupid people but not with sensible ones, you know that very well I said getting a little angry, one never discusses anything with anybody who can understand one discusses things with people who cannot understand and that is the reason I discussed with Dali and I do not discuss with you. What he said Dali cannot understand anything, of course he can't I said you that as well as I do, he looked a little sheepish yes I guess that is true, he said and then he got excited but you said that painters can't write poetry, well they can't I said, look at you, my poetry is good he said Breton says so, Breton I said Breton admires anything to which he can sign his name and you know as well as I do that a hundred years hence nobody will remember his name you know that perfectly well, oh well he muttered they say he can write, yes I said I you do not take their word for whether

> somebody can paint, don't be an ass I said, Braque spoke up, a painter can write he said I have written all my life, well I said I only saw one thing of yours that was written and that in a language that you cannot understand and I did not think much of it that is all I can say, and he said that I did not write he said, oh didn't you I said well anyway you signed it I said and I have never seen any other writing of yours so you do not count, and anyway we are talking about Pablo's poetry, and even Michael Angelo did not make much of a success of it. (37-38)

By reading this passage from an unconscious neuraesthetic standpoint, it seems that Stein fears Picasso would be able to transform his cubist portraiture strategies into neuraesthetic writings that would archive the phenomenal qualities of his passing states of consciousness in the form of literary hieroglyphs, as she had attempted to consciously do with her "pointillist renderings of consciousness." The point is that their cubist writings resemble each other on a number of levels, especially in terms of how they use color words, in the form of adjectives and nouns, to create structures, lines and dimensions for the mind's phenomenal realities and its perceived subjects. Also, their cubist poems resemble Steinberg's pointillist cartoon, to the extent that both of these artists assimilate other art forms into their aesthetic purview and then re-inscribe these art forms within the aesthetic consciousnesses of their respective, cubist writings. However, there are also fundamental differences between Stein's cubist writings and Picasso's cubist poems. Stein's cubist historiography and cubist writing demonstrates that language generates, as well as exposes, neuraesthetic principles that rely upon color to recreate passing states of consciousness.

If we study Stein's writings from the 1930s, including such works as *Picasso*, *Everybody's Autobiography*, "What Are Master-pieces and Why

Are There So Few of Them," "What is English Literature," and *The Geographical History of America*, then we can better understand the etymological, literary and neuraesthetic theories that are inherent in her cubist writings and their brain hieroglyphs. At some point in the 1930s, Stein's literary theories about the universal value of dissociative literary writing and masterpiece creation evolve into a set of beliefs about the hieroglyphic possibilities and evolution of the creatively written, English language. During this period, the strong, negative emotions that Stein associates with Picasso's cubist writings serve as the impetus for a renewed emphasis upon 'reading with the eyes' and language's visual qualities. Sometime prior to the emotional scenes that occurred in 1935 with Picasso over his cubist poetry, Stein began to focus again on the visual qualities of the English language in her synthetic, cubist portraits, perhaps as early as 1932. Her shift in focus from sound to sight likely led to the creation of brain hieroglyphs, beloved mistakes and multidimensional brain maps, in *The Geographical History of America*.

2.2 Gertrude Stein, the Brain, and the "Beloved Mistake"

There are innumerable ways to read Stein's 'cubist puns' and 'beloved mistakes.' However, for the sake of this argument, I have limited my interpretative scope to the 'mistakes' and puns that pertain to her neuroanatomical portraits.[72] I believe that the color-coded qualialects that comprise a neuroanatomical imaginary function as "beloved mistakes," to the extent that the color words that Stein uses to illustrate the brain's neural network architecture signify a "number of possible referents and a number of different aspects of the same referent within a single sign. In advancing this proposition, I expand upon Steiner's research on "cubist punning."

However, I note that an analogue to this research can be found in the neuraesthetic and neurobiological research that S. Zeki, V. S. Ramachandran and J. Lehrer are conducting on the generic perspective, perceptual principle, the peak shift principle, and on inherited and acquired, brain concepts. For example, the color signifier "blue" could be representing naturally pigmented brain nuclei, such as the blue neurons of the locus coeruleus. Similarly, "yellow" could be representing the yellow-colored cellular tissue from the piriform, nerve layer of the cerebellar lamellae, where the Purkinje nerve cells are nestled. Also, these color words could be representing artificially stained nerve tissue samples that scientists have collected from the human brain, so that, in the context of portrait's neuroanatomical imaginary, the color "blue" represents chemically-stained blue-colored neurons, like the neurons that have been stained with the methylene-blue method in the laboratories of Barker, Dogiel and Cajal. Extending this neuraesthetic principle, the signifier "yellow" thus could represent the yellow-colored neurons that have been dyed with the gold choride stain that von Gerlach developed in the nineteenth-century. The color "yellow" could also represent naturally-pigmented, yellow-colored neurons, such as the Purkinje nerve cells. It seems plausible that Stein would find cubist punning to be an exemplary way of exploring the brain's neural architecture, because this representational strategy would have provided her with the semiotic, discursive and conceptual latitude to examine western science's "beloved mistakes." This cubist representational strategy also gave Stein the freedom address some of western medicine's scientific limitations and thus to supplement its empirical modes of brain research. For these reasons, I find Steiner's definition of the "beloved mistakes" and "cubist puns" to be a useful way of reading the obscure, neurophysiological entities and the aesthetically encrypted, perceptual principles that comprise her cubist brain maps.

However, I would like to qualify this statement about the generic perspective perceptual principle that is encoded at the level of these cubist puns, by clarifying what I mean by the phrase "beloved mistake." I do not believe that Stein was confused about the appearance of colored neurons in the human brain's cellular tissues and its neural networks. Nor do I think that she mistook the ways in which neurons appear to a scientist's eye, when s/he is examining colored brain nuclei, such as the red nucleus, the locus coeruleus (the blue place) or the substantia nigra (the black substance), from a surgical perspective. Also, I do not think that Stein made egregious mistakes about the pigmented colors and neural structures of different brain nuclei; nor do I feel that she confused their microscopic appearance of colored neurons for other neurophysiological entities and cellular elements in her neuraesthetic writings. For example, when Stein's dissociative discourse describes the human mind's subjectively experienced, neuroanatomical landscape in *The Geographical History of America* with six distinguishable colors, we should not automatically assume that Stein has committed scientific errors with her portrayals of the brain's colored neurons and its colored matter. Instead, I propose that the literary description that Stein provides of multicolored neurons in this neuroanatomical landscape can be characterized as a conscious and deliberate act, as well as being insightful, whimsical and partly unconscious because it represents inherited and acquired, brain concepts: "There is blue and green and green and yellow pale yellow and blue, there is pale yellow and green and blue and warmth and there is not any such thing as human nature" (120). In other words, I do not think that Stein has committed a "deliberate error" (to use Meyer's phrase), or grammatically produced a "beloved mistake" (to use Steiner's expression), when she places individually colored, word neurons in a serialized, layered and myelinated formation, so as to frame the human mind's subjectively experienced, neuroanatomical landscape. Through the sequential deployment of color words in this qualialect formation, Stein figuratively represents the interneuronal relationships and synaptic connections that correspond with the cerebral cortex's "white and "grey" matter, in an ambiguous and relational fashion. Also, this detective story investigates the metaphysical relationship that exists between human nature and the human mind, at the level of its colorful neural architecture and its phenomenal color experiences.

To summarize: the color words that Stein uses to describe the brain's "neuronal network architecture" represent naturally pigmented brain nuclei, artificially stained nervous tissue and surgically examined brain nuclei simultaneously. Alternatively, these color signifiers represent naturally pigmented brain nuclei, brain neurons and cellular tissues with its ambiguous meanings and structural relations. Additionally, these color words, in conjunction with the non-color words and enigmatic phrases that appear with them in Stein's dissociative discourse, describe how the brain appears to neuroscientists, who are studying artificially stained nervous tissue in prepared brain sections and brain slices. For neuroscientists who surgically and microscopically examine the naturally-pigmented neurons and axons that comprise brain nuclei, these color words do not accurately portray the brain's uniformly colored, cellular elements. Or, rather, these multicoloured and variegated, neuronal networks vaguely resemble the colored brain nuclei and neuronal networks that have been produced in transgenic animals, especially the Brainbow mice. The color language qualia from Detective Story number VII represents many scientific meanings and semiotic possibilities, at once, thereby demonstrating the inadequacy of nineteenth-century, nerve tissue staining methods, the scientific value of neuraesthetic writing strategies that generate multiple perspectives for colored brain tissue, and the short-sightedness of 'Nature' in providing scientists and artists with a limited color palette to work with, at the level of the brain's neural architecture. In addition to these interpretative possibilities, these language qualia indirectly refer to earlier works in Stein's corpus, such as "A Long Dress," where the color words "green," "yellow" and "blue" generate color combinations, such as "only a yellow and green are blue" (*Tender Buttons* 8), as a means of exploring the color-based and language-centered, brain mapping strategies. As I suggested earlier, these brain mapping strategies evolved into sophisticated, neuraesthetic compositions over a twenty-five year period, which operate through a range of perceptual and neural principles simultaneously.

Thus far, I have mentioned the most obvious possibilities that might be informing Stein's "beloved mistakes," leaving out some of the more insightful, intuitive and prophetic possibilities of neuron coloring and brain mapping that Stein posits at the level of language. In order to decipher the metaphysical metaphors, color signifiers, non-descriptive phrases, grammatical devices and cubist puns in Detective Story number VII, we may need to acquire or cultivate specialized forms of neuraesthetic knowledge. Such knowledge makes it possible for us to appreciate the originality of Stein's laboratory experiments and brain research at Johns Hopkins, as well as to understand the radical nature of her imaginative, neurobiological investigations. With the aid of the *Brainbow* photographs provided by Lichtman, Sanes, Livet, Weissman and Draft, I believe that it is possible to challenge Thornton Wilder's assertion that Stein's "private language" is a discursively translated, subjective phenomenology that is absolute, unknowable and prophetic.

One of the ways that we can reconcile the conflicting neuraesthetic, perceptual principles that comprise Stein's portraits is by reading her cubist puns and brainbow-like qualialects allegorically. Allegorical representations can permit a writer to present contradictory, radical and emergent ideas, as Joel Fineman observes in "The Structure of Allegorical Desire." In his words: "historically, we can note that allegory seems regularly to surface in critical or polemical atmospheres, when for political or metaphysical reasons there is something that cannot be said" (28). Allegory emerges under difficult, political and historical conditions, because it "makes up for the distance, or heals the gap, between the present and a disappearing past, which, without interpretation, would be otherwise irrecuperable and foreclosed, as, for example, the pseudo-hieroglyphology of Horapollo, whose magic, hermetic graphesis is developed just at the moment when the legibility of hieroglyphs is lost" (Fineman 29). By reading these cubist brain portraits as allegories of the creative mind, I hope to avoid a binary logic that privileges sight over sound, sense over nonsense, reason over the imagination, expression over description, and vice versa. Though Stein may have wished to privilege sound over sight in certain works and taken the opposite approach to these sensory qualities in other writings, James considered these sensory experiences to be equally important, elementary qualities that comprise the mind's "subjective nature" (*Principles of Psychology II* 618). Following James's radical empiricist logic, there is a sense in which the color signifiers that constitute these cubist portraits perform the *same function* as the mind's phenomenal qualities, by allowing this writer to explore different facets of phenomenal consciousness from different angles and perceptual perspectives.

The creative act of looking and the phenomenology of color vision serve important functions and act as noticeable landmarks within Stein's brain maps. Stein knew that her American readers would find her emphasis upon sight, looking and seeing difficult to understand, given the stress that was placed upon hearing, recitation and oral memory in American educational institutions:

> It has always bothered me a good deal that and as in America hearing plays such a large part in everything it is a thing that makes any one really creating worry about everything. It does not worry me but it might if I could listen, that is if I could hear, but hearing tires me very quickly. Lots of voices make too much sound, any one voice sounds too much like that voice, and soon I do not worry, hearing human voices is not real enough to be a worry. When you have been digging in the garden or been anywhere when you close your eyes you see what you have been seeing, but it is a peaceful thing that and it is not a worry to one. On the other hand as I write the movement of the words spoken by some one whom lately I have been hearing sound like my writing feels to me as I am writing. That is what led me to portrait writing. However lecturing is another matter. (90-91)

Detective Story number VII reflects Stein's renewed stress upon the special kind of "seeing" that occurs within the purview of the creative imagination. The inventive act of brain visualization and the literary practice of scientific detection become coextensive domains of qualia-knowledge in Stein's dissociative, detective stories. In *Everybody's Autobiography* Stein confesses that she found the task of writing detective stories to be difficult work, perhaps for this very reason: "I tried to write the story of Blood on the Dining Room Floor, and although I did it, I did not really do it and everybody was writing to me and I did not do any writing [since *Wars I*

Have Seen and *The Autobiography of Alice B. Toklas*]" (88). I take Meyer's point about not focusing exclusively on sight, or on the "objectifications of sight," when contemplating these imaginary nervous systems. However, Meyer focuses almost exclusively on the second-phase literary portraits in Stein's corpus. "The problem with this second stage of portraiture," Steiner stresses, "was that Stein finally became so interested in the purely musical properties of words that she began to ignore her own subjects, and hence the portrait situation, as she herself admits in "Portraits and Repetition" (pp. 197-98). Her reaction was to impose a severe discipline upon herself. As a result, in the final phase of portraiture, in such works as "George Hugnet," "All the looking was there all the talking and listening was there but instead of giving what I was realizing at any and every moment of them and of me until I was empty of them I made them contained within the thing I wrote that was them" (pp. 199-200).

> This is the final stage of an indexical-iconic program, for the intention here is to produce a portrait sign that does not work mediately, but instead, intermediately, so that a perception of the sign functions as a perception of the subject himself. Though such a claim about a literary work begins to sound a bit mystical, it is the pushing toward this impossible state that is significant in Stein's ideas, as we saw before with her ideas about time. … As an intellectual exercise, this development represented a very complex quasi-scientific process of fitting theory and technique to precise observation. Seldom has any author examined and experimented with the possibilities of a genre so consciously, and no one but Stein has ever done so with the literary portrait. (62-63)

If we surveyed Stein's literary experiments with sound, sight and sense over the course of her writing career, then we would find that sometimes she placed more emphasis upon sight, and other times she placed more stress upon sound. In other cubist writing experiments, she sought to combined the two senses so as to simulate the brain condition known as sensory synaesthesia, so it is difficult to tell where the stress lies, in these works. Meyer just so happens to be reading the works where Stein is placing more emphasis upon the "purely musical properties of words," to the detriment of reading portraits that privilege vision, sight and looking at the level of language, such as *Tender Buttons* and other second-phase, non-mimetic cubist portraits.

By carefully inspecting Stein's color experiments and literary portraits from this period, we find some fascinating neuraesthetic patterns and neuroscientific experiments, which balance and perhaps even counteract the prevailing view that Stein's second-phase literary portraits concern themselves exclusively with a "rollicking, sometimes rapturous sound play," to the exclusion of other linguistic, psychological, and neuroscientific, thought experiments that Stein may have been conducting at the time (Steiner 199). To put this in simple terms: she wanted to avoid the impression that she was conducting imaginary brain surgeries or neuroscientific thought experiments, at all costs. In "Portraits and Repetition," she clarifies that she did not wish to alienate her literary readers and further antagonize her reviewers by revealing too much about her "color thing." If she had announced that she was secretly conducting brain experiments that resembled the laboratory experiments she had previously conducted at Harvard University with color, many of her supporters would have regarded her as a hypocrite, considering that she had been giving her readers the distinct impression that she had abandoned her psychological studies and her neuroscientific interests at the turn of the twentieth-century.

If we examine the cubist portraits from a visually-centered and contra-institutional ideological perspective, then it appears that Stein left important clues about her institutional resistances and her attempts to represent the visual brain. Wendy Steiner claims that the phrase, “the language of education,” from *A Long Gay Book,* “is associated with logic or science,” and the phrase, “expression of the emanation of evil” evokes Blake’s prophetic style of poetic expression. This interpretation can help us to understand Stein’s secrecy around the subject of brain portraiture, especially if we are willing to puzzle our way through Steiner’s enigmatic phrasings and Stein’s cryptic discourse (90). In *Exact Resemblance to Exact Resemblance*, Steiner argues, “The language of education is not replacing the special position that is the expression of the emanation of evil.” In her reading of “Constance Fletcher,” Steiner claims that the phrase, “the language of education,” ought to be viewed as a contemplative, symbolic utterance:

> Since the language of science or logic does not “replace” the other, we may assume that it “is not overpowering,” so that the “language of education” is synonymous with “an expression when contemplation is not connecting the object that is in position with the forehead that is looking,” that is, [with an] expression [that is] not based on the visual perception of the object. Thus the “language of education” is devoid of visuality and is associated with logic or science, the inadequacy of which was demonstrated by the ‘moving in the shoe’ paragraph. Surely all this is a condemnation of the early style which programmatically ruled out “looking,” which was a quasi-scientific description (a “language of education”), and which involved a distortion of the immediacy of thought and perception. (91)

According to Stein's portrait "Constance Fletcher," education does not place enough stress upon looking, vision, perception, expression and immediacy. Emphasizing this point with a number of her second- and third-phase portraits, Stein uses color to emphasizes these aspects of the visual brain and, perhaps as well, its relation to the "education of the hemispheres" (to use James's expression). Wendy Steiner points out that the adverb "Tenderly," in "Constance Fletcher, most likely refers to *Tender Buttons*, since this book was "the beginning of her visually-oriented writing," and its functions in this poem/portrait as an iconic-indexical, cubist pun. Significantly, for allegorical readers of these works and for our purposes here, Steiner argues that the color words and the linguistic signifiers in "the early second-phase portraits are intelligible, [and] second, … they make direct reference to their subjects, and finally, they call attention to this reference by fairly obvious clues" (101). If we confuse the neuraesthetic principles that inform the construction of the second- and third-phase portraits with other grammatical forms, then we might not appreciate the shifting, evolving and subtle roles that vision, sight and looking play in the composition of neuroanatomical imaginaries, which playfully challenge nineteenth-century educational practices and scientific ideologies.[73] In chapter three of *Everybody's Autobiography*, Stein confirms that she privileges vision over sound and hearing, when states that her "eyes have told me more than [her] ears. Anything you hear gets to be a noise, but a thing you see, well of course it has some sound but not the sound of a noise" (89). While it may be difficult to read these cubist writings allegorically and neuraesthetically, *the reward for such difficult thinking*, as Wilder elegantly put this, in his introduction to *The Geographical History of America*, is that readers can discover the scientific possibilities that are encoded at the level of her "creative metaphysics." It would be a mistake to confuse the second-phase neuroanatomical portraits with the third-phase neuroanatomical portraits, I submit, for to do so is to underestimate the important roles that vision, sight and looking play in the detective stories and meditative books from the 1930s.[74]

2.3 Modern Brain Science, the Cubist Pun and the Detective Story

At the level of a text's allegorical brain representations, changes in color representation and peculiar color combinations allow Stein to move with confidence from the abstract, invisible, and mostly unintelligible literary representations of the human brain in *Tender Buttons* and the second-phase cubist portraits, to the explicit, highly visible and mostly intelligible representation of the human brain that we find in *The Geographical History of America or the Relation of Human Nature to the Human Mind* (1936). These allegorical brain maps enable Stein to conduct imaginary laboratory experiments, brain surgeries and microscopic analyses, without having to disclose the quasi-scientific aims of her literary experiments with phenomenal consciousness to her readers. However, interpretative chaos can occur with such modes of representation, which is why Stein uses the color-based cubist pun in her neuroanatomical portraits sparingly, as an experiment with color consciousness and brain representation that easily could escape the reader's notice. From a neuroscientific perspective, Edelman and Tononi emphasize the confusion that normally results from the presentation or portrayal of such multidimensional objects or object relations: "When human subjects are presented with more than a few objects characterized by multiple attributes, they often confuse which object has which attribute. Such conjunction errors have been extensively documented in human perception" (*A Universe of Consciousness* 119).

With the use of cubist puns that have many neurophysiological referents and neuroscientific meanings, Stein's goal may have been generate as many performative possibilities and semantic meanings for the brain's colored neurons and neuronal networks as possible. If this was the case, then her generative, playful and yet subjective approach to the representation of the brain's neural architecture and the mind's phenomenal realities may have freed her "non-representational" literary portraiture from some of its perceived, communicative failures and discursive constraints. Used in moderation within these brain portraits, the cubist pun can cause *positive* confusion by enhancing the "conjunction errors that have been extensively documented in human perception," as Tononi and Edelman observe is the case with any objects that possess multiple attributes and plural meanings.

The cubist pun also functions as a way for Stein to create innumerable, qualitative phenomenal discriminations for a portrait's aesthetic consciousness, or for its symptomatic discursive subjectivity. For example, the cubist pun from Detective Story number VII explores the literary portals of core consciousness and phenomenal consciousness, by enhancing the reader's perceptual abilities and linguistic apperceptions. From a literary perspective, Steiner underscores that the "pun functions in the same way in Stein's writing, as do Stein's beloved "mistakes," combining a number of possible referents or a number of different aspects of the same referent into a single sign" (156). In "A Long Dress" and "Detective Story number VII," the pun works by condensing biological, phenomenal and metaphysical data into color words and other signifiers. In these explicit and non-explicit neuraesthetic compositions, the cubist pun functions, at once, as a performative speech act, as an introspective mode of psychological inquiry, as a brain imaging device, and as an imaginary surgical tool. With the cubist puns from *Tender Buttons* and *The Geographical History of America*, Stein thus was able to generate multiple aspects and innumerable meanings for the brain's neuroanatomical features, neurophysiological mechanisms and non-neuronal, cellular entities.

In proposing this neuraesthetic approach, I argue that the cubist pun functions as a generative process of meaning production (and as a performative process of linguistic signification). By virtue of its figurative associations with the brain's colored matter, the cubist pun acquires culturally intelligible meanings through its perceived, neuroscientific meanings and its neurophysiological connotations. With allegorical reading strategies such as this one, neuraesthetic readers can deduce some of the encrypted neuroscientific insights, brain concepts, and perceptual principles that inform Stein's cubist, representational strategies. In *The Origin of German Tragic Drama,* Walter Benjamin explains that allegory is used in circumstances where it is advantageous for "any person, any object, any relationship … [to] mean absolutely anything else" (*The Origin of German Tragic Drama*, 175). If Benjamin is correct about allegory's conflicting meanings, then Stein did not need to disclose her neuroscientific aims to her readers, for the neuraesthetic art of brain mapping, mind exploration and consciousness representation always already consists of internally contradictory meanings and relationships, which readers can interpret as they will.

For the non-specialist who happens to be reading these masterpieces for the very first time, the idea that Stein might *not* actually be writing about "a long dress," "a red hat," a seltzer bottle," "a blue coat" or a "beautiful sky" may come as a surprise. After the portrait's title, there does not seem to be much in her writing that discloses much about the nature of the portrait's elusive subjects. As Steiner explains, these literary portraits ought to be read as allegories of the human mind. Steiner has defined the second and third phase literary portraits as special kinds of cubist allegory, emphasizing that these portraits draw their inspiration from the cubist paintings of Pablo Picasso and his contemporaries, but differ in key ways from the visual modes of meaning production that are found in the analytic and synthetic, cubist paintings of Picasso and other modern artists in key ways. Steiner does not discuss Picasso's cubist *poetry* much in her study, but I would like to emphasize that Picasso's cubist writings greatly resemble Stein's cubist allegories and neuroanatomical portraits on the surface, though the neural principles they illustrate seem to be different, if one considers that Picasso is talking about memory, identity and nature and Stein is not "talking" about these subjects (or absenting them from her dissociative discourse).

It is important for me to explain Steiner's argument about the allegorical nature of Stein's second- and third-phrase cubist portraiture, before proceeding with my argument about Stein's cubist brain mapping experiments. There are a number of scholars, who do not conceive of her experimental writings as "masterpieces" that explore the brain's phenomenal experiences, creative processes and neural spaces through a neuraesthetic, writing process. Therefore, it is crucial that I discuss the allegorical nature of her cubist writings, before I explain the neural principles that inform her neuraesthetic writing practices and brain mapping strategies. Steiner notes that the second and third phase (analytic and synthetic) cubist portraits that Stein wrote from 1914 to 1936 "call attention" to their referents "by fairly obvious clues" (101). Yet, she also underscores that these works

> have an unintelligible surface which, we might say, is militantly unintelligible through striking disruption of syntax, time-space reference, and sense, through the rhyming of words devoid of semantic relation, the multiplication of negatives, the use of

> circumlocutions so disjointed as seldom to suggest their real meaning. These groups of ideas must be kept in mind in dealing with such portraits, for they explain the most important characteristic of the early second-phrase portraits. This might be termed their 'allegorical' quality, for like an allegory they have both a surface level and one of several interpretative levels. The allegory does not work unless the surface level is taken seriously, and the value of the reading of the 'higher' levels depends on an understanding of both the surface and the norms of the other levels in question. The surface texture of the early second-phase portraits, read and perceived as such, provides no knowledge-about. It is meant to recreate the flow of immediate perceptions of the subject and the second "of" here is deliberately ambiguous – without the reader's being able to understand the motivations for these 'thoughts.' He is to experience [a] Jamesian 'acquaintance' of the subject. And then afterward, the clues we have mentioned lead him to a different level of cognition – memory – where he can reconstitute the meaning of the portrait, where, in effect, he discovers 'knowledge about' the subject. The norms involved in this second level are the norms of portraiture itself. For if we were not accustomed to the representation of people in terms of their work, their clothes, their resemblance to the great, their nationality, and so on, the interpretation of these portraits would be impossible. (101)

Based upon Fry's analysis of Picasso's *Man Leaning on a Table*, Steiner proposes that a "descriptive interpretation" may be derived from cubist portraits that set out to systematically destroy plausible, semantic and syntactic relations. She believes that it is possible for readers to decipher the external referents that are being incoherently signified and partially obscured by a portrait's fragmentary discourse, compressed meanings and cubist puns. As she puts it, "By the third-phase portraits, when external reference is totally absent, this formal, internal set of correspondences is one of the numinous factors in the work upon which a 'descriptive interpretation' can be based" (157).

By taking a contrary approach to the third-phase, non-mimetic (synthetic-style) cubist portraits in Stein's corpus, Steiner argues against their cultural intelligibility and their semiotic viability. "It is ironic that Stein's portraiture broke down precisely when it took the "Rosetta stone" analogy too seriously," she argues, "when it tried to make a translation of cubist technique and psychological theory into a medium that was fundamentally different from paint and canvas, and from "raw perception." Rather than serving as the key to cubism, Stein's writing illustrates the very real barriers between painting and literature. And furthermore, whereas the cubists were satisfied with a compromise in overturning the norms of their medium, Stein insisted on trying the impossible" (160). Every critic means something different when s/he says that Stein was trying to achieve "the impossible" with her experimental writings. This is what Steiner means by this expression:

> The extension of the artist into the world, dictated definitionally by the portrait, was now impossible. Thus, the meditations of the thirties rationalized, in both senses of the word, the contradiction of non-representational portraiture, easing Stein into the compromise of communication, but with a severely limited sphere to communicate. The strain created in her by this limitation is dramatized in the "Identity" texts, and virtually all the rest of her writing is caught between audience-directed referentiality and self-reflexive isolation. The mimetic representation of reality epitomized by the portrait had

been proven an impossibility. (204)

I do not share Steiner's opinions in the passage above, nor do I agree with her conclusion, which is that the "mimetic representation of [a creatively experienced phenomenal] reality" in the third-phase cubist portraits proves to be "an impossibility." For the record, I not believe that Stein's synthetic-style neuroanatomical portraits make communication all but impossible.[75] This is because I take the surface level of these neuroanatomical portraits seriously, for, as Steiner advocates in the passages above, "allegory does not work unless the surface level is taken seriously" (101). If, indeed, "the value of the reading of the 'higher' levels depends on an understanding of both the surface and the norms of the other levels in question," then the literal surface of neuraesthetic compositions may account for the epistemological gap that exists between a portrait's "audience-directed referentiality" and its "self-reflexive isolation" (Steiner 101).

Despite my enormous respect for Steiner's research, I disagree with her conclusions about Stein's third-phase (synthetic) cubist portraiture, on the basis of what I have discovered about the performative, scientific creations and colourful, brain maps that she produces in *Tender Buttons* and *The Geographical History of America*. Hence, I challenge Steiner's Rosetta Stone analogy *in Exact Resemblance to Exact Resemblance*, which essentially holds that the synthetic, cubist portraits fail to communicate knowledge at the level of their color signifiers, color relations and color combinations. Stein's neuroanatomical portrait manage, by virtue of their literary functions as cubist allegories, to signify the brain's neurophysiological entities, neuroanatomical features, cellular elements and morphological functions, with color words, grammatical devices and poetic conventions that simultaneously operate as perceptual principles and as psychological precepts.

Even though Stein made it difficult for her readers to decipher the colored entities of her neuroanatomical imaginaries, it is not an impossible task to isolate some of the perceptual principles and brain concepts that inform a text's imaginary nervous system. Recent discoveries in the fields of molecular genetics, brain research, and literary theory make it possible for us to decipher some of the neurophysiological entities and neuroanatomical features in her modernist writings, for the very first time. As I argue below, Stein's third-phase brain cubist portraits do not disintegrate, because they take the idea of cubist writing *too seriously*. I find to the contrary, in the explicit brain portrait from *The Geographical History of America*, that Stein invites her readers to consider the "hot" topics of brain research and consciousness analysis from the subjective perspective of the human mind's coextensive, "neural" and "qualia" spaces (Edelman and Tononi, *A Universe of Consciousness* 164).

2.4 Gertrude Stein, Brainbow Neurons, and Modern Art

Consider the following photograph, taken by Jean Livet with a confocal microscope, of part of the hippocampus of a 'brainbow' mouse. See Figure 28, Brainbow-mapped Cerebral Cortex, which graced the cover of Nature, November 1, 2007.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 277 is Figure 28, Brainbow-mapped Cerebral Cortex. The information contained in this figure concerns the color mapping of the brain's neuronal network architecture. The source of this material is cover page for Nature, November 1, 2007. Vol. 450. © Jeff Lichtman, Harvard University. The source of the image used in this thesis is <http://www.npr.org/templates/common/image_enlargement.php?imag>. Another source of the enlarged image that I used in my thesis comes from the following, website address:

<http://news.softpedia.com/newsImage/Brainbow-The-Fluorescent-Rai…>.

Compare the three-dimensional image of individually colored neurons, in Figure 28, with Stein's literary description of the human mind's colorful, neuroanatomical landscape from *The Geographical History of America*, in Detective Story number VII: "There is blue and green and green and yellow pale yellow and blue, there is pale yellow and green and blue yellow and blue, there is pale yellow and green and blue and warmth and there is not any such a thing as human nature" (120). Livet's image contains 94 more colors than does Stein's literary description of the human mind's neuroanatomical landscape in *The Geographical History of America*: "In the [Brainbow] constructs presented, combinatorial expression of three XFP genes generates approximately 100 colours in neurons. This labelling appears well suited for visualization and tracing of large numbers of neurons and their connectivity" (61; original spelling). This is a crucial point, one that easily could be lost in my "colors of rhetoric," because the photograph of the Brainbow-mapped cerebral cortex that Livet and his colleagues feature in their article (which is the same one that I am analyzing in this section), contains only a limited number of colored neurons, not the full 90 colors that actually appear in the cerebral cortex that these scientists produced with their two, Brainbow constructs. The photograph, in other words, does not do justice to the 166 distinguishable colors that can be observed in the Brainbow-mapped hippocampus, which these researchers were able to detect with computer and visual tests in Lichtman's Harvard laboratory. Because I am focusing on Stein's fleeting, brainbow-like neural architectures to the exclusion of other kinds of connectivity maps, it might not seem as though her neuron coloration strategies apply to the "visualization and tracing of large numbers of neurons and their connectivity" patterns. Yet, this is the precisely the point that I am making about the brain's linguistic connectivity patterns: namely, that Stein uses color (and color words, in particular) for the purposes of nervous system coloration and multidimensional, brain mapping. Based on their 2007 Brainbow research, Livet et alia "show that colour differences between neurons provide a way to sort their processes while tracing through sections, to directly visualize their putative synaptic interactions, and to distinguish the neurons that converge onto a postsynaptic cell" ("Transgenic Strategies" 61). In "Transgenic Strategies for Combinatorial Expression of Fluorescent Proteins in the Nervous System," they emphasize,

> *Brainbow* transgenes are novel reagents for large-scale studies of cellular interactions. These *Cre*/*lox*-based transgenes create a mosaic gene expression offering two key advantages. First, they use DNA excision and/or inversion to create a stochastic choice among several genes – up to four with the configuration presented here as opposed to two with other methods. … Second, this stochastic choice can give rise to either mutually exclusive gene expression when a single copy of the construct is present, or to combinatorial expression when there are multiple copies. Several parameters might affect the diversity of the combinations obtained, including promotor choice, transgene copy number and length, efficiency and duration of the combination. (61)

There are only six distinguishable colors and fourteen word-neurons in Stein's brainbow-like neural imagery in Detective Story number VII. By contrast, in Livet's three-dimensional photograph of a Brainbow-mapped hippocampus, there appear to be several hundred neurons that express fluorescent proteins, in a range that is visible to the human eye of approximately 90 distinguishable colors (and in the computer-detectable range of approximately 166 distinguishable colors). The point that I am making about these radically different, brain-mapping strategies is that

Stein's "pointillist rendering of conscious experience" showcases a small number of distinguishable, colored neurons,' because this was a proven, scientific strategy from a nineteenth-century medical perspective. The small "sample size," of colored neurons in Stein's neuraesthetic compositions, suggests hermeneutic obstacles and historical limitations that ultimately determine how she visualizes the brain's connectivity patterns. Perhaps Stein did not imagine the entire brain mapped out with colored neurons, axons, glia and cellular elements. Yet, her fleeting representations of brainbow-like, neural networks reveal to us that she did not have to paint or label all of her word-neurons with color, in order to call attention to her neuraesthetic writing strategies and her neuroscientific aims. As I argue in chapter three, with the aid of Sporns, Kötter and Tononi's latest research on the "human connectome," there are distinct advantages to small sample sizes, because these "single neuron" studies can provide us with new ways of probing the brain's "neuronal network architecture," using microanatomical and macroanatomical perspectives that are virtually unexplored within literary studies (Livet et alia, "Transgenic Strategies" 56).

If I describe the blue, yellow and green neurons that are in Livet's photograph of the Brainbow-mapped hippocampus and exclude the red-, orange-, pink- and violet-colored neurons from consideration, I end up with a literal transcription of this brain region that closely approximates Stein's description of the brain in Detective Story number VII. Could a Brainbow-mapped cortex, hippocampus or cerebellum be what Stein was visualizing when she composed this detective story and cubist brain portrait? Could this be what she was imagining, when she composed "A Long Dress," roughly twenty-three years before *The Geographical History of America* was published? It's a distinct possibility that she was able to imagine something like the Brainbow nervous system coloration effects, based on her medical knowledge of the brain's colored nuclei from her neuroanatomical research at the Johns Hopkins Medical School and her use of experimental, nerve tissue staining techniques in her microscope studies, brain modeling assignments, and dissection exercises. See Figure 29, of a Brainbow-mapped Hippocampus, which is a photograph taken by Jeff Lichtman for the cover of Nature, November 1, 2007.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 282 is Figure 29, Brainbow-mapped Hippocampus. This figure offers a condensed, as well as enhanced, view of the "usefulness of the Brainbow system to analyse complex connectivity patterns [that] depends on the number of distinguishable colours expressed by neurons" ("Transgenic Strategies" 60). Explaining how the degree of colour variation affected their ability to study individual neural circuits in different brain regions, Livet et alia report that "[they] analysed the distribution of colour profiles in the reconstructed volume from line H above (eight transgene copies). The population of axons exhibited many different colour profiles (Fig. 5c [in the cerebellum samples studied]); the mean colour values calculated for the different axons varied greatly in hue and saturation and filled a large portion of colour space (Supplementary Fig. 5c). Using a visual colour discrimination test, we found that 98.9 % of randomly selected rosette pairs [in the cerebellum] expressed colours distinct enough to discriminate (see Methods). This degree of colour variation is equivalent to having approximately 89 colours (that is, if 09,0 % of axon pairs appear different, then the remaining 1.1 % or 1 out of 88,7 pairs are too similar to discriminate). An alternative computer-based colour analysis of hippocampal neuron cell bodies from *Brainbow 1.0* line L (See Fig. 4c [our Figure 29) gave an estimated 166 colours. This large number of colours should be useful in resolving individual components of many neural circuits" (60). The source of the image for Figure 29 is the cover of Nature, November 1, 2007. © Jeff Lichtman, Harvard University. The website sources for Figure 29 are
<http://news.softpedia.com/newsImage/Brainbow-The-Fluorescent-Rai…>.
and
<http://www.npr.org/templates/common/image_enlargement.php?imag…>.

If I describe this image using color signifiers from the English language, such as blue, green and yellow, in order to convey the variegated neuronal layering (i.e. the mosaic expression of fluorescent proteins) and the finer grained, cellular elements that I see on the page before me, then my literal description corresponds closely with Stein's literary description of the mind's neuroanatomy in "Detective Story number VII." Starting at the bottom left-hand corner and proceeding diagonally across the image toward the right-hand upper corner, I will adopt a mundane, overly simplistic and repetitive form of description to make a key point about the "repetition," perceptual principle that is encrypted at the level of her neurological descriptions. Also, I want to emphasize the commonalities at the level of neuron coloration that exist between Stein's cubist portrait and this Brainbow-mapped cortex. See Figure 29, Brainbow-Mapped Cerebral Cortex.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 284 is Figure 29. This figure offers a condensed, as well as enhanced, view of the “usefulness of the Brainbow system to analyse complex connectivity patterns [that] depends on the number of distinguishable colours expressed by neurons” (“Transgenic Strategies” 60). The source of this material is the cover of Nature. November 1, 2007. Vol. 450. © Jeff Lichtman, Harvard University. Source of image used in this thesis:
<http://www.npr.org/templates/common/image_enlargement.php?imag>.

Using ordinary words from the English language, I will describe the colored neurons of the cerebral cortex with color words and conjunctions, as Stein does in her sentence, “There is blue and green and green and yellow pale yellow and blue, there is pale yellow and green and blue yellow and blue.” The purpose of this exercise is to reproduce the cortex’s “neuronal network architecture” with grammatical parataxis and color signifiers (Livet et alia, “Transgenic Strategies” 56). Without adding any adjectives and adverbs to embellish my “scientific” description of the cortex’s multi-colored neurons, I offer a *steinesque* reading of this Brainbow, connectivity map: ‘There is blue and green and green and yellow and green and blue and violet and blue and green and blue and violet and blue and green and yellow.’ To finish this off properly, I should add, “there is not any such there as human nature,” as this is what Stein does in her cubist brain map. It is important to note that she invokes the metaphysics of colored “mind stuff,” in order to question the presence of human nature at the level of the human mind’s subjectively experienced and objectively described, neural architecture. This colorful mind stuff also calls attention to the neuraesthetic “nature” of the brain that is being observed, touched, and described with colorful language in this portrait. To create a more realistic picture of the neural architecture I see before me, I would need to find innovative ways of portraying the multicolored axons that form dense entanglements around the colored, cortical neurons in Livet’s three-dimensional, photographic image. Looking at this photograph, we can see that the conjunction “and” does not do justice to the fluorescent “branches” of axons, the colored neuron-blobs and the grainy cellular tissues that comprise the finer-grained, neuronal and non-neuronal elements of the Brainbow-mapped, cerebral cortex.

I wish to stress that these Brainbow photographs do not represent the way a brainbow-mapped brain region actually appears to the scientist’s naked eye, but rather, as these neural structures and brain regions appear to the scientist who is viewing them with a confocal microscope that has fluorescent imaging and image enhancing abilities. This is because, Livet notes, "the colors are only visible when viewed under fluorescent light, so the Brainbow-ed brains still look like normal mice brains … or "normal transgenic mice brains, I should say."[76] In "Brain Cells Colored to Create 'Brainbow,'" Kerr further observes, "Brainbow does have some disadvantages. For one, it relies on fluorescent microscopes, which can cost several hundred thousand dollars. "It's not like the Golgi stain, where you can just look through a normal microscope," Livet [adds]. Another limitation is that it only works with genetically modified, or transgenic, animals, which at the moment only include mice. With the Golgi stain, "you can do everything, including humans," Livet [explicates]. In contrast, Brainbow allows researchers to tag several hundred neurons at once with roughly 90 distinct colors. The resulting images, which resemble abstract color paintings, are both beautiful and informative. They look like they could hand in a modern art museum and are among the most detailed images of neuronal connections ever made." The image of a brainbow mouse's brainstem that Jean Livet submitted to The Olympus Bioscapes International Competition, which subsequently won first prize, "is a montage of images showing large caliber axons of the auditory pathway and their characteristic calyx-like ends." This photograph blurs the boundaries between pointillism and fauvism, in that a viewer can make out the subject (the motor axons running through the brain stem's auditory pathway), but these axons are represented by digital computer that enhances a confocal microscope's fluorescent view of the brain's grey- and white- colored matter. It is a Fauvist-style of brain representation, to the extent that the Brainbow map/photograph presents a fauvist (wildly colored) yet also pointillist (individually distinguished) view of the brain's neural architecture. Put another way: this photograph captures a microscope's enhanced and reconfigured, fluorescent views of the colorful neural structures that exist in particular brain regions. The photographs of brainbow-mapped cortex and hippocampus are artistic creations, as much as they are scientific tools, with which to study the brain. With the confocal microscope, Livet controls the depth of field, eliminates any "degrading" or "out-of-focus information," and "collect[s] serial optical sections from thick specimens."[77] With its fluorescent imaging capacities, Livet can see what the human eye cannot see: a multidimensional and multicoloured, neuronal network architecture that belongs to a transgenic (Brainbow) mouse. See Figure 30, Brainbow-mapped Brain Stem, from The Bioscapes 2007 Digital Imaging Competition Gallery, for which Jean Livet was awarded First Prize.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 289 is Figure 30, Brainbow-mapped Brain Stem, from The Bioscapes 2007 Digital Imaging Competition Gallery. First Prize was awarded to Jean Livet, of Harvard University for this submission. © Jeff Lichtman and Jean Livet, Harvard UP, 2007. As Jean Livet explicates, this photograph "is a montage of images showing large caliber axons of the auditory pathway and their characteristic calyx-like ends." Brainbow-mapped neural structures are scientific creations, as much as they are artistic creation. The source of this material is the following website address:
<http://olympus.bioscapes.com/gallery/2007/1stplaceexlarge.html>.

According to Steve Bradt, the brainbow-mapped cerebral cortex, brain stem and the hippocampus regions consists of "Equal parts pointillism, fauvism, and abstract expressionism." At this point in my argument, I would like to stress that it is the "equal" mixture of these art movements that allegedly comprises the brainbow aesthetic, just as it is an equal mixture of these art movements that informs Stein's neuroanatomical, portraiture strategies. Cubism is only one facet, arguably the most prominent one, of Stein's brain mapping practices in the second- and third-phase, cubist portraits. I find it significant that the Brainbow connectivity maps seek to emulate modernist paintings, not other natural phenomena, such as intergalactic star formations, or man-made constructions, such as laser displays, or even other kinds of visual art.

By finding ways to mimic the visual effects of pointillist, fauvist and abstract expressionist paintings in their Brainbow-mapped nervous systems, Harvard scientists Lichtman and Sanes express perceptual principles and aesthetic tenets through their Brainbow research. Gertrude Stein similarly sought to express conscious and unconscious, brain concepts with her cubist/fauvist/pointillist renderings of the central nervous system. In what follows below, I will define fauvist, pointillist and abstract expressionist art, using Fine Art Surrey.com, which is the website link that Bradt and the Department of Molecular and Cellular Biology and the Center for Brain Science provides for their audiences to comprehend the art movements that conceptually influenced and look like the 'Brainbow aesthetic.'

> Pointillism is a style of painting in which small distinct points of primary colors create the impression of a wide selection of secondary colors. The technique relies on the perceptive ability of the eye and mind of the viewer to mix the color spots into a fuller range of tones, and is related closely to Divisionism, a more technical

> variant of the method. It is a style with few serious practitioners, and is notably seen in the works of Seurat, Signac, and Cross. The term itself was first coined by art critics in the late 1880s to ridicule the works of these artists, and is now used without its earlier mocking connotation.[78]

We can expand this definition into the domain of neuraesthetics proper, by noting that each symbol and word in a pointillist discursive representation, such as in Saul Steinberg's "pointillist" cover print for the *New Yorker*, represents a language "quale," or a qualitative discrimination of phenomenal consciousness that is language-based.

Emphasizing that philosophers usually seek to isolate one quale from the next in order to theorize the subjective nature of conscious experience, Edelman and Tononi explicate the multidimensional nature of conscious experience, using James's nineteenth-century psychological research. These neuroscientists reconceptualize James's spatial qualia and discuss the ways that other kinds of qualitative phenomenal experiences can be mapped onto, and deduced from, the brain's coextensive, neural space and qualia space. Unlike James in "Necessary Truths," these scientists do not set out to classify the kinds of conscious experiences, evolutionary adaptations, spontaneous variations and qualitative discriminations that the mind perceives, either directly or indirectly, through its primary senses and bodily processes. Instead, they conceptualize the different "axes, modalities and submodalities" of the brain's "*N*-dimensional qualia space" in an abstract manner that does not account for, or accurately represent, the many dimensions, functions and effects of consciousness. In their words,

> this graphic illustration should not be taken literally, since at this stage it is considerably simplified and imprecise. It may be useful, however, in obtaining an understanding of the meaning of the quale

in the context of our view of consciousness as an integrated process, as well as in grasping the relevance of the various theoretical concepts that we presented earlier. The first claim of the dynamic-core hypothesis is that these *N* neuronal groups constitute a functional cluster, that is, over a short period, they are highly integrated among themselves and much less so with the rest of the brain. Since a functional cluster identifies a single, unified physical process, it follows that the activity of these *N* neuronal groups should be considered within a single reference space. In the figure, this reference space is indicated by the common origin of all the dimensions defining the core at that moment. By the definition of a functional cluster, it follows that such a reference space cannot be decomposed into independent subspaces (corresponding to subsets of neuronal groups (without a loss of information with respect to other portions of the core. By the same token, it also follows that neuronal groups that are not part of the dynamic core should be considered as constituting separate neural spaces, since within that time scale they are effectively functionally disconnected from it. Accordingly, the figure also represents several smaller neural spaces spanned by a few axes that have a separate origin. An example of such a small, functionally disconnected space may correspond to, for instance, neurons responding to the fluctuations of blood pressure. Clearly, it would be meaningless to consider neuronal groups that are not part of a single functional cluster as part of the same neural reference space because they do not correspond to an underlying unified physical process. It would be like considering the neural space spanned jointly by the neurons of the brain of a person in America and of another person in Europe and wondering what a point in that space might

> mean. (165-166)

As suggested by the passage above, these scientists emphasize the multidimensional nature of conscious experience and pose ways of approaching the problem of "discriminative attention" within empirical studies of consciousness:

> As William James correctly anticipated, there is no "pure," atomistic sensation: "No one ever had a simple sensation by itself. Consciousness, from our natal day, is of a teeming multiplicity of objects and relations, and what we call simple sensations are of discriminative attention, pushed often to a very high degree." In short, a "pure" sensation of red defines a point in this *N*-dimensional space as much as the conscious perception of a busy street in New York City, full of different objects, sounds, smells, associations, and reflections, defines another point. In both cases, the meaning of the conscious perception is given by the discrimination among billions of other possible states of the core, each of which would lead to different consequences. (168)

Meyer clearly places less emphasis upon "sense-data," or what James defines as the elementary qualities of phenomenal experience that comprise "our subjective nature" (*Principles of Psychology* II 618), when he reads Stein's dissociative writings from a neuraesthetic, "organicist" perspective. By contrast, I argue that it is necessary to factor in both the elementary and secondary qualities of conscious experience, if we are to appreciate how Stein translates sensory experiences into dramatic works and cubist masterpieces that serve purposes other than the creative representation of the artist's subjective nature and her embodied experiences.

I believe that Stein sought to incarnate a *theatre of the mind*, using language as well as other people's ideas, bodies, landscapes, histories, props, encounters, vocalizations, actions, songs, enigmatic messages, emotions and feelings, to produce embodied versions of passing states of consciousness in her abstract plays and operas. Edelman and Tononi draw upon James's psychological principles as a means of theorizing the 'quale' within the context of their neuroscientific research on consciousness, that is, in order to view the quale as a discriminable point within the theatre of the mind. To be more precise, they specify how the quale, which is considered to be the smallest unit of phenomenal discrimination within a given field of conscious experience, ought to be used by philosophers and scientists to describe the brain's "*N*-dimensional neural [and qualia] space" (162). "Contrary to common usage by many philosophers and scientists," they propose, "every different conscious state deserves to be called a *quale*, from the state of perceiving pure red, pure darkness, or pure pain, to the state of perceiving a complicated visual scene, and to the state of "thinking of Vienna" (168; original emphasis). Using Figure 13.2 ("Qualia Space"), they explain how a quale is always already a qualia relation within the "*N*-dimensional neural space" of the brain's "dynamic core:"

> The figure depicts *N*-dimensional neural space corresponding to the dynamic core, where *N* is the number of neuronal groups that, at any given time, are part of the dynamic core, where *N* is a large number (only a minimal number of dimensions is plotted). Some of these dimensions correspond to neuronal groups that are color selective and exhibit color constancy (exactly as in figure 13.1). However, a large number of other dimensions is represented in the dynamic core, as indicated by the axes corresponding to the activity of neuronal groups specialized for visual form or visual motion, for auditory or somatosensory inputs, for proprioceptive inputs, for body schemas, and so forth. The appropriate neural reference space for the conscious

> experience corresponding to the quale "pure red" would correspond to a discriminable point in this space (see the crossed circle). (164)

See Figure 33, Qualia Space.

According to the *N*-dimensional "qualia space" that is illustrated by Edelman and Tononi, the pointillist rendering of conscious experience could be conceptualized as a way of illustrating the "discriminable point[s]" in the brain's "*N*-dimensional neural space." The Brainbow connectivity maps demonstrate how neuroscientists conceive of distinguishable qualitative properties, neuron colors and language-based, conscious experience as pointillist renderings of phenomenal experience. These maps show how innovative forms of brain mapping and consciousness analysis occur through the creative expression of the scientific imagination.

According to Bradt and the Brainbow map creators, the art movement that is known as abstract expressionism informs the Brainbow aesthetic by contributing to its colorful vibrancy, aesthetic spontaneity, and emotional involvement. In its political sentiment and its aesthetic mandate, American abstract expressionism differs from early twentieth-century, European pointillism and fauvism. According to the website link that Brainbow scientists provide, abstract expressionism is the "art movement in the 1940s an 1950s[,] where the essence of the work was the artist's personal involvement that was based on emotion and not the desire for realistic depiction[,]" is opposed to Fauvism and Pointillism, by virtue of its aesthetic spontaneity. According to their source, "Many consider Abstract Expressionism the first truly American art movement, although it had roots both in America and Europe. Some European artists who had fled the Hitler regime to America such as Max Ernst, Fernand Leger, Hans Hofmann and Piet Mondrian were involved along with Americans Willem de Kooning, and Jackson Pollock."[79] Fauvism, by comparison, "emphasized painterly qualities, and the use of deep color over the representational values retained by Impressionism. [The] Fauvists simplified lines, made the subject of the painting easy to read, exaggerated perspectives and used brilliant but arbitrary colors. They also emphasized freshness and spontaneity over finish. One of the fundamentals of the Fauves was expressed in 1888 by Paul Gauguin to Paul [Sisier,] "How do you see these trees? They are yellow. So, put in yellow, this shadow, rather blue, paint it with pure ultramarine, these red leaves? Put in vermilion." The name was given humorously and not as a compliment, to the group by art critic Louis Vauxcelles. In French, "Fauves" means "wild beasts." The painter Gustave Moreau was the movement's inspirational teacher, a professor at the [school] de Beaux-Arts in Paris, he pushed students to think outside of the lines of formality and to follow their visions. The leaders of the movement, Moreau's top students, were Henri Matisse and [Andre Derain], [who became] friendly rivals of a sort, each with his own followers."[80]

Given these descriptions, the problem that I am trying to address concerns Stein's "literal" representation of colored neurons and neuronal networks in her cubist writings. The Brainbow-mapped hippocampus region that was taken by Jean Livet using confocal microscopy, in Figure 32, comes closest to representing the Fauvist aesthetic. The neurons in this photograph look like large splashes of color, and these color splashes resemble the imaginary, expressionistic renderings of the woman's facial features, clothes and hat in Matisse's "Woman With a Hat." It seems plausible to me that Stein could have made the leap from artistic fauvism to literary fauvism to an embryonic (i.e. modernist) form of brainbow portraiture in her cubist writings, given the commonalities that we find between the Brainbow-mapped nervous systems and her colorful, cubist renderings of the human brain. See Figure 32, XFP Expression in Brainbow Transgenic Mice [Brainbow-mapped Hippocampus and Dentate Gyrus].

Material has been removed from this thesis because of copyright restrictions. The material removed from page 298 is Figure 32, XFP Expression in Brainbow Transgenic Mice [Brainbow-mapped Hippocampus and Dentate Gyrus]. Figure 32 contains information about the neuron coloration and brain mapping, which corresponds with Gertrude Stein's neuraesthetic writing strategies and colorful brain mapping activities in Tender Buttons and The Geographical History of America. The source of this material are Figures 3c and Figure 3d, from Livet et al, "Transgenic Strategies for Combinatorial Expression of Fluorescent Proteins in the Nervous System." Nature. November 1, 2007. Vol. 450. 58.

My point is this: if we take the “literal” level of Stein’s neuroanatomical portraiture seriously (which is not necessarily the historical “real” or the impossible-real of her creative vision), and if we visualize the colors that we are reading at the level of the portrait’s color symbolism as colored neurons with the help of these Brainbow photographs, then it becomes less difficult for us to imagine kinds of neuraesthetic *communications* that could be taking place between Stein, her portraits, and her readers. At the level of the color signifiers alone, a reader would not be able to detect a difference between the cerebral cortex and the hippocampus. We have seen that it is difficult to distinguish between different Brainbow-mapped brain regions and other kinds of non-neuronal elements and cellular tissues, without the help of enhanced, microscopic photographs. Through a laborious process of empirical analysis, scientific elimination and logical deduction that is comparable to the ones that occur in today’s scientific laboratories, it becomes possible to associate the color words in Stein’s cubist puns with specific brain regions, brain states and brain functions. In *Exact Resemblance to Exact Resemblance*, Steiner observes, “Stein came to feel that every theoretical exploration was a kind of detective story, a charting of the mind in its progress toward discovery” (164).

2.6 The Chicago Provenance of Detective Story number VII

Throughout Part II of *The Geographical History of America,* Stein expresses controversial views about the ways in which the detective story can act as a means for modern writers to probe the scientific mysteries of consciousness formation, mind evolution and brain development. This narrative explicitly showcases Stein’s cubist approach to the phenomenological exploration of the brain’s colored neurophysiological entities, when it calls attention to the human mind's subjectively experienced neural architecture in "Detective Story number VII." This is a complex literary performance that foregrounds Stein's subjective phenomenology, her brain based imagery and her creative metaphysics, all at once. The stream of consciousness narrative that Stein employs in "Part II" to capture the seemingly mundane content of secondary phenomenal experience contains the following, enigmatic statement: "Mostly in detecting anything being finished is begun. And so they prefer not to have dead children. Any detective story is ready to be told. And as you know it you know it" (119). According to Stein, "this is how a detective story can be written" (119). In Stein's capable hands, the detective story serves as a modernist investigative practice and as an intuitive form of neuroanatomical portraiture. When Detective Story number VII considers the disjunctive relations and the possible connections that exist between objects that are perceived by passing states of consciousness, it serves as an aesthetic consciousness whose role is to provide information about the brain's colored matter at the level of human mind's subjective phenomenology. Hence, the primary role of the detective story as an aesthetic consciousness is to examine the implied, neurophysiological mechanisms and organic processes that are occurring within the brain that could bring disconnected, subjective experiences "to life" within the work at the level of its dissociative prose.

Throughout "Part II," Stein leaves enigmatic clues about the kinds of phenomenal properties, neuroscientific insights and creative acts that comprise this human mind's subjectively experienced, neuroanatomical landscape. Statements, such as "That has nothing to do with any sky," and "When there is has been no rain the sky is very beautiful," are supposed to prepare the reader to see a "brainbow" that has no parallel in the scientific literature of the period, no precedent in the natural phenomena witnessed by the human eye and no literary antecedents to speak of. The modernist “brainbow” that Stein creates for this detective story in the form of a cubist pun certainly has its origins in other neuroanatomical portraits, such as “A Long Dress” from *Tender Buttons*. However, one would have to be looking specifically for the resemblances between the two portraits to see that Stein has created an advanced version of the brainbow-like neural architecture that she produced in “A Long Dress.” Functioning, at once, as an imaginary neuroanatomical landscape of this book’s human mind, as a neurobiological description of the human brain’s synaptic circuitry and as a microscopic literary analysis of the neurobiological entities that comprise the brain’s neural architecture, this cubist portrait from Detective Story number VII reveals Stein’s fascination with the brain’s colored matter and with the experimental neuron coloring practices of western science. She apparently considers this to be a “hot” topic, which she currently enjoys thinking about. Concerning the special kind of writing practice that occurs in such detective stories, Steiner points out, “The act of writing itself is being discussed as a detective story and the detective story is about detecting in writing. What is detectable there is the existence of the human mind, for it is only through this faculty that masterpieces come about” (194).

In the context of my exploration of Stein’s color-coded and consciousness-based neuroanatomical portraiture strategies, the least relevant but perhaps most interesting point is that Stein and her partner, Alice Toklas, researched crime scene investigation techniques by riding around with Chicago homicide police and observing them investigate various, crime scenes. In *Everybody’s Autobiography* Stein recalls, “It was a rainy evening. They were big men and we were tucked in with them and we went off with them. We drove around, we had just missed one homicide and it had not been interesting it had been a family affair and everybody could understand everything … It was very interesting, it was the night they caught Baby Face and they were having messages all the time about that and it was twenty-five miles away so it was pleasantly interesting but not except that it was the first time that we heard the radio in a police car not too exciting" (214). Given that Stein met Wilder in Chicago around the same time she and Alice were experiencing their first homicide patrols with the Chicago police (*Everybody's Autobiography* 207), I find it curious that Wilder does not mention Stein's interest in the detective story, or in crime scene investigation or, to a lesser extent, in forensic pathology when he wrote the critical introduction to the 1936 edition of her book, *The Geographical History of America or the Relation of Human Nature to the Human Mind*. In this editorial introduction, Wilder proposed that Stein's metaphorical "condensations" could be defined as a "creative metaphysics," which encrypted literary prophecies, scientific insights and philosophical intuitions at the level of her Picasso-like cubist writings. Though Wilder suspects that the detective stories in this book may serve no other purpose but to supply this Stein's readers with a "glimpse" into her imaginative, linguistic worlds and her subjective phenomenology, he nevertheless crafts a theory to give his close friend and her indecipherable writings the benefit of the doubt. According to Wilder,

> The third reason that renders … [her] style difficult for many readers proceeds from the author's humor. Metaphysics is difficult enough; metaphysics by an artist is still more difficult; but metaphysics by an artist in a mood of gaiety is the most difficult of all. The subject matter of this book is grave, indeed; and there is evidence throughout of the pain it cost to express and think these things. (It is not without "tears" that Human Nature is found to be uninteresting and

> through a gradual revelation is discovered to be sharing most of its dignities with dogs.) But Miss Stein has always placed much emphasis on the spirit of play in an artist's work. The reward of difficult thinking is an inner exhilaration. Here is delight in words and in the virtuosity of using them exactly; here is wit; here is mockery at the predecessors who approached these matters with so cumbrous a solemnity. One of the aspects of play that most upsets some readers is what might be called "the irruption of the daily life" into the texture of the work. Miss Stein chooses her illustrations from the life about her. She introduces her friends, her dogs, her neighbors. … She weaves into the book the very remarks let fall in her vicinity during the act of writing. Similarly, at one period, Picasso pasted subway-tickets upon his oil paintings; one aspect of the "real" by juxtaposition gives vitality to another aspect of the real, the created. (11-12)

The Geographical History of America "is a series of such [metaphorical] condensations [and puns], some of them, like plays and the "detective stories" about pigeons, of considerable difficulty," Wilder explains. "These latter, it is only fair to add, have, with a number of other passages, so far exceeded the delighted but inadequate powers of this commentator. The book presupposes that the reader has long speculated on such matters and is willing and able to assimilate another person's "private language" – and in this realm what can one give or receive, at best, but glimpses of an inevitably private language?" (11). By combining a phenomenology of consciousness with a creative form of neurological description, or with a "creative metaphysics," Stein was able to examine the brain's colorful neurophysiological entities and neuroanatomical features from a set of obscure, microanatomical and macroanatomical perspectives that generate multiple meanings for the brain's colors through a representational strategy that is known as "cubist punning."

This is one of the first things readers should know about Stein's detective story-neuroanatomical portraits and her cubist portraiture techniques: even though she possesses the personal experience and the ability to write stories about the human mind from the perspective of a back-seat homicide detective in a comprehensible manner, she prefers not to pursue this course of action. The only time, in *The Geographical History of America*, that she appears to be referring to the Chicago homicide detectives and her interesting experiences with them exploring crime scenes in Chicago, comes from out of the blue, in Detective Story number one, when the omniscient narrator of tries to explain the "difference between writing and listening," using Stein's logic of non-identity: "When you write it is so when you listen it is not so because of course when you listen it is not so and when you speak well of course when you speak it is not so. And therefore there are strong silent men. If not why not" (113). With these enigmatic statements, Stein makes it clear that ordinary memory and personal identity have nothing to do with a masterpiece's creative representation of the human mind's subjectively experienced, inner states of consciousness. Even though Stein could write and has written about the human brain and the human mind from the perspectives of a budding brain scientist and psychological researcher in cutting-edge academic publications, which is what she did in the nineteenth century before she became a writer, playwright, librettist, and art collector, she often prefers to write about these subjects in an indirect way within her modernist masterpieces. In doing so, she was able to explore subjects that would have been impossible to pursue in empirical scientific studies because of their technological, ethical or epistemological constraints, and she was also able to pursue subjects that her literary readers might have little knowledge about or interest in, such as her own neuroscientific insights regarding the brain's neural architecture and the kinds of neuron coloration strategies that could be invented to study the brain's complex structures, functions and states. It is important to know that Stein conducted extensive psychological, medical, neuroanatomical and criminal research before creating her detective stories about the human brain and the human mind; unfortunately, this does not make them any easier to read.

In *The Geographical History of America*, Stein works across a range of literary genres that include identity poems, plays, cubist portraits, metaphysical meditations and detective stories, while investigating the subject of the human mind through the interdisciplinary perspectives offered by evolutionary science, geography, neuroscience, literature, psychology, philosophy and history. "Part II" is a section of the book that Stein describes as "a detective story of how to write," as a "play of the relation of human nature to the human mind," as "a poem of how to begin again," and as "a description of how the earth looks as you look at it which is perhaps a play if it can be done in a day and is perhaps a detective story if it can be found out" (112). There are other sections called "Part II" in this book, but this one is dedicated to "finding" the human mind through a series of "detective stories" that explore the "difference between writing and listening" (113), between writing and learning (114), between writing and hearing (115), between writing and seeing (116), between writing and telling (117), between writing and painting (118), between writing and counting (118), between writing and remembering (118), between writing and "detecting anything" (119) and, last but not least, between writing and pleasure" (120). I agree with Steiner that *The Geographical History of America* seems to be using "the word "play" as a pun," that it means "*ludus* as well as drama" (172). Stein first reveals this cubist "joke," Steiner remarks, in the following passage: "Play I. The human mind. The human mind at play" (Steiner 172). "Here," she points out, "a play becomes synonymous with the play of the "human mind," which is precisely that degree of immediate seeing and hearing, disjoint from memory and anticipation, that Stein sought to create in the readers of her plays" (172). This is not the only reference in this masterpiece to the human mind at play. In Chapter II, Stein writes, "And so the human mind has no relation to human nature. And therefore and once again it is a ready made play to make a play of how there is no relation between human nature and the human mind" (108). Stein, or her omniscient narrator, also stresses, "Human nature is animal nature but the human mind the human mind is not. If it were then the writing that has been written would not be writing that any human mind can read, it really has no memory nor any forgetting. Think of the Bible and Homer think of Shakespeare and think of me. There is no remembering and no forgetting because memory has to do with human nature and not with the human mind" (109). Literally speaking, "Detective Story number VII" from *The Geographical History of America* is a 'neuroanatomical portrait' because it portrays the human brain's neural architecture and organic matter using a variety of literary devices, including color signifiers, figurative language and grammatical parataxis. However, if we go by this masterpiece's internal definitions for the way genres are to be defined, this cubist-style neuroanatomical portrait could also be defined as a "description," as "a play," as "a detective story" and as a "poem." "Beginning with the second phase, we encounter a rather bewildering multiplicity of genres," Steiner remarks, "especially after the uniformity of the first phase" (164). In her study, Steiner defines the "first phase" of Stein's literary portraiture as the works that were composed between 1908 and 1912, the "second phase" as the works that were composed between 1913 and 1925, and the "third phase" as the works that were composed between 1926 and 1935. I am following Steiner's classifications and chronology, when describing Stein's second-phase and third-phase neuroanatomical portraiture strategies because we are, of course, talking about the same literary works. With this interdisciplinary, cross-genre approach to brain mapping, Gertrude Stein produces a "detective story" that transforms the colors of the human brain in questionable metaphysical properties, or into a neuraesthetic writing practice and prophetic mode of mind representation that Wilder calls a "creative metaphysics." Some readers may appreciate the fact that she plays with the "language" of detective fiction, dropping terms such as "motive" and "detecting" and "crime" with abandon, so as to re-signify the meanings of these popular terms within the context of her phenomenological investigations about the human mind's neuroanatomical landscape. For Stein, this form of investigation may be a matter of scientific exploration, linguistic play and personal pleasure, but, for her twenty-first century readers, it is a neuraesthetic compositional practice that has serious, scientific implications and fascinating, cultural meanings.

With the explicit portrait of brain-like human mind in Detective Story number VII from *The Geographical History of America*, Stein renders the human brain in an unprecedented, neuraesthetic fashion. "Complications are always easy but another vision than that of the world is very rare," Stein observes in *Picasso*:

> That is why geniuses are rare, to complicate things in a new way that is easy, but to see things in a new way that is really difficult, everything prevents one, habits, schools, daily life, reason, necessities of daily life, indolence, everything prevents one, in fact

> there are very few geniuses in the world. Picasso saw something else, not another complication but another thing, he did not see things evolve as people saw them evolve in the nineteenth century, he saw things evolve as they did not evolve which was the twentieth century, in other words he was contemporary with the things and he saw these things. (*Picasso* 43-44)

Perhaps Stein should have added that her readers ought to be looking for such a rare artistic vision, or the possibility of such a vision, in places where there appear to be no complications whatsoever, or where there appear to be relatively few complications. In many respects, a cubist portrait's neuroanatomical imaginary does not resemble the 'real thing.' Yet, in certain respects, these imaginaries reveal degrees of neurobiological realism that are striking in their exacting, structural reconstructions of the brain's cellular elements, synaptic connections and neural networks.

In accounting for the "world-knot," or the relation between the human brain and its conscious experiences, Edelman and Tononi observe, "The immense richness of the phenomenological world that we experience -- conscious experience as such – appears to be dependent on what seems to be a mere trifle in the furniture of that world, a gelatinous piece of tissue contained in the skull. Our brain, presenting itself as a fleeting and minor actor on the stage of consciousness that most of us have never seen, seems to hold the key to the entire performance" (35). *The Geographical History of America's* little paper brain (only about 14 lines long) has received sparse attention from literary critics, even, surprisingly, from those critics who are most interested in Stein's neuroanatomical laboratory experiments and her phenomenological writings. Perhaps this is because it seems to play a minor role in this book's "stage of consciousness," in much the same way the human brain seems "gelatinous" and unglamorous, as compared with the universes of consciousness that it creates for its human subjects, through their literary works and cultural artefacts. Edelman and Tononi also add, "It is a reflection of human arrogance that entire philosophical systems have been constructed on the basis of subjective phenomenology—the conscious experience of a single, philosophically inclined individual. As Descartes recognized and took as his point of departure, such arrogance is partly justified, since our conscious experience is the only ontology of which we have direct evidence" (35). With this book's brain-like human mind, Stein avoids having to face criticism from twentieth-century empirical scientists, who would have charged that she displayed her "human arrogance" by constructing an artefact that was based solely on her "subjective phenomenology." Some might argue that there is nothing much to see, just a random sprinkling of color words, some literary questions, and a few vague propositions that are associated with the brain's colored matter.

Yet, in other respects, this neuroanatomical portrait is comprised partially or wholly of this author's scientifically-informed, subjective experiences. It is based partially on the scientific literature she read as a medical student and as a post-graduate literary writer; it is based partially on the neuroanatomical laboratory experiments and exploratory surgeries that she performed on the post-mortem brains of embryos and infants at Johns Hopkins; and it is based partly on the psychology classes she took with William James at Harvard University and the laboratory experiments that she created, conducted and participated in, from 1893 to 1897. To leave out the pleasurable meanings associated with the brain colors in these portraits may be the kind of "crime" that her omniscient narrator alludes to, at the end of Detective Story number VII.

Stein's *brainbow*-like image of *The Geographical History's* imaginary neurons, neural connections and neural architectures seems less arrogant, than it is playful, in its phenomenological reconstructions of Stein's neuroscientific desires and her neuraesthetic pleasures. This portrait encourages its readers to smirk at the colored neuron-words forming a modernist *brainbow* over this human mind's "white and grey" cortical landscape. By 1936, Stein's cubist portraiture had achieved another crucial stage in its neuraesthetic metamorphosis. Its allegorical *other*, the neuroanatomical portrait, was fast becoming a modernist prototype of the 'brainbow maps' that the abovementioned Harvard scientists perfected in 2007. With an apt "Rosetta Stone" analogy, Steiner compares Alfred Stieglitz's comparison of Stein's first-phase portraits, "Matisse" and "Picasso," with "the work of men of whom they treat to the painting and sculpture of older schools." In his "Editorial" for *Camera Work*, Stieglitz claims that it is precisely because Stein's portraits are "expressed in words" that "they offer --to all who choose to examine them with an inquiring mind – a common denominator of comprehension, a Rosetta stone of comparison; a decipherable clew to that intellectual and esthetic attitude which underlies and inspires the movement upon one phase of which they are comments and of the extending development of which they are themselves an integral part" (Editorial, *Camera Work*, Special Number, August, 1912; Steiner 160).

2.6 Stein's "Hot" Consciousness and "Cool" Grey Matter

To understand what Stein means by progress, discovery, and the evolution of consciousness in these detective stories, one must have a sense of why these subjects matter to neuroscientists, psychologists and philosophers, and why they will continue to matter literary theorists for some time to come. Stein considers neuron coloring to be a "hot" topic, and she even uses the word "hot" to describe the feeling that she gets, or that her "narrator" gets, when she thinks about the human mind's colored matter, near the end of Detective Story number VII. Stein's narrator describes colorful human mind as the "detective story of liking it as much as they ever had liked it before" (120). To stress this point, the narrator repeats herself, to the point where, in the last line, the repetition perhaps serves as a stab at the reader's dull powers of comprehension: "They liked it as much as they ever liked it before because it was hot and they like it to be like that to be hot. They liked it as much as they ever liked it before because the wind blew and blew the birds about and they liked it as much when the wind did that. Now how could you detect that they liked it as much as they ever liked it before" (120). Assuming that this book's readers might suspect that, for Stein, as well as for the pigeons, these maps had become a "detective story of liking it as much as they ever liked it before because it was hot and they liked it to be that they liked it to be hot," this sentence could mean that Stein derives pleasure, almost a form of sexual pleasure, from creating these neuroanatomical portraits, but especially that she derives some sort of neuro-erotic pleasure from Detective Story number VII, which features the human mind's subjective experienced and objectively described, neuroanatomical imaginary (120).

Stein plays with the reader's expectations when her language implies that "they," by which pronoun her discourse seems to be producing a "beloved mistake," in the form of grammatical error that simultaneously refers to the pigeons in this sentence but also implies that others, perhaps the author, her narrator, and the human mind, find this detective story about colored brain matter to be "hot" stuff. With the frequent references to different kinds of birds in Part II and with the brain portrait that is featured Detective Story number VII, there is also the possibility that Stein is showcasing her knowledge of Egyptian hieroglyphics, particularly the discovery of the Edwin Smith Surgical Papyrus and its multiple references to the brain, by virtue of her cubist brain hieroglyphs.[81] The Egyptian hieroglyphic for the word ‘brain’ is comprised of a bird image, a feather image, a hairpin figure and a mouse symbol. See Figures 33 and Figure 34, for views of The Edwin Smith Surgical Papyrus and its brain hieroglyphs.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 313 is Figure 33, Column II from The Edwin Smith Surgical Papyrus. This figure contains information about the bird symbols that the ancient Egyptians used in their brain hieroglyphics.[82] The source of this material is the following website: <http://www.neurosurgery.org/cybermuseum/pre20th/epapyrus.html>.

The passages above, and the article to which they belong, were reprinted with Dr. Wilkins' permission from the *Journal of Neurosurgery*, March 1964, pages 240-244.

(<http://www.neurosurgery.org/cybermuseum/pre20th/epapyrus.html>).

The source of Figure 33 is Principles of Neural Science, 4th ed. Ed. Eric R. Kandel, et al. New York: McGraw-Hill, 2000. N. pag.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 314 is Figure 34, Column IV from *The Edwin Smith Surgical Papyrus*. This figure contains information about the bird symbols that the ancient Egyptians used in their brain hieroglyphics. Dr. Wilkins, from the *Journal of Neurosurgery*, releases the following information about this important find: "The Edwin Smith Surgical Papyrus, dating from the seventeenth century B.C., is one of the oldest of all known medical papyri. It differs fundamentally from the others in the following ways: 1. The seventeen columns on the recto comprise part of a surgical treatise, the first thus far discovered in the ancient Orient, whether in Egypt or Asia. It is therefore the oldest known surgical treatise." The passages above and the article to which they belong were reprinted with Dr. Wilkins' permission from the *Journal of Neurosurgery*, March 1964. 240-244.

Website:

(<http://www.neurosurgery.org/cybermuseum/pre20th/epapyrus.html>).

The source of Figure 33 is Principles of Neural Science*,* 4th ed. Ed. Eric R. Kandel, et al. New York: McGraw-Hill, 2000. N. pag.

Consider the following statement by Stein's omniscient narrator: "Now how could you tell detect that they liked it as much as they liked it before" (121). The "hot" form of sexual pleasure that Stein's narrator receives from this neuroanatomical portrait may be one of the reasons why Stein treated such works as "secret," allegorical representations for the better part of her writing career. With the birds and winds added in, perhaps for their *cooling* and *cooing* effects, the word "hot" seem to be connoting linguistic meanings, other than "sexy," "pleasurable," or "orgasmic." Stein seems to be telling us, through her dissociative discourse and removed narrative voice, that one of the things that makes her "hot" is the creative act of composing colorful, neuroanatomical portraits about the human mind. However, I do not want to rule out the sexy, pleasurable, orgasmic meanings that could be associated with the human mind's colorful neuroanatomical landscape. Perhaps it is more appropriate for me to suggest that this detective story seduces the reader's visual senses by calling attention to the colors and perceptions that comprise the human mind's objectively described and subjectively experienced, neural landscape. These sensory experiences and this neuroanatomical landscape could give Stein pleasure in ways that we have not yet fully imagined or explored.

To summarize my argument thus far: the color words in this neuroanatomical perform a number of important functions. First and foremost, they act as metaphors for the imagined or imaginary colored neurons that comprise the neural networks of the human mind's neuroanatomical landscape. By repeating the refrain that occurs hundreds of times in the course of this book, regarding the relation that does or does not exist between human nature and the human mind, Stein's dissociative discourse beckons the reader to observe the human mind's non-relation to human nature and, in the course of doing so, to participate in what seems to be an internal, mental debate as to whether or not there is "any such thing as human nature" be found in the colors that comprise the human mind's neural architecture. Acting as metaphysical metaphors and as neurophysiological entities that are responsible for the scientific intelligibility of the human mind's "organic mental structure" (James, *Principles of Psychology* II 619), this portrait's color words create dimension, perspective, and meaning for the mind's implied brain regions and brain functions, through their actual and connoted, visual, structural and semiotic relations with one another. Because the colors used in this portrait are related to Stein's neuroanatomical descriptions of the human mind and because clear distinctions are being drawn between the different colors in this portrait at the level of grammar, syntax and rhetoric, readers can surmise that these colors contribute, in meaningful ways, to the detective story's literary phenomenology, its brain-based imagery and its creative metaphysics.

That Stein seems to conceive of this human mind's colorful neuroanatomical landscape as "hot" may mean that she conceptualizes it in a fashion that is similar to the way in which William James envisioned desire, volition and emotional excitement within passing states of consciousness. That is, she may be thinking of this neuroanatomical landscape as a passionate area of intellectual interest and as a zone of emotional investment, not simply as an expression of her sexual desire for someone (i.e. Alice Toklas) or as a illustration of her erotic attachment(s). In *The Varieties of Religious Experience*, James uses the word "hot" to signify intellectual passion, which may be the sense in which she uses this word:

> Things hot and vital to us to-day are cold to-morrow. It is as if seen from the hot parts of the field [of consciousness] that the other parts

> appear to us, and from these hot parts personal desire and volition make their sallies. They are in short the centres of our dynamic energy, whereas the cold parts leave us indifferent and passive in proportion to their coldness. Whether such language be rigorously exact is for the present of no importance. It is exact enough, if you recognize from your own experience the facts which I seek to designate by it. Now there may be great oscillation in the emotional interest, and the hot places may shift before one almost as rapidly as the sparks that run through burnt-up paper. Then we have the wavering and divided self we heard so much of in the previous lecture. Or the focus of excitement and heat, the point of view from which the aim is taken, may come to lie permanently within a certain system; and then, if the change be a religious one, we call it a *conversion*, especially it be by crisis, or sudden. Let us hereafter, in speaking of the hot place in man's consciousness, the group of ideas to which he devotes himself, and from which he works, call it *the habitual centre of his personal energy*. It makes a great difference to a man whether one set of ideas, or another, be the centre of his energy; and it makes a great deal of difference, as regards any set of ideas which he may possess, whether they may become central or remain peripheral in him. (196; original spelling and emphasis)

I find it significant that Stein finds this "part" of her masterpiece's "aesthetic consciousness" to be "hot." Her diction suggests that this subject matter is, as James eloquently puts it, a "hot place" in her "consciousness." This diction suggests that, for Gertrude Stein, the creative act of painting the brain's individual neurons with four distinguishable colors and then placing them in a series of multicolored neuron words to form cellular formations that resemble the triple-layered, concentric nerve tissue that is found in the cerebellar lamella, is, even at this point in time, “a “group of ideas to which [s]he devotes [her]self, and from which [s]he works.” By the phrase “even now,” I interpret this to mean that her ‘neurological description’ of the brain’s colored regions, brain tracts and neural networks remain as important to Stein in the immediacy of her compositional “present” (c. 1935-1936), as the points in time, when she examined the post-mortem brains of human embryos, infants and adults at the Johns Hopkins Medical School. However, as James observes, one person cannot create “excitement and heat” in another person’s passing states of consciousness. The conversion of ideas, emotions and perceptions cannot occur in an individual’s passing states of consciousness, unless an idea or set of ideas become central and important to that individual. At the very least, a new idea must be situated at the periphery of an individual’s consciousness, otherwise it becomes next to impossible for someone or something to occupy another person’s attention. It is difficult for someone or something to generate interest in the human mind, to stimulate the imagination, and to provoke exciting thoughts, unless this “hot” condition of consciousness exists. This may explain why numerous, literary critics have found this neuroanatomical portrait to be of little interest or, as Wilder puts it, why they have found it to be of “considerable difficulty”; Stein did not give her readers enough of an opportunity to warm up to “hot” topic of neuroanatomical portraiture, not only over the course of this book but, also and more importantly, over the course of her writing career. By the time that she showcased her neuraesthetic compositional practices in *The Geographical History of America*, Stein would have had a difficult time convincing her literary readers that this kind of neuraesthetic composition was an important, scientific exercise, and it was also a pleasurable way of spending one's time.

By cuing the reader to pay attention to radical shifts in artistic perspective, to differing modes of scientific observation, and to different kinds of conscious experience, Stein's dissociative discourse alerts readers to the possibility that human mind's neuroanatomical features are being represented from microanatomical and macroanatomical perspectives. Statements, such as "That has nothing to do with any sky" (119) and "When there is has been no rain the sky is very beautiful" (119), prepare a reader to see a *brainbow*-like image at the level of the human mind's neural architecture that resembles a rainbow in certain respects, but which is unlike any rainbow that has been produced by the forces of nature. Throughout "Part II," Stein leaves subtle clues about the kinds of phenomenal properties, neuroscientific insights and creative acts that comprise the human mind's subjectively experienced, neuroanatomical landscape. In retrospect, we know that these clues indirectly prepare the reader to visualize a "brainbow" that has no parallel in the scientific literature of the period, in the natural phenomena witnessed by man's naked eyes, or in the previous neuroanatomical portraits that she produced over the course of her writing career. Functioning, at once, as an imaginative neuroanatomical landscape, as a neurobiological description of the human brain's synaptic circuitry, and as microscopic analysis of the brain's neural architecture," Stein's modernist "brainbow" can be conceptualized as a collage of neuroscientific intuitions and personal desires that form a linguistic, connectivity map. In this detective story, which focuses our attention on Stein's dissociative writing style and its metaphorical logic, Stein's narrator remarks, "Swallows flying in and out have nothing to do with any pigeon, flying in and out of a room. And so there is no such thing as human nature.

Why there is no such thing as human nature is that anybody can observe swallows and a pigeon" (120).

Stein's narrator, who is a discursive incarnation of the creative mind, asks us to bear witness to the elementary and secondary qualities of the human mind's neuroanatomical landscape, through the microscopic and macroscopic perspectives offered by its neuraesthetic discourse. A description of the human mind's neuroanatomical landscape appears only four lines after the statement, "there has been no rain." In my opinion, this placement implies that the human mind's "rainbow effect" ought to be attributed to factors other than natural causes, that the rainbow or brainbow effect is partially a function of the reader's prismatic vision of the human mind's neuroanatomical landscape. We know that a rainbow consists of a continuous spectrum of colors – i.e., red, orange, yellow, green, blue, indigo and violet. However, in Stein's cubist portrait of the human mind, there is only a partial, rainbow effect. This rainbow effect is coupled with the tactile sensation of "warmth," giving the impression that the brain-like human mind we are observing is alive: "There is blue and green and green and yellow pale yellow and blue, there is pale yellow and green and blue and *warmth* and there is not any such thing as human nature" (120; emphasis added). The phenomenological observation of the mind's neuroanatomical features occurs at imaginary microanatomical and macroanatomical levels; Stein strategically deploys color words and non-mimetic representational strategies, so as to engage the reader's imagination in visualizing the neurons, neural networks and neural architecture of this book's brainbow-like, "human mind."

In light of this recognition, the book's previous discussions about pigeons and other birds sound like they may be discursively encrypted, neuroscientific concerns and modes of neuroanatomical portraiture. In a manner of speaking, they can be conceptualized as neuroscientific thought experiments and as literature-based, phenomenological studies. If we view this book's dissociative discourse from a neuroscientific perspective that analyzes the brain's epigenetic formation of language and mathematical skills, in the way that Edelman does in *Second Nature*, then Stein's strange perspectives, numerical formations and color combinations begin to make sense as 'linguistified,' neural principles. Armed with this scientific knowledge, we can read Stein's seemingly nonsensical literary formalisms as legitimate qualitative, phenomenological evaluations of the human brain's creative processes, numerical talents and linguistic capacities. Edelman's epigenetic view of the brain's linguistic evolution provides an understanding of how the numbers appear to the human mind (or brain) when it engages in a creative acts of perception. Stein's narrative supports such a view, by making the relation between creation, perception and imagination the focus of its "numerical approximation[s]". Here is an example of Stein's cubist-style, numerical approximations: "But if looking at it you are to paint it, the pigeon is there again and turning his back on the two other pigeons who are below it. You only can see from the side where you are seeing everything you only can see the two heads of the other two pigeons and now there are three. That makes four in all" (118). The point that Stein perhaps wished to impress upon her readers is that "numerical approximation" does not involve memory of any sort: as she puts it, "you might suppose then that if numbers mean anything there must be remembering. But not at all the number of pigeons being there is interesting as one follows one even if sometimes the one following is two or three, but you do not have to remember the one to know that there are two and three and all of a sudden four. The minute you remember the one you do not want to look at him when they are one and then two and then four suddenly anything suddenly happening there is no remembering" (118). This dissociative "talk" about prime numbers is a matter of neuroscientific and philosophical interest, Edelman observes, because it addresses the question of whether or not neurophysiological pictures arise in phenomenal consciousness, because of a scientist or an artists' specialized approaches to "the theory of knowledge" (*Second Nature* 63). Edelman explains that the "case of mathematics and its relation to language is even more challenging than that of logic. Is language necessary for arithmetic to be developed?" Hence, there may be sound neuroscientific reasons why Stein insists, "numbers really have something to do with the human mind," then counts to four in a nonlinear manner: it may be that she wished to demonstrate that numbers themselves, not the order of numbers or their mathematical values, are what matter to the human mind's linguistic evolution and its creative processes. As Edelman explicates,

> There is empirical evidence that preverbal infants and nonhuman primates have the ability to deal with sets containing from one to four numbers. Moreover, studies of the indigenous Munduruku people in Brazil have revealed that their language lacks words for numbers beyond five. Although these Indians fail in counting and precise arithmetic beyond the number five, they can compare and "add" large collections of objects. These findings appear to exclude the absence of linguistic tokens It has been suggested that this capability may require the activity in humans of neurons in the parietal cortex, specifically those in the intraparietal sulci (shallow fissures separating folds of the parietal cortex). Although this proposal has been challenged, neurons tuned to numerical quantity have been found in the prefrontal and parietal cortices of macaque monkeys. The results suggest that although language is perhaps not

> essential for the beginnings of arithmetic, it plays a role in the further emergence of exact counting and arithmetic during child development. (62-63)

Based on Edelman's research, I view Stein's dissociative phrases as coded, neuroscientific propositions about the epigenetic characteristics and the qualitative characters of a text's aesthetic consciousness. I also happen to think that these color-coded neuroscientific propositions (i.e., these *qualialects*) correspond with creative, scientific insights that appear within Stein's subjectively experienced, inner states of consciousness. However, Stein was not interested in representing her subjective phenomenology directly: this was what artists from other centuries did, not avant-garde writers that were versed in the latest phenomenological methods of consciousness analysis, neuroanatomical experimentation and artistic creation. It seems plausible to me that sentences, such as "That is why numbers really have something to do with the human mind," could be referring to how Stein uses color within her neuroanatomical portraits to construct "cytoarchitectural maps" of the nervous systems that she is creating with her neuraesthetic writing strategies.

Because Wilder did not understand the significance of the birds in Stein's dissociative discourse, I am going to assume that he was unfamiliar with James's bird-metaphors and his psychological theories about the passing states of linguistic awareness in phenomenal consciousness. If Wilder had known about these, he might have been able to offer some kind of explanation as to the metaphysical meanings these images, or hieroglyphs, have in this masterpiece. As I've suggested above, the birds could be representing different states of consciousness, different modalities of sensory perception, and differing qualities of phenomenal experience.

With respect to the linguistic qualities of conscious experience, James proposes,

> Like a bird's life, [our mental life] seems to be made of an alternation of flights and perchings. The rhythm of language expresses this, where every thought is expressed in a sentence, and every sentence closed by a period. The resting-places are usually occupied by sensorial imaginations of some sort, whose peculiarity is that they can be held before the mind for an indefinite time, and contemplated without changing; the places of flight are filled with thoughts of relations, static or dynamic, that for the most part obtain between the matters contemplated in the periods of comparative rest. Let us call the resting-places the 'substantive parts,' and the places of flight the 'transitive parts,' of the stream of thought. It then appears that the main end of our thinking is at all times the attainment of some other substantive part than the one from which we have just been dislodged. And we may say that the main use of the transitive parts is to lead us from one substantive conclusion to another. Now it is very difficult, introspectively, to see the transitive parts for what they really are. If they are but flights to a conclusion, stopping them to look at them before the conclusion is reached is really annihilating them. Whilst if we wait till the conclusion be reached, it so exceeds them in vigor and stability that it quite eclipses and swallows them up in its glare. Let anyone try to cut a thought across in the middle and get a look at its section, and he will see how difficult the introspective observation of the transitive tracts is. The rush of the thought is so headlong that it almost always brings us up at the conclusion before we can arrest it. (*Principles of Psychology* I 243-244) [83]

Sara Ford explicates James's passage above, as follows: "The resting or perching places in language are the substantive parts, the parts we are most aware of, and the places of flight are those that get us from one resting place to the next. We pay more attention, for example, to the noun and verb phrases of our thoughts than we do to the smaller and seemingly less significant prepositions and conjunctions: [or, as James puts it,] "We may then say that the main end of our thinking is at all times the attainment of some other 'substantive' part than the one from which we have just been dislodged" and that "the main use of transitive parts is to lead us from on substantive conclusion to another." James further proposes in the essay, "On Some Omissions of Introspective Psychology," that

> [t]here is not a conjunction or preposition, and hardly an adverbial phrase, syntactic form, or inflection of voice, in human speech, that does not express some shading or other of relation which we at some moment actually feel to exist between the larger objects of our thought. … We ought to say a feeling of *and*, a feeling of *if*, a feeling of *but*, and a feeling of *by*, quite as readily as we say a feeling of blue or a feeling of cold. Yet we do not: so inveterate has our habit become of recognizing the existence of the substantive parts alone, that language almost refuses to lend itself to any other use. The Empiricists have always dwelt on its influence in making us suppose that where we have a separate name, a separate thing must needs be there to correspond with it; and they have rightly denied the existence of the mob of abstract entities, principles, and forces, in whose favor no other evidence than this could be brought up. But they have said nothing of that obverse error, of which we said a word in Chapter VII, (see p. 195), of supposing that where there is no name no entity can exist. All dumb or anonymous psychic states have, owing to

> this error, been coolly suppressed; or, if recognized at all, have been named after the substantive perception they led to, as thoughts 'about' this object or 'about' that, the stolid word about engulfing all their delicate idiosyncrasies in its monotonous sound. Thus the greater and greater accentuation and isolation of the substantive parts have continually gone on. (*Principles of Psychology* I 245-246)

This is a powerful observation about the ways in which language regulates the mind's subjective experiences with discriminative, aesthetic feelings, in the form of prepositions, expletives, conjunctions, and subjunctives that figuratively color the meanings of the human imagination. But also, James points out how linguistic states of consciousness that have "been coolly suppressed" by scientific ideologies possess playful and performative qualities that fundamentally alter the structures of phenomenal consciousness. Contributing to the debate about James's influence upon Stein's cubist representations of phenomenal (linguistic) experience, Steiner claims, "when James gives examples of words which create acquaintance [with thought's objects], he relies exclusively on indexes: "The minimum of grammatical subject, of objective presence, of reality known, the mere beginning of knowledge, must be named by the word that says the least. Such a word is the interjection, as *lo*! *there*! *ecco*! *voilá*, or the article or demonstrative pronoun introducing the sentence, as *the*, *it, that*" (p. 222). All these words express the reality, presence, immediacy of their referents. They are an epitome of the portrait function" (29-30; original emphasis).

We can see this at work, in "Part II" of *The Geographical History of America*, when Stein uses the expletive, "there is," to depict the colorful but enigmatic, neurophysiological entities that comprise the human mind's organic matter. Defined by Steiner as the kind of "acquaintance" that connotes "minimum of the grammatical subject, of objective presence, of reality known, [and] and "mere beginning of knowledge," the expletive "there is" speaks volumes about the immediacy of the objects in the human subject's thoughts. Specifically, it conjures strong mental images of the linguistic, sensory, and perceptual objects that appear to the perceiver's mind at the level of phenomenal consciousness. If you recall, "There is blue and green and green and yellow pale yellow and blue, there is pale yellow and green and blue and warmth and there is not any such a thing as human nature" (120). The expletive, "there is," creates interest by drawing the reader's attention to unusual combinations of colors that are being used to illustrate the human mind's neural architecture, in addition to expressing the "reality, presence, [and] immediacy" of this human mind's subjectively experienced and objectively described, neurophysiological entities. In James's words, "the famous world of universals would disappear like a soap-bubble if the definite contents of feeling, the *thises* and *thats*, which its terms severally denote, could at once be withdrawn" (James, "Some Problems of Philosophy" 5). In contradistinction to the nineteenth-century religious notion that there was a unified ego or soul that defines the subject, James argues, in *The Varieties of Religious Experience,* that the subject or self does not necessarily require the metaphysical underpinnings of the 'soul' to qualify for cultural intelligibility. Here, he subsumes the 'soul' into western science's conceptions of 'self' and the 'mind'; however, he does not view the dissociative, linguistic expression of the human mind's "subjective nature" in literary texts, or any other kind of cultural discourse, as a pathological event, or as a "memoro-politics" (to use Hacking's expression), in the ways that Janet, Ribot and Charcot conceptualized the minds, selves, and souls of their hysterical, perverse and traumatized patients from the perspectives of "pathological psychology." In James's view, the soul can be conceptualized as a facet of phenomenal consciousness, as a symptomatic subjectivity that corresponds with phenomenal experience but is not perhaps reduced to it. As such, this consciousness could be interpreted as a 'self' or as an 'ego,' using a radical empiricist, psychological approach that treats the human mind's subjectively experienced, inner states of consciousness as a constellation of grammatical, spatial and aesthetic entities that collectively (and, perhaps retrospectively) constitute the mind's phenomenal experiences and its "subjective nature" (*Principles of Psychology* II 618-619). In *The Varieties of Religious Experience*, James claims, "the soul is only a succession of fields of consciousness: yet there is found in each field, a part, of sub-field, which figures as focal and contains the excitement, and from which, as from a centre, the aims seem[s] to be taken talking of this part, we involuntarily apply words of perspective to distinguish it from the rest, words like "here,' 'this,' 'now,' 'mine,' or 'me'; and we ascribe to the other parts the positions 'there,' 'then,' 'that', 'his,' or 'thine,' 'it,' 'not me.' But a here can change to a 'there,' and a 'there' become a 'here,' and what was mine and what was not mine change their places" (195). With respect to religious conversion and the fields of consciousness that produce the converted 'self,' 'soul,' and 'mind,' James reasons,

> In the end we fall back on the hackneyed symbolism of a mechanical equilibrium. A mind is a system of ideas, each with the excitement it arouses, and with tendencies impuls[ive] and inhibitive, which mutually check or reinforce each other … But a new perception, a sudden emotional shock, or an occasion which lays bare the organic alteration, will make the whole fabric fall together, and then the centre of gravity sinks into an attitude more stable, for the new ideas that reach the centre in the rearrangement seem now to be locked in there, and the new structure remains permanent. (197)

In James's "fields of consciousness," as in Stein's Detective Story number VII, the expletive, "There is," directs the viewer's attention to a phenomenal field that is comprised of different colors. Included in Detective Story number VII"s field of consciousness are the feelings of tactile sensation and the somatosensory perception of "warmth," as well the aesthetic judgment and the scientific impression, that there is no "human nature" in the colorful, brain matter that is being observed by the narrator: "There is blue and green and green and yellow pale yellow and blue, there is pale yellow and green and blue and warmth and there is not any such thing as human nature" (120).

Readers familiar with James's consciousness research will appreciate how Stein deploys the elementary and secondary qualities of phenomenal experience, in *The Geographical History of America*, to crack a metaphysical joke about the "colors" that comprise this book's "human mind" and its neuroanatomical imaginary:

> There is blue and green and green and yellow pale yellow and blue, there is pale yellow and green and blue and warmth and there is not any such thing as human nature.
>
> Please see my human mind.
>
> It is here.
>
> Is white a color.
>
> Yes white and grey is a color.
>
> Grey and white is a color. (120)

This neuroanatomical portrait warmly invites us to investigate the processes of qualia discrimination, scientific observation and creative representation that inform the visual brain's perception of colors. Stein likely named the cubist-style literary portrait "Detective Story number VII" for this very reason. However, there may be something special about the *grey color* that Stein's narrator draws our attention to, in this detective story. In women, the periaqueductal gray matter is believed to be indirectly responsible for copulation and for achieving a pleasurable, sexual orgasm. To be more precise, "the ventromedial nucleus (VMN) of the hypothalamus facilitates copulation, and VMN lesions inhibit it. The influence of the VMN seems to be mediated by a path that descends from the VMN to the periaqueductal gray (PAG); destruction of this tract or of the PAG itself eliminates copulation in females. Because the PAG also plays a role in analgesia, one of its functions may be to reduce in females any pain associated with copulation" (Pinel, *A Colorful Introduction to the Human Brain* 200). *The Human Brain Coloring Book* supplements this knowledge about the brain stem's pain and pleasure centers by observing, "periaqueductal gray [matter] … is rich in small neurons and is a significant repository of the naturally occurring opioid (morphine-like) peptide β (beta) endorphin. Electrical stimulation in this area has been shown dramatically to reduce the awareness of pain" (5-9).

Stein's cubist pun (her brainbow-like qualialect) indirectly refers to the sexually arousing qualities of the periaqueductal gray matter, to the somatosensory qualities that are associated with the brain's colored neurons, and to the communicative qualities of the myelinated axons that comprise the brain's white matter. For Stein, there may be a special kind of pleasure to be found at the end of her modernist "brainbows:" a neuraesthetic jouissance, so to speak. This may not be the kind of literary pleasure, or the kind of neuraesthetic jouissance, or the kind of neuroscientific eroticism, that others find to be sexy or "hot." But this hot pleasure nevertheless pertains to Stein's nineteenth-century brain research, and it is an important component of her "intellectual creations." Operating from a cubist perspective that is inflected with homoerotic and neuroerotic meanings, Stein's brain portrait thus stages neuraesthetic modes of qualia-knowledge and qualia-eros. It coyly calls attention to its discursively encrypted, *neuro-erotic pleasure* and its emergent style of *neuraesthetic jouissance*, While some readers may derive pleasure from deciphering the brain hieroglyphs and neuraesthetic compositions in Detective Story number VII, others may find intellectual enjoyment in the interpretative practices that are associated with Stein's empirical aesthetics, that is, with her neuraesthetic approaches to empirical, detective work. One of the questions raised by this text is whether the literary practice of neuroesthetics qua neuroerotics is "hot" or not? This is a question that Stein leaves her readers to ponder, at the end of this detective story. However, she does not answer this question in her dissociative prose, because she seems to have understood that the conversion of a reader's passing states of consciousness to a permanent state of neuraesthetic jouissance would be all but impossible.

The drive to integration is so strong that often no
empty space is perceived where there is, in fact,
a frightening gap. Apparently, the feeling of an
absence is far less tolerable than the absence of
a feeling. The detailed neural mechanisms
underlying these syndromes are so far not well
understood and are probably quite heterogeneous.
Gerald Edelman and Giulio Tononi

Thus the object can never be an absolute,
there being "an indefinite imperfection
resulting from the insuppressible essence
of the correlation between thing and
perception of thing"… In the course of
perception the successive profiles are
altered, and a new perspective of the object can
come to correct an earlier one; there is no
contradiction here --since the flux of all these
perspectives merge into the unity of one
perception – but only the object emerging
throughout these alterations without end.
Jean-François Lyotard

Figured as such a site or surface, … the
natural is construed as that which is also
without value; moreover, it assumes its value
the same time that it assumes its social
character, that is, at the same time that nature
relinquishes itself as the natural. According

to this view, then, the social construction of
the natural presupposes the cancellation of
the natural by the social. Judith Butler [84]

Gertrude Stein's Modernist "Brainbow"

3.1 Gertrude Stein's Rosetta Stone

Stein's cubist vision of the human mind's subjectively experienced, neuroanatomical landscape in *The Geographical History of America* could serve as a 'Rosetta Stone' for the non-explicit or secretive brain maps in her literary corpus, because it explicitly calls attention to the colored brain matter and the phenomenal color experiences that constitute the neural architecture of this masterpiece's "human mind." In doing so, this masterpiece reveals that color is the key to deciphering the microscopic perspectives, semiotic codes and cubist puns that comprise the human mind's neuroanatomical imaginaries in her literary portraits. With this explicit brain map, Stein offers her readers a rare chance to examine the extent to which her neuroanatomical portraiture strategies parody the nerve tissue staining techniques and experimental laboratory practices of her scientific predecessors. Even though the phrase "human mind" appears on almost every page of this one hundred and ninety seven page book, sometimes as many as seven times on a single page, this is the only brain-like image of the human mind in this entire work. To the best of my knowledge, this is the only *explicit* image of a brain-like human mind in her entire literary corpus. The empirical brain research and scientific historiography that are needed to prove that these neuroanatomical portraits are functioning as cubist puns can make for difficult, scientific reading.

Meyer's study is vital reading for anyone who wishes to know about Stein's "neurophysiological imaginaries," and I believe it should be required reading for anyone who wants to know how Stein's medical studies, brain research, laboratory practices and psychological experiments informed her dissociative writings about the human mind. In *Irresistible Dictation*, Meyer observes that Stein's "early exposure to the new science of physiological psychology was supplemented by a summer at the Woods Hold Marine Biological Laboratory in 1897, followed by four years, and part of a fifth, of further study at Johns Hopkins Medical School. This thorough training in experimental science played a crucial role in Stein's subsequent development as perhaps the twentieth century's preeminent [sic] "experimental writer" (3). With this educational background and medical training, Stein was able to create modernist experiments that placed neuroscientific observation, literary creation, philosophical reflection, evolutionary speculation and scientific historiography on a relatively even 'playing field' within her modernist writing. Meyer does not cover this brain portrait in his monograph study, but I think it could be the most important one to study, of all her neuraesthetic compositions.

By incorporating new brain mapping strategies into the literary brain maps that Stein provides in *The Geographical History of America* and in other masterpieces, it becomes possible for readers to generate performative meanings for these neuroanatomical imaginaries, while historicizing the science of the reading brain that could be encrypted at the level of a masterpiece's imaginary neurons, axons and cellular elements. As opposed to Meyer, I do not think that her experimental writings, or her "neurophysiological imaginaries" (as he calls them), fail to communicate scientific knowledge; nor do I think that these imaginative writings reveal Stein's scientific confusion, either in the past or present sense, about the broader aims of the brain stem research that she was conducting in medical school. I have argued elsewhere that Stein's second- and third-phase cubist brain portraits offer biologically realistic and culturally intelligible representations of the brain's neural structures, at both the literal and metaphorical levels of meaning production. Contrary, then, to what Meyer argues in *Irresistible Dictation*, I am arguing that if we pay close attention to the color signifiers, grammatical conventions, and poetic conventions that are used in the composition of The Geographical History's brain map, it is possible to conceive of Stein's so-called "beloved mistakes," or her "deliberate errors," as strokes of artistic genius and as flashes of scientific insight.

With this neuroanatomical portrait, Stein anticipates the "*Brainbow* system," or rather, the multicolored "mosaic expression of multiple genes" that led to production of the Brainbow photographic images that were produced and developed in Jeff Lichtman's Harvard laboratory in the Department of Molecular and Cellular Biology, in 2007. Since many readers know that the human brain has colored nuclei with pigmented neurons, it may strike these readers as unusual, but not necessarily a "complication," that, in this book's neuroanatomical landscape, "There is blue and green and green and yellow pale yellow and blue, there is pale yellow and green and blue and warmth and there is not any such thing as human nature" (120). Immediately following this description, this book invites its readers to "Please see my human mind. It is here. Is white a color. Yes white and grey is a color. Grey and white is a color" (120). With the simultaneous introduction and interrogation of these "white" and "grey" colors, Stein raises the possibility that all of the colors mentioned in these two passages correspond with unspecified, neurophysiological entities and neurophenomenological experiences that this book, her "master-piece," is subjectively experiencing through the phenomenal qualities of its brain-like human mind. By paying close attention to how Stein uses color to paint the individual neurons that comprise the human mind's neural networks and cellular tissues, the reader is led to discover "another vision than that of all the world" (Stein, *Picasso* 43). In this work of art, Stein uses a number of literary devices, not only color but also the stanza form, grammatical parataxis, line spacing, a dissociative writing style, and metaphysical tropes to create an unprecedented vision of the human brain's "neuronal network architecture" (Livet et alia, "Transgenic Strategies" 56). In "Transgenic strategies for combinatorial expression of fluorescent proteins in the nervous system," Jean Livet, et alia explain how they developed "Brainbow transgenes" by manipulating the "widely used Cre/*lox* recombination system, which can switch on gene expression by DNA excision, inversion, or interchromosomal recombination" (56). Steve Bradt, spokesperson for the Faculty of the Arts and Sciences at Harvard University, usefully summarizes the genetics research behind the production of the "Brainbow transgenes" that these scientists produced at the Department of Molecular and Cellular Biology at Harvard University and the Center for Brain Science, in an accessible statement to the press:

> By permitting visual resolution of individual brightly colored neurons, this increase should greatly help scientists in charting the circuitry of the brain and nervous system. "In the same way that a television monitor mixes red, green, and blue to depict a wide array of colors, the combination of three or more fluorescent proteins in neurons can generate many different hues," said Lichtman, professor in the Department of Molecular and Cellular Biology and the Center for Brain Science in Harvard's Faculty of Arts and Sciences. "There are few tools neuroscientists can use to tease out the

> wiring diagram of the nervous system; Brainbow should help us much better map out the brain and nervous system's complex tangle of neurons," Lichtman said. ... The researchers painstakingly assembled the Brainbow transgene from snippets of DNA, and inserted it into neuronal DNA. As they predicted, the cut-and-paste recombination occurred totally at random, in the process assigning scores of different colors to neurons. This variation makes neurons leap out from one another visually under ordinary confocal microscopy. "The technique drives the cell to switch on fluorescent protein genes in neurons more or less at random," says Livet, a postdoctoral researcher in the Department of Molecular and Cellular Biology and Center for Brain Science who did much of the legwork behind Brainbow. "You can think of Brainbow almost like a slot machine in its generation of random outcomes, and Cre/*lox* is the hand pulling the lever over and over again." Using Brainbow to look at mouse neural circuits over periods as long as 50 days, the Harvard researchers were able to observe some neural reorganization over time and to ascertain that Brainbow labeling is stable and long-lived. Livet, Sanes, Lichtman, and colleagues are now using Brainbow to scour the nervous system for new insights into its organization and function.
> (http://harvardscience.harvard.edu/node/7662).

The clearest indication that Stein may be envisioning a system such as this, or, more precisely, that she is imagining the visual effects that such a system would produce within the human brain and nervous system, comes from the way in which she uses color words to ‘paint’ the human mind’s neuroanatomical landscape and cellular tissues in “Detective Story number VII.”

The unusual variegated color expression of human mind's neural networks may not be the first thing a reader notices about Stein's cubist portrait from *The Geographical History of America.* The "human mind," in Detective Story number VII, is clearly an artistic rendering of the human brain, Moreover, it can be conceptualized as a cubist mind puzzle. One of the functions of this human mind is to observe the brain's neuroanatomical structures from the subjective perspective of a modernist masterpiece's elementary and secondary, literary qualities. This masterpiece's "dissociative rhetoric" paints phenomenological portrait of the brain's physical properties and its implied, neuroanatomical structures with color words and other linguistic signifiers.

> There is blue and green and green and yellow pale
> yellow and blue, there is pale yellow and green and blue
> and warmth and there is not any such a thing as
> human nature.
> Please see my human mind.
> It is here.
> Is white a color.
> Yes white and grey is a color.
> Grey and white is a color.
> It is now come to be certain that there is not any such
> a thing as human nature.
> Of course there is such a thing as human nature and anybody
> can observe it.
> The relation of human nature to the human mind. (120)

At a basic level, the portrait that Stein *paints* with the "metaphysical metaphor" that Wilder defines as the relation between human nature and the human mind operates as a cubist pun and a sight gag, whereby the reader is being asked to observe the brain's outward appearance and to identify its neuroanatomical structures by visualizing how it appears, both the naked eye and to the mind's eye, in terms of its perceived colors, tactile sensations and implied spatial boundaries. This tiny, but nevertheless powerful, human mind is situated at the center of the swirling universe of consciousness that has been imaginatively created all around it with language consisting of enigmatic signifiers and floating symbols. In actuality, this brain-like human mind appears eighty-five pages into a masterpiece that is one hundred and ninety pages long (at least, this is how it appears in the Random House edition, which excludes the introduction that is given by William Gass); hence, the brain-like mind does not actually appear in the center of the work, but just short of the halfway point, by some twenty pages. There may be some significance to Stein's placement to this brain at the "heart" of the text; if you recall, in ancient Egyptian burial practices, the heart was considered to a sacred object and it was considered far more important than the brain. By placing the brain near the heart of her manuscript, Stein subtly reverses the ancient Egyptian surgical practice of revering the heart and treating the brain as offal. The ancient Egyptians removed the brain during their processes of mummification and threw it away, but carefully preserved the heart. By contrast, Stein honours the brain's elevated stature within nineteenth-century science and modern culture. Yet, at the same time, she makes it a convention of the modern detective story, by forcing her readers to attend to subtle linguistic clues that will lead them to this enigmatic brain portrait and its surprising neuroscientific revelations. The last sentence in Detective Story number VII states, "Begin being ready to find the human mind," which suggests to her readers, once the brain portrait has been discovered amongst the hieroglyphic images of birds and unsettling references to dead children, the difficult process of forensic analysis has begun in earnest.

3.2 Gertrude Stein's Compositional Landscapes and Their Cerebral Forms

Stein's cubist rendering of the human brain thus delivers covert, neuroscientific meanings through its location in the printed text, as well as through its neuroanatomical and compositional landscapes. By focusing on how Stein's vocal intonations provide the epistemic framework for her neuraesthetic compositions and then using this argument to denigrate Zeki's neurobiological research on color vision and his interests in modernist literature, Meyer downplays the significance of the elementary qualities of phenomenal experience at the level of Stein's compositional processes. As we have seen before, he apotheosizes consciousness's secondary qualities and higher order thought processes, in order to substantiate a particular view of James's pragmatist psychology. In his conclusion to *Irresistible Dictation*, Meyer turns this argument about the epistemic and phenomenological "constraints" of Zeki's biological empiricism around, when he argues to the contrary, that

> Intonation is not grammar; rather, it provides a compositional landscape for grammar, and thereby provides grammatical constructions with determinate significance. It is certainly not the only "landscape" that can do so, nor is it the only one that Stein made use of in her compositions. Other comparable landscapes include the paragraph, the manuscript page, and the manuscript notebook. In addition, more obviously poetic devices such as stanzas and other verse or metrical forms serve a similar function, although these are typically less central to Stein's writing; and, of course, she

> used portmanteau sentences and an astonishingly wide range of grammatical wordplay to put the very conception of grammar as a strictly formal, rule-bound phenomenon to the test. Even so, attending to the intonational contours of her sentences generally enables one to recite them with the sort of "delicately modulated expression of intelligence" that William James mistakenly believed did not entail genuine understanding. (301-302)

In what follows below, I discuss how Stein uses color, perspective, metaphor, spacing and poetic form to produce a sense of neurobiological realism for her brain portraits. In doing so, I basically disagree with Meyer's claim that Stein tries to liberate her neurophysiological entities from the "external constraints" of physical reality. I am arguing, to the contrary, that she strives for and achieves a level of neurobiological realism with her cubist brain portraits in Detective Story number VII*,* when she recreates the cellular tissues and neural networks of the human cerebellum (or some other unspecified brain region), using these literary devices. To be clear: I am not interpreting this book's neuroanatomical landscape as a soundscape, or as an intonational horizon of epistemic intelligibility. That is, when I call it a "compositional landscape" or a "neuroanatomical landscape," I mean these terms in some of the ways that Meyer does in *Irresistible Dictation*, but closer to his sense of a "neurophysiological imaginary." When Meyer speaks of "intonation" and "composition" in the same sentence or in the same paragraph, he usually means them in opposing but complementary ways at once. Which is to say, he deploys them as oxymorons in his oxymoronic, organicist neuraesthetic radical empiricist literary analysis of Stein's dissociative writings. (This is quite a mouthful, but it is an accurate assessment of his critical approach to her modernist aesthetic). According to his oxymoronic methodology, a "compositional landscape" can signify the way in which intonation, or 'voice,' provides a hermeneutic horizon of cultural intelligibility for Stein's grammatical constructions largely from the perspective of sound, phonetics and voice. Also, in his critical usage, the phrase "compositional landscape" can refer to the voice recordings and musical scores (in the case of the operas, which he doesn't discuss in this context) that deliver an "impression of intelligibility – of meaning carried by intonation – that Stein herself supplied in reading her work aloud" (302).[85] Thus, I counteract Meyer's arguments about the hermeneutic understanding and cultural intelligibility of the intonational landscapes that comprise Stein's neuraesthetic compositions, by pointing out that the selections that Stein read aloud, either to her contemporaries or to her general audiences, are not the same ones that he uses to analyze her dissociative writings and their "invisible nervous systems."

Unless one can see color at the level of sound through the compositional landscape that is implied or supplied by vocal intonation, it would be difficult for most listeners *to see* how Stein was using color words to map out the brain's neural networks and synaptic connections, using figurative language, grammar, syntax, paragraphing, spacing and other poetic conventions. In "Portraits and Repetition," Stein reports that she was interested in exploring something along these lines with her second-phrase cubist portraits, in the experiments she conducted with the "color thing" and "literary synaesthesia." I would now like to return to my earlier point about James's classifications of phenomenal experience and to Meyer's argument about the difference that "tone" makes when comparing fine, qualitative discriminations within scientific and literary perspectives that share many things in common. I am arguing that Stein was able to evaluate, transcribe, and translate the subjective qualities of her scientific visions and her laboratory experiences into comprehensible psychological data and intelligible literary forms, at the level of her brain allegories, largely because of her color experiments at the Harvard laboratory. By advancing this proposition, I am agreeing with certain aspects of Meyer's argument and disagreeing with other aspects of it. For example, I have argued that she deploys the elementary qualities of phenomenal experience to create a neuroanatomical landscape in *The Geographical History of America* that features nineteenth-century neurobiological discoveries and biological realities. But also, I am saying that the elementary qualities of conscious experience that are being incorporated into her textual discourse operate as secondary qualities at the level of her textual discourse, because they have been transformed from qualitative characters, which take the form of colors, bodily sensations, vague feelings and ego mappings, into complex aesthetic judgments that comprise this artistic creation and its modernist aesthetic. At the level of the printed manuscript, Stein's eccentric presentations of the brain's neural networks highlight the possibility (or the probability, depending on your view) that additional scientific and aesthetic meanings can and will be detected via the human mind's "compositional landscape." I acknowledge that one "compositional landscape" can be difficult to distinguish from another at the level of Stein's neuraesthetic, writing style and her hybrid, modernist book. Indeed, this seems to be the point: Stein's neuraesthetic writing style literally becomes part of the "creative metaphysics" that constitutes the human mind's colorful, neuroanatomical landscape, which, in turn, is the metaphysical relation between human nature and the human mind that questions the ontological, physical and phenomenal realities of this curious, cerebral entity.

There is another sense in which we might derive neuroscientific meaning from Stein's compositional practices, which complements the experimental neuron coloring and performative anatomical representations that Stein creates with cubist representational strategies in this synthetic-phase brain portrait. This other sense has to do way in which the text literally appears on the printed page: namely, with how it leans to the left and simulates the outward appearance of the cerebral cortex. Neuroscientists Claus C. Hilgetag and Helen Barbas explain that the folds of the cerebral cortex arose out of evolutionary processes that met the need for more gray matter space than the inside surface of the skull was able to provide animals with high-level thought processes (*Scientific American Mind* 86). These neuroscientists explain, "In the 19th century scientists proposed that simple mechanical principles might underlie the brain's characteristic structure. The also postulated that the brain's surface shape (morphology) and function were related. For decades, these ideas seemed naïve next to emerging genetic theories. Recent studies, however, have given new support to the concept that mechanical factors play a key role in the brain morphology and function" (86). Hilgetag and Barbas's explanation of the brain's appearance, morphology and function provides historical insight into Stein's graphic depiction of this "human mind," particularly with respect to how language can be used to illustrate the cerebral cortex's neural architecture and to speculate about the function of the colored gray and white matter in a given "cortical landscape." (86). They also explain how nineteenth-century scientists viewed the brain's outward appearance, its morphology, and its anatomical functions as being language-related, brain functions with interrelated, neural features:

> Nerve fiber bundles are tense, like stretched elastic. Regions in the brain that are densely connected are pulled toward one another, producing outward bulges between them – the hills of the cortical landscape. Weakly connected regions drift apart, forming cortical valleys. The stretching and compression of brain tissue also have an

> effect on the architecture of the cortex and the shape of individual cells, most likely affecting brain function. One example that illustrates this principle is the asymmetry between the language regions in the left and right hemispheres. A massive fiber bundle connects frontal and posterior language regions in each hemisphere, but the bundle is denser and therefore pulls harder on the left – complementing the idea that in most people the left hemisphere is dominant in language processing. Observations of this type have led scientists to return to the ideas first proposed by anatomists in the 19th century. Modernist techniques have shown that the landscape of the brain correlates with brain function after all. (86)

If you inspect the brain portrait in Detective Story number VII, then you will see that human mind's tiny brain also pulls to the left of the page, perhaps simulating the "asymmetry between the language regions in the [brain's] left and right hemispheres." Stein, it seems, has arranged her written text to give the impression of the cortical landscape's valleys and bulges, whereby the colors "gray" and "white" create a visual effect that is comparable to the cortex's compressed and stretched, brain matter. In doing so, she produces a textual "brain pun" that literally illustrates the "asymmetry between the language regions in the left and right hemispheres." Also, she produces a linguistic "brain pun" that asks the reader to consider the production of meaning about relation between the human mind and human nature that putatively comes from the compressed, left hemisphere where language processing takes place. As Hilgetag and Barbas point out, "Modernist techniques have shown that the landscape of the brain correlates with brain function after all." But the pun here is that the modernist technique is a form of cubist writing that questions the relationship between the brain landscape and brain function in the creation of neuraesthetic writing practices that could engender new methods of reading and interpretation.

The Geographical History of America thus explicitly asks its readers to consider the different kinds of physical properties, phenomenal experiences, scientific meanings, linguistic signs and literary meanings that comprise the human mind's subjectively experienced, neural architecture. It also asks its readers to consider which metaphysical tropes or fallacies comprise the neurophenomenological mechanisms of the human brain and which particular metaphysical relation between the human mind and human nature is constituting the unusual, neurobiological color properties of the brain's organic matter. This masterpiece deploys a series of metaphysical tropes, or a "creative metaphysics" (to use Wilder's expression), as a means of examining the chiasmic relationship that exists between the human mind's subjective phenomenology and its neural imagery. In *Consciousness Explained* Dennett explores how recognition happens at the phenomenological level of reading and writing, noting that, "When somebody explains something to us, we often announce our newfound comprehension by saying "I see," and this is not merely a dead metaphor. The quasivisual nature of the phenomenology of comprehension has been almost entirely ignored by researchers in cognitive science, particularly in Artificial Intelligence, who have attempted to create language-understanding computer systems" (56). For the benefit of "more theoretically minded researchers," Dennett argues,

> imagery *couldn't* be the key to comprehension, because you can't draw a picture of an uncle, or of yesterday, or firing, or a lawyer. Uncles, unlike clowns and firemen, don't look different in any characteristic way that can be visually represented, and yesterdays don't look like anything at all. Understanding, then, cannot be

> accomplished by a process of converting everything to the currency of mental pictures, unless the pictured objects are attached by something like attached labels, but then the writing on these labels would be bits of verbiage in need of comprehension, putting us back at the beginning again. (57)

Adding the phenomenology of color perception into the mix, Dennett further proposes, "If we attempted to paint an "impressionist" rendering of your experience, the jangling riot of color blobs would not capture the content; you do not have the experience of a jangling riot of color blobs, any more than you have the experience of an ellipse when you look at a penny obliquely … the painting is not a painting *of* the resulting impression, but rather something that can provoke or stimulate such an impression" (*Consciousness Explained* 54-55; original emphasis). In the case of the brain portrait from Detective Story number VII, Stein clearly identifies the "color blobs" as linguistic signifiers that belong to the human mind's colorful, neuroanatomical landscape, so it is not simply an "impressionist rendering of Stein's literary, aesthetic or scientific experiences, a "jangling riot of color blobs," as Dennett puts it.

Stein cleverly deploys the color phenomenology of the brain's "*N*-dimensional neural space" and the mind's "*N*-dimensional qualia space" (to use Edelman and Tononi's terms) in this literary laboratory, thereby giving sculptural definition, visual interest and literary form, as well as a sense of self, to this book's colorful "human mind." Working at the problem of semiotic, dissociative and phenomenological, consciousness representation from the perspective of the "phenomenology of laughter," Dennett *explains* that our subjective phenomenologies "are our most intimate acquaintances[,] … [despite the fact that] they are defiantly inaccessible to materialistic science; nothing could be less like an electron, or a molecule, or a neuron, than *the way the sunset looks to me now*—or so it seems" (65). With respect to how we might settle difficult philosophical questions with a "phenomenology of laughter," he proposes that we approach the "qualia problem" by trying to answer the following question from a materialistic perspective: "What is the difference between our epistemic relations to our phenomenology and our epistemic relations to the objects in the external world?" (65). In comparative literature and in English studies, this means looking at Stein's creative representations of the brain and mind, as Dennett puts it, with an appreciation for the "intrinsic hilarity" and for the playfulness of her phenomenal experiences and their correlative, literary qualia.

Enter Gertrude Stein. From 1912 to 1937, this modernist writer, playwright and librettist composed hundreds of dramatic and non-dramatic masterpieces about the human mind, in addition to the many autobiographies, lectures, letters, and interviews that she wrote during this compositional period. No one disputes that imagery, color, style, drawing, painting, indeed, that most aspects of the visual arts and the performance arts influenced her literary experiments with phenomenal consciousness, for she writes prolifically about these experiments. Yet, few readers would claim to understand the brain's imagery or its functional anatomy based on her "pictured objects" or "mental pictures," as Dennett rightly points out cannot be the case with most paintings and art forms. I believe Plato said something similar in *The Republic*. I disagree with his proposal about 'phenomenology of color' and the "quasi-visual nature of phenomenology of comprehension" at the level of the mind's or a text's 'multiple drafts of consciousness,' on the grounds that Stein's neuron coloring experiments literally communicate the "idea" of colored neurons and colored axons. Of course, they could be representing other things as well, such as colored brain matter, “colored blobs” on the written page, colored words, and all the other things I am about to mention. Once we are able to recognize what genre of representation these colored words belong to, namely, a synthetic style of cubist brain portraiture, then we should able to supply mental pictures of the brain that will create the “quasivisual phenomenology of comprehension” that Dennett doubts is possible.

3.3 Stein’s ‘Brainbow’ and its Performative Meanings

So, how do we know that the color words in these literary masterpieces accurately represent Stein’s neuroscientific vision of a variegated series of colored neurons in the human brain, like the ones we see in Jean Livet and Tamily Weissman’s Brainbow mouse photographs, and not some other construction of phenomenal color experiences? My response is that we can’t know for sure what Stein is describing with her color signifiers and invisible color relations. Or, as Stephen Jay Gould puts it, “We can never be completely sure that a hypothesis is right, though we may be able to show with confidence that it is wrong. The best scientific hypotheses are generous and expansive: they suggest extensions and implications that enlighten related, and even far distant, subjects. Simply consider how the idea of evolution has influenced virtually every intellectual field” (“Sex, Drugs, Disasters, and the Extinction of Dinosaurs” 32). Using empirical methods of scientific analysis in conjunction with literary criticism, we can rule out the possibility that Stein is using the color yellow to represent the gold chloride formula that Joseph von Gerlach used to stain the “nerve fibre network” of the “spinal cord” in the early nineteenth century. Even though, in Detective Story number VII, it looks like Stein may be using the color “yellow” to illustrate multicoloured neurons within the human mind’s neuroanatomical landscape, in a fashion that resembles the Brainbow aesthetic and anticipates the genetics research behind the mosaic expression of fluorescent proteins in the nervous systems of transgenic animals; she does so by combining the color "yellow" with blue and green to created a variegated expression of coloured neuron-words. By excluding the color red from her literary representation, Stein indirectly indicates that she is not referring to the gold chloride and carmine nerve tissue stains that Gerlach used in his mid-nineteenth century laboratory practices.

Even though many of us know, without being told by Stein, that the human brain has colored brain nuclei and these pigmented nuclei possess neurons that appear to have different colors, such as red, pink, brown, black and blue, it might not occur to us to *look* twice at the unusual color combinations that Stein is using to describe the human mind's neuroanatomical landscape in her masterpieces. For example, in "A Long Dress" from *Tender Buttons*, Stein uses a variety of colors, such as "yellow," "green," "blue," and "white," "pink", "red," "black," and "scarlet," to paint the brain's neural architecture. If a reader does not realize that there are different brain pigments that generate the appearance of different colors in the brain stem nuclei, then, naturally, the significance of these colors and their neurophysiological referents will escape that person's attention when s/he reads Stein's cubist portraiture. For example, if a reader does not know that "neuromelanin" produces a blue color in the brain stem nucleus that is known as the "locus coeruleus," then the word "blue" and its neurophysiological significance will elude that person's notice. In the context of an explicit brain map, such as one found in Detective Story number VII of *The Geographical History of America*, the word "blue" effectively becomes an area of color blindness and functions as an epistemic blind-spot that prevents the reader from investigating further into the subject matter, which is, of course, the colored brain matter that comprises the human mind's neuroanatomical landscape. By conducting some empirical detective work in the "distant" fields of histology, neurobiology and neuroanatomy, literary readers may be able deduce which brain regions Stein is excluding from her creative representation of the mind's colored brain matter. Also, by empirically accounting for the colored brain nuclei and colored neurons that could or might be included in her creative representations of the brain, readers of these colourful brain maps can better appreciate the prescient nature of Stein's neuroscientific insights and the extent of her medical knowledge.

An abstract view of the neuron as a communicative cell existing within a three-dimensional space, such as the one that Meyer advances in his study, does not explain how Stein creatively presents individually colored neurons that do not communicate information *as such* within texts. Also, such a neuraesthetic model does not show the differences in her imaginative, neuron coloration techniques and brain mapping schemes that occur over time. Moreover, such Meyer's communicative model assumes that there is a correlation between language and brain representation, even when it tries to deny that literary metaphors "about" the brain do not explain the brain's neurogenetic mechanisms or illustrate the mind's psychogenetic processes. Gerald Edelman explains why it is unadvisable to correlate linguistic expression, or language *per se*, with the brain's neurophysiological mechanisms in *Second Nature: Brain Science and Human Knowledge*:

> our understanding of how language is enabled by the brain is in its infancy. Language, arguably the most powerful vehicle for the elaboration of knowledge, both enhances and complicates matters. I hazard a surmise: even if we could accurately record and analyze the activity of millions of brain neurons as an individual formulates a

> sentence, we could not precisely specify the contents of that sentence by reference to neural recording alone. The idea that we might develop a "cerebroscope" capable of doing so is confuted by the complexity, degeneracy, and unique historical causal path of each brain. Nonetheless, through neuroscientific research, we will certainly be able to develop important generalizations about how we acquire knowledge. (66)

The approaches to brain mapping and neuron reading that I outline below expose some of the conceptual limitations inherent in Stein's neuroscientific imagination, while emphasizing the fidelity of her literary depictions to the brain's neurobiological realities and its historically established, neuroanatomical features. Using these contemporary perspectives, I will explain how Stein achieves the scientific desires of her medical professor, Lewellys Barker, by creating a brain portrait of the "human mind" that connects the medulla oblongata, cerebellum, and cerebral cortex through an imaginary exploration of the creative mind's neuroscientific insights and its subjective phenomenology.

3.4 The Neuroanatomy of Close Reading

In *The Geographical History of America* Stein's neuroscientific vision consists of two distinct, yet apparently related, levels of mind representation and neuroanatomical portraiture. First and foremost, this masterpiece offers a microscopic view of a series of colored neurons that form a rainbow-like arch, or a 'brainbow-like' effect, above the human mind's "white" and "grey" cortical landscape. The perspective that is given would be similar to the one that would have if looking through the lens of a microscope at a two-dimensional image of a prepared brain section or stained slice;

however, the difference is that Stein's neuroscientific vision of this human mind's colorful neurons does not correspond with the physical realities of the brain's colored nuclei or with the known properties of nerve tissue staining techniques from the nineteenth and twentieth centuries. In order 'to read' some of the brain colors in this neuroanatomical portrait and to be able appreciate some of the finer connectivity patterns, or neural networks, that comprise this human mind's neuroanatomical landscape, one must learn to read *microscopically*. That is, for the first part of this neuroanatomical portrait, one must learn to read as if one's eyes were looking through the magnifying lens of a powerful microscope at a color-stained brain slice or section. In order to understand how the color signifiers "blue" and "green" and "yellow" could be representing individually colored neurons within a particular neuronal grouping of this masterpiece's "human mind," one must learn to read these color words *as if* one could see the brain's individually colored neurons and cellular elements with the trained eyes of an anatomist or neurologist. In other words, one must learn to read the human mind's neuroanatomical imaginary in a way that complements and interrogates Stein's creative writing process. One way to do this is to read the human mind's subjectively experienced and objectively described, neural architecture in a quasi-scientific, "experimental" fashion, from the perspective of a "brain based epistemology" (to use Edelman's expression) that seeks to account for the 'evolution' of the human mind's neuroscientific insights, creative acts and philosophical inquiries. Though Meyer does not include this masterpiece in his study of her modernist brain maps, he claims that, in the course studying Stein's scientific writings from medical school, "one may find oneself feeling a little dizzy in trying to distinguish the *mind* of the observer from the slices of *brain* she is observing as well as from the textbooks she has *read* and which may have supplied her with knowledge of this region of the brain, not to mention the relation between brain and mind. Perhaps these entities are harder to distinguish than the *anatomical perspective built into Stein's instrument of choice at the turn of the century, the microscope*, would have one believe. *Resistance, then, to the dictates* of this perspective, a resistance that derailed the medical career the early successes at Harvard and Johns Hopkins had seemed to promise, at the same time started Stein on a literary career of deliberate error" (99; original emphasis). With this portrait, however, Stein reveals that she has advanced in her knowledge of clinical microscopy, neurological description and neuroanatomical examination, even though she has not stepped foot in a medical laboratory for over thirty years. Not only is she able to distinguish between the neurophysiological entities that comprise her scientific imagination and the anatomical perspectives that are being created at the level of her dissociative writing style, but also she is able to distinguish between microscopic and macroscopic forms of neuroanatomical description by positing a relation between colored brain regions that otherwise lack distinction within the field of vision implied by the nineteenth-century microscope. From this reader's perspective, the colourful neurophysiological entities that Stein briefly describes in the "first part" of her cubist portrait can be distinguished from the "macroanatomical" brain parts that are implied by the white and grey colors in the "second part" of this portrait.

By the time that she published *Tender Buttons* in 1914, the microscopic perspective simultaneously functions as a cubist perspective that transforms the reading dimensions of the neuroanatomical landscape, so that what we witness from one sentence to the next is the world of the micron-sized neuron in its interactions with other neurons, axons, glial cells and cellular elements. Unofficially, with *Tender Buttons*, Stein begins to create brain maps that are not predicated upon "deliberate error," but which create performative meanings and referential possibilities through her creative literary deployments of the cubist pun. The second level of neuroanatomical portraiture in Detective Story number VII consists of the human mind's phenomenological exploration of the "white" and "grey" colors that comprise its subjective nature and its neural architecture:

> Please see my human mind.
>
> It is here.
>
> Is white a color.
>
> Yes white and grey is a color.
>
> Grey and white is a color.
>
> It is now come to be certain that there is not any such a thing as human nature.
>
> Of course there is such a thing as human nature and anybody can observe it.
>
> The relation of human nature to the human mind. (120)

This macroanatomical level of brain portraiture foregrounds an internal mental debate, taking place between passing states of consciousness, as to whether or not there is a relation between the human mind and human nature at the level of the human mind's subjectively experienced, brain colors. The full title of this masterpiece –*The Geographical History of America or the Relation of Human Nature to the Human Mind* – uses the conjunction "or" to suggest that the 'relation of human nature to the human mind' will be the book's primary theme and sub-theme. This grammatical conjunction does not prepare the reader for the reverse scenario, which is that the book is mostly be concerned with the human mind's non-relation to human nature and human nature's non-relation to the human mind. There are hundreds of propositions in this book about the relation of human nature to the human mind, about the relation of human mind to human nature, about human nature's non-relation to the human mind and about the human mind's non-relation to human nature. By making the non-relationship between human nature and the human mind pivotal to understanding the human brain's psychogenetic processes of phenomenal experience, this book invites speculation as to how biological comparisons between animal nature and human nature, between human minds and animal brains, might be opened up in a creative way to pragmatist methods of neuraesthetic inquiry. Structuralism taught us that not all relations, substitutions, and reversals mean the same thing. Wilder considers the ongoing debate that Stein conducts about the relation or non-relation that exists between human nature and the human mind in *The Geographical History of America* as that which defines her role as a "creative metaphysician" within western society and her modernist writing style as a 'creative metaphysics.'

Without the visual and empirical scientific evidence that the 'Brainbow' maps provide, I would have difficulty convincing you that *The Geographical History of America's* 'brainbow-like' imagery constitutes an original contribution to twentieth-century brain research and literary modernism. With these "connectivity maps," I am able to decipher some of Stein's otherwise ineffable, color "condensations" (to use Wilder's metaphorical expression). With the Brainbow photographs, it may be possible to decipher Stein's color-coded and qualia-based cubist puns in Detective Story number VII, from an abstract scientific perspective that allows for different interpretations of the brain's colored neurons and colored nuclei. These *brainbow maps* can serve as empirical reality tests for Stein's condensed, neuroscientific intuitions and neuroanatomical portraiture techniques, because they are allow us to translate "white" and "gray" brain matter into colored neurons and vice versa. Harvard scientists

Jeff Lichtman, Joshua Sanes and Jean Livet created these ‘brainbow maps’ to help researchers “visualize [the brain’s] synaptic circuits by genetically labelling them with multiple, distinct colours” (“Transgenic Strategies” 56). By creating individually colored neurons, axons and glia in the brains of transgenic animals that look like rainbows, these scientists have been able to create “connectivity maps” that can be used to study relations between neuronal and non-neuronal entities. In a photograph that has been entitled “Colorful “Gray Matter,” which was taken by Tamily Weissman at Jeff Lichtman’s Harvard laboratory, a confocal microscope has been used to produce a three-dimensional image of the colored neurons that comprise the cerebral cortex’s “gray matter.” See Figure 35, Colorful Grey Matter.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 358 is Figure 35, Colorful Gray Matter. Figure 35 is a color photograph of Brainbow mouse's cerebral cortex, which Tamily Weissman of Harvard University produced with a confocal, fluorescent microscopy. The caption associated with this image, from Wired. Com. states, Figure 35 points out, "These neurons sit in the cerebral cortex, often referred to as the gray matter for the area's color in non-living specimens. These cortical neurons are involved in higher-thought processes and [the] perception of different senses." Without this caption, a layperson would not automatically recognize which part of the brain these colored neurons belong to. The cerebral cortex's "gray matter" is *always already* comprised of these colored neurons that can only be seen by a microscope with special fluorescent imaging capabilities, such as the confocal microscope, and the colored neurons always already comprise a perspective of "gray matter" that exceeds ordinary human vision by virtue of the fact that these neurons are the visual effects produced by cutting-edge genetic technologies, microscopic imaging capabilities and neurobiological research. The source of the material for Figure 35 is the website address <http://wired.com/print/science/discoveries/multimedia/2007/10/g…>.

As the caption above the photograph in Figure 35 underscores, "These neurons sit in the cerebral cortex, often referred to as the gray matter for the area's color in non-living specimens. These cortical neurons are involved in higher-thought processes and [the] perception of different senses." Without this caption, a layperson would not automatically recognize which part of the brain these colored neurons belong to. The cerebral cortex's "gray matter" is *always already* comprised of these colored neurons that can only be seen by a microscope with special fluorescent imaging capabilities, such as the confocal microscope, and the colored neurons always already comprise a perspective of "gray matter" that exceeds ordinary human vision by virtue of the fact that these neurons are the visual effects produced by cutting-edge genetic technologies, microscopic imaging capabilities and neurobiological research.

For our purposes here, it is important to recall that 'brainbow mapping' is a multistage, advanced scientific process that produces genetically modified brains that look like the modernist paintings of the expressionists, fauvists and pointillists (Bradt). In other words, it is as much as creative process that involves the manipulation of sophisticated scientific technologies, as it is a scientific venture that investigates the brain's neural architectonics with empirical methodologies and laboratory experiments. Stephen Tang, Group Vice President and General Manager, Life Science, for Olympus America, explains how the Brainbow mapping system, as manifested in Livet's "winning technique," "reflects the awesome intricacy and beauty of the natural world and it shows how much science and fine art can echo one another."[86] Although Stein's neuraesthetic compositions do not specify which brain regions, neural networks or nerve cells are being represented by the blue-, green- and yellow-colored neuron-words in her portraits, these compositions can be thought of as the "awesome intricacy" of her “winning technique,” they are nevertheless intricate literary constructions. In Detective Story number VII, Stein’s narrator tells us, “There is blue and green and green and yellow pale yellow and blue, there is pale yellow and green and blue and warmth and there is not any such thing as human nature” (120). It is up to the reader to identify the creative processes, the brain regions, and the neuraesthetic practices that produced these colorful neural networks and the colored brain matter of the cortical landscape directly below them. Only the reader can generate meanings for this *text*, for there are no “mistakes” in Stein’s “neurophysiological imaginaries.”

This is the reason why: the scientific translation of colored neurons into gray matter and gray matter into colored neurons makes perfect sense from a nineteenth-century brain modeling practice that Stein would have used at Johns Hopkins University. However, this scientific practice is difficult to detect from most perspectives – whether it be a completed scientific brain model, a medical illustration, or a neuroscientist’s drawing of a particular brain region -- because it constitutes the formative part of the brain modeling process. In other words, it is the part of the process that the scientist later erases from her two-dimensional brain illustrations, save for a few remaining, color markers and discursive traces that have been deliberately left by the scientist to explicate the brain’s neural structures. In other words, “the complex color system that was necessary” for the construction of a three-dimensional model of a particular brain region would be invisible to everyone but the scientist who created it. Being a year ahead of Stein in her medical studies and also being a graduate student of Dr. Mall and Dr. Barker, Florence Sabin had produced a three-dimensional model of the medulla, pons and midbrain of the kind that Stein was supposed to produce for Mall to satisfy her program requirements. In “A

Model of the Medulla, Pons and Midbrain of a New-Born Babe," Florence Sabin explains her methodology, as follows:

> a complex color system was necessary in building the model, in presenting it as a finished structure the color system has been made simple. All the fibres are shown in white and black, the nuclei of the gray substance in colors. Of these but three have been used – red for the motor nuclei, blue for the sensory and yellow for all other nuclei. In describing the model, the words proximal and distal have been used, proximal meaning toward the cerebrum and distal away from it. No review of the literature has been given, inasmuch as the ground has been so ably covered by Dr. Lewellys F. Barker, in his recent book. In the study of the sections I have been guided constantly by the works of Forel, von Monakow, Flechsig, v. Koelliker, His, Ramón y Cajal, v. Bechterew and Held. … It is believed that here, for the first time, the form relations of the fibre-bundles and gray masses of the pons and medulla oblongata are shown in three-dimensions. Certain observers have given descriptions that permit most graphic mental pictures, but as far as I am aware no one has treated the subject as a whole from the point of view of form. (931-932)

See Figure 36, a <u>three-dimensional model of the medulla, pons and midbrain that is viewed from the lateral surface</u>, from Plate 1 of Florence Sabin's "A Model of the Medulla, Pons and Midbrain of a New-Born Babe." Also see Figure 37, entitled <u>Diagram from Plate 1 to show the levels of the sections of the two series,</u> (which is based on Sabin's three-dimensional model of the medulla, pons and midbrain, as viewed from the lateral surface), from Florence Sabin's "A Model of the Medulla, Pons and Midbrain of a New-Born Babe," Figure 52.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 362 is Figure 36, which is a color photocopy of a three-dimensional model of the medulla, pons and midbrain viewed from the lateral surface, taken from Plate 1 of Florence Sabin's "A Model of the Medulla, Pons and Midbrain of a New-Born Babe." Dr. Sabin observes that the lateral surface view "is designed to relate the model to the cord, the cerebellum and the cerebrum. The cut edge of the [spinal] cord shows on the extreme right [of the page]. The information that is important and that is contained in this figure is the color system that Sabin used to illustrate the nerve fibres and brain nuclei, which I believe is similar to the one that Stein used in the construction of her three-dimensional model of the medulla oblongata, midbrain and pons, as partial fulfilment for her medical studies requirements at the Johns Hopkins Medical School. Sabin notes, "The color system is as follows: all fibres are in white and black, all nuclei in colors. Red represents the nuclei of the motor cerebral nerves, blue the nuclei of the sensory cerebral nerves and yellow all other nuclei [e.g., [as noted by the yellow coloration] of the substantia nigra, of the olive, and of the pons]. *Nu et Radix N. vestibuli*: The nucleus is distinguishable from the root by its color. The ascending and descending parts of the root are to be determined by their relation to the entering root-bundle of the nerve" (Description of the Plates, Plate 1, N. pag.; original emphasis). The source of this material is Florence Sabin's "A Model of the Medulla, Pons and Midbrain of a New-Born Babe." Contributions of the Science of Medicine: Dedicated By His Pupils to William Henry Welch on the Twenty-Fifth Anniversary of His Doctorate. Baltimore: Johns Hopkins P, 1900. 925-1045.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 363 is Figure 37, which is entitled Diagram from Plate 1 [above] to show the levels of the sections of the two series and numbered Figure 52 in Sabin's "A Model of the Medulla, Pons and Midbrain of a New-Born Babe." This hand-drawn diagram is based on Sabin's three-dimensional model of the medulla, pons and midbrain, as viewed from the lateral surface. This drawing shows where the sections were derived for the two series that comprised the three-dimensional model of the medulla, pons and midbrain that Sabin constructed, in order to show "for the first time, the form relations of the fibre-bundles and gray masses of the pons and medulla oblongata" (932). The information that is important and that is contained in Figure 37 concerns the color system and the structural planning Sabin used in her construction of the three-dimensional model that is illustrated in Plate 1; this three-dimensional model and its color systematicity can be compared to the one that Stein constructed for Dr. Franklin Mall at the end of her medical studies, except that Stein paid particular attention to the midbrain region that consists of the nucleus of Darkschewitch, the midbrain and the red nucleus. In her "Description of the Model," Sabin observes, "The model as a whole will be most readily understood by a study of Plates I and II. Plate I is a view of the lateral surface in which the model is related to the spinal cord, the cerebellum and the third ventricle; Plate II is a view of the dorsal surface in which the fourth ventricle is the important guide. The model brings out the three dimensions – length, breadth and thickness of its component parts – hence, in a description, there will be a definite advantage in following the course of its construction, which was to make the central fibre mass the skeleton of the model and to relate all other structures to it. Since the region has been studied only by sections, the central fibre mass has been considered in its parts – the medial, lateral, superior, lemnisci, etc.—and not as a structural unit. The description will be divided into five parts: (1) the long fibre-tracts that relate the spinal cord with the higher centers; (2) the cerebral nerves and their nuclei; (3) the nucleus olivaris inferior; (4) the midbrain and (5) the formatio reticularis" (932). The original source of this material is Contributions of the Science of Medicine: Dedicated By His Pupils to William Henry Welch on the Twenty-Fifth Anniversary of His Doctorate. Baltimore: Johns Hopkins P, 1900. 1045.

I have discussed the invisible “color thing” that Stein maps onto her cubist literary portraits elsewhere. Here, somewhat differently, I am underscoring how Sabin and other students of the brain devised complex, color systems in order to construct three-dimensional models of the brain, making it possible for these researchers to study the brain’s basic neuroanatomy and functional neuroanatomy from prepared brain slices and medical textbooks. The importance of a color system and the creation of one’s own color systematicity, in the empirical study of the brain’s neuroanatomical structures cannot be underestimated, as an underlying principle that informed Stein’s neuraesthetic writing practices, for it seems likely that she expresses this “color systematicity” through the color signifiers in her cubist brain maps, in order to generate open-ended neuraesthetic reading practices.

I think that it is important to account for the invisible “color thing” that informs Stein’s portraiture techniques, if one is to analyze Stein’s colourful brain maps and their performative, neuron coloration strategies. As I discuss in this chapter, it may be that a version of Stein’s “color thing” manifests itself in the literary practice of devising a color system for a brain map. The color system and the color thing, in both of these cases, all but disappears from view, while permitting the neuroesthetician to investigate and to illustrate the brain’s neural principles and its neurophysiological mechanisms with a limited color palette. I propose that Stein’s “color thing” can be conceptualized as a diagnostic tool that allowed her to envision the advantages of a “brainbow” mapping system, or one like it that would not have to disappear from the final presentation, in order for the scientist or neuraesthetic to be able to visualize the brain’s neural network architecture. There is the chance that Stein’s “color thing” could turn “gray matter” into colored neurons, metaphorically speaking, but such a transformation would occur in the reader's imagination, as part of a neuraesthetic reading strategy that seeks to visualize the brain's complex neural circuitry by deciphering the color words and semiotic codes that comprise an imaginary nervous system's grammatical-synapses and syntactical-exchanges.

Critics tend to place more stress upon the planes and geometric structures in three-dimensional brain models, rather than on the conceptual and visual processes that go into the comprehension, analysis and modeling of these structural forms. In addition to explaining her color system, Sabin also describes how her model was constructed, using dissecting microscopes, detailed drawings, wax plates and eventually three-dimensional models that were held together with wires and fused with hot irons: "To limit the error as much as possible the following precautions were taken (1) each section was studied with a dissecting microscope and Leitz Obj. 3.[,] before making the drawings, (2) each line of the drawings was controlled with the microscope, and (3) all of the masses outlines were measured and compared with the corresponding structures in the transverse series" (928). Sabin's study of the medulla, pons and midbrain, which contains 8 plates and 52 figures, consists of 125 pages of careful neuroanatomical analysis in *Contributions to the Science of Medicine.* Having read Sabin's article, Meyer either overlooks or dismisses the significance of this color system in the construction of Sabine's three-dimensional brain model. He also downplays the potential significance of a color system to Stein's three-dimensional brain model and ignores the colors in her literary brain maps. It seems to me that color serves as way for Stein to express her subjective experiences of previously observed and personally conducted, laboratory experiments at the Johns Hopkins Medical School.

Where "we" see simple color words in her brain maps, Stein perhaps envisions complex neuroanatomical structures with color-coded brain slices and three-dimensional brain models. Where her literary critics struggle to find culturally intelligible, discursive meanings in the enigmatic signs and phrases that comprise her cubist portraits (Thornton Wilder comes to mind here), she may simply recall previous laboratory experiments, where she devised arbitrary color systems, as a means of labelling different kinds of neuroanatomical structures and chemically-stained nerve tissues that belonged to the medulla, the pons and other parts of the brain stem. In following nineteenth-century neuroanatomical protocols with color systematization, Stein would have been able to differentiate between the sensory, motor and other brain nuclei, using the English language. Also, she would have been able to discern between neurodevelopmental features that were pertinent to an infant brain's white (and grey) matter in the upper and lower medulla oblongata, particularly with respect to the degree of "medullation" or "myelination" that was occurring in the white matter, as compared with the medullation that was taking place in the cerebral cortex, and in other brain regions.[87] Though Stein does not overtly specify the color system that she employed in the construction of her three-dimensional model of the medulla oblongata and the nucleus of Darkschewitch at Johns Hopkins (that is, of course, assuming she developed a color system like the one Sabine developed for her model of the medulla, pons and midbrain), she does describe the medullated axon fibers that put the coarse black fibres of the fasciculus longitudinalis medialis and the nucleus of Darkschewitch into bold relief, in her published research within Barker's book: "At this period of medullation the commissural posterior cerebri, considered simply topographically (that is, as a medullated fibre-mass without particular reference to the course of the fibres), appears as a dorso-ventral bundle, solid in the middle, subdivided dorsally into an anterior (proximal) portion and a posterior (distal) portion, while ventrally it expands in the form of a hollow pyramid, which rests directly upon the nucleus of Darkschewitsch."

In contrast with Meyer's neuraesthetic reading, I propose that the color words that Stein uses to represent the brain's neurons, axons and cellular tissues in *Tender Buttons* and *The Geographical History of America* allegorically represent the evolution of her creative processes, scientific insights and philosophical intuitions. In her neuraesthetic compositions, Stein expresses a cubist vision of how color words and other elements can function as metaphors for the brain's neural architecture and its neurophysiological mechanisms. With these cubist brain maps, she anticipated that neuroscientists someday would be able to stain individual neurons with distinguishable colors. In "The Structure and Connexions of Neurons" (his 1906 Nobel Lecture), Santiago Ramón y Cajal avidly supports the neuron doctrine, as a result of his experiments with Golgi's silver nitrate method of nerve tissue staining, and he proposes a pragmatic course of study that would allow future scientists to understand, explore, and map out the brain's complex, neural architecture.[88] With so much yet to be discovered about the brain's synaptic connections and its neurobiological mechanisms, Cajal modestly states his objectives and knowledge with respect to neuron coloration, as follows:

> Present-day science, in spite of its well-founded conclusions, has not the right to foretell the future. …Perhaps, with tune, technique will discover some coloration process capable of revealing new and more intimate connections between neurons thought to be in contact. We cannot reject, a priori, the possibility that the inexplicable forest of the brain, the last branches and leaves of which we imagine ourselves to have discerned, does not still possess some enigmatic system of filaments binding the neuronal whole, as creepers attach

the trees of tropical forest. (239-40)

Because of Barker's great support for Cajal's methods and theories (as given in his summary of Cajal's methodologies, findings theories in *The Nervous System*), Stein was able to 'branch off,' as it were, into new areas of neuroscientific inquiry, both within her medical studies and through her literary writings. However, she did not resume her neuroscientific experiments right away. After a decade or so, she began to do so in a completely new way, as neuroscientific and psychological thought experiments. At first, the form that these thought experiments took were the cubist literary portraits that allowed her to explore unprecedented neuron coloration strategies and consciousness creation techniques from the secluded, "aesthetic enclaves" of her cubist allegories and neuraesthetic writing practices. There could be a legitimate reason why it took approximately ten years for Stein to compose her first brain portraits in *Tender Buttons*, using the knowledge that she had amassed, but did not completely master, in her medical studies. In "The Expert Mind" Philip E. Ross observes that the "one thing that all expertise theorists agree on is that it takes enormous effort to build these [memory chunking] structures in the mind. Simon coined a psychological law of his own, the 10-year rule, which states that it takes approximately a decade of heavy labor to master any field. Even child prodigies, such as Gauss in mathematics, Mozart in music, and Bobby Fisher in Chess, must have made an equivalent effort, perhaps by starting early and working harder than others" (69; original spelling).

The color signifiers in Stein's literary portraits thus can be conceptualized as genetic markers or as *psychogenetic symbols* that chart the evolution of certain creative processes, scientific insights and philosophical intuitions in a masterpiece's symptomatic literary phenomenology, or its aesthetic consciousness. In *Second Nature: Brain*

Science and Human Knowledge, Gerald Edelman emphasizes, "the brain origins of imagination do not differ from those necessary for poetry, music, or the building of ethical systems. On the model of Neural Darwinism, which recognizes the historical and creative dimensions of human thought, no divorce is necessary between science and the humanities" (156). Acting as "metaphysical metaphors" that represent unspecified neurophysiological entities within the human mind's neural architecture, Stein's color words create dimension, perspective, and meaning for the human mind's implied brain regions, states and functions, through their visual, structural and semiotic relations with one another. At the same time, these color signifiers indirectly refer to historically-specific experimental laboratory practices, medical protocols, and neuroscientific discoveries that Stein participated in, when she was conducting brain stem research at The Johns Hopkins Medical School, on behalf of her anatomy professors, from 1897 to 1902.

When Gertrude Stein toured the United States in 1934 and 1935 and presented her academic lectures to university audiences across the country, she advocated for reception practices and literary theories that privileged the human mind and entity over human nature, identity and memory. In the process of explaining her compositional methods and writing practices to eager academic audiences, she was performatively producing a literary phenomenology of human creativity that would account for the cultural reception, theatrical expression and embodied performance of phenomenal consciousness. These lectures can help us to understand how she conceptualized the human mind's subjectively experienced, inner states of consciousness over the course of her writing career. However, it is her modernist writings that illustrate her neuroesthetic principles and creative theories masterfully. It is precisely because her literary "master-pieces" are not living human beings, functioning human brains or conscious entities, but archives of consciousness that transcend their discursive conditions of historical, social and political production, that their historical readers must be able to desublimate the identity, memory and human nature in these works as a means of deciphering their phantasmatic DNA.

3.5 The Cubist Pun and 'Close Reading'

One of the key differences between Stein's literary brain maps and those of her scientific predecessors is that she deploys Picasso's cubist portraiture techniques, as a means of representing the human nervous system. As I noted in section one, the cubist brain maps in "A Long Dress" from *Tender Buttons* (1914) and "Detective Story number VII from *The Geographical History of America*, resemble one another by using the same color combination (yellow, blue and green) and virtually the same structural formations. As I have also noted in chapter one, the obscure brain representations in these masterpieces differ in certain key ways from two-dimensional microscope slides, from three-dimensional brain models and from the descriptive medical research that was produced by Stein, her medical professors and her graduate peers at the end of the nineteenth century. Barker may have suspected that Stein was caricaturing the brain, her medical education and perhaps even her medical professors with her obscure literary writings, but it would have been difficult for him to prove this assertion without the assistance of today's brain mapping technologies. If, indeed, Stein is caricaturing the nerve tissue staining methods of her scientific predecessors and if she is questioning their experimental laboratory practices with her literary brain maps, then it is by generating multiple referents and a plurality of scientific meanings for the human brain with her 'colorful' cubist puns. I believe that Barker would have been impressed with Stein's ingenuity, given what he says about her "strange literary forms" and their relation to his medical pedagogy.

In *The Geographical History of America*, Stein's neuroscientific vision consists of two distinct, yet apparently related, levels of mind representation and neuroanatomical portraiture. First and foremost, this masterpiece offers a microscopic view of a series of colored neurons that form a rainbow-like arch, or a brainbow-like visual effect, above the human mind's "white" and "grey" cortical landscape. The perspective that is given is similar to the one that a person would have if he or she was looking through a microscope lens at a two-dimensional image of a prepared brain section or stained brain slice; however, the difference is that Stein's neuroscientific vision of this human mind's colorful neurons does not correspond with the physical realities of the brain's colored nuclei, nor does it correspond with the nerve tissue staining techniques of nineteenth- and twentieth-century brain scientists. In order 'to read' some of the brain colors in this portrait and to be able to appreciate some of the finer connectivity patterns, or neural networks, that comprise this human mind's neuroanatomical landscape, one must learn to read *microscopically*. That is, for the first part of this neuroanatomical portrait, one must learn to read as if one's eyes were looking through the magnifying lens of a powerful microscope at a color-stained brain slice or brain section. In order to understand how the color signifiers "blue" and "green" and "yellow" could be representing individually colored neurons within a particular neuronal grouping or a particular cellular structure of this book's "human mind," one must learn to read these color words *as if* one can see the brain's individually colored neurons and cellular elements with the trained eyes of a neurobiologist or a neurologist. In other words, one must learn to read the human mind's neuroanatomical imaginary in a way that complements and interrogates

Stein's creative writing processes. One way to do this is to read the human mind's subjectively experienced and objectively described, neural architecture in a quasi-scientific, "experimental" fashion, from the perspective of a "brain based epistemology" (to use Edelman's expression), so as to account for the 'evolution' of creative mind's neuroscientific insights, creative acts and philosophical inquiries which happen to coincide, in this case, with some of Stein's laboratory experiences and medical observations.

In the first "part" of this portrait, Stein displays modernist "brainbow" mapping strategies, whereas, in the second "part" of the portrait, she showcases her talents as an artist that can manipulate the "greys" and "whites" of the modernist palette for the purposes of creating colorful brain maps that reveal layers of neuroscientific, psychological, philosophical, literary and aesthetic meanings through her portrait's clever, linguistic deployments of the cubist pun. (The two parts do not really exist as such; they are imaginary divisions that can be determined because of the colors and the strategies that Stein uses to create different neurophysiological meanings and neuroanatomical features). In making these arbitrary divisions between sections of the brain with color words and simple poetic structures, Stein signals her conceptual departures from the neuroanatomical discoveries and experimental laboratory techniques of her neuroscientific predecessors, to the extent that she creates a variegated, 'brainbow-like' image of the human mind's colored neurons in the first "section," and a cortical landscape in the second "section." To be clear, she cannot be describing rows of *colored* neurons as they have appeared to other scientists or even as they have appeared to her naked eyes when she was examining the brain, for these formations do not exist in actuality. Rather, she seems to be envisioning a variegated, “mosaic expression” of neurons like the ones we see in the “brainbow maps.”

By paying microscopic attention to the individually colored neurons in this brain’s neural networks, we can make some progress toward understanding Stein’s neuraesthetic compositions. Rather than trying to decipher an imaginary nervous system’s “massively reentrant connections” on a large scale, whether it is the grand scale of the human mind that is embodied by an opera’s musical architectonics or a book’s entire text, it helps if we can focus on the synaptic connections and neural networks that appear at the level of single words, individual phrases and single sentences. Though I discuss the merits of Edelman and Meyer’s “reentrant” theories in greater detail elsewhere, I want to offer some preliminary remarks about what is at stake in reading Stein’s dissociative writings as “highly connected, layered local structures with massively reentrant connections,” without first understanding the finer patterns of linguistic-neuronal connectivity that comprise the larger, neuroanatomical landscape. To be clear: I am referring specifically to the neuron-words that comprise the sentence-neural networks in Stein’s imaginary nervous systems, when I talk about the “finer connectivity patterns” in these neuroanatomical landscapes, or representational systems. Likewise, when I am talking about the “massively re-entrant connections,” I am speaking, in a metaphorical sense, about the “neural connections” that occur between the different chapters, “parts,” descriptive studies, “plays,” “poems” and “portraits” of this meditative work.

Though, generally speaking, the finer linguistic patterns are always already metaphorical figures that represent the brain’s neural networks and synaptic connections, they are, also, in a special sense, a literal representation of the stained neurons and cellular tissue colors that a neuroscientist would see when s/he examined chemically stained brain slices under a microscope. In this sense, the finer connectivity patterns of certain neuronal networks can be conceptualized as a literal representation of what a scientist would see if s/he probed one of the brain's colored nuclei with her surgical tools and discovered layers of naturally pigmented neurons and non-neuronal cellular elements.

Meyer's view of Stein's dissociative writings as a communicative network of invisible or visually nondescript neurons does not account for the ways that *The Geographical History of America* portrays the brain's "finer connectivity patterns" (Sporns et alia, "The Human Connectome" 2). I do not want to give you the impression that Meyer completely excludes these finer neural patterns from his neuresthetic readings. Focusing on the synaptic circuitry and neuronal network connections that are implied by Stein's question in "A Long Dress" – "What is the current that makes machinery, that makes it crackle, what is the current that presents a long line and a necessary waist" (*Tender Buttons* 17) -- Meyer focuses most of his attention on the sounds that he associates with the brain's synapses. Yet, according to Olaf Sporns, Giulio Tononi and Rolf Kötter in "The Human Connectome: A Structural Description of the Human Brain," "The connection matrix of the human brain (the human "connectome") represents an indispensable foundation for basic and applied neurobiological research. However, the network of anatomical connections linked the neuronal elements of the human brain is still largely unknown."[89] These scientists further stress,

> While a larger number of anatomical studies of the human brain have been carried out at the macroscopic (cerebral lobes, surface landmarks, and white matter tracts) or microscopic (cytoarchitectonics, myeloarchitectonics, chemoarchitectonics, etc.)

> anatomical level, there is virtually no information on the finer connectivity patterns, including neuronal connection densities or laminar projection patterns in relation to anatomically segregated cortical areas or intraregional differentiation. Furthermore none of the available information is deposited in a single standardized data format, nor can it be accessed through a public database. (1-2;<http://compbiol.plosjournals.org/perlserv/?request+get-document&doi…>.)

Explaining the difficulty of approaching "a structural description of the human brain," or what is being called the "human connectome" from the microscale of single neurons and synapses, even with the technologies and knowledge that are available to twenty-first century neuroscientists, Olaf Sporns et alia observe, "An advantage of single neurons is that the elements themselves are relatively easily demarcated and well defined. In contrast, brain areas and neuronal populations are more difficult to delineate. No single universally accepted parcellation scheme currently exists for the human brain regions (e.g., areas of the cerebral cortex), posing a significant obstacle to creating a unified resource such as the connectome. In the human cerebral cortex, neurons are arranged in an unknown number of anatomically distinct regions and areas, perhaps on the order of 100 or more. Different subdivisions of the human brain (e.g., brain stem, thalamus, cerebellum, or cortex) may require different criteria for parcellation" (3). Approaching this problem from the opposite standpoint, that of the "human connectome," these scientists argue,

> Attempting to assemble the human connectome at the level of single neurons is unrealistic and will remain unfeasible at least in the near future. With single neurons as the basic element, the size of the connectome would be several orders of magnitude larger than that of

> the genome, comprising an estimated 10 [to the power of 11] neurons, with 10 [to the power of 15 connections] between them (approximately 10 [to the power of 10] neurons and 10 [to the power of 13 connections] in the cortex alone. Recording or tracing 10 [to the power of 15 connections] is not only technically impossible, it may also be unnecessary. While a genomic mutation in a single base pair can have dramatic consequences, alterations of single synapses or cells have not been shown to have similar macroscopic effects. Instead, there is overwhelming evidence that human cognitive functions depend on the activity and coactivity of large populations of neurons in distributed networks, including the corticothalamic system. Furthermore, individual neurons and connections are subject to rapid plastic changes. These changes include synaptic weights as well as structural remodeling of dendritic spines and presynaptic boutons, possibly switching synaptic connections between large numbers of potential synaptic sites. We suggest that the vast number, high variability, and fast dynamics of individual neurons and synapses render them inappropriate as basic elements for an initial draft of the connectome. (2-3)

Given this information about single neuron studies and their value in creating brain maps that will eventually serve as the "basic elements for an initial draft of the [human] connectome," my aim is to show how Stein creates microscopic, literary perspectives that showcase miniature neuron studies and larger connectivity maps.

By developing a literary form of clinical microscopy, she demonstrates upon Cajal's neurobiological discoveries and illustrates James's psychological principles, by using color words and other English symbols to construct 'brainbow-like' images of the brain's neural architecture and then using this colorful imagery to construct *human connectomes* in her modernist works. Livet et alia observe,

> Cajal revolutionized neurobiology when he used Golgi's silver stain to label small numbers of neurons in their entirety, thereby identifying the cellular elements of neural circuits. The small number of labelled cells, however, was also a limitation, because quantitative information such as divergence and convergence at synaptic relays was inaccessible. Efforts are presently underway to produce connectivity maps in which multiple, or even all, neuronal connections are rendered. Building such connectomic maps would be more straightforward with the equivalent of a multicolour Golgi stain that would allow many neurons within a single sample to be individually identified by virtue of a large number of cell-specific labels. (56; original spelling)

Perhaps by demonstrating the historical constraints and epistemological limitations inherent in her creative neuroscientific vision, the neuroanatomical imaginaries that Stein creates in *Tender Buttons* and *The Geographical History of America* contain only a small number of individually colored, neuron words.

From the publication of *Tender Buttons*, in 1914, leading up to the publication of *The Geographical History of America*, in 1936, Stein composed innumerable brain portraits, knowing that it was not possible for neuroscientists to stain individual neurons with distinguishable colors, so as to study them under a microscope or to create large-scale, connectivity maps with brain slices or brain sections that have been stained with conventional, nineteenth-century methods, such as the Weigert-Pal method, with Cajal's reduced silver nitrate method, or with Ehrlich's methylene-blue method. As Sporns and his colleagues point out, the "advantage of single (word) neurons is that the elements themselves are relatively easily demarcated and well defined." With such an approach, Stein could concentrate on delivering qualitative, phenomenological information about single neurons and their synaptic connections at the level of language's formal structures, rather than trying to deliver quantitative information about the kinds of "divergence and convergences" that are occurring between nerve cells at the level of their "synaptic relays." At the level of color signification, Stein could identify the "cellular elements of neural circuits," in much the way that Cajal did with Golgi's silver nitrate stain in his comparative studies of the cerebellum's nerve tissues, the retina's nerve tissues and the motor nerves.

3.6 The Modernist Brainbow and its Generative Functions

We know that there are innumerable ways that Stein could have been conceptualizing the relationship between the colored neurons in her literary portrait and their relationship to the brain's grey and white matter. The author's intentions are not that important, if we place the emphasis upon the reader's response to her enigmatic, cubist puns and their generative scientific meanings. With such a view, scientific historiography would take a back seat to literary theories of reader response and discursive performativity. Contrary to what Meyer has proposed in *Irresistible Dictation*, I do not think that Stein's present choices (of neuron color, or of brain mapping methods) not reflect her previous failure to comprehend the obscure brain stem tracts and to construct a three-dimensional model of the brain stem area for her graduation requirements. In *The Autobiography of* Alice *B. Toklas* Stein claims, "Observation and construction make imagination, that is granting the possession of imagination" (*The*

Autobiography of Alice B. Toklas 85). She also adds, "She [Gertrude] understands very well the basis of creation and therefore her advice and criticism is invaluable to all her friends" (85). Rather than representing the communicative capacities of nerve cells, as Meyers claims is the case with Stein's word neurons in "A Long Dress," I hold that *The Geographical History of America's* color words figuratively represent the colored neurons that belong to different brain regions and neuronal networks. In other words, I am proposing that the brain regions represented in these cubist portraits are generative entities, which stage different kinds of neural principles, perceptual principles and aesthetic principles through Stein's strategic use of ambiguous, performative and playful language.

Stein produced these ambiguous cubist brain representations deliberately, in my opinion; they are not "deliberate errors," as Meyer claims in his study, because her brain representations correspond with inherited and acquired, brain concepts that expose and actualize aspects of this author's creative mind. For example, the brain region that white and grey matter in the brain portrait from *The Geographical History* could be representing the cerebral cortex, the medulla oblongata, the brain stem, the spinal cord, or the cerebellum because there is white and grey matter throughout the human brain. It would be fitting if this white and grey cortical landscape represented this book's "little brain," or its "cerebellum," because that is figuratively and literally the case. If Stein had the cerebellum's neural structures in mind when she was composing this piece, then she may have wanted to represent how the grey and white matter looks within its lobes. In these lobes, the "white and grey" matter borders onto the triple layers of nerve tissue that consists of the granular nerve cells, the Purkinje nerve cells, and the basket nerve cells. In other words, the "cortical zone" is where the cerebellar nerve tissue borders onto the cerebellum's grey matter; if you look closely at the Brainbow photograph shown below and also consult with Cajal's observations about the separation of grey matter and nerve cells in the spinal cord, you will see that Stein has kept her cubist representation of the brain faithful to medical findings and neurophysiological facts. To make a point about the generic perspective perceptual principle from the standpoint of the Brainbow photograph and Cajal's illustration, I merely wish to state that Stein shapes color signifiers into ambiguous, neural architectures, as a means of creating the kind of tissue separation that we see in the photographs of the Brainbow-mapped dentate gyrus, cerebral cortex and hippocampus regions, or that Cajal and other neuroscientists observed in the lobes of cerebellum, in the spinal cord, and in other brain regions. See Figure 38, which is a Brainbow-mapped Cortex, Dentate Gyrus and Hippocampus, from the November 1, 2007 cover of Nature. © Jeff Lichtman Harvard University, 2007. The Brainbow-mapped cortical, gyrus and hippocampal regions in this photograph illustrate the "separation" between the different neuron layers that Cajal illustrated, with his written descriptions and hand-drawn pictures of the retina's triple-layered nerve cells and the cerebellum's triple-layered neural architecture, in "The Structure and Connexions of Neurons." Also see Figure 39, of the Brainbow-mapped Cerebral Cortex, Dentate Gyrus and Hippocampus, from the November 1, 2007 cover of Nature. © Jeff Lichtman, Harvard University, 2007.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 382 is Figure 38, which is a color photocopy of a Brainbow-mapped Cortex, Dentate Gyrus and Hippocampus, from the November 1, 2007 cover of Nature. This figure illustrates the dense, connectivity mappings at the level of the dentate gyrus, cerebral cortex and the hippocampus in a Brainbow mouse. It also illustrates the separation of colored neural tissue from gray matter, which Stein seems to be replicating or anticipating in her brain portrait in *The Geographical History of America*. The original source of this material is the November 1, 2007 cover of Nature. Vol. 450. The scientific research pertaining to the material in Fig. 39 comes from Livet et al, "Transgenic Strategies for Combinatorial Expression of Fluorescent Proteins in the Nervous System." 56-62. © Jeff Lichtman Harvard University, 2007.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 383 is Figure 39, which is a color photocopy of a Brainbow-mapped Cortex, Dentate Gyrus and Hippocampus, from the November 1, 2007 cover of Nature. This magnified image of Fig. 39 illustrates the connectivity mappings at the level of the dentate gyrus and the hippocampus in a Brainbow mouse. The original source of this material is the November 1, 2007 cover of Nature, Vol. 450. The scientific research pertaining to the material in Fig. 39 comes from Livet et al, "Transgenic Strategies for Combinatorial Expression of Fluorescent Proteins in the Nervous System." 56-62. © Jeff Lichtman Harvard University, 2007.

The human mind's neuroanatomical landscape thus uncannily resembles the image of the *brainbow* mouse hippocampus that was featured in the November 1, 2007 issue of *Nature*, in which "the multicolored neurons of the dentate gyrus … lie beneath the cells of the arching CA 1 region, while neurons of the cerebral cortex can be seen twinkling above." Looking at this imaginary neuroanatomical landscape from the perspective of the brainbow mouse hippocampus image, a series of color neuron words form a partial 'brainbow' above a "white and grey" cortical landscape. As Stein's narrator observes, "There is blue and green and green and yellow pale yellow and blue, there is pale yellow and green and blue yellow and blue, there is pale yellow and green and blue" glowing directly above the masterpiece's "mind" (120). *The Geographical History's* dissociative discourse directs our attention to these colors and to the tactile sensation of "warmth," before asking us to, "Please see my mind. It is here. Is white a color. Yes white and grey is a color. Grey and white is a color" (120). As with Lichtman and Sanes's photograph of the Brainbow mouse dentate gyrus and cerebral cortex neurons, Stein's modernist masterpiece pictures the mind's colorful words neurons against the background of the cerebral cortex's "grey" color palette. But whereas their photograph graphically illustrates how "the multicolored neurons of the dentate gyrus lie beneath the cells of the arching CA 1 region, while neurons of the cerebral cortex can be seen twinkling above," Stein's neuroimaging strategies serve to question the subjective phenomenology and the scientific knowledge that informs this creative representation of the brain's neural network architecture and this brain-like "human mind." Stein seems to be thinking along similar visual lines as the Brainbow scientists as well as Cajal, when she uses language to portray a triple-layered, multicolored neuronal network that borders on a white and grey, cortical landscape. Yet clearly, she wished to separate the colored neurons and grey matter in her neuroanatomical portrait of the human mind, as a means of advancing her own creative, neuroscientific vision of the brain's colored neurons, not because she wanted to illustrate the human version of the brainbow mouse's dentate gyrus (Broca's region), or because she wished to represent the seat of memory (the hippocampus), or because she wanted to represent the cerebral cortex (the seat of higher-order thought processes in humans). Though, conceivably, these might be brain regions that she is representing with her colored neurons and gray and white colored brain matter.

There is another kind of separation that occurs in her brain portrait between the colored word-neurons and the grey matter of the cerebral cortex. However, it is one that has more to do with perspective, than with color, language, grammar or structure per se. This shift in perspective and the ensuring separation between a microscopic and macroscopic level of observation occurs between the word "nature" and the sentence, "Please see my mind." Here, an *objective*, microscopic perspective separates the colored brain matter, or the colored word-neurons, from a *subjective*, macroscopic perspective that then proceeds to interrogate the human mind's grey and white colored, brain matter:

> There is blue and green and green and yellow pale
> yellow and blue, there is pale yellow and green and blue
> and warmth and there is not any such a thing as human
> nature.
>
> Please see my human mind.
> It is here.
> Is white a color.
> Yes white and grey is a color.
> Grey and white is a color. (120)

Note that it is a subtle shift in perspective, which creates the separation between the colored neurons and the grey matter in this brain region, or this brain portrait. The expletive 'There is,' connotes an objective perspective, whereas the pronoun "my" denotes a subjective point of view. In the first part of the portrait, there seems to be an objective observer or perspective that is being used, whereas in the second part of the portrait there are shifts between the subjective and objective points of view: "Please see my mind. It is here. Is white a color. Yes white and grey is a color" (poor grammar aside). Stein's portrait subject, the human mind, seems bewildered by its own neuroanatomical landscape and, yet, there is a complex structure to the neuroanatomical description that layers the multicolored neuron-words on top of the gray- and white-colored brain matter. Perhaps, for her own pleasure, Stein decided to add a degree of biological and structural realism to her neuroanatomical portraiture. One would assume that her aesthetic pleasure was an important factor, because it is not a given that any of her contemporary readers would have recognized that there were neuroscientific insights being encrypted at the level of a portrait's color signifiers, grammatical conjunctions, line spacing and metaphysical inquiries, even if her works call explicit attention to these unusual, neuroanatomical features.

Granted, it could be that Stein literally saw differently colored, single neurons comprising a neural network from a particular brain region or brain nuclei, within her creative imagination. If this were true, then the qualitative difference between the word 'blue' (and, also, the blue neurons) that she envisioned with her creative mind as part of this book's "human connectome" might be negligible, in terms of distinguishing between literal and figurative levels of conscious experience: both entities, according to James's psychological principles, ought to be classified as secondary qualities of conscious experience. That is, both entities – the linguistic entity that is the word ‘blue’ and the creative insight corresponding with the vision of the blue neuron in its neuronal network architecture -- would be considered by him to be important elements of the human mind’s subjective nature and equally important facets of its mental evolution.

If one is reading these neuroanatomical portraits as cubist allegories and as modernist brain maps, then it is possible to read microscopically and macroscopically, at once, without there being a contradiction between the functional, neuroanatomical and scientific meanings that are being signified, connoted and generated by such representational strategies. In order ‘to read’ some of the neurons in Detective Story number VII and to be appreciate their “finer connectivity patterns,” it helps if one can learn to read *microscopically*. That is, one must learn to read as if one’s eyes were looking through the magnifying lens of a powerful microscope at a chemically stained, brain slice or brain section, or possibly at a genetically engineered, brain slice or brain section. To understand how the color words “blue,” “green” and “yellow” could be representing individually colored neurons within a particular neuronal grouping or neural network, one must learn to read these color words *as if* one could see the brain’s individually colored neurons and cellular elements with the expert eyes of a neurobiologist or a neurologist. In order to appreciate the cubist pun that Stein is creating about the practice of ‘close reading’ with her microscopic perspectives and linguistic connectivity patterns, one can learn to read the human mind’s neuroanatomical imaginaries in ways that complement her neuraesthetic compositional practices while also interrogating her literary meanings and her scientific aims.

By layering the color words “yellow,” “green,” and “blue” into a poetic form that resembles the way the Purkinje cells, astrocytes and granule nerve cells appear within the concentric nerve tissue layers of the cerebellar lamellae, Stein achieves a special kind of neurobiological and neuroanatomical realism. Stein's brainbow-like image begins with two rows of color words that are layered on top of another row of non-color words to form three rows of neuron-words that are then completed with the dangling, single word 'nature' in the fourth row, as follows:

> There is blue and green and green and yellow pale
> yellow and blue, there is pale yellow and green and blue
> and warmth and there is not any such thing as human
> nature.

Because the human mind's color perception and visual phenomenology are being illuminated by Stein's grammatical display of layered neuron-words, the structural formation suggests another way of reading the blue, green and yellow colors of the human mind's neuroanatomical landscape. Read in this fashion, these color words portray the sensory neurons, or the eye's retinal nerve cells, except that we need to keep in mind that brain's colored neurons would be presented in a serialized and variegated fashion when viewed by a microscope, after the brain sections had been sectioned and stained. Note that Stein does not describe rows of similar colored neurons, only to stack these rows of similar colored neurons in a horizontal formation to illustrate their "medullation," with a row of blue word-neurons, then a row of green word-neurons, then a row of yellow word-neurons, if she was aiming to create a realistic picture of the neural structures that exist within the cerebellum, the retina, and parts of the brain stem. My point is that Stein utilizes only three colors, serializes these colors to form a neural network, and then layers these color words within the sentence form to simulate the appearance of 'myelinated' neural formations within the human brain.

Another possibility that I would like to consider is that she is envisioning different colored neurons in a neural network from a particular brain region or brain nuclei, and she is using her neuraesthetic writing practices to illustrate such a vision. This is how I conceptualize Stein's creative process of neuroanatomical portraiture: by translating the artificially and naturally pigmented neuron colors and colored brain matter that she envisions with her creative imagination and working memory into color words and other English signifiers, she transcribes the scientific insights, philosophical intuitions and artistic leaps that correspond with her medical knowledge of the brain's neural architecture onto her literary canvas through a process of consciousness translation, which occurs when she 'translates' her subjective experiences of her inner states of consciousness into enigmatic messages, dissociative phrases and cubist representational strategies. Assuming that this is kind of process that Stein follows in creating her brain portraits, her representation of the human mind's phenomenal experiences at the figurative level of the brain's colored matter and at the literal level of a text's color words exceeds the "prototypical" or "paradigmatic," phenomenal qualities that philosophers usually associate with the elementary qualities of conscious experience, such as the "grayness" of "gray" or the "painfulness" of "pain."[90] One way to fathom this neuraesthetic writing practice is to read the human mind's subjectively experienced and objectively described, neural architecture in a quasi-scientific, "experimental" fashion, from the perspective of a "brain based epistemology" (to use Edelman's term), which seeks to account for the 'evolution' of the human mind's neuroscientific insights, its creative acts and its philosophical inquiries.

Stein firmly believed that a person could never enter into the mind of another person, which is why her neuraesthetic writing practices could be conceptualized as "heterophenomenological" practices. In *The Geographical History* Stein writes, "there are no witnesses to the autobiography of any one that has a human mind" (90). Also, in her transatlantic phone interview with Robert Haas, she repeats this sentiment again: "Nobody enters into the mind of someone else, not even a husband and wife. You may touch, but you do not enter into each other's mind. Why should you?" ("Interview" 30). Regarding the importance of absolute clarity when it comes to representing the scientific insights and creative processes experienced as aesthetic feelings in phenomenal consciousness, Stein writes, "Clarity is of no importance because nobody listens and nobody knows what you mean no matter what you mean, nor how clearly you know what you mean. But if you have vitality enough of knowing enough of what you mean, somebody and sometime and sometimes a great many will have to realize that you know what you mean and no one will agree what you know, what you know you mean, which is as near as anybody can come to understanding anyone" (*Four in America* 128). If we embrace these views about the mind's subjective nature and extend them to a masterpiece's aesthetic consciousness, then perhaps the most we can hope to achieve is to read *as if* one grasps the creative mind's intuitive aims and scientific leaps. If one is reading allegorically, microscopically and experimentally, then perhaps, as Meyer explains could happen to anyone that was trying to analyze Stein's institutional correspondence and brain research from Johns Hopkins,

> one may find oneself feeling a little dizzy in trying to distinguish the *mind* of the observer from the slices of *brain* she is observing as well as from the textbooks she has *read* and which may have supplied her with knowledge of this region of the brain, not to mention the relation between brain and mind. Perhaps these entities are harder to

> distinguish than the *anatomical perspective built into Stein's instrument of choice at the turn of the century, the microscope*, would have one believe. *Resistance, then, to the dictates* of this perspective, a resistance that derailed the medical career the early successes at Harvard and Johns Hopkins had seemed to promise, at the same time started Stein on a literary career of deliberate error. (99; original emphasis)

With the cubist brain portrait from Detective Story number VII, Stein reveals that she has advanced her knowledge of clinical microscopy, neurological description and neuroanatomical examination, even though she has not stepped foot in a medical laboratory for roughly thirty years. Not only was she able to distinguish between the neurophysiological entities that comprise her scientific imagination and the anatomical perspectives that are being created at the level of her dissociative writing style, but, also, her neuroanatomical portrait reveals that she was able to distinguish between microscopic and macroscopic levels of neurological description, by virtue of the fact that she posits relations between colored neurons and colored brain matter, through an adept use of the English language. These writing practices exceed the purview of nineteenth-and twentieth-century medical knowledge. Detective Story number VII playfully showcases Stein's literary phenomenology, her neuroscientific insights and her creative metaphysics, when it calls attention to the colorful, neuroanatomical landscape of its "human mind." With this neuroanatomical portrait, Stein did not resist the "dictates of the [anatomical] perspective" that were "*built into Stein's instrument of choice at the turn of the century, the microscope*," as Meyer claims was the case with her brain research and laboratory studies at Johns Hopkins. The "first part" of her cubist portrait, beginning and ending with the sentence, "There is blue and green and green and yellow pale yellow and blue, there is pale yellow and green and blue and warmth and there is not any such a thing as human nature," serves as a microscopic and a microanatomical perspective, in which an omniscient narrator objectively describes a series of colored neurons for us, the book's readers. The macroanatomical level of cubist brain portraiture stages what appears to be an mental debate that is taking place between the human mind's subjectively experienced inner states of consciousness, as to whether or not there is a relation between the human mind and human nature at the level of the witnessed, brain colors.

The full title of this masterpiece –*The Geographical History of America or the Relation of Human Nature to the Human Mind* – uses the conjunction "or" to suggest that the 'relation of human nature to the human mind' will be a theme for this work. The title does not prepare the reader for the reverse scenario, which is that this book will be mostly be concerned with the human mind's non-relation with human nature and human nature's lack of a relationship with the human mind. There are hundreds of propositions in this book about the relation of human nature to the human mind, about the relation of human mind to human nature, about human nature's non-relation to the human mind, and about the human mind's non-relation to human nature. By making the non-relationship between human nature and the human mind pivotal to understanding the human brain's neural networks and phenomenal experiences, this book invites speculation as to how biological comparisons between animal nature and human nature, and between human minds and animal brains, might be opened up in a creative way to literary methods of neuraesthetic inquiry. Structuralism taught us that not all relations, substitutions, and reversals mean the same thing. By the same token, Wilder considers the debate that Stein conducts about the relation or non-relation that exists between human nature and the human mind in this masterpiece as a "creative metaphysics" that can be compared to the prophetic writings of Plato, Blake and Keats.

While it is premature to say that she completely resisted the limitations of the "anatomical perspective" that were associated with the experimental procedures of late nineteenth-century clinical microscopy, an invisible or imaginary, microscopic perspective could be an important literary contribution, one that defines this author's phenomenological explorations and her subjective phenomenology, as a pun about 'close reading' the brain's neurons for clues about one's scientific intuitions. Contrary to what Meyer claims, an imaginary *discursive* microscope seems to be the diagnostic, creative and neuroanatomical tool of choice for Stein, especially when she creates the human mind's neuroanatomical imaginary in this text. By the time that she published *Tender Buttons* in 1914, the microscopic perspective implicitly functions as a cubist perspective that transforms the dimensions of the neuroanatomical landscape, so that what we witness from one sentence to the next is the world of the micron-sized neuron in its interactions with other neurons, axons, glia and cellular elements. With *The Geographical History of America*, Stein created a cubist brain map that was not predicated upon "deliberate error," as Meyer claims, but which had the capacity to generate performative meanings and referential possibilities through the discursive deployment of metaphysical metaphors, introspective inquires, and textual puns.

The second level of neuroanatomical portraiture in Detective Story number VII consists of the human mind's phenomenological exploration of the "white" and "grey" colors that comprise its subjective nature and its neural architecture. This macroanatomical level of brain portraiture foregrounds an internal mental debate, which is taking place between passing states of consciousness, as to whether or not there is a relation between the human mind and human nature at the level of the human mind's subjectively experienced, brain colors. If Stein is caricaturing the nerve staining methods of her scientific predecessors and questioning their experimental laboratory practices and neurobiological discoveries with this brain map, then it is by generating multiple referents and a plurality of scientific meanings for the colored brain regions and neuronal networks that she is portraying with non-descriptive color signifiers, color relations and color experiences. In other words, I conceive of her color-coded cubist puns as indirect modes of literary parody that hold considerable scientific, philosophical and psychological value.

Stein stumbled onto an important field of brain research in the twenty-first century by practicing cubism in relation to, and in conjunction with, radical empiricist psychology: namely, she visualized the transgenic color mapping of the brain's neuronal networks and synaptic connections. With these neuraesthetic conceptual tools, she foresaw the acrimonious, scientific debates and philosophical arguments of the twentieth-century, concerning the neural correlates of conscious experience. In *The Geographical History of America,* Stein examines the ineffable relationship that exists between the brain's colored matter and the mind's phenomenal experiences by asking her readers to consider the metaphysical properties, literary qualities, phenomenal experiences and physical characteristics of the human mind's subjectively experienced, neuroanatomical landscape at the level of six distinguishable colors: blue, green, yellow, pale yellow, grey and white. Her dissociative discourse explicitly calls the reader's attention to this masterpiece's brain imagery, subjective phenomenology and creative metaphysics, when it suddenly pleads for recognition from a first-person perspective, "Please see my human mind. It is here. Is white a color. Yes white and grey is a color" (120). With these statements, Stein suddenly reveals to her readers that this book has a brain-like "human mind." The reader is asked observe the brain's outward appearance and to identify its obscure neuroanatomical structures by visualizing its "grey" and "white" colored brain matter, to note its spatial boundaries ("I am here") and to participate in its higher-order thought processes ("Is white a color. Yes white and grey is a color. Grey and white is a color"). By giving the "human mind" of this masterpiece a subjective phenomenology with the pronoun "I" and a definite spatial presence with the phrase, "I am here," this book draws explicit attention to the relation that exists between the human mind's subjective phenomenology and its neuroanatomical features.

Here, then, are some of the reasons why this neuraesthetic composition ought to be thought of as an important contribution to modernist literature. First and foremost, it delivers a form of brain-based, discriminative forms of knowledge that is valuable to literary critics and scientific historians alike. In *Second Nature* Edelman explicates the meaning of this consciousness based discriminative knowledge from a neuroscientific standpoint: "The brain structures and dynamics leading to such [phenomenal] properties [like color discrimination] *are* scientifically describable, even if the properties themselves cannot be fully reduced" (146; original emphasis). In his opinion, "Similar considerations apply to the cultural exchanges that give rise to art and to ethics, the relationships of which are not entirely subject to rigorous scientific reduction. No limitation of our potential is implied by this view. Creative matching of social experience, developments in art, and expansion of our knowledge in all spheres [has] no obvious limit. Globally speaking, scientific observations and theory can provide descriptions of the brain events that result in such activities" (146). Noting that he "follow[s] in the footsteps of William James, who pointed out that consciousness is a process whose function is knowing" (4), Edelman adds, "Science is imagination in the service of verifiable truth. And as such, imagination is actually dependent on consciousness. Science itself is so dependent. As the great physicist Erwin Schrödinger observed, no scientific theory in physics includes sensations and perceptions and to get ahead it must therefore assume these phenomena as being outside of science's grasp" (8). In chapter thirteen, which also is entitled "Second Nature," Edelman argues,

> it is important to recognize the priority of experience in giving rise to the [scientific] descriptions that illuminate the bases of that experience itself. Once higher-order consciousness and language operate recursively to connect thought, emotion, memory, and experience, the number of discriminative combinations [within the mind's "qualia space"] grows without bound. We move in corridors of the mind ranging from the certainties of mathematical insight to the fantasies of *A Midsummer's Night Dream*. Often, the parts of our second nature that seem to deviate from the truth are just those necessary to establish new truths. But, of course, they are not sufficient. Various criteria must be applied to establish each kind of truth. The main point is that truth is not a given, it is a value that must be worked for during our personal and interpersonal interactions. The richness of those interactions is no surprise given the associativity and degeneracy of reentrant interactions in the brain. If, in our scientific descriptions of world events and of consciousness, we do not duplicate either the events or the experience, is that personal experience a form of knowledge? Given the range that is covered by higher-order consciousness and despite its subjectivity, we must admit that qualia are indeed discriminative forms of knowledge. By including myriad possibilities of pattern recognition, metaphor, and complexity, such knowledge goes beyond the formalities of justified

> true belief. If we adhere to this language game, we must qualify the connection between knowledge and truth. In this view knowledge and truth are not the same. Taking this position would admit that individual creative experience and even psychiatric alterations are kinds of knowledge. Certainly the exchanges in reacting to art can be so considered. Admittedly, while realizing various aspects of truth as they emerge during inter[-]subjective exchange, we are inclined to discount or at least limit such a broad view. (150-151)

Stein's neuroanatomical landscape certainly would not "prevent us," Edelman stresses, "from studying [the] neural correlates of consciousness" (*Second Nature* 144); though, to be sure, we would need to distinguish between scientific truth and subjective knowledge before proceeding to analyze the 'creative experience' that gives rise to endless discriminative combinations and neurophysiological referents in a multidimensional "neural space" or "qualia space" (Edelman and Tononi, *A Universe of Consciousnesss* 164). The cubist puns in Stein's brain maps thus act as way for her to create innumerable, qualitative discriminations and neurophysiological referents, while exploring the literary portals of core consciousness and phenomenal consciousness.

To understand this cubist brain portrait from the standpoint of Edelman's "brain-based epistemology," and from the perspective of Stein's nineteenth-century "brain-based epistemology," one can learn to appreciate the kinds of color experiences that Stein was trying to re-produce for herself and her readers, the experiences that Zeki says can "only … be fully understood in neural terms." In *A Universe of Consciousness* Edelman and Tononi explain that the "flattened dome of the sky and the hundred other visible things underneath, including the brain itself – in short, the entire world – exist, for each of us, only as part of our consciousness, and they perish within it. This enigma wrapped within a mystery of how subjective experience relates to certain objectively describable events is what Arthur Schopenhauer brilliantly called the "world knot." This observation is based upon the neurophysiologist Sherrington's nineteenth-century writings, and it must be noted that he found the brain's workings to be inexplicable from the perspective of conscious experience. "Despite the appearance of mystery," Edelman and Tononi state, "the best hope of disentangling this knot will come from a scientific approach that combines testable theories and well-designed experiments" (2). When working with "brain-based epistemologies," Edelman further argues in *Second Nature*, it matters greatly whether we "arrive at knowledge, whether by scientific inquiry, by reason, or by happenstance. Wrongheadedness, severe reductionism, or insouciance can each have unfortunate long-range consequences for human welfare. This book is the result of a line of thought leading to what I have called brain-based epistemology. This term refers to efforts to ground the theory of knowledge in an understanding of how the brain works. It is an extension of the notion of naturalized epistemology, a proposal made by the philosopher Willard Van Orman Quine. … I believe that above all, it is particularly important to understand the basis of consciousness" (2-3).[91]

The second, important thing that Stein's brain portrait is to explore the "neuroanatomy of consciousness" from the standpoint of playful language. "The first fact" we need to know about consciousness, Antonio Damasio claims, "is that some aspects of the processes of consciousness can be related to the operation of specific brain regions and systems, thus opening the door to discovering the neural architecture which supports consciousness. The regions and systems in question cluster in a limited set of brain territories and no less so than with functions such as memory or language there will be an anatomy of consciousness" (*The Feeling of What*

Happens 15). *The Geographical History of America's* dissociative style implies that there is an operational "*core consciousness*" is capable of exploring the brain's qualic sources, neural architecture and neurophysiological mechanisms from the perspective of colourful language (Damasio 16). As Damasio puts it,

> consciousness is not a monolith, at least not in humans: it can be separated into simple and complex kinds, and the neurological evidence makes the separation transparent. The simplest kind, which I call *core consciousness*, provides the organism with a sense of self about one moment – now – and about one place –here. The scope of core consciousness is the here and now. Core consciousness does not illuminate the future, and the only past it vaguely lets us glimpse is that which occurred in the instant just before. (16; original emphasis)

In the nineteenth-century, James defined the temporality that corresponds to "core consciousness" as the "continuous present." Understood in the context of Stein's dissociative writings, Meyer observes that the continuous present of literary creation creates an open-ended experience of the relations that exist between human nature and the human mind:

> It was to the human mind that Stein attributed the self-conscious experience of an extended or continuous present, a sense of oneself that wasn't limited by the dictates of an ever-advancing or ever-retreating time as well as a deterministic human nature. The human mind no more precedes or *causes* human activity than emotions determine their apparent symptoms. Instead of requiring a dualistic explanation, mental and emotional experience might be understood as operating in terms of the nonvitalist organicism in Stein's automobile simile, not as a "contradiction but a combination. (*Irresistible*

Dictation 116)

The human mind that is being represented through the time frame of the "continuous present" in this brain portrait is thus always already implicated in a evolutionary time loop, by which it becomes possible for the brain's "spontaneous variations" to spark the mind's creative thought processes, be they scientific insights, literary prophecies or philosophical intuitions, which, in turn, transform the brain's organic matter and molecular mechanisms through the literary practice of "psychogenesis."

With respect to developing a "brain based epistemology" that comprehends the relation between creative experience and scientific knowledge as a form of qualitative discrimination and neurophysiological exploration, Edelman asks us to consider the following scenario: "suppose an individual actually knew in detail how his or her brain works. Would we expect that person to abandon his or her reaction to others in terms of propositional attitudes—beliefs, desires, and intentions? I think not. But knowledge of the workings of the brain might at least give that person the ability to reject preposterous assumptions and cant" (151-152). In the next chapter, I consider the broader implications of Stein's brain-based knowledge and its impact upon her "strange literary forms," by looking at the three-dimensional model of the medulla oblongata that she produced in medical school as a possible, conceptual model for *The Geographical History of America's* brain portrait. Even though Stein uses a much more limited range of colors than Picasso does when he writes with color words to express his cubist vision of the seen and unseen world, she uses color words in ways that he did not even dream of doing: to generate brain maps that visualize the complex relations that exist between different neural networks, synaptic connections and cellular structures.

With the cubist pun serving as a generative, semiotic process and performative, linguistic construct within her literary neuroanatomical portraits, Stein does not need to foreground her previous laboratory experiences, microscopic analyses and brain dissections at Johns Hopkins Medical School directly. Instead, she advances her latest neuroscientific insights about future neuron coloration strategies and microscopic imaging techniques indirectly, by illustrating their performative qualities and semiotic virtues, at the level of the represented brain's neural structures. Through a dissociative writing style that redeploys James's psychological theories and Picasso's portraiture techniques for the purposes of neuroscientific exploration and literary experimentation, Stein arranges her color neuron-words on the written page, so as to explore the possibility of creating other neurophysiological realities, neuroscientific methodologies and neuroimaging techniques with the English language. Her cubist brain portrait is a "master-piece," precisely because it does not "remember" past neuroanatomical experiments, clinical procedures and microscopic analyses. Or, at least, it does not recall these past scientific experiences with ordinary, narrative memory. It is not an "identity," even if it illustrates the human mind's subjective phenomenology with introspective, ego-centered linguistic abilities. Yet, remarkably, there is no "human nature" to speak of, even though the human mind resembles the human brain in many ways.

In this century, we distrust the word "masterpiece" because we reserve it for artistic works displaying consummate skill above all others; a masterpiece is supposed to be a "production that surpasses all others in excellence by the same hand," according to the *Oxford English Dictionary*, or a work of art that possesses a "particular kind of excellence" (1045). Stein does mean the word in these conventional senses, when she uses it to describe her modernist writings; but she also uses the word "master-piece" to describe the ways in which an writer masters the pieces in a particular work by losing identity, memory and human nature in those discursive pieces. *The Geographical History of America* is a literary masterpiece, because this book contains the first, 'modernist brainbow.' Figuratively speaking, we could say that this book actually contains many 'modernist brainbows,' which neuraesthetic readers can generate in the form of innovative, neural maps and brain-based, interpretative strategies.

The evolution movement would be a simple one,
and we should soon have been able to determine
its direction, if life had described a single course,
like that of a solid ball shot from a cannon. But it
proceeds rather like a shell, which suddenly bursts
into fragments, which fragments, being themselves
shells, burst in their turn into fragments destined to
burst again, and so on for a time incommensurably
long. We perceive only what is nearest to us, namely,
the scattered movements of the pulverized explosions.
From them we have to go back, stage by stage, to the
original movement. Henri Bergson

Such is the human ontological imagination,
and such is the convincingness of what it
brings to birth. Unpicturable beings are realized,
and realized with the intensity almost that of a
hallucination. They determine our vital attitude
as decisively as the vital attitude of lovers is
determined by the habitual sense, by which each
is haunted, of the other being in the world.
William James

There is no use in telling more than you know,
no not even if you do not know it. Stein [92]

Toward a Literary Science of the Reading Brain: The "Medulla Oblongata's "Intricacies" and Stein's "Strange Literary Forms"

4.1. Lewellys Barker and Gertrude Stein: Finding the Brain's 'North Passage'

In *Time and the Physician*, Dr. Lewellys Barker states that he had "often wondered whether [his] attempts to teach [Gertrude Stein] the intricacies of the medulla oblongata had anything to do with the development of the strange literary forms with which she was later to perplex the world" (60). Perhaps it is because he can find no other place to showcase this gem of an idea that he simply inserts it into a narrative that is ostensibly about his "Study in Europe." Though this statement about Stein's "strange literary forms" seems out of place, the thought is so fleeting that many of his scientific readers probably never gave it a second thought. For certain readers, it matters a great deal that one of Stein's anatomy professors from Johns Hopkins makes an explicit link between his medical pedagogy, her brain stem research and her modernist writings. In the context of his medical memoirs and autobiographical recollections, this comment about Stein's "strange literary forms" and their scientific provenance functions as more of an aside, than a direct challenge or a carefully considered proposition. Freud would have been interested in the melancholic forms of symptomatic, institutional, scientific and social expression that Stein's modernist writings exhibited through Barker's medical pedagogy. But this is another topic to explore, not the one that I wish to pursue in this chapter.

Barker's passing comments about Stein's brain stem research are central to my study of Stein's twentieth century neuraesthetic writing practices and brain mapping practices. In recording his hunches about the possible connections that exist between his medical pedagogy and Stein's literary writing, Barker hints that such relations might be worth exploring by those who possess the inclination, knowledge and patience to do so. Though I come lately to this task, I entirely agree with his scientific intuitions. I believe that Barker's instruction in the subjects of histology, biology, neurology, and anatomy may have inspired Stein to create a series of colorful brain maps. In turn, these allegorical brain maps may have enabled her to explore the medulla's relation to other brain regions that are involved in the act of reading and in the science of the reading brain. Though arriving a different set of conclusions about Stein's her neuraesthetic compositions and her science of reading, Meyer believes something similar about Barker's medical pedagogy and its effects upon Stein's creative writings. For instance, he also emphasizes that Barker never forgot Stein: "Forty years later in his autobiography, Barker recalled Stein as having been among the first batch of medical students to whom he taught "modern neurological histology," or the neuroanatomical structure of animal and plant tissue" (78-79). In agreement with Meyer's scholarship, I believe it was because Stein was so frustrated with the limitations of late nineteenth-century clinical microscopy, experimental brain science, and the general practice of medicine that she created esoteric brain maps, as a means of conducting secret operations, experiments and procedures away from the prying eyes of her previous medical professors and the general public. As we have seen, Stein developed introspective, generative and objective modes of cubist portraiture that could be used for different kinds of neuroscientific, philosophical, aesthetic and psychological inquiry.

But this is not all that she achieved with her neuroanatomical portraiture: her interest in evolutionary science and its speculative solutions led her to investigate the genetics of language, consciousness evolution and human creativity in *The Geographical History of America or the Relation of Human Nature to the Human Mind.* In this book, researched during Stein's lecture tour of the United States in 1934 and 1935 and published in 1936, Stein explores the effects certain, genetic mutations and evolutionary processes have upon human nature and the human mind, by telling stories about the evolution of reading, writing, language, communication and masterpiece creation, over the course of human history. The question that Stein poses from a number of different perspectives in *The Geographical History of America* can be phrased in the following way*:* Is it possible for literary masterpieces to indirectly express the genetic codes of the human brain by creatively representing the disconnected relationship that putatively exists between human nature and the human mind? Like most of the masterpieces that Stein wrote during her career, *The Geographical History of America* features a dissociative writing style that many literary scholars over the past century largely have attributed to James's psychological teachings, Pablo Picasso's cubist views, and Henri Bergson's philosophical views. Naturally, there were other important influences that informed Stein's modernist representations of the human nervous system, such as the neuroanatomical training that she received at Johns Hopkins Medical School, from 1897-1902, under the direction of Dr. Franklin Mall and Dr. Lewellys Barker. Because of her background in comparative neuroanatomy and human embryology at Johns Hopkins, Stein was able to comprehend the brain's evolutionary processes and its neurodevelopmental mechanisms better than most of her literary peers. The problem is, of course, that her cubist portraits look like a "buzzing blooming confusion," to use James's expression. In this chapter, I will explain how it is possible to view the three-dimensional model of the brain that Stein built for her medical professors at the end of her program as a model that is relevant to the science of the reading brain and its neural principles of sensory mapping. To put this simply, this is because Stein's research on the medulla oblongata's nerve tracts and brain nuclei was part of a larger research project with Barker that sought to understand the brain's somatosensory neural networks, its language connections and its reading circuits through the obscure vantage point that is called the nucleus of Darkschewitch.

First, I will explain how the color signifiers that signify sensory experiences and sensory neurons at the level of a text's imaginary nervous system also may be representing the medulla oblongata's "intricacies" and their relation to the act of reading, to the science of reading and to the reading process that is thwarted by Stein's neuraesthetic writing processes. By supplementing Meyer's neuraesthetic model of reading with the brain mapping strategies provided by the "Brainbow system," I am encouraging others to create their own neuraesthetic models of reading, so that it is not simply a matter of *neuraesthetically reproducing* her "study of the relation of words in meaning sound and volume" in ways specified by the compositions themselves," as Meyer claims, but also of accounting for unexpected, cultural meanings that a reader can generate in relation to a masterpiece's colorful brain maps and their obscure, neurophysiological entities. Speaking on my own behalf, it was not until Jeff Lichtman, Joshua Sanes and Jeff Livet of Harvard University published the Brainbow photographic images, in the fall of 2007, that I was able to comprehend the neuroscientific significance of Stein's neuron-coloration experiments in *Tender Buttons* and *The Geographical History of America*. However, there are many other ways of interpreting Stein's contributions to the discipline of neuroesthetics: the science of the reading brain and the science of the sensory homunculus are two such ways of approaching Stein's literary brain maps and of incorporating other kinds of knowledge into our reading practices.[93]

In 1899, Barker published a medical textbook that was entitled *The Nervous System and its Constituent Neurones*. Along with many other cutting-edge medical studies of the central nervous system, this book contains Stein's neuroanatomical description of the midbrain region that consists of the red nucleus, the nucleus of Darkschewitch, and the nerve tracts known as the fasciculus longitudinalis medialis. Barker had hoped that the small nerve bundles associated with nucleus of Darkschewitch, which are known by their Latin name as the fasciculus longitudinalis medialis, could be tracked into the hypothalamus and perhaps even into the cerebral cortex, so that it would be possible for his team of graduate researchers to establish the somatosensory links between the lower brain stem, the midbrain, the cerebellum, the thalamus and the cerebral cortex. In the chapter that is dedicated to the fasciculus longitudinalis medialis (which are also known as the medial longitudinal fasciculus), Barker writes, "Especially conflicting are the views which have been held concerning the relations to the nucleus of Darkschewitch, and to the gray matter of the hypothalamic region. It would be unfruitful to discuss at length, in the present state of our knowledge, the various theories which have been advanced. I shall restrict myself, therefore, in the main, to a mere statement of the results of my own studies, and of those of Miss Sabin and Miss Stein, who have especially studied this region" (721). In 1897 and 1898, Barker heavily depended upon Stein and a senior graduate student, Florence Sabin, to produce original research about the medulla oblongata, pons and midbrain, because, as he notes, the research that did exist offered conflicting views of this brain region and its neuronal connections to other important, brain regions.

By comparing the brain stem research that Barker, Sabin and Stein conducted with the neuroanatomical research conducted by their European and American contemporaries, it is possible to speculate about the ways in which Stein portrayed this scientific knowledge and her own neuroscientific insights at the level of language, within her cubist brain maps. However, I will focus instead on how she uses this knowledge to produce a three-dimensional model of the midbrain, nucleus of Darkschewitch and the surrounding region that articulates her embryonic vision of the brain's somatosensory networks, language centers and reading circuits.

Stein's neuroanatomy professors, Dr. Franklin Mall and Dr. Lewellys Barker, considered her contributions to the study of the nucleus of Darkschewitch and its nerve tracts to be important, original and brilliant by the standards that were being set in the discipline by scientists, as von Kölliker, Held and van Gehuchten. As Barker puts it, "The best Golgi studies of this region [containing the nucleus of Darkshewitch] are those of Held and van Gehuchten. The comparative anatomy is dealt with by Edinger. A full description, which, however, is not satisfactory, is given by von Köllicker" (725). At this point in his argument, Barker states, "Miss Gertrude Stein, who is now studying a series a sagittal sections through this region from the brain of a babe a few weeks old, describes the nucleus of Darkschewitch as follows" (725). Clearly impressed by Stein's neuroscientific findings and her research abilities, Barker defers to Stein's specialized knowledge of the nucleus of Darkschewitch, by publishing her description of this brain nucleus and surrounding midbrain region of the medulla oblongata in his textbook, *The Nervous System and Its Constituent Neurones* (1899). Stein presents the following information about the nucleus of Darkschewitch's basic neuroanatomy:

> The nucleus is more or less conical in shape. It lies dorso-medial from the red nucleus, being about as thick in a dorso-ventrical direction as is the dorso capsule of the red nucleus in which it lies. At this period of medullation the commissural posterior cerebri, considered simply topographically (that is, as a medullated fibre-mass

> without particular reference to the course of the fibres), appears as a dorso-ventral bundle, solid in the middle, subdivided dorsally into an anterior (proximal) portion and a posterior (distal) portion, while ventrally it expands in the form of a hollow pyramid, which rests directly upon the nucleus of Darkschewitsch. (725)

From this description, we can draw numerous inferences about Stein's neuroscientific insights and medical abilities. It is difficult to tell *exactly* what Stein knew about the experimental nerve tissue staining practices and the three-dimensional brain modeling practices of her fellow graduate students, medical professors, and neuroscientific contemporaries. I leave it to Barker to explain the neuroscientific significance of Stein's research findings and to judge the originality of her contributions to medical science. Stein's brain stem research is part of Barker's larger research project, which seeks to track the nerve connections between different parts of the brain and understand their functional mechanisms:

> The upward continuations of the fasciculus longitudinalis medialis, which could be looked upon as being concerned in the conduction of sensory impulses toward the somaesthetic area of the cortex, are not at well understood. So far as we can find in serial sections through the baby's brain cut in all three dimensions of space, it is not possible to follow any direct upward continuations far into the hypothalamic region, and if the fasciculus longitudinalis medialis is to be regarded as one of the paths mediating sensory impulses on their way to the cerebral cortex, this path is almost certainly interrupted in the hypothalamus or thalamus. (726)

In this regard, Barker's report speaks volumes about Stein's precise knowledge about the *basic neuroanatomy* of the nucleus of Darkschewitch and the surrounding midbrain region near the red nucleus. However, he does not reveal much about her grasp of the functional neuroanatomy of this brain region and its constitutive neurons; nor does he tell us much about her knowledge of the medulla's neural connections to other brain regions, such as the cerebral cortex, the thalamus, the hippocampus and the cerebellum, though this can be deduced from his many references to this research aim in his medical textbook.

Stein's directional terms and neurological descriptions do not give us much of an idea as to what she may have thought, at the time, about the naturally pigmented brain nuclei, and this is unfortunate because she continues to write about these colored brain nuclei and their sensory qualities long after she abandons her medical studies at Johns Hopkins. We do know, from various sources, that she was required by Franklin Mall and the other professors at Johns Hopkins to examine the sagittal sections of a six-month old, infant's midbrain section under the microscope and she was required to construct a three-dimensional model of this region, in order satisfy her program requirements. We can deduce, from Barker's medical writings and Sabin's report on the construction of her three-dimensional model of the medulla, pons and midbrain, that Stein's microscopic analyses of the medulla's brain sections likely involved the application of chemical stains to nerve tissue samples and her three-dimensional modelling of the brain region involved close manual work with chemically stained brain slices and brain sections. Though her description of the nucleus of Darkschewitch does not reveal what she may have thought about the naturally pigmented brain nuclei, outside of their structural relations with other brain nuclei and nerve tracts in the upper midbrain region, it does provide an empirical foundation for understanding the brain research that she conducted at Johns Hopkins from 1897 to 1902. Even though we do not know what conclusions she may have drawn about the functional morphology of the brain nuclei that she was examining, her published description of this region provides evidence of her scientific abilities that can be used in comparison with other studies, such as Florence Sabin's neuroanatomical study of the medulla, midbrain and pons, which was published in *Contributions to the Science of Medicine* by the Johns Hopkins Press, in 1900.

4.2 Stein's "Sensory Homunculus" and its Allegorical Meanings

To qualify for graduation from medical school in June of 1902, Stein was given the task of dissecting, describing and modeling the midbrain region containing the nucleus of Darkschewitch for Dr. Franklin Mall, her anatomy professor. I believe that Stein deliberately botched her three-dimensional model of the brain stem region surrounding the nucleus of Darkschewitch for a number of reasons: first of all, she did not have enough time to complete an exhaustive investigation of the medulla oblongata's "intricacies." According to Sabin, Stein had a few months to complete the task, but this amount of time would not been enough for her to construct the kind of three-dimensional model that would have passed Mall's examination and satisfied the program requirements. If the historical records and the witness reports are correct, it took Florence Sabin a full year to complete her three-dimensional model of the medulla, pons and midbrain, whereas Stein only had a few months to do the same amount of research and work. Secondly, it seems that Stein knew the construction of a model that linked the fasciculus longitudinalis medialis nerve bundles of the medulla with the somatosensory nerve tracts of the thalamus and cerebral cortex was an impossible task. If she thought of Barker's research as a hopeless scientific endeavor, she may have decided it was best resume her graduate studies in the fall, with a different research project. Despite her interest in continuing with her studies in comparative neuroanatomy and "pathological psychology," Stein likely realized the three-dimensional model she was creating already existed in some form, since Sabin had produced one the year before. Hence, she might have known that it was impossible to construct such a model in such a short period of time, without additional assistance and further academic resources.

During the research process that preceded the construction of the three-dimensional model, Stein admitted to having problems conceptualizing the neural structures of the brain stem region for her three-dimensional model: "I had so much difficulty in understanding the conditions that I felt such a clarifying process to be much needed. Not that the books do not tell the truth as I know it but that they tell so much that one is confused. By my series of recapitulations and a pretty careful selection of sect[i]ons I felt that I had to a certain extent accomplished this." To these statements, which partially explained her unsatisfactory results and her confusion, she appended the following explanations in her letter [to Barker]: "Of course of such a matter I am not the best judge. My object has been to save the next man from a long p[re]lim[i]nary work" (Meyer, *Irresistible Dictation.* 93). In spite of the trouble that Stein admits to having when conceptualizing the midbrain region that surrounds the nucleus of Darkshewitch, she nevertheless asserts, "I have endeavoured to expres[s] a very clear image which exists in my own mind of a region which the existing literature of the subject leaves in a hopeless mess. My drawings are of course very much more diagrammatic than von Kolliker's but … they clearaway the underbrush and leave a clear road" (Meyer 93).[94]

From these remarks to Barker, we can see that Stein tried to use "clear image[s]" from her mind to construct her three-dimensional model of the midbrain's neuroanatomical structures. The difference between the *written*, neurological descriptions that Stein produced in medical school and the cubist neuroanatomical portraits that she writes after medical school is that, with the latter, she manipulates the English language to portray brain regions that she sees clearly in her mind. We could say that all of Stein's brain representations, with the exception of the one that Barker published in his book, function as allegories. It seems to me that Stein created a special kind of *sensory homunculus* for Franklin Mall, a three-dimensional homunculus that represented Barker's aspirations of connecting the medulla oblongata, the nucleus of Darkschewitch and the fasciculus longitudinalis medialis, through the neural pathways of the brain stem. Rather than seeking to reproduce the exact structures of these brain regions, as Sabin did with her model, she produced a sculptural, brain allegory that represented her concept of the amount of cortical area that would be dedicated to the cortex and thalamus's somatosensory inputs, thereby representing her vision of the kinds of neural connections that would be available to the thalamus's somatosensory neurons via the spinal cord and the medulla oblongata. According to David G. Amaral,

> The [sensory] homunculus is a way of illustrating the location and amount of cortical area dedicated to a particular function. The entire body surface is represented in an orderly array of somatosensory inputs to the cortex. The area of cortex dedicated to processing information from a particular part of the body is not proportional to the mass of the body part but instead reflects the degree of innervation of that part. Thus the sensory input from the lips and hands occupies more area of the cortex than, say, from the elbow. Output from the motor cortex is organized in a similar fashion; the amount of surface dedicated to a part of the body is related to the

> degree of motor control exercised in that part. Thus, in humans much of the motor cortex is dedicated to moving the muscles of the fingers and the muscles related to speech. ("The Functional Organization of Perception and Movement," Figure 18-6; 344)

See Figure 46: A.) Sensory homunculus and B.) Motor Homunculus, from Figure 18-6, in David G. Amaral's "The Functional Organization of Perception and Movement" (*Principles of Neural Science* 344).

Material has been removed from this thesis because of copyright restrictions. The material removed from page 416 is Figure 40, which is a color photocopy of David G. Amaral's models of a sensory homunculus and a motor homunculus. These figures have been adapted from Penfield and Rasmussen's 1950 models. Figure 46 contains information about the role that Stein's three-dimensional model of the midbrain played, in a figurative sense, as a 'sensory homunculus,' which reflected the complex nature of her brain research at Johns Hopkins Medical School and appears to be the prototype for some of her twentieth-century neuroanatomical imaginaries. The information contained in Figure 18-6 comes from "The Functional Organization of Perception and Movement." The source of this material is David G. Amaral, "The Functional Organization of Perception and Movement." Principles of Neural Science. 4th ed. Ed. Eric R. Kandel, et al. New York: McGraw-Hill, 2000. 344. (Adapted from Penfield and Rasmussen 1950).

Commenting on the ideological and cultural significance of Warren Neidich's Homunculus Drawing, Bryson writes, "Though the "homunculus" may lack the harmony and grace of the classical image of man, its capacities for shape-shifting and self-transformation give it a new range of powers" (19). Operating as a neural figure, or a "neural interface," that represents radical forms of institutional subversion and ideological resistance, the homunculus can be conceptualized as a neuraesthetic art form that "directly accesses the inner activity of the brain" and has "the potential to create [a] new configurations of image, space, and time, to forge new pathways within mind/world nexus," Bryson claims. "In the older, archaic picture of the coercion of the cultural subject (Marx, Freud, technological determinism)," he adds,

> it was assumed that the subject could be mapped, interpellated, and manipulated – that the subject of ideology could be made uniform and acquiescent. Neidich presents a different conception of freedom, in which the subject of culture has the ability to remap itself, rewire itself, and assume forms so creative and protean that it will always outrun the forces that seek to limit its plasticity. In a sense, the image of the body that is sketched here is invulnerable and indestructible – even trauma and amputation cannot irreversibly damage the neural body, since its basic plasticity allows it to regroup and reorganize its pathways of association and combination into new, unforeseen morphologies. (19)

Like Bryson and Neidich, I view Stein's "sensory homunculus" as a figure of institutional and ideological resistance, as a protean form that has the capacity to remap itself in Stein's dissociative writings and her readers' associative pathways.[95] The three-dimensional brain model that Stein created for Dr. Franklin Barker at Johns Hopkins serves as a special kind of "sensory homunculus" because it allegorically represents the scientific desires of the two anatomy professors at Johns Hopkins, Barker and Mall, who devoted themselves to studying the medulla oblongata's basic and functional anatomy, with the greater aim of understanding its connection to other brain regions and their somatosensory functions. Viewed from this perspective, Stein's three-dimensional brain model qua sensory homunculus caricatures Barker's scientific desires and his medical research, particularly his desire to find the neural pathways between the brain stem and the somatosensory cortex.

The sensory homunculus, or the 'little man,' that Stein's brain model allegorically represents with its unrealistic (i.e., surreal) connections between the spinal cord and the cerebral cortex cryptically shows how institutional practices and professional desires can be subverted with the special kind of neural configurations and bodily mappings that are proper to normally functioning human brain. As Neidich observes, "The somatosensory cortex, through which all sensory information concerning touch is routed, is located in an area called the post-central cortex. What's truly fascinating and wonderful about this area is that it is constructed as a *homunculus*: a little man … In this homunculus, the surface of the body is not represented by square inches of peripheral skin area, but by degree, density, and character of innervation. Thus the face, the hand, and foot areas are intensely represented, well beyond what would be expected by physical area alone, but in accordance with their sensitivity to touch and need for dexterity" (*Blow-Up* 154). Neidich and Bryson both underscore that the absurd figure of the sensory homunculus can be remapped and reconfigured by artists and writers, so as to reproduce the brain's naturally occurring, phantasmatic sensory forms in a wide variety of aesthetic, discursive and cultural contexts. These remapped neural configurations can and do generate subversive, neuraesthetic meanings for the human body and for the human mind. As Neidich notes, "The representation of the hand coming out of the cheek, or the simultaneous stimulation of the heel during defecation and micturation, resonates from annals of surrealist manuscripts like "the exquisite corpse." By making the link between the brain's somatosensory brain function and the representation of the distorted human body in avant-garde painting, sculpture, cinema, photography and writing impossible to ignore, Neidich highlights the process of neural remapping as a kind of "neurobiological collage" (155). In the cubist portraits that I am studying, Stein's "neurobiological collage" consists of many experimental writing strategies, which include but are not limited to the strategic deployment of color signifiers, described sensations, perceptual principles, and brain representations. "Color combination, repetitive elements, structural integrity and spatial distance each have distinctive temporal dimensions," Neidich points out. Additionally, he observes that,

> [d]uring critical periods of neural development, the nervous system is pruned by these external relations. Changing external relations are recoded in the brain as reconfigured spatial and temporal coded routings in neural network assemblages of local and global mappings. External relations represent a history/anti-history (or cultural memory) of such objects or relations, including how they have been reconfigured over time. What this means is that artists, artisans, and crafts people use the object as a foundation for their present work or else totally erase it in order to do something new. However, the object itself continues to reside in the space of external space-time reality generation after generation. (*Blow-Up* 166)

Barker's hypothesis about the relation that exists between his medical pedagogy and Stein's "strange literary forms" relies upon the existence of these temporally coded, neural networks. Neidich emphasizes precisely this point, in the following statements: "The brain need not code *a priori* for every set of relations it will encounter in the outside world. Instead, multiple systems of memory – fashion, art, architecture, dance, literature, or each aesthetic practice through its specific modalities – concretize and code different systems of relations into different systems of representation that coexist as heterogeneous but (temporally, spatially) interconnected repositories of cultural memory" (*Blow-Up* 172; original emphasis). Acting as a homunculus figure, of sorts, Stein's three-dimensional brain model not only represents the sensory-motor neurodevelopment of a fetus in utero, but also it figuratively portrayed the brain of the six-month old infant that Stein examined in the laboratory, as part of Barker's medical research on the somatosensory cortex, the thalamus, the midbrain and the brain stem, at the Johns Hopkins Medical School. Indirectly then, her anatomically incorrect model represents the failure of Barker to achieve his scientific goals, which meant that she was able to caricature his research failures and his scientific ambitions by artificially reconstructing the neural pathways that ascend from the midbrain to the hypothalamus and by connecting the thalamus to the somatosensory cortex by fantastical means.

Stein's "inaccurate" brain model both yields and produces important data about her past frame of mind and her future brain mapping activities. If we give the neuraesthetic theories of Zeki, Neidich, Meyer, Bryson and Onian their due, then we can say that Gertrude Stein found unique ways to recreate imperfect medical practices and incomplete neuroscientific knowledge in her cubist literature, for the express purpose of neuraesthetic composition, if not for the pursuit of scientific knowledge. Her three-dimensional brain model was, according to the accounts of her adversaries and contemporaries, inappropriate, imperfect and incomplete. Yet, I am arguing that these are precisely these qualities that make her imperfect, brain replica a perfect model for future, literary explorations of "inherited and acquired, brain concepts" (to use Zeki's terminology). According to Zeki,

> every time we find something imperfect we are doing so with reference to the synthetic concept in the brain, which becomes the standard against which all else is judged. Neurobiology has not yet managed to unravel the details of the thought process. There is progress in this direction at present but it is still at the macroscopic level, by which I mean we do not know much about the cellular events involved. There is little doubt that the thought process involves quite complex neural operations but we have not figured out how to study the contribution that individuals cells make to this process. … Perfection is thus achieving or finding in the outer world a reflection of the synthetic concept constructed by the brain. This may be nothing more than the ideal landscape painting, one that is representative of all the landscapes that the brain has experienced and hence can be used to represent each and every one of them. Or it may be the perfect individual, perfect in terms of the seeker's brain. … In each case, the perfection is not easy to achieve. In each case it is the attempt to translate into reality what is derived from reality but is no longer real, in the sense that it is synthetic and therefore cannot fit into any single particular real example. (53)

Even though Stein's three-dimensional brain model flouted medical protocols and exhibited a modicum of disrespect for the school's examination processes, the synthetic "brain concept" that it indirectly represents, at the level of a portrait's neuroanatomical imaginary, as well as at the level of Stein's "Cubist brain," holds value for us as interdisciplinary researchers, because it reveals more about the historiography of a neuraesthetic writing practice than other kinds of literary tools and conceptual methodologies currently in use. “The difficulty here lies in the fact that the concept itself changes with experience,” Zeki claims:

> Cézanne’s series drawings of the *Montagne Sainte Vincent* represent an attempt to come nearer to giving a perfect representation of form, as constituted and as it developed with every new depiction in Cézanne’s brain. Many remain dissatisfied with the final product and start afresh, either on a new work or on trying to develop the work at hand. Georges Braque had very much the brain concept in mind when he referred to finishing off his paintings, although he did not refer to the brain. He once said that when he painted he tried to put the concept in his mind onto canvas. He often found that when he left a painting untouched for periods of months, and came back to it, the unfinished painting was finished because he had forgotten the original concept. The painting had therefore become divorced from his mind and had acquired an existence of its own. (*Splendors and Miseries of the Brain* 55)

Stein’s imperfect and unfinished, three-dimensional brain model most likely served as a prototype for her future brain allegories and other kinds of sensory homunculi, by virtue of the fact that it represents one or more “impossible,” brain concepts for Gertrude Stein. In this way, Stein’s brain model qua sensory homunculus survived the institutional politics that plagued her at the Johns Hopkins Medical School, as a result of its literary metamorphoses through the neural and perceptual principles that inform her cubist, “neurobiological collages.”

To better understand the brain physiology and the institutional politics that shaped the sensory homunculus of Stein’s neuroscientific imagination, it helps to have a vision of what her three-dimensional brain model may have looked like and why her egregious “mistake” has been overlooked as a possible source of intuition for her subsequent, brain representations. See Figures 40, 41, 42, 43, 44, and 45 for Florence Sabin’s illustrations of the brain sections from the midbrain region that contain the nucleus of Darkschewitch and the fasciculus longitudinalis medialis Stein also used in her three-dimensional brain model.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 424 is Figure 41, Brain section number 158, from Florence Sabin's "A Model of the Medulla, Pons and Midbrain of a New-Born Babe," Figure 34, Series II, Section no. 158. This figure contains information about the brain slices that Gertrude Stein used in her three-dimensional model of the midbrain, pons and medulla oblongata. The original source of this material is Florence Sabin's "A Model of the Medulla, Pons and Midbrain of a New-Born Babe," Figure 34, Series II, Section no. 158, which is found in Contributions of the Science of Medicine: Dedicated By His Pupils to William Henry Welch on the Twenty-Fifth Anniversary of His Doctorate. Baltimore: Johns Hopkins P, 1900. 1034.

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Meyer recounts the story Dorothy Reed Mendenhall, "an acquaintance of Stein at Johns Hopkins and the aunt of Edmund Wilson," told her nephew about the scientific, political and conceptual problems that Stein encountered during the last weeks of her medical studies (84):

> Dr. Mall set her a problem similar to the one Dr. Sabin had completely successfully in her fourth year. This was the sectioning of an embryo human brain and its reconstruction, and a study of the development of the centers in the brain and in the tracts leading from them. She worked on it for weeks and finally handed in her reconstruction to Dr. Mall in the hope that it would be credited to her instead of obstetrics and allow her graduate. Some days after—Dr. Mall – the greatest living anatomist at the time – came to Dr. Sabin and said, "Either I am crazy or Miss Stein is. Will you see what you can make out of her work?" (p.63) (*Irresistible Dictation* 85)

As a result of Wilson's hearsay account and other tertiary witnesses, Meyer supplies the following information about Stein's three-dimensional model of the medulla oblongata: "To Sprigge, Mendenhall gave the following account of what ensued, which she had directly from her "intimate friend … Dr. Florence Sabin":

> Dr. Mall brought the model in to [Sabin] one morning and said that it was beyond him to see what Miss Stein had done. Dr. Sabin, the best woman ever graduated at J. H. Medical and afterwards head of one of the Rockefeller Institute departments, spent hours working over the model and finally decided that Gertrude had bent the spinal cord under the head of the embryo so that every section contained cells of the cerebral cortex and of the cord, so that the reconstruction was fantastic. Dr. Mall listened to the explanation of what Dr. Sabin *thought* had happened and chucked the entire model into the waste

> basket. (40; *Irresistible Dictation* 85)

At the end of this passage, Meyer writes, “So much for Stein’s degree. Besides judging Stein’s work, Florence Sabin also set the standard against which it was judged. Classmate of Dorothy Mendenhall and a year ahead of Stein at Johns Hopkins, she “has been hailed as the outstanding woman scientist in the medical field in the first half of this century” (Farnes, p. 274). In the authoritative biography of Franklin Mall that she brought out in 1934, Sabin observed that “the course in neurology, given in his laboratory, was for many years the most extensive one on this subject give in America” and “formed the basis of the book on the Nervous System, published in 1899 by Dr. Barker,” who was the course director at the time. Mall, having “realized the structure of the brain stem was obscure,” asked “one of his students [to] make a model of the tracts of the brain stem as far as they were medullated at birth.” Sabin neglects to mention the student, who was of course herself, although she does add that the model continued to be used in the course “until newer work in comparative anatomy, that is, the study of the determination of each tract as it developed in lower forms [of animal life,] provided a simpler and better basis for an understanding of the nervous system” (pp. 166-167). Concerning Stein’s failure to produce a viable model, Meyer observes,

> The letter she wrote to Barker in response to Knower’s criticism [of her three-dimensional anatomical model] suggests the solution that she ultimately arrived at concern[ed] the delineation between *object of knowledge* and the *increasingly knowledgeable investigator*, which lies at the heart of the anatomical perspective. … Her “aim in writing this article” [that Barker thought “ought to be published as it is in the *Journal of Anatomy”*], she observed, “was “not so much to give new matter but to make confusion clear” – adding that she did not feel

> Dr. Knower is a good judge of this matter because “he does not know the region and its confusion.” (92)

The significance of the sensory neurons to Barker’s brain stem research and to Stein’s cubist brain maps can get lost in the interpersonal struggles and the institutional drama that unfolded during the last few months of Stein’s medical studies. Before I explore the implications of Barker’s “somatosensory” brain stem research to the science of the reading brain and the implications of Stein’s neuroanatomical research to the literary art of brain mapping and to the reading brain, I want to focus briefly on the model that Stein produced for Franklin Mall, as part of her graduation requirements. Although Wilson, Sprigge and Mendenhall provide reports of Stein’s dramatic exit from medical school and the brain model that caused such a stir, I have wondered (and perhaps Barker did, as well) whether her “fantastic” model did not bear some resemblance to the sensory homunculus of Freud’s imaginings, or better yet of her own creative imaginings. I wonder if it doesn’t have a special relationship with the human mind’s neuroanatomical imaginary in *The Geographical History of America*. With this sensory homunculus theory in mind, I think it made sense for Stein to “ben[d] the spinal cord under the head of the embryo so that every section contained cells of the cerebral cortex” (Mendenhall 40). In this way, her otherwise unacceptable, three-dimensional model of the medulla oblongata abstractly represented Barker’s scientific goal, which was to connect the brain stem and spinal cord to all the sensory cells of the cerebral cortex through his research on the medulla oblongata’s neural “intricacies.” Though Stein’s ‘flawed’ submission fell short of Mall and Sabin’s expectations, it nevertheless represented something important. Functioning as a product of the creative scientific imagination, her three-dimensional model of the midbrain region surrounding the nucleus of

Darkschewitch captures the medulla's "upward conduction of sensory impulses toward the somæsthetic area of the cortex," because every section of this model contained the cerebral cortex's nerve cells.

If this is how Stein visualized the medulla's "upward conduction of sensory impulses toward the somæsthetic area of the cortex," then she had found a way to represent Barker's research aims in a three-dimensional homunculus sculpture, even if it was true that she failed Mall by not producing the model that she was capable of building with enough time and instruction. The odd position of the spinal cord, in Stein's seemingly inexplicable brain model, could have been illustrating the way in which the fasciculus longitudinalis medialis conducts sensory impulses down the length of the medulla oblongata toward the spinal cord along the vestibulospinal pathway. See Figure 48, Lewellys Barker's <u>Reconstruction of a Human Embryo, showing development of the sensory ganglia</u> (Fig. 108).

Material has been removed from this thesis because of copyright restrictions. The material removed from page 434 is Figure 47, Reconstruction of human embryo [at] … fourth week showing development of sensory ganglia, which comes from Lewellys Barker, The Nervous System and its Constituent Neurones (180). Figure 108. New York: D. Appleton and Company, 1899. This figure illustrates the developing sensory ganglia that form along the medullary tube. Since Stein primarily conducted her brain stem research on post-mortem human infants and embryos, her fantastic three-dimensional representation of the medulla oblongata, the nucleus of Darkschewitch and the nerve bundles in this region likely drew upon nineteenth-century images such as this one, which reveal the extent to which nineteenth-century medical knowledge about the developing sensory ganglia and the human central nervous system at this stage of embryonic development informed three-dimensional constructions of the spinal cord, brain stem and medulla oblongata. The source of Figure 47 is Figure 108, from Lewellys Barker's The Nervous System and its Constituent Neurones (180). New York: D. Appleton and Company, 1899. 180.

In Figure 47, the spinal cord is wrapped around a four week-old fetus, as I imagine would have been in Stein's three-dimensional model of the medulla oblongata, of the pons and the of the midbrain. What stands out, for me, about this image are the developing sensory ganglia that form along the medullary tube. Since Stein primarily conducted her brain stem research on post-mortem human infants and embryos, her fantastic three-dimensional representation of the medulla oblongata, the nucleus of Darkschewitch and the nerve bundles in this region likely drew upon such images and medical knowledge. Sabin confirms that embryos and lower forms of life provided them with ideal models with which to study the developing brain, when she observed, "until newer work in comparative anatomy, that is, the study of the determination of each tract as it developed in lower forms [of animal life,] provided a simpler and better basis for an understanding of the nervous system" (pp. 166-167). To such an image, Stein may have incorporated Barker's scientific vision of the medulla's neural connections to the cortex's somatosensory neurons, turning a complex three-dimensional model of the medulla into a monstrosity of a sensory homunculus, with many layers of meaning and neuroscientific significance.

From a literary perspective, we could call such a fantastic construction a 'conceit.' However, I also think that Stein's abstract sculpture of the medulla could also be defined as an allegory because it literally represents Barker's scientific research aims, one of which was to represent the neural networks associated with the somatosensory areas of the brain. As well, Stein's three-dimensional model accurately represents desire to render the brain's neural architecture visible to other researchers and accessible to the human eye, with medical illustrations, scientific descriptions. By caricaturing the failure of Barker to reach his desires and aims with her distorted, homunculus-like rendering of the brain's interregional networks and neural pathways, Stein ironically sealed her own academic fate. Not expecting and not understanding the neuroscientific pun that Stein was creating with her abstract model of the medulla's "somatosensory" neural architecture, Dr. Franklin Mall could only come up with one response: "Either I am crazy or Miss Stein is" (Mendenhall 40), which meant, of course, that Stein must be crazy to present such a "fantastic" model for examination. Because records show that Mall supported Stein's re-entry into the medical program in the fall (after a short summer recess), we can assume that he did not actually think Stein was actually "crazy," or clinically insane. Rather, his frustrated response to the inexplicable model of the medulla oblongata that Stein presented him with is an idiomatic expression. This might seem odd for me to say but it must be said, because innumerable critics have questioned Stein's sanity, and even Meyer has argued that Stein produces neuraesthetic compositions that require readers to correct for the "deliberate errors" that she has encoded at the level of her brain representations because of her confusion in medical school.

For the most part, I disagree with these opinions, based on what I have learned about Barker's somatosensory, brain research and Stein's colorful, brain maps. Put simply, Barker's ambition was to map out the neural circuits that were responsible for the brain's sensory impulses. Though, in the passage I quoted, Barker sounds pessimistic about finding "direct upward continuations far into the hypothalamic region," in other sections of his textbook he expresses his hope in being able follow the ascending fibers of the medial longitudinal fasciculus to other brain regions: for example, in "The Somaesthetic Path to the Cerebrum By Way of the Cerebellum," Barker questions whether the "nerve fibres, which run in to terminate in the gray matter of the cerebellum, help to carry impulses toward the cerebral cortex by means of neurones of a higher order" (648). "That they do," he responds, "seems fairly certain from clinical evidence that need not now be discussed, and partly from anatomical findings to be immediately mentioned":

> We have seen that the axons entering the cerebellum from the nuclei of termination of the sensory nerves do so chiefly by way of the corpus restiforme (inferior cerebellar peduncle); a few of them enter by way of the brachium conjunctivum (superior cerebellar peduncle) and velum medullare anterius (for example, a part of Gower's tract), and few possibly through the brachium pontis (middle cerebellar peduncle). These axones terminate chiefly in the cortex of the vermis; some terminals as well as many collaterals go directly to the nucleus dentatus, others to the nuclei fastigii and adjacent masses of gray matter. … Given these conditions, it is not difficult to find an anatomical path which could serve for the further conduction of sensory impulses cerebralward. (649-650)

From this report, it is clear that the ultimate objective of Barker, Sabin and Stein's research was to examine the extent to which there was "possibly a central conduction path for the passage of sensory impulses through the cerebral cortex" (718). The obstacles to achieving this goal, as Barker observes, were daunting from numerous perspectives:

> The study of cases of secondary degeneration thus far has thrown but little light on the subject, though in the case studied by Jakovenko* the degeneration of the bundle [of the fasciculis longitudinalis medialis] stopped suddenly anteriorly on reaching the level of the nucleus of Darkschewitch. Golgi's method has proved definitely the existence of numerous axons passing into the fasciculis longitudinalis medialis, axones which have their origin in the cell bodies or dendrites of neurones situated in the nuclei of termination

> of the sensory cerebral nerves. Axones of the cerebral conduction path connected with the vestibular and other sensory nuclei entering the fasciculis longitudinalis medialis have been referred to above. On the other hand, Golgi preparations of the midbrain have shown large numbers of axones passing from cells in the superior colliculus of the corpora quadrigemina and in the nucleus of Darkschewitch, which pass ventral to the nucleus nervi oculo-motorii to decussate with corresponding fibres in the middle line and to enter the ventral portion of the fasciculis longitudinalis medialis to descend into it. (718-720)

See Figure 48 (Barker's Fig. 419), Horizontal section through medulla, pons and midbrain of newborn babe, [at the] level of the fasciculus longitudinalis medialis, from Figure 318: Lewellys Barker's The Nervous System and its Constituent Neurones (489).

Material has been removed from this thesis because of copyright restrictions. The material removed from page 439 is Figure 48, which is a black and white photocopy of Lewellys Barker's Figure 318, Horizontal section through medulla, pons and midbrain of newborn babe, [at the] level of the fasciculus longitudinalis medialis, from The Nervous System and its Constituent Neurones (489). The information contained in this image pertains to Stein's neuroanatomical research on this part of the brain during her medical studies at Johns Hopkins Medical School, in particular her use of the Weigert-Pal staining method, her knowledge about the nerve bundles that connect the midbrain to the thalamus and the cerebral cortex and her ability to reconstruct this part of the brain using chemically-stained brain slices and brain sections, textbook illustrations and laboratory experiments. The source of this material is Figure 318, from Lewellys Barker's The Nervous System and its Constituent Neurones. New York: D. Appleton and Company, 1899. 489.

From Barker's description of the ascending and descending fibers of the medial longitudinal fasciculus, we can deduce that Stein would have knowingly participated in Barker's research efforts to find evidence of the link between the bundles of axons ascending upward from the nucleus of Darkshewitch into the cerebral cortex and thalamas through the red nucleus, using Golgi's silver nitrate method of nerve tissue staining, or possibly with the Weigert-Pal method of silver (purple) staining that Sabin employed in her model of the medulla, pons and midbrain. This information potentially reveals something important about Stein's colored brain maps: namely, that their linguistic and semiotic indeterminacies may be a function of her medical research with Barker at Johns Hopkins, to the extent that she may have adapted the color systematicity and structural dimensions of the three-dimensional model that she created for Doctor Mall at Johns Hopkins to a set of neuraesthetic writing practices that operate by generating pluralistic, sensory cues and linguistic, connectivity mappings for her readers. Barker may have been correct, then, to suspect that there are undiscovered connections between his medical pedagogy, their shared neuroanatomical research on the brain stem, and Gertrude Stein's "strange literary forms."

4.3. Reading Picasso through Stein's Portraits: The New Brain Science

The only intelligible image of a brain in Stein's literary corpus comes from Detective Story number VII, even if this is an image that literally questions the phenomenal qualities, the tactile sensations and metaphysical properties of its colored brain matter. Ironically, it could be that most advanced brain map in Stein's literary corpus is based upon a three-dimensional brain model that is a "sensory homunculus," of sorts, that was once contrived in the imagination of a younger Stein, who perhaps wanted to visualize the embryological development of the brain's somatosensory system at the level of poorly understood brain stem and midbrain neural pathways. Toward the end of Part II, in Detective Story number VII, Stein's omniscient narrator observes,

> There is blue and green and green and yellow pale
> yellow and blue, there is pale yellow and green and blue
> and warmth and there is not any such a thing as
> human nature.
> Please see my mind.
> It is here.
> Is white a color.
> Yes white and grey is a color.
> Grey and white is a color.
> It is now come to be certain that there is not any such
> a thing as human nature
> Of course there is such as thing as human nature and
> anybody can observe it.
> The relation of human nature to the human mind.
> When anybody likes it as much as they ever liked it
> before they like it as much as that. (120)

As far as I know, this is the only *explicit* image of a brain-like human mind in Stein's literary corpus. It is the only one that subjectively experiences and objectively describes its own neuroanatomical features with the stylistic flair of a cubist writer. Because of these distinctive qualities, this neuroanatomical portrait reminds me of Picasso's portrait, "Woman Writing," where cubist lines, bright colors and unusual shapes are used to create the appearance of the female writer's bodily insubstantiality. Stein even uses the same colors that Picasso does in his portrait, Woman Writing: whites, greys, blues, greens and yellows. See Figure 50, Woman Writing.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 443 is Figure 50, which is a colored copy of Picasso's cubist painting, Woman Writing. This figure contains information about Picasso's cubist portraiture strategies, particularly his use of color, line and perspective to create insubstantial yet substantial outlines for his subject, a woman writing. The source of this material is Pablo Picasso: Portraits of Women Calendar 2009 (June), Tushita Verlags GmbH Germany. Succession Picasso/VB Bild-Kunst, Bonn 2008.

Perhaps it is because the brain portrait in Detective Story number VII was designed as a mimicry of Picasso's portrait, "Woman Writing," that this portrait of a woman's creative mind writing a masterpiece about the human mind's colorful, neural architecture makes such a strong statement about the "*non*substantial, neither substantial nor insubstantial" properties of the neuraesthetic writing process, to use Meyer's phrasing. In other words, the three-dimensional, supposedly "insubstantial" brain model of the medulla that Stein likely used as a conceptual prototype for her literary brain maps may be more substantial and important than anyone originally thought. This imperfect and incomplete, brain model may have provided her with a metamorphic and protean, "sensory homunculus" that could adapt itself to new artistic perceptions and cultural conditions, especially in the case of the dramatic works (i.e., the plays and operas) that exposed her neuraesthetic compositions to a variety of historical audiences, aesthetic transformations and cultural/artistic producers.[96]

With this literary "sensory homunculus," Stein would have been able to produce cubist brain maps that functioned as aesthetic vehicles for emergent, neural and perceptual principles. This is precisely because these maps conjure up neurophysiological entities and neuroanatomical features in the reader's mind that are neither "substantial nor insubstantial." We can compare Stein's non-substantial neuraesthetic compositional strategies with the way that Picasso's *writing woman* displays an insubstantial, female corporeality through merging lines, fantastic colors and geometric shapes that meld into the portrait's illusory background. As we have seen before, the brain map from Detective Story number VII can be used to study specific brain regions, neural networks and connectivity mappings, as well as to generate generic perspectives and perceptual principles that correspond with well-known, cellular formations and neurobiological entities. It also serves as a neuroanatomical imaginary that posits ingenious neuron coloring strategies, microscopic imaging techniques and connectivity mapping devices, even though such coloring strategies and mapping techniques could not have been conducted with fin-de-siècle, scientific technologies and surgical methods. Functioning as a colored brain map that illustrates, elucidates and probes the human mind's imagined, neuronal configurations and synaptic connections with the English language, this cubist portrait creates new forms of "qualia-knowledge" and participates in western society's "qualia-politics," by exploring the brain's "finer connectivity patterns" and its interregional, neural networks with aesthetic feelings that correspond to white-, grey-, blue-, green- and yellow-colored, brain matter.

In the brain portraits from *Tender Buttons* and *The Geographical History of America*, color is arguably one of the most noticeable features, next to the dissociative writing style that Stein deploys as means of directly or indirectly expressing the human mind's subjectively experienced inner states of consciousness to her readers. By deploying color as structural device in an insubstantial, nonsubstantial or obscure fashion, Stein avoids having to 'draw' the concave and convex neuroanatomical dimensions of a masterpiece's "human mind" with the three-dimensional brain representations that bedevilled her in medical school. From the third person perspective of her lover, Alice Toklas, in *The Autobiography of Alice B. Toklas*, Stein recalls how she had "never been able or had any desire to indulge in any of the arts. She never knows how a thing is going to look until it is done, in arranging a room, a garden, clothes or anything else. She cannot draw anything. When at medical school, she was supposed to draw anatomical things she never found in sketching how a thing was made concave or convex" (84). In his study, Meyer rejects the notion Stein sought to represent "the convolution of the inferior olive" with her three-dimensional model of the medulla oblongata (93). He argues to the contrary, "It would pose difficulties, that is, if Stein had actually aimed to portray three-dimensional *objects" (Irresistible Dictation 93).* In my reading of the cubist brain portrait from *The Geographical History of America*, I am not denying that Stein had problems drawing three-dimensional objects or that she experienced tremendous difficulty producing a three-dimensional model of the medulla. With her three-dimensional brain model, Stein may have been trying, in a roundabout way to allegorically represent "mechanisms of reentry and the notions of perceptual categorization, conceptual formation, and value-category memory," which have constituted primary consciousness over the course of evolution (Edelman and Tononi, *A Universe of Consciousness* 107). With an embryo-looking sensory homunculus as a partial guide and conceptual model for her three-dimensional brain model, she may have stumbled onto an important area of neuraesthetic inquiry by resisting Mall's request for a realistic model of the medulla oblongata's basic neuroanatomy. In "Primary Consciousness: The Remembered Present," Edelman and Tononi explain the evolution of the abovementioned neural structures within the human brain and their functional neuroanatomy, as follows:

> Massively reentrant connectivity arose between multimodal cortical areas carrying out perceptual categorization and the areas responsible for value-category memory. This evolutionarily derived reentrant connectivity is implemented by several grand systems of corticocortical fibers linking one part of the cortex and the thalamus (see figure 4.4 A). The thalamocortical circuits mediating between these reentrant interactions originate in the major subdivisions of the thalamus: structures known as the specific thalamic nuclei, the

> reticular nucleus, and the intralaminar nuclei. The specific nuclei of the thalamus are the ones that are reentrantly connected with the cerebral cortex; they do not communicate directly with each other; but the reticular nucleus has inhibitory connections with those nuclei and can act to select or gate various combinations of their activity. The intralaminar nuclei send diffuse projections to most areas of the cerebral cortex and help to synchronize its overall activity. All these thalamocortical structures and their reciprocal connections acting together via reentry lead to the creation of a conscious scene. The dynamic reentrant interactions that occur via the connections between memory systems and systems for perceptual categorization take place within periods ranging from hundreds of milliseconds to seconds – the "specious present" of William James. (107-108)

Note that these are the structures Barker tried to connect to the midbrain and the nucleus of Darkschewitch, in his research with Stein and Sabin. This information is crucial if we are to grasp how the "grey" and "white" colors of the human mind's cerebral cortex connect with "the specific thalamic nuclei, the reticular nucleus, and the intralaminar nuclei," with the colored brain stem nuclei and neuronal groupings that Stein was familiar with as a result of her neuroanatomical experiments at Johns Hopkins. Also, Edelman and Tononi's explanation provides necessary knowledge about the neural connections between the thalamus, cortex and brain stem that Barker was not able to supply because of their limited resources and medical knowledge at the time. When Stein says that time is not a central concern of her masterpieces, part of the reason for such a statement may be that she knows "time" within the human brain is measured in "periods ranging from hundreds of milliseconds to seconds – the "specious present" of William James," as these scientists also point out (107-108).

4.5. Gertrude Stein and the Reading Pyramid

We know that Stein was interested in color, but it turns out that she may have been interested in producing literary brain maps that stimulated theories about the reading brain, when they were not being used to represent the emergent sciences of the reading brain. Prior to the invention of the Brainbow system and the publication of the Brainbow photographic images, I would have to describe myself as a color-blind reader of Stein's dissociative writings.[97] There may be legitimate reasons why so many readers have "blanked out" when they are faced with the task of trying to make sense of the connections between color, reading, and naming, in Stein's cubist writings.[98] To explain the failure of reading and the expert processes of reading from a neuroscientific perspective that will make sense to you, I rely upon neuroscientist and dyslexia expert Maryanne Wolf's expertise:

> The pediatric neurologist Martha Bridge Denckla of Johns Hopkins University tested [Geshwind's theory, which basically proposes that the "systems for naming colors and reading must use some of the same neurological structures and share many of the same cognitive, linguistic, and perceptual processes"] and found that readers with dyslexia can name colors perfectly well, but they cannot name them rapidly. The time it takes for the brain to connect visual and linguistic processes to name colors (or letters and numbers) was the predictor of who would be unable to learn to read. Denckla's discovery and her work with the neuropsychologist Rita Rudel of MIT became the basis of "automated naming" (RAN) tasks in which the child names rows of repeated letters, numbers, colors, or objects as fast as possible. Extensive research in my laboratory and

> around the world shows that RAN tasks are "one of the best predictors of reading performance" across all tested languages. This stimulus" (RAS), which I designed to add more attentional and semantic processes to the RAN naming requirements. If you consider that the whole development of reading is directed toward the ability to decode so rapidly that the brain has time to think about incoming information, you will understand the deep significance of those naming speed findings. In many cases of dyslexia, the brain never reaches the highest stages of reading development, because it takes too long to connect the earliest parts of the process. Many children with dyslexia literally do not have time to think in the medium of print. (178-179)

To decipher the color systematicity and subjective phenomenology of Stein's brain portraits, we also need to "think in the medium of [the] print." Some of us do this by connecting the visual, linguistic, aural, semiotic and textual qualities of a given text, with other forms of cultural production. If Stein's texts are meant to teach us something about brain science and the reading brain, then we must attend to how the ways in which the cubist brain images in these texts portray the neural circuits of the reading brain. As Wolf notes, the nerve tracts of the midbrain and upper brain stem play a key role in the reading process by allowing us to "move our attention to the new focus [of attention] (by pulling ourselves to the text)" (145). In *Proust and the Squid: The Story and Science of the Reading Brain*, Wolf explains the processes of attention that are involved in the act of reading, as follows:

> All reading begins with attention—in fact, several kinds of attention. When expert readers look at a word (like "bear"), the first three cognitive operations are: (1) to disengage from whatever else we're doing; (2) to move our attention to the new focus (pulling ourselves

> to the text); and (3) to spotlight the new letter and word. This is the orienting network of attention and imaging research shows that each of these three operations involves a different region of the brain (Figure 6-4) [See my Figure 52]. To disengage attention involves areas of the back of the parietal lobe; to move our attention involves part of the midbrain responsible for eye movements (called the superior colliculi); and to spotlight something involves part of our internal switchboard known as the thalamus, which coordinates information from all five layers of the brain. The other network of attention that is extremely important to all phrases of reading is the better-known executive attention network, which comes next. Situated deep within the frontal lobes, the executive system occupies a fairly expansive area (called the cingulate gyrus) that lies below the deep fissure between hemispheres in the two frontal lobes. The more frontal part of this region is deeply involved in functions specific to reading: directing the visual system to focus on specific visual features in a given letter or word (for instance, a novice reader must pay close attention to the direction of "b in "bear"); coordinating information from other frontal areas, particularly with regard to the semantic processing of the meaning of words (is a "bear hug" something you want or not?); and controlling the use of a particular kind of memory called working memory. (145-146; original italics removed).

See Figure 50, <u>A Time Line of Reading</u>, from Figure 6-3, in Maryanne Wolf's *Proust and the Squid: The Story and Science of the Reading Brain* (144). Also see Figure 51, <u>Attention Networks</u>, which is Figure 6-4, in Maryanne Wolf's *Proust and the Squid: The Story and Science of the Reading Brain* (146).

Material has been removed from this thesis because of copyright restrictions. The material removed from page 451 is Figure 50, which is a black and white photocopy of Maryanne Wolf's Figure 6-3, A Time Line of Reading, from Proust and the Squid: The Story and Science of the Reading Brain (144). "On the basis of work by Michael Posner and various cognitive neuroscientists, [Wolf] describe[s] a time line for the processes that every expert reader uses (Figure 6-3). Any linear conceptualization of reading (such as a time line) has to be qualified because the processes in reading are interactive. Some take place in parallel, and some activate and then reactive when additional conceptual information needs to be integrated. … The time line here portrays the … instantaneous fusion of cognitive, linguistic and affective processes; multiple brain regions; and billions of neurons that are the sum of all that goes into reading" (145). This description by Wolf sums up the information that is contained in this figure. The source of this material is Fig. 6-3, from Maryanne Wolf's Proust and the Squid: The Story and Science of the Reading Brain. New York: Harper, 2007. 144.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 452 is Figure 51, which is a black and white photocopy of Maryanne Wolf's Figure 6- 4, Attention Networks, from Proust and the Squid: The Story and Science of the Reading Brain (146). The information contained in this image is the brain regions that are specific to the reading process. The source of this material is Figure 6-4, from Maryanne Wolf's Proust and the Squid: The Story and Science of the Reading Brain. New York: Harper, 2007. 146.

In the narrative that corresponds with Figures 6.3 and Figure 6.4, Wolf does not explain the roles that the medial longitudinal fasciculus, the nucleus of Darkschewitch and the cerebellum play in the brain's reading circuits and in the act of reading. Because her analytical focus is on the brain regions that direct the expert reader's attention to certain visual features, while a person is reading a particular text or a particular word, Wolf limits her analysis of the neurophysiological mechanisms and basic neuroanatomy involved in the act of reading to the brain region known as the superior colliculi, which is the part of the midbrain that is responsible for moving the subject's attention from one set of objects to other and for generating eye movements that are associated with new-found objects of attention.

Through Posner and Raichle's *f*MRI studies (which Wolf also incorporates into her study), Meyer stresses that the area in the midbrain that is known as the superior colliculus contains "cells involved in selective attention" and adds that the "superior colliculus directly connects to the neighbouring nucleus of Darkschewitsch" (321). Based on his research on the medulla oblongata's nuclei and brain tracts, Meyer argues, "it turns out that in her neuroanatomical investigations Stein was examining several of the structures implicated in the innermost mechanisms of "reading in slow motion," if not the process of close reading itself (320).[99] See Figure 52, Distinct sets of Brain Areas for Distinct Tasks, from Michael I. Posner and Marcus E. Raichle's Images of Mind (115), which Meyer presents as Figure 14, in Irresistible Dictation: Gertrude Stein and the Correlations of Writing and Science (322). (Used by permission of W. H. Freeman and Company.)

Material has been removed from this thesis because of copyright restrictions. The material removed from page 454 is Figure 52, Distinct sets of Brain Areas for Distinct Tasks, which originally comes from Michael I. Posner and Marcus E. Raichle's Images of Mind. New York: W. H. Freeman, 1994. p. 115. © Scientific American Library. This figure contains information about how the brain processes information that is used in the process of reading. The source of the material for Figure 53 is Figure 14 from Steven Meyer's Irresistible Dictation: Gertrude Stein and the Correlations of Writing and Science. Stanford: Stanford UP, 2001. 322. (Used by permission of W. H. Freeman and Company.)

Even though Meyer's neuraesthetic study places little value upon the visual qualities of the reading process and undervalues the impact of these visual qualities upon Stein's neuraesthetic writing processes and the reader's interpretations of her neurophysiological imaginaries, it nonetheless provides an important, conceptual foundation for understanding the basis of the nineteenth-century, twentieth-century and twenty-first century sciences of the reading brain. In contrast with Wolf's study, Meyer uses Posner and Raichle's neuroimaging studies on the reading brain to show that the "elementary" operations [of reading] … -- listening to, or looking at, a stream of nouns; generating appropriate verbs for given nouns—are actually *abstractions* from the ordinary operations of auditory and visual word processing. To be more precise, Meyer's observations about the possible roles that the nucleus of Darkschewitch and the superior colliculus could be playing in the brain's reading circuits and in the production of neural pathways associated with the reading process derives, in part, from Posne and Raischle's study of how the "component operations of auditory and visual word processing are localized" in the brain (*Images of the Mind* 242). "As Stein so compelling demonstrates," Meyer writes,

> actual reading is neither *either* auditory or visual but is always to some extent crossmodal. Hence, by subtracting the first level (brain activity due to fixing one's gaze on a crosshair in the middle of a television screen) from the second (activity due to fixing one's gaze on nouns that appear below the crosshair, or listening to nouns while fixing one's gaze on the crosshair), Posner and Raichle cannot have isolated the brain areas devoted to seeing or listening to words. To the extent that one is actually seeing *a particular word* and not just a bunch of squiggly lines, or that one is still focusing on the crosshair while listening to the word, one's experience is not going

> to be exclusively auditory or exclusively visual. More importantly, Posner and Raichle have certainly not localized the ordinary experience of *passively viewing words* (namely, reading understood as information processing, as distinct from writing or even "reading in slow motion") nor the typical experience of *listening to words* (listening to someone speak, possibly oneself). At best, scans localize the process of *abstraction*. These experimental subjects have been instructed either to listen to, or to look at, a set of discontinuous words streaming by at the rate of forty a minute, with no reading or repeating permitted. By implication, they are to ignore any possible relations among the words. This is bound to take good deal of work and is hardly a passive process. Whether it has much to do with reading and listening, that is to say, with sentence comprehension, remains an open question. (321-323)

With this analysis, Meyer finds a connection between the brain's frontal and posterior areas. However, he does not link Barker's search for the somatosensory neural connections between the brain stem, thalamus and the cerebral cortex to Posner and Raichle's analysis of their 1988 experiments with PET brain scans; nor does he connect Barker's and Stein's brain stem research with Edelman's "theory of neuronal group selection" and "reentrant signaling," as he does in this part of his argument with the PET brain studies. Though Meyer stresses the importance of understanding the "anatomical connections leading in both directions," he does not specifically link Stein's medical research on the nucleus of Darkschewitch, midbrain and the medulla oblongata in Barker's anatomy laboratory with Barker's research on the somatosensory neural connections between the frontal and posterior brain regions. Arguing, instead, against empiricist notions of brain localization in the process of reading, Meyer claims,

> The gap between empiricism and radical empiricism are perhaps best measured in these terms, and Posner and Raichle provide a signal opportunity for such measurement when, in the final chapter of their study (entitled "Future Images"), they seem to find common ground with a figure I have been representing as an exemplary radical empiricist, Gerald Edelman. Posner and Raichle cite Edelman on his "theory of neuronal group selection" as well as on the notion of "reentrant signaling" that he has advanced as the principal mechanism for such selection. "It has been clear for many years," they write, "that the front and the back of the brain are linked by anatomical connections leading in both directions. However, we are just beginning to understand the functions of the connections that *feed back* information from frontal areas to posterior ones." … Earlier, Posner and Raichle explain that the "information *fed back* to sensory-specific areas" is sometimes called *reentrant processing* because "a brain area that has already performed a function now receives a new signal fed from some higher level. In other words, a signal reenters the cortex that had handled the signal previously"—or more exactly, that had already handled another, related, signal (p. 144, emphasis added). (323)

Stein might have surmised as much about the midbrain's role in visual tracking and in the reentrant neuronal processes that are associated with the act reading, given her research project with Barker, but she could not have known, for certain, that the nucleus of Darkshewitch was involved in the brain's reading circuits. However, this is not the main point that I wish to make: namely, we can derive a "reading pyramid" from her brain portraits and dissociative writings, because she openly speculates about what would happen to human nature and the human mind, if something were to affect their respective writing, reading and linguistic abilities, such as genetic mutations and other evolutionary changes.

As Wolf points out, the process of close or slow reading that is carried out by expert readers involves many areas of the brain working closely with one another to produce intelligible meanings for a printed text, through an organic 'pyramid of reading behaviors' that consist of complex interrelated genetic, neurodevelopmental, cognitive, behavioral and evolutionary processes that form the brain's "reading circuit." Citing the British neurospsychologist Andrew Ellis "who declared that whatever dyslexia turns out to be "it is not a reading disorder" (168), Wolf stresses, "in terms of human evolution the brain was never meant to read; as we've seen, there are neither genes nor biological structures specific only to reading. Instead, in order to read, each brain must learn to make new circuits by connecting older regions originally designed and genetically programmed for other things, such as recognizing objects and retrieving their names. Dyslexia cannot be anything so simple as a flaw in the brain's "reading center," for no such thing exists. To find the causes of dyslexia, we must look to older structures of the brain and their multiple levels of processes, structures, neurons, and genes, all of which have come together in rapid synchrony to form the reading circuit" (168). See Figure 7.1, Pyramid of Reading Behaviors, from *The Proust and the Squid*. Using this figure to illustrate the brain's reading circuits, Wolf explains the relations that exist between the five layers of the pyramid, which is based on neuroscientist and artist Catherine Stoodley's depiction of the "surface" and "depth" processes and/or behaviors involved in reading.

> In the top layer of this pyramid, reading the word "bear" is the surface behavior; below it is the cognitive level, which consists of all those basic attentional, perceptual, conceptual, linguistic,

> and motor processes you just used to read. These cognitive processes, which many psychologists spend their entire lives studying, rest on tangible neurological structures that are made up of neurons built up and then guided by the interaction between genes and environment. In other words, all human *behaviors* are based on multiple cognitive processes, which are based on the rapid integration of information from very specific *neurological structures*, which rely on billions of neurons capable of trillions of possible connections, which are programmed in large part by *genes*. In order to learn to work together to perform our most basic functions, neurons need instructions from genes about how to form efficient *circuits* or *pathways* among the neurological structures. This pyramid functions like a three-dimensional map for understanding how any genetically-programmed behavior, such as vision, happens. It does not explain, however, how it can be applied to a reading circuit, because there are no genes specific only to reading in the bottom layer. Unlike its component parts such as vision and speech, which *are* genetically organized, reading has no direct genetic program passing it on to future generations. Thus the next four layers must learn how to form the necessary pathways anew every time reading is acquired by an individual brain. This is part of what makes reading – and any cultural invention – different from other processes, and why it does not come as naturally to our children as vision or spoken language, which are preprogrammed. (10-11)

See Figures 53 and 54, which are Stoodley's illustrations of the "reading pyramid" and Wolf's reproductions of Stoodley's model in <u>Proust and the Squid.</u>

Material has been removed from this thesis because of copyright restrictions. The material removed from page 460 is Figure 53, Pyramid of Reading, which is a black and white photocopy of Figure 1-1, from Maryanne Wolf's Proust and the Squid: The Story and Science of the Reading Brain (11). This figure contains information about the brain's reading circuits. The source of this information is Figure 1-1, from Maryanne Wolf's Proust and the Squid: The Story and Science of the Reading Brain. New York: Harper, 2007. 11.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 461 is Figure 54, Pyramid of Reading Behaviors. Figure 54 is a black and white photocopy of Figure 7-1 from Maryanne Wolf's Proust and the Squid: The Story and Science of the Reading Brain (169). This figure contains information about the brain's reading circuits. The source of this material is Figure 7-1, from Maryanne Wolf's Proust and the Squid: The Story and Science of the Reading Brain. New York: Harper, 2007. 169.

I believe that Wolf (and Stoodley's) three-dimensional, pyramidal model of the brain's reading circuits can help literary theorists and neuraesthetic researchers develop interpretative strategies that can account for a text's genetic, neurophysiological, cognitive and visual imaginaries. In this fourth and final chapter, I have shifted my focus from the study of single neurons and microanatomical levels of connectivity mapping to the reentrant neuronal connections and complex brain processes that some scientists believe are responsible for the brain's reading capacities. By concentrating on the obscure, neural pathways and the brain nuclei that connect the midbrain and the brain stem to the "higher" brain regions, I have sketched out some of ways that Stein may have abstractly conceptualized brain anatomy and brain function, in her cubist portraits about the human mind, using fantastical figures like the "sensory homunculus." In the section below, I discuss some of the genetic elements that Stein indirectly represents with a dissociative style of evolutionary reasoning in "Chapter II" of *The Geographical History of America*. Following William Gass, Steven Meyer and Jonah Lehrer, I believe that a discursive form of literary genetics can be linked with Stein's neuraesthetic writing practices and their phenomenological concerns. However, I also submit that the genetics research that has recently been published on FOXP2, the so-called language gene, by Joseph, Fisher and other researchers, ought to be a part of our critical debates, especially when we consider the kinds of biological, environmental and linguistic elements that might comprise a text's literary genetics, or its "literary genome" (Lehrer, *Proust Was a Neuroscientist* 43).

4.5 Gertrude Stein's Literary Genetics

This leads me to the next stage of my argument about the reading brain, which is to ask the following set of questions: Do literary masterpieces express the genetic codes of the human brain by miming the human genome's 'exonic' processes of biological reproduction? William Gass thought this was a possibility, when he proposed, in 1973, that *The Geographical History of America* functioned like a biological organism, because it reproduced itself in the minds of its readers through mundane, literary repetitions. Is it possible to develop reading practices that would enable us to interpret a literary text's phantasmatic, genetic codes and neural networks through its aesthetic representations of the human mind? Once again, William Gass proposed in his critical introduction to this 1973 edition of *The Geographical History of America* that literary readers ought to develop phenomenological reading practices that could help them to decipher a masterpiece's mundane phrases as biological entities and genetic codes. Do literary masterpieces serve as archives of consciousness that not only reproduce, but also preserve and memorialize, the human mind's evolutionary history, in addition to anticipating the future of the human mind's predictable, creative metamorphoses and its random, genetic mutations? These are some of the speculative hypotheses about the human mind's 'creative evolution' that Stein indirectly poses in *The Geographical History of America or the Relation of Human Nature to the Human Mind,* by investigating the relationship and the non-relationship that exists between human nature and the human mind at the level of speech, language and writing. In these ways, Stein anticipates Wolf's "reading pyramid," and she shows that she understands the science behind the brain's reading circuits.

The evolutionary reasoning that Stein employs to interrogate the human mind's evolved creative capacities in Part IV, Chapter II, derives from a number of scientific, philosophical and psychological, source materials. To construct this "very simple story" about the "human mind," Stein draws upon William James's radical empiricist, evolutionary psychology, Charles Darwin's evolutionary science, Franklin Mall and Lewellys Barker's comparative studies of the human brain from Johns Hopkins University, her own brain stem research on the human embryos and infants at Johns Hopkins, and Henri Bergson's philosophical notions about the human mind's "creative evolution." This "very simple story" about the human mind implicitly considers the epigenetic, linguistic and neurophysiological differences that comprise the "genetics of language" for human nature, animal nature, and the human mind. With this "simple story," she creates a unique, cubist vision of the human genome by treating the human mind and human nature as though these conceptual entities were on separate evolutionary pathways, with the human mind having achieved a creative evolution that separates it from human nature and animal nature, by virtue of its unique capacity to write and to express itself through its literary and artistic masterpieces.[100] Like Darwin, Stein associates animal nature's innate, communication abilities with human nature's linguistic abilities and its innate, speech capacities. In Part IV, Chapter II of *The Geographical History of America,* Stein's omniscient narrator tells the following story about the human mind and its creative evolution:

> The human mind is the mind that writes what any human mind years after or years before can read, thousands of years or no years it makes no difference. Now human nature human nature is just the same as any animal nature and so it has nothing to do with the human mind. Any animal can talk any animal can be but not any animal can

> write. Therefore and so far is the human mind not related to human nature. And the writing that is the human mind does not consist in messages or in events it consists only in writing down what is written and therefore it has no relation to human nature. Events are connected with human nature but they are not connected with the human mind and therefore all the writing that has to do with writing does not have to be written again, again is in this sense the same as over. And so the human mind has no relation to human nature. And therefore and once again it is a ready made play to make a play of how there is no relation between human nature and the human mind. (107)

It would be easy to gloss over this section, since it seems outrageous for Stein's narrator, or for her dissociative discourse, to be claiming, "Any animal can talk." Perhaps it is because of the way these ideas are being presented in a series of propositions that lack scientific evidence and substantive argumentation that many readers have failed to notice their neuroscientific, psycholinguistic and biological implications. After all, this story is being presented by Stein's dissociative discourse, or by her omniscient narrator, as a playful, simple and familiar literary tale, one that anyone would agree with and comprehend immediately. Because parts of this story appear in previous academic lectures and in other texts from Stein's literary corpus, it is entirely possible that readers, who are familiar with this body of writings, would recognize some of the "literary formalisms" and critical ideas that she has incorporated into this evolutionary tale. In other words, Stein advances bold, evolutionary hypotheses about the human mind's "creative evolution" through a series of literary propositions that act as morphological homologies.[101]

By producing a story that generates radical, scientific insights into the human mind's creative, evolutionary processes and its feedback mechanisms, Stein supports Darwin's view that "there is no fundamental difference between man and the higher mammals in their mental faculties" (*The Descent of Man* 658), for she sees human nature and animal nature as being "the same thing." Or, as she puts it, "human nature is just the same as any animal nature and so it has nothing to do with the human mind" (107). However, she takes Darwin's observations from *The Descent of Man* into the domains of radical empiricist evolutionary psychology and literary neuraesthetics, when she assigns the human mind special, creative abilities that are associated with the ways in which "writing" appears in consciousness, or in the human mind" as a set of innate and acquired, linguistic qualities. As Stein's narrator puts it, *the writing that is the human mind* does not consist in messages or in events it consists only in writing down what is written and therefore it has no relation to human nature" (107; emphasis added). I interpret this statement to mean that Stein does not believe that language and the human mind are the same thing; yet, this statement also implies that language and writing are not the same thing "for" the human mind, as the metaphor, the "human mind is writing," strongly implies (107). When Stein asserts, through the agency of her narrator, that the human mind must be distinguished from human nature on the basis of its difference from mundane forms of animal communication and from non-creative forms of human "talk," she is arguing that speech capacity and the language instinct are difficult to distinguish in both animal nature and in human nature. From these provocative claims, one can see Darwin's influence upon Stein's evolutionary reasoning, particularly in terms of how she conceptualizes the biological origins of human/animal language and in terms of how she conceives of the psychosocial vicissitudes of the language instinct in animals and human nature.

Emphasizing the differences between language and mind, speech and writing, mind and nature, language and speech, the narrator of *The Geographical History of America* states, “Any word can say something but really that has nothing to do with the human mind” (55; 1936). As a means of comparing how human nature differs from the human mind in terms of its metaphysical nature, its linguistic capacities and its evolutionary changes over geological time, Stein considers the differences that exist between human speech and phenomenal consciousness to be of paramount importance, especially when it comes to understanding the evolutionary, neurotheological and psycholinguistic implications of the consciousness-based ‘writing’ that the creative mind subjectively experiences and creatively translates into literary texts, such as this meditative work.

Through the creative deployment of these literary tropes and modernist perspectives, Stein anticipates the late twentieth-century debate about the existence of language, grammar and speech genes. It is precisely because Stein viewed the relation between human nature and the human mind in a disconnected manner that she may have been able to foresee the discovery of *FOXP2*, the so-called “language gene,” by Anthony Monaco et alia, in 2001.[102] This Oxford research team has shown that the disruption of the *FOXP2* gene (also called the “forkhead-domain transcription factor”) “causes a severe developmental disorder of verbal communication, involving profound articulation deficits, accompanied by linguistic and grammatical impairments.” In conjunction with Lai, Gerrelli, Fisher, and Copp, Monaco argues that the discovery of this gene

> offers [scientists] a unique opportunity to explore the relevant neural mechanisms from a molecular perspective. In the present study [for the Neural Development Unit], we have determined the detailed spatial and temporal expression pattern of FOXP2 mRNA in the

> developing brain of mouse and human. We find expression in several structures including the cortical plate, basal ganglia, thalamus, inferior olives and cerebellum. These data support a role for FOXP2 in the development of corticostriatal and olivecerebellar circuits involved in motor control. We find intriguing concordance between regions of early expression and later sites of pathology suggested by neuroimaging. Moreover, the homologous pattern of FOXP2/Foxp2 related expression in human and mouse argues for a role for this gene in [the] development of motor-related circuits through mammalian species. Overall this study provides support for the hypothesis that impairments in sequencing of movement and procedural learning might be central to the FOXP2-related speech and language disorder.

(http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=12… 5/19/2007). These research findings, on the outset, may appear to contradict the conclusions drawn by R. Joseph in regard to the genetic engineering of DNA's evolution. Disruptions to *FOXP2*, as Monaco and his colleagues report, result in significant neural impairment that, in turn, leads to the loss of speech and language capacity in affected individuals. Because the genetic mutations that result from disruptions to *FOXP2* affect the cortical plate, basal ganglia, thalamus, inferior olives and cerebellum, individuals who have the genetic mutations experience the loss of motor control comes from changes to the brain's corticostriatal and olivecerebellar circuits.

Overly familiar textual (and intertextual) elements may be one of the reasons why many readers have failed to recognize the influences of Darwin's evolutionary theories, James's evolutionary hypotheses and Bergson's intuitive philosophy upon Stein's meditative book. Yet, as Simon E. Fisher points out in "Tangled Webs: Tracing the Connections Between

Genes and Cognition," "it is quite possible to genetic analyses with only an abstract perception of the nature of a gene. The relevant methods are easily transposable to virtually any trait of interest (assuming that such a trait has at least some heritable basis). However, a proper appreciation of the significance of genetic findings must depend on a solid foundation in basic molecular concepts" (271). As Fisher further notes, "The key point is that theories of normal and abnormal reading processes have led geneticists to explore phenotypes such as phoneme awareness, phonological decoding, orthographic coding and rapid automised naming in families affected with dyslexia" (281). The genetics research that has been based on these theories of abnormal and normal reading processes, by researchers such as Castles and Coltheart, Grigorenko et al, Fisher et al, Cardon et al, Smith, Kimberling, Pennington and Lubs, also can be used to illuminate Stein's historical brain research and his fanciful literary genetics. Fisher warns against using "only an abstract concept of the gene" in interdisciplinary academic research, because such concepts can "lead to erroneous conclusions, which are incompatible with current knowledge of molecular and developmental systems" (270). This has especially been the case with the genes that are related to grammar, language and speech development in the human brain, as Fisher observes in the following passage:

> The apparent ease of correlating genotype with phenotype without reference to molecular/developmental mechanisms promotes an erroneous impression of neurogenetics; one in which individual genes are able to mysteriously control specific behaviours or cognitive abilities, leading to talk of "language genes," "smart genes," "gay genes," "aggressive genes" and so on. It is indisputable that variations of gene sequence can contribute to variability in cognitive abilities and personality traits (sometimes in a dramatic manner) and that

> apparently straightforward genotype-phenotype correlations can sometimes emerge in our datasets. But the simplicity of these relationships is merely an illusion; genes do not (and indeed can not) specify particular behavioural outputs or cognitive processes, except in the most indirect way. As highlighted by Inoue and Lupski (2003), assumptions of simple linear relations between gene cognitive /behavioural phenotypes have impeded progress in the field, and fuel hypotheses that must ultimately be untenable. The gross activities of the human brain are the products of a complex interplay between factors at multiple levels; be they genetic, cellular, developmental, anatomical, or environmental, and the routes linking genes to cognition will inevitably be tortuous (Marcus, 2003). It is worth noting that this is likely to apply even to supposedly simple monogenic disorders of brain development, as I illustrate below with the example of the FOXP2 gene. This is not to imply that any attempts to disentangle links between genes and cognition are a waste of time. However, we ignore at our peril the existence of molecular and ontogenetic complexity and the importance of developmental context. Grant (2003) has similarly argued that the gap between genes and cognition can only be bridged by a thorough systems biology account of brain development and function. (279-280)

The Geographical History of America indirectly anticipates the devastating linguistic, social and neurological effects of FOXP2's expression in the brain, or more specifically, in "human nature." The statements that Stein makes in "Chapter II" of *The Geographical History of America* agree with the research that R. Joseph has been conducting on introns, FOXP2, and their role in the human mind's "evolutionary metamorphosis," because she seems to be more interested in the "neurotheological" effects of the creative mind's "evolutionary metamorphoses" – with the way it escapes the trap of being associated with human nature and animal nature at the level of speech and language – than she is concerned with the neurodevelopmental effects that a "language gene" might wreak upon the human mind; following James's psychological hypotheses about the localization of brain function and the education of the hemispheres, Stein's evolutionary story about the human mind would have us believe that human beings still would be able to write *in their minds* and create *mental* masterpieces.

She did not anticipate the extent to which the impaired, grammatical, cognitive and linguistic functions that have been associated with genetic mutations, such as *FOXP2*, affect the brain's neurodevelopmental progress, for she separates the brain and mind when she pits human nature against the human mind, at this level of her evolutionary reasoning. Nonetheless, she may have intuited the brain's creative evolution in ways that coincide with recent accounts of genetic mutations and their language deficits. For example, in "Tangled Webs: Tracing the Connections between Genes and Cognition," Simon E. Fisher observes that the "rise of molecular genetics is having a pervasive influence in a wide variety of fields, including research into neurodevelopmental disorders like dyslexia, speech and language impairments, and autism" (270. He further notes, "the deceptive simplicity of finding correlations between genetic and phenotypic variation has led to a common misconception that there exist straightforward linear relationships between specific genes and particular behavioural and/or cognitive outputs" (270). Recently, literary theorists have begun to examine the relationships that exist between genes, language, neurodevelopment and cognition, using Stein's modernist masterpieces about the human mind. For example, in *Irresistible Dictation*, Steven Meyer uses Alfred North

Whitehead's philosophy of the organism and Gerald Edelman's neuroscientific theory of 'reentrant signaling' to argue that is possible for literary critics to theorize the imaginary, metaphorical connections that exist between a masterpiece's linguistic expressions, its genetic codes and its neural networks. Specifically, Meyer argues,

> Individual sentences prove to be the verbal equivalent of "idea[s] … quivering directly on the limit" between fields of consciousness, while paragraphs are the equivalent of states of mind or feelings and thus might be said to be emotional." In Whitehead's terms, individual sentences are patterns or eternal objects whereas paragraphs are rhythms or vibratory organisms; in Gerald Edelman's more physiological terms, they might even be said to correspond respectively to protein molecules (and the genetic blueprints that determine the configuration of these molecules) and to the neurons that activate, or inhibit, the production of molecules in the outer membranes of cells, regulating cellular adhesion and mobility. Stein's creative paragraphs differ from those of ordinary discursive prose (which is composed, after all, for purposes of communication, for getting ideas across) in that the noncontradictory "combination" is itself twofold. In addition to the usual emotional sentences coexisting in her paragraphs, multiple states of mind (and typically states of different minds) coexist in them as well. In other words, instead of a paragraph expressing a single state of mind or feeling, as is the norm, Stein's paragraphs are quite literally of two minds; yet like the more "fundamental" relation between sentences and paragraphs, the relation between the coexisting personalities is "not a contradiction but a combination." (254-255)

This particular argument is based on Meyer's reading of Stein's 1934 lecture "Plays." Meyer's argument essentially functions as a form of speculative science fiction, or oxymoronic scientific historiography that ignores the basic principles of molecular genetics as outlined by Fisher in the statements above. But some would say that this is not the purpose of literary criticism or interdisciplinary discourse: to be empirically accurate. On points pertaining to a masterpiece's phantasmatic genes or especially to its imagined language genes, I disagree with Meyer's neuraesthetic/genetic critical approach the most. When viewed from the disciplinary perspectives of molecular genetics, cognitive psychology and psycholinguistics, Meyer's argument does not satisfy the methodological practices and definition criteria that are needed to establish even the imaginary, genotypic 'elements' of a literary masterpiece. That is, his arguments about a text's genetic blueprints do not allow readers to categorize the allelic variants and to study the various phenotypes within Stein's dramatic corpus (leaving aside, for the moment, all the possible incarnations of these dramatic works in theatrical practice). As he puts it, "in Gerald Edelman's more physiological terms, they [individual sentences] might even be said to correspond respectively to protein molecules (and the genetic blueprints that determine the configuration of these molecules) and to the neurons that activate, or inhibit, the production of molecules in the outer membranes of cells, regulating cellular adhesion and mobility." With this statement, Meyer does not provide enough information about the dramatic texts that showcase these genetic scripts or "blueprints" through their individual sentences to permit us to consider the kinds of "physical, biochemical, physiological or neurodevelopmental" characteristics that might correspond with the genetic makeup of these literary works (Fisher). By sidestepping the issue of how an emotional paragraph would be performed onstage as a “vibratory organism,” and by neglecting to explain how the different kinds of genes, protein molecules and neurons in the brain would be incarnated by a script’s individual sentences, Meyer links genetic expression, neural architecture and cognitive reception or processing in one fell swoop. He does so without explaining or speculating how a “language of genetics” and/or a ‘literary genome’ might be dramatized as a form of consciousness, or as Sara Ford puts it, as the “performance of modern consciousness,” that is related to the act of reading or some other cognitive operation in a particular play or opera.[103] Yet, to Meyer’s credit, this method of neuraesthetic reading instinctively understands Wolf and Stoodley’s three-dimensional, pyramidal model of the brain’s reading circuits, by providing a literary model that simulates the brain’s reading circuits at the level of the words, sentences, paragraphs and the entire text.

Meyer uses Edelman’s research on artificial machines to support his theories about a masterpiece’s phantasmatic genes. However, in *Second Nature: Brain Science and Human Knowledge*, Edelman updates his research and stresses, “we are not born with enough genes to specify the synaptic complexity of higher brains like ours. Of course, the fact that we have human brains and not chimpanzee brains does depend upon gene networks. But these gene networks, like those in the brain themselves, are enormously variable since their various expression patterns depend on environment context and individual experience” (22). Based on his theories of degeneracy and neuronal selection, Edelman deduces that the singularity of each human brain can be explained by the fact that environmental “econiches” and phenomenal experience supervene upon genetic expression. Which is to say, both the “brain and body are embedded in the environment (or econiche)” (55). As Edelman puts it, “once language emerged in human evolution, our knowledge and its development, as well as our evolutionary path, depended on culture. Yet, "as Peter J. Richerson and Robert Boyd point out, culture is not equatable directly to the environment or econiche" (55).

My research on Stein's dramatic plays, her brain stem research, James evolutionary psychology and the FOXP2 gene has encouraged me to different approach to reading a masterpiece's "language genes" and deciphering Stein's "literary genetics" than the one Meyer adopts in *Irresistible Dictation*. Through her comparative neuroanatomical studies at Johns Hopkins, her embryological experiments with the human brain, her biological studies on evolutionary science, and her psychological studies with William James at Harvard, Stein was able to see the disconnection between human nature and the human mind as a genetic phenomenon. Elsewhere, I set out to prove that she had insights into the neurodevelopmental disorders and language problems caused by the FOXP2 gene's mutation, and these insights parallel Fisher's findings in the following report:

> In 2001, Lai and colleagues reported that a change to a single nucleotide in one copy of the FOXP2 gene on chromosome 7 was responsible for the speech and language problems of the affected KE individuals. They also identified an unrelated subject with speech and language problems resulting from a translocation disrupting the FOXP2 locus (Lai et al., 2000; Lai et al, 2001). Although at the time of its discovery FOXP2 was a novel human gene (in that nobody had previously reported its full coding sequence) it was possible to made predictions about the gene's likely function by comparing it to other genes that had already been characterised. This comparison revealed that FOXP2 codes for a type of regulatory protein, called a transcription factor, which is involved in modulating expression of

> (i.e. switching on and off) other genes (Lai et al., 2001). As explained earlier in this article, genomic biology is characterised by regulatory networks involving control regions in genes and regulatory factors that bind to them. This feature allows a static linear genome to encode the dynamic adaptive systems underlying the development and functions of a complex living organism (Hood & Galas, 2003). The FOXP2 protein belongs to a subclass of transcription factors known as forkhead proteins (Carlsson & Mahlapuu, 2002), each of which contains a DNA-binding domain (called a "forkhead-box" domain) with a characteristic structure. The human genome codes for more than 40 types of forkhead protein, and these are involved in a wide variety of developmental and physiological pathways (Carlsson & Mahlapuu, 2002). Of note, many forkheads play important roles in controlling genetic cascades during embryonic development and a number are critical for normal patterning of the central nervous system (CNS). (286-287)

The Geographical History of America anticipates the discovery of FOXP2, the so-called "language gene," in 2001, by Dr. Anthony Monaco and his team of co-researchers at Oxford University, by imagining the devolution of language, speech and communicative ability in "human nature." Through a special kind of evolutionary reasoning that I have defined as her "literary genetics," Stein advances the hypothesis that human mind has evolved over the course of "thousands of years" (108), to the point where it exists as a separate entity and "there is no relation between human nature and the human mind" (109).[104] The propositions that Stein advances in "Chapter II" of *The Geographical History of America* anticipate some of the discoveries that these Oxford scientists have made, in the past seven years, about the genetics of language. This research does not explain, however, how a

genetics research on the FOXP2, the so-called language gene, can be applied to a reading circuit, because, as Wolf points out, “there are no genes specific only to reading in the bottom layer [of the pyramid]. Unlike its component parts such as vision and speech, which *are* genetically organized, reading has no direct genetic program passing it on to future generations.” According to Stein’s neuraesthetic evolutionary logic, the human mind “is” writing. Following this logic, a genetics of reading, if such an approach were to be developed by neuroscientists and geneticists, would account for the complex connections between inherited and acquired, brain concepts. By correlating this genetics of reading with the “literary genome,” to use Lehrer’s term, it would be possible to hypothesize how inherited and acquired, brain concepts express themselves through the “writing” that is the human mind. Potentially, brain scientists and humanities scholars would be able to read the genetics of language, at the level of the brain’s neuraesthetic productions, with the help of sophisticated theories about cubist writing and the reading brain. See Figure 56. The FOXP2 gene in Neurological Development, from Simon E. Fisher’s website at the Wellcome Trust Centre for Human Genetics, Oxford University
(< http://www.well.ox.ac.uk/~simon/FOXP2/index.shtml>).

Material has been removed from this thesis because of copyright restrictions. The material removed from page 478 is Figure 55, which is a color photocopy of The FOXP2 gene in Neurological Development, from Simon E. Fisher’s website at the Wellcome Trust Centre for Human Genetics, Oxford University, at

< http://www.well.ox.ac.uk/~simon/FOXP2/index.shtml>.

4.6 Myths about the Stein Neuron, the Picasso Axon, and Brain Whispering

In placing stress upon the kinds of "sensory maps" that Stein constructs with color words and other English signifiers in her modernist writings, which may have been based partially on her three-dimensional model of the medulla oblongata and on her research on the nucleus of Darkschewitch under Barker's supervision, I shift my focus temporarily from a "brain whispering model" to a "noisy brain model." John Horgan, in "The Myth of Mind Control," explains the neuroscientific theory behind the notion of neuron whispering, or brain whispering, in the following passage:

> a single neuron may resemble less a simple switch than a customized microcomputer, sophisticated enough to distinguish your grandmother from Grandmother Moses. If this view is correct, meaningful messages might be conveyed not just by hordes of neurons screaming in unison but by a small group of cells whispering, perhaps in a terse temporal code. Discerning such faint signals within the cacophony of the brain will be "incredibly difficult," Koch says, no matter how far neurotechnology advances. Efforts to detect the whispers and the cacophony are further complicated by the improvisational dexterity of the brain. Studies of the motor cortex, which underlies body movement, have shown that the brain invents entirely new coding schemes for novel situations. (*The Brain* 8)

Reading is one of these novel situations, where there may be small groups of cells whispering to one another and communicating new coding schemes across brain regions that were not designed for the act of reading but for other processes or activities, such as color vision, language formation, and the act of writing. "A critical step in learning to read involves mastering the perceptual properties of written language," Thomas Carr reports, "so that the visual system can talk effectively to the language system. The product of this learning is a new set of computational structures in the prestriate visual cortex that did not exist prior to reading" (as cited by Wolf, on p. 147). Adding to this recognition, Wolf observes, "Learning to read changes the visual cortex of the brain. Because the visual system is capable of object recognition and specialization, the expert reader's visual areas are now populated with cell networks responsible for visual images of letters, letter patterns, and words" (147). I suppose the process of discovery never ends with a writer such as Stein. I have been my own worst example of *colorblind* literary reading, which is why I have sought to correct this misrecognition in my reading practices. I now know that Stein's literary portraits contain coding schemes that help us to detect brain whispers and other faint signals.

I turn now to two of Stein's portraits of Picasso, "If I Told Him: a Completed Portrait of Picasso" and "Picasso." The former is one of the portraits that contains no color words but utilizes the "color thing" and the latter was composed before Stein began to experiment with this "color thing." Though I embarrass myself by including these incomplete and naïve readings of Stein's portraits, I feel it is important to show that Stein's color thing may have gender implications and linguistic meanings beyond what I am able to show in this project. At any given point in time, we are expert readers and not so expert readers of Stein's literary portraits. These are readings I produced before I knew any brain theory: I leave it up to you to decide if there is a difference, if there are murmurs, whispers and other sounds that I could pick up before that I am now somewhat deaf to.

In "If I Told Him: A Completed Portrait of Picasso," Stein plays with repetition of the masculine pronoun "he" in a mimetic sequence that brings into relief the status of Picasso's aesthetic vision and the meanings that he associates with his chosen art objects: "He he he he and he and he and and he and he and he and and as and as he and as he and he. He is and as he is, and as he is and he is, he is and as he and he and as he is and he and he and and he and he" (*Prayers and Portraits* 23). Using a similar strategy in "Picasso," Stein not only creates suspense around the question of 'meaning,' but also mocks the audience's expectation for "meaning" in modern art when she writes, "something had been coming out of him, certainly it had been coming out of him, certainly it was something, certainly it had been coming out of him, certainly it was something, certainly it had been coming out of him and it had meaning, a charming meaning, a solid meaning, a struggling meaning, a clear meaning" (17).

By contrast, Stein's second portrait of Picasso – "If I Told Him: A Completed Portrait of Picasso" suggests, through the title, that both she and Picasso are both the subjects of this portrait. Through the subjunctive "if," Stein implies that there is a secret she is withholding from Picasso, a secret that enables her to make a "completed," rather than an evolving or unfinished, portrait of him. Stein's mime of Picasso illustrates Judith Butler's point, which is that the act of miming means one is reabsorbed into the mime; to portray Picasso and to perform his actions, especially with respect to 'copying' (i.e. transforming) his artistic perceptions and his cubist writings onto her own literary canvas is to put herself into a position where she sees what he sees, to paint herself as he has painted her on his canvas. Yet, such a performance also requires that she reveals what he paints and what he artistically perceives through his cubist vision is not what he literally sees, which is his portrait's proper object or even his portrait's implied subjects, but that what he misrecognizes as the portrait's true subjects and objects with his ideological blinders (or "shutters"), as occurs with the feminine other, who must identify with "he and he and he and he."

But this complex act of literary portraiture also reveals what Stein perceives to be true of Picasso's "real colors," of his artistic persona and of his life's work, if only she could tell him that. In other words, she perceives that he is reproducing himself and his vision of the 'exact resemblance' within his artwork through 'woman,' even through the muse of the 'woman writing,' but 'he' has little sense of the writing that a woman like Stein actually does in her cubist portraits, particularly the ones that feature him as a portrait subject. Each "he" in the sequence seems to be an "exact resemblance" to the other "hes"(the plural third person pronoun I use here, of course, represents a grammatical impossibility in English, since, to be correct, the many "hes" should be converted to the plural third person form, 'they,' but this would be incorrect translation of Stein's aesthetic vision of Picasso's mimetic non-reduplication and her own 'endocryptic identification,' a vision that visually seeks to account for the singularities of each "Picasso" at work in his respective, cubist visions of his non-mimetic portrait subjects and the singularities of the Steins that exist in relation to Picasso's visualized quasi-objects and quasi-subjects. By producing a series of cubist puns that speak to the representational paradoxes found in Picasso's art, with respect the status of the 'lost referent' of the women that are removed from in his portraits at the level of color, line and perspective, Stein's clever portrait draws analogies between different registers of the alleged singularities and universals of 'woman' within his cubist paintings. Stein mimics Picasso's non-mimetic portraiture of her, with these grammatical errors and performative misfires. In *The Autobiography*, she gives her account of how Picasso came to paint her unlikely portrait: "Picasso had never had anybody pose for him since he was sixteen years old, he was then twenty-four and Gertrude Stein had never thought of having her portrait painted, and they do not either of them know how it came about. Anyway it did and she posed to him for this portrait ninety times and a great deal happened during that time." (123). Stein writes proudly about how she begins to look like her portrait after the fact, though, oddly enough, the portrait was headless or had a different head than the one it finally came to have in its final incarnation: "The day he returned from Spain Picasso sat down and out of his head painted the head in without having seen Gertrude Stein again. And when she saw it he and she were content. It is very strange but neither can remember at all what the head looked like when he pained it out" (57). See Figure 56, which is Picasso's cubist painting of Gertrude Stein (1906).

Material has been removed from this thesis because of copyright restrictions. The material removed from page 484 is Figure 56, Gertrude Stein. This figure contains a portrait of Gertrude Stein that Picasso painted, in 1906, after approximately ninety sittings. The source of the material for Fig. 58 is the Metropolitan of Museum of New York's website: <http://www.metmuseum.org/works_of_art/collection_database/modern_art/gertrude_stein_pablo_picasso/objectview_enlarge.aspx?page=1&sort=0&sortdir=asc&keyword=&fp=1&dd1=21&dd2=0&vw=1&collID=21&OID=210008443&vT=1>. This website provides the following information about this painting and its copyright: ‟Oil on canvas; H. 39-3/8, W. 32 in. (100 x 81.3 cm). Bequest of Gertrude Stein, 1946 (47.106) ©1999 Estate of Pablo Picasso/Artists Rights Society (ARS), New York. Metropolitan Museum, New York.

For Picasso's *multiplicity* and his *singularity* to complement each other within Stein's portrait as discursive and grammatical coordinates of "entity" (that is, as referential markers of the limits of his aesthetic consciousness that exist in relation to Stein's redoubled vision of his projected, artistic consciousness(es)), this portrait must create impossible images through the use of enigmatic messages and signifiers. In turn, these messages and signifiers must produce a desire on the part of reader to be part of this "queer" couple and their grammatical couplings, that is, to be part of the portrait and, also, to become part of the portrait-making process.

The reader is not an autobiographical witness, as Stein remarks, but he or she is a symbolic mirror that supports a vision of the lost referents within Picasso's cubist vision of 'woman.' See Figure 58, which is Picasso's analytic-style cubist painting of a woman with a guitar or a zither.

Material has been removed from this thesis because of copyright restrictions. The material removed from page 486 is Figure 58, which is a color photocopy of Pablo Picasso's cubist painting, 'Ma Jolie': Femme à la guitare ou cithara ('Ma Jolie': Woman With Zither or Guitar). This figure contains information about Picasso's cubist portraiture strategies and the relation that Gertrude Stein had to other cubist representational practices and to other cubist artists in the early twentieth century. The source of this material is Plate 114, from Primitivism, Cubism, Abstraction: The Early Twentieth Century. Ed. Charles Harrison, et al. New Haven: Yale UP, 1993. p.136. Picasso's portrait currently belongs to The Museum of Modern Art, New York. Acquired through the Lillie P. Bliss Bequest. © DACS 1993. Winter 1911-1912, oil on canvas, 100 x 65 cm.

In *The Geographical History of America* Stein states, “there are no witnesses to the autobiography of any one that has a human mind” (90). With respect to this statement, my reading of Stein’s portrait zooms in on the erotics of such non-witnessing to “mind” that I register as the obliquely signified, sensual geometries and psychological principles are inherent in Stein’s composition of herself and Picasso as the abstract ‘subjects’ and ‘objects’ of an aesthetically represented, historical reality. The neuronal and identificatory mirroring that occurs at the level of grammar, syntax and style suggests that Stein’s completed Picasso portrait indirectly indexes, or is *about,* the portraits they have constructed of each other in the past. We know, from what Stein tells us in *The Autobiography of Alice B. Toklas*, that Picasso had Stein come to his studio for approximately ninety sittings before giving Stein her completed portrait. This repetitious, historical reality finds expression as a subjunctive situation and as a mood, a virtual reality, which is captured in Picasso’s completed portrait of Gertrude. As Steiner usefully notes, “the implications of this continuity of self over other, over one’s companion [or friend], one’s audience, are rather mind-boggling. However we see a similar kind of mimetic confusion occur in Stein’s plays and operas, where characters merge into each other through their speeches. In portraiture such a merging of subject and writer is essential, the writer recording his [or her] perceptions of another and in so doing recording himself” (*Exact Resemblance* 187). Provided with this description, we might ask, what does the process of ‘witnessing’ mean to Stein? If there are not witnesses to the human mind’s autobiography, then what are we to make of the performative co-symbols that comprise these portraits, and how do these encrypted relations engender a “color thing” at the level of a masterpiece’s neuroanatomical imaginary?

How can we bypass the linguistic obstacles that we know are placed in our path, which partially screen Stein's 'subject matter' and prevent the reader from fully encountering the 'primal scenes' that Stein uses as raw material for her abstract compositions and her critical mimes? Is the "color thing" one of those "primal scenes"? With respect to a similar kind of cryptic scenography and mental topography that manifests itself in the primal scenes of modernist art, literature and science, Jacques Derrida, in his introduction to Torok and Abraham's *The Wolf Man's Magic Word: A Cryptonomy*, theorizes,

> a problematic of the *sign's* "motivation" or "arbitrariness," of the "mimetic" powers or illusions of language, if it did not pass through this new logic of name effects or signature effects, would simply bypass what effectively produces *both* the effect of arbitrariness *and* the effect of motivation. That problematic would to this day remain enclosed within the narrow limits: the conscious representations of "words" and "things" for a self speaking within the "internal" system of language. Within the strict limits of this "internal" functioning governed by the principle of the arbitrariness of the sign, no effect, even an illusory one, of motivation is possible. ("Fors" xlvi; original emphasis)

Derrida uses Stephane Mallarmé's *English Words* to buttress his proposition about re-conceptualizing the seemingly arbitrary juxtaposition or composition of signs in a cryptic poetics (or "poetics of the crypt"), by suggesting that the way 'around' the hermeneutic obstacle of authorial 'motivation' or intentionality is to focus on

> what is produced in speech or in writing by a *desire for idiom* or an *idiom of desire*. There, a system is// wrenched open within the system, general (national) codes are diverted and exploited, at the

> cost of certain transactions, in a type of economy that thenceforth is neither purely idiomatic (the absolutely indecipherable) nor simply commonplace (conventional and transparent). ("Fors" xlvi-xlvii)

What is often seen by critics as a pathological, linguistic constellation and a cryptic style, especially in regard to the Wolf Man, Mallarmé, and Stein's respective texts (or 'cryptonomies'), will be seen, using this approach, as having less to do with authorial intention than with a group of stylistic effects, or "qualialects," particularly if the "desire for idiom" or an "idiom of desire" can be located within a given style. Witnessing to a writer's "desire" through an "idiom of desire," as opposed to witnessing to the human mind, will mean shifting our focus from an intrapsychic economy of displaced witnessing and transphenomenal, linguistic distribution that is hermetic and largely inaccessible to the average reader, to that of the performative utterance that is 'encrypted' within seemingly illegible or non-narrativizable texts.

Using Torok and Abraham's 'cryptonomy' theory, as well as Derrida's philosophical readings of the Wolf Man's cryptic translations and poetics, Jodey Castriano calls such quasi-melancholic forms of literary or philosophical dictation 'cryptomimetic,' which I think also works well as a description of Stein's burlesque representations of her chosen subject(s). The term "cryptonomy," coined by the post-Freudian psychoanalysts Nicolas Abraham and Maria Torok, signifies a number of different concepts simultaneously. It is first and foremost a theory of intraspsychic ego formation, involving the radical re-structuration of spatial, semantic, and libidinal formations within the human psyche as a result of traumatic, primary or secondary witnessing. A cryptonomy is also a theory of language and the broken symbol, what Torok and Abraham refer to as the process of "antisemantics" or "anasemic retranscription." Functioning as an emergent, architectural and spatial paradigm, this theory seeks to understand the "politico-juridical instance" of traumatic witnessing ("Fors" xv), the "free circulation and exchange of objects and speeches" (xiv), "the assembled system of various places" (xiv), the history of an artifice, an architecture, [or] an artifact" (xiv), and the processes by which any or all of the above things come into interaction with one another. Not only, then, does a cryptonomy serve as a theory of space and localization, of "temporization" and assimilation, of conservation and suppression, and of commemoration and loss -- all of which have far reaching practical and theoretical applications within the field of postcolonial studies – but it also, and perhaps most importantly, acts as an anti-theory of sorts, presenting its own internal incoherencies and lack of systematicity as a possible ideological antidote to what Derrida calls "hieroglyphist prejudices," those instances of wilful or interested blindness that accrue to social subjects who cannot 'voice' their own instances of oppression, dispossession, or '*jouissance*.' In other words, this theory has vast potential for literary studies and for the study of traumatic texts, however such texts are defined.

The elaborate jokes and riddles that Stein composes as portraits and plays act as 'cryptomimetic' representations because they, too, can be conceived of as encrypted scenes of displaced, mental witnessing. In Stein's "Completed Portrait of Picasso," proper names operate as "name effects" and signature effects," in that they give the illusion of arbitrariness but, in fact, create a labyrinth of signification and derailed meaning that signifies Stein's desire to identify with the object – "Picasso" -- in a number of different ways. The portrait opens with, "If I told him would he like it. Would he like it if I told him. Would he like it would Napoleon would Napoleon would he like it. If Napoleon if I told him if I told him if Napoleon. Would he like it if I told him if I told him if Napoleon" (*PP* 21).

What do Napoleon and Picasso have in common? What is the mode of resemblance that makes them comparable entities in Stein's imagination? This portrait advises the reader after the passage that compares "exact resemblance to exact resemblance the exact resemblance as exact as resemblance," to do the following: "Have hold and hear, actively repeat at all. I judge judge. As a resemblance to him. Who comes first. Napoleon the first. Who comes too coming coming too, who goes there, as they go they share, who shares all, all is as all as as yet or as yet. Now to date now to date. Now and now and date and the date" (22). It appears that Stein is courting Picasso's desire in this portrait through the incessant questioning of whether he will be pleased or not when she presents his portrait to him. But, it also occurs to me that she is making fun of her own hysterical (read histrionic) questioning, while she parodies her role as Picasso's portraitist and his role as her portraitist. What this suggests is that even as she is participating in, or constructing, this literary mime and is *reabsorbed* into it, as Butler and Irigaray argue is the case with woman's mimicry of the phallogocentric economy of language, she inaugurates hysterical desire in her reader by hystericizing and transforming her subject, "Picasso," into a questionable/questioning entity that will judge her portrait and quibble about "Proportions" (23), just as she "judges" her own skilfully crafted resemblances at the level of language: "Exact resemblance to exact resemblance the exact resemblance as exact as a resemblance, exactly as resembling, exactly resembling, exactly in resemblance exactly a resemblance, exactly and resemblance. For this is so. Because" (22). Stein's deferent nod to a phallogocentric economy of language and mimetic repetition comes unravelled in her following composition of "trains," whereby she uses a cubist pun, or visual 'sight gag,' in the form of a homology, "Father and farther" (24), to derail the appearance of her crossdressing linguistic mime. "Father and farther" might sound like a homonym in certain American dialects, but it does not 'look the part' because it suffers a visual 'near miss,' much like two trains of thought caught in a tragic accident. In this case, it also functions as a cubist pun because it could be construed as typographical or grammatical error, just the kind that Stein is prone to making. This phrase belongs to a line of questioning that further hystericizes the relation between Stein and Picasso, Stein and the symbolic Father, Picasso and the Paternal Father, between the king (Napoleon) and a unspecified room (the bedroom?), as well as the semiotic/semantic distance between the words in the homonym: "Father and farther. Was the king or room. Farther and whether. Was there was there was there what was there was there// what was there was there there was there" (24; original repetitions). Stein, or rather her portrait's, desire for Picasso's favourable response comes to naught through this sly derailing of meaning, a derailment that is not completely literal but which nevertheless accords with the composer's desire to present "exactitude/As trains" (25). The portrait's language does two things at once by connoting that trains are exact, or on time ("presently"), and also by sustaining a line of questioning that rhetorically and repeatedly asks, "what was there was there" (23), only to imperfectly echo and cagily answer back, "there was there," which leads us to realize belatedly that all kinds of accidental comparisons *and* intentional analogies *and* asymmetrical, though necessary mirror relations are what constitute Picasso's literary "portrait." The paradoxical resemblances of Stein/Picasso, Napoleon/Picasso, kings/queens, now/not now, like the "trains" in the next section of the portrait, not only connote in-exactitude or non-mimetic singularity, but also lead to accidental discoveries (what was there was there") and create visual/aural wreckage that cannot be repaired (the portrait is "completed"). What this portrait achieves is a "cryptomimetic" (or partly secretive) process of linguistic reparation and poetic 'justice,' which we can conceptualize as a parody because of the aesthetic and linguistic 'turns' that make "Picasso" resemble Stein's aesthetic vision, instead of his own self-perception, whereby even his own cultural sense of masculinity (or maleness) will be brought into question and her femininity (or lack thereof) will be brought into bold relief.

The portraitist's desire occurs and coincides with Stein's identification of Picasso's role as painter-king, yet this symbolized desire also departs from this identification to the extent that "queens" enter the picture, so to speak, as an aperture or opening to another kind of mimetic, verbal performance: "Shutters shut and open so do queens. Shutters shut and shutters and so shutters shut and shutters and so and so shutters and/so shutters shut and so shutters shut and shutters and so" (22). The flapping of shutters (of sphincters shutting? of ideological blinders being removed?) ominously prepares the spectator for a virtuoso 'performance' within the portrait, wherein the portraitist mimes the actions of the painter that is being linguistically painted and mimed here, by a kind of reverse mimesis: "Exact resemblance to exact resemblance the exact resemblance as exact as a resemblance, exactly as resembling, exactly resembling, exactly in resemblance exactly a resemblance, exactly and resemblance. For this is so. Because" (22). Stein's not-so-mundane repetitions, in this part of the portrait, construct a vision of the (female) portraitist's performance as a burlesque comic, because what is being mimed and elevated simultaneously at the level of language is a performative process of cryptomimetic portraiture that bespeaks an amused, yet also anxious, participation on the part of the author *other* scenes and places. Here, her cryptic language mimes its own creative acts of mundane repetition, thereby questioning the ways in which language operates recursively to "play" with copies and originals. In this portrait, Stein strives for a level of linguistic "play" that is "fair," rather than malicious. However, it is no less theatrical for its linguistic, even-handed treatment of Picasso's fame and for its representation of his "bottom nature," or of his discursive subjectivity, as the following section of Picasso's portrait suggests:

> Miracles play.
> Play fairly.
> Play fairly well.
> A well.
> As well.
> As or as presently.
> Let me recite what history teaches. History teaches. (25)

Stein's identification with Picasso's role as artistic and 'king' or 'queen' comes to a subtle and tasteful 'end' in this portrait through a suggestion of 'fair play' between them. If Stein's texts can be conceived of as cryptic scenes of displaced witnessing, whereby, a *desire for idiom* is substituted for coherent narrative or an *idiom of desire* exerts its presence as a screen memory of a 'real' (perhaps here the 'real' of sexual difference) that is displaced into a fetishistic relation that signifies an identification with a lost object or referent (i.e., just as the Wolf Man identifies with his molested sister), then 'witnessing' will also transpire, to the extent that it takes place at all, in a similar 'cryptomimetic' fashion. This *desire for idiom* or *idiom of desire* can be witnessed in Stein's "Completed Portrait of Picasso" as a slippage along a number of identificatory lines that give the appearance of exactitude but which function as openings onto other questions, onto other apertures of identificatory resemblance and derailed desires.

Stein's 'burlesque solution' to the dilemma of queer non-existence and non-identity presents itself as a question to the *other* in the form of a hystericized discourse that not only oscillates but also mediates between visual tropes (or catachreses) of multiplicity and singularity. These burlesque solutions 'fix' the imaginary coordinates of 'entity' within a symbolic order that appears to be disintegrated and disorderly, yet which nevertheless communicates the subject's desire to flirt with the impossible-real of sexual difference, *jouissance*, and desire within the very framework of the portrait's intertextual and inter-subjective translations. The pun that is being played out through each and every literary repetition seemingly occurs at Picasso's expense; but these puns may be interpreted as a complicity between Picasso and Stein, whereby the joke is really being played on the readers, so that "he and he and he and he and he" are the true subjects of Stein's literary portraiture, in a mimicry of the reader that mirrors the ways in which Picasso reproduces himself in his art through his desire for 'woman.' In part, her cubist puns play with the recognition that "Gertrude Stein" or any other of Picasso's portrait subjects – be it Fernande, Eva, Gaby, Olga, Marie Thérèse, Dora, Françoise, or Jacqueline (his wives and lovers) – partake in a mimetic, phallic economy that displaces the painted subject/object within the receding frameworks of his cubist portraits (if you recall, Stein argues that cubism figuratively removed the frames from its portraits, that was one of its signal achievements). Stein lets the reader in on her cubist pun in more than one way: first, by the title -- 'if he knew' – and, secondly, by pointing out that Picasso, very much the other non-woman in Stein's abstract portrait, exists only as the lost referent, as the subject that cannot be secured in a given discursive domain except as "a certain traumatic impossibility," or as the 'bar' in a symbolic universe and phrase regimen that separates the 'real' from the re-presented object (of the portrait's linguistic desire).

With these cubist writings, Stein undercuts the seriousness with scientists approach the investigation of certain subjects and the solemnity with which philosophers approach the subject of death, but the main subject that concerns her is the relation or the non-relation that exists between human nature and the human mind. The color puns in Stein's neuroanatomical portraiture are not exempt from these performative misfires and performative infelicities. I am arguing that this is to their benefit, for Stein learned how to manipulate these cubist puns to create brain portraits with performative, introspective, and visual qualities that could be used in numerous ways to further human knowledge.

The neuroanatomical portrait that Stein creates in *The Geographical History of America* does not explicitly mock Picasso, the nerve tissue staining techniques and neuroanatomical discoveries of her medical professors at Johns Hopkins University or brain scientists, such as von Gerlach, Cajal and Golgi. To the contrary, the portrait's deployment of a cubist pun and its proliferation of semantic references and condensation of semantic meanings act as a mockery because it provokes new reading strategies, interrogates difficult scientific ideas and suggests plausible alternatives to existing medical practices. As a result of her brain research and medical studies at Johns Hopkins, her psychological experiments with color consciousness at Harvard University, and her literary experiments with analytic and synthetic cubism, Stein was able to develop sophisticated brain maps that present subjective knowledge at the level of a masterpiece's of surface grammatical structures and as cubist allegories that reveal important aspects of the human mind's creative processes, past failures and scientific insights.

[1] The epigraphs above come from the following sources: Gertrude Stein's "Poetry and Grammar," *Lectures in America*, p. 221, and Giorgio Agamben's *Infancy and History*, p. 38.

[2] In *Everybody's Autobiography* Stein explains how these influences shaped her modernist aesthetic and modern subjectivity. In a section where she recants her published ideas about the ability of her and Solomons to have produced automatic writing in the Harvard psychology laboratory, Stein recalls, "When I was at Radcliffe I was of course very interested in psychology. I was interested in biology and I was interested in psychology and in philosophy and history, that was all natural enough, I came out of the nineteenth century you had to be interested in evolution and biology. I liked thinking so I had to be interested in philosophy and I liked looking at every one and talking and listening so I had to be interested in history of psychology. I did not like anything abnormal or frightening so I did not care for histology or medicine and I do not like what is not what people are doing so chemistry and physiology did not attract me, and astronomy and mathematics were too far away again too frightening. I read everything that was natural enough and not a thing to be studied. I knew what writing was and if you read it and could read it you knew it so there was no use having any one teach you anything about it, I suppose about all these things I have not changed much. James and Münsterberg were interested in me and so although I was an undergraduate student indeed one who had not yet passed the entrance examinations they said I could come to the seminar in psychology and I liked that. We were quite a funny lot. Sidis was there who afterwards had the son who passed everything when he was a little boy and then did nothing, McDougall a man afterwards well known who worked on conversion, William James was interested in that in connection with his Varieties of Religious Experience and Thorndyke who was busy incubating

chickens and what they did then and a man named Leon Solomons who came from California and who was an intimate friend of mine, there were a number more but these were the ones I remember. Münsterberg had just come from Berlin and was interested in experimental psychology and William James liked thinking and talking and wondering about what any one was doing and we all of us worked with both of them" (272-273; original spelling and emphasis). Things did change for Stein, as I point out in my chapters, when she went to medical school and studied histology, medicine, chemistry, embryology and brain science with Dr. Franklin Mall and Dr. Lewellys Barker. In *The Autobiography of Alice B. Toklas*, after reciting some of the problems that she faced with her professors and examinations at medical school, Stein claims she still dislikes the abnormal and the pathological. However, in the context of her medical education and brain research, these words assume new significance, for Stein learns novel ways of assimilating her past neuroscientific interests and her psychological experiments to her current literary experiments with cubism, phenomenology and avant-garde theater, beginning with the portraits she writes in *Tender Buttons.* In foregrounding these influences upon Stein's conceptual methodologies and neuraesthetic writing practices, I wish to emphasize the non-pathological, allegorical, interdisciplinary and inclusive nature of Stein's modernist representations of the human brain and the human mind..

[3] I begin and end this project with color enigmas that are really 'skinny question marks' (as Nietzsche would say). I hope that I will have teased out enough of the theoretical, scientific, literary and historical material surrounding this "color thing" and its corresponding, linguistic and literary enigmas, so that Stein's first-time readers and my readers will be able to comprehend some of the conceptual problems pertaining to Stein's

phenomenology of consciousness and her esoteric brain mapping practices. In foregrounding these conceptual problems here, I aim to outline some of the critical arguments and to frame the literary history that has shaped the foreclosure of this "color thing" from Stein scholarship. This "color thing" did not made it into Steven Meyer's neuraesthetic readings of Stein's modernist masterpieces, so it is imperative that my readers grasp what is at stake with this anxiety-causing "color thing": namely, that it may be at the heart of Stein's secretive, brain mapping practices and, also, it may have uses that exist outside of literary studies proper.

In "Portraits and Repetition," Stein confesses that she has a secret "color thing" that has caused her anxiety over the years: "One of the things that made me most anxious at one time was the relation of color to the words exactly meant but had not element in it of description. One portrait I did … of Lipschitz did this color thing better than I had ever before been able to do it" ("Portraits and Prayers," *LIA* 191). Here is the complete portrait that Stein wanted her readers to see and hear with their own senses, as that which exemplifies her "color thing":

> LIPSCHITZ
>
> Like and like likely and likely likely and likely
> like and like.
>
> He had a dream. He dreamed he heard a pheas-
> ant calling and very likely a pheasant was call-
> ing.
>
> To whom went.
>
> He had a dream he dreamed he heard a pheas-
> ant calling and most likely a pheasant was call-
> ing. (192)

If someone is reading only the words on the page and if that person did not have access to Stein's critical writings, it would be nearly impossible for that reader to find a correspondence between Stein's "color thing" and the non-descriptive words "that exactly meant" the "relation of color to the words" within her creative imagination. As I discuss in chapter three, Stein does not expect her literary readers to be mind-readers or clairvoyants.

For the first time in her writing career, Stein reveals that she used to create cubist portraits with non-descriptive words, such as "like" and "likely," then fashioned these non-descriptive words into phrases such as, "Like and like likely likely and likely like and like," all the while conceiving of these words as "the relation of color to the words exactly meant" (191). Even though Stein does not explicitly describe her compositional methods as a philosophical experiments with the elementary and secondary qualities of conscious experience, her "color thing" functions as means of creating colorful brain, mind and consciousness maps with relational qualia, which are the phenomenal qualities of conscious experience that she conceptualizes, in a relational manner, to create correspondences between a text's invisible color spaces and her inner states of consciousness.

Earlier in this essay, Stein hints at why she has been secretive about her invisible color experiments: "every time one of the hundreds of times a newspaper man makes fun of my writing and of my repetition he always has the same theme, that is, if you like, repetition, that is if you like the repeating that is the same thing but once started expressing this thing, expressing any thing there can be no repetition because the essence of that expression is insistence, and if you insist you must each time use emphasis and if you use emphasis it is not possible while anybody is alive in the telling the emphasis is different. It has to be, anybody can know that" (167).

Though these statements might enhance a reader's understanding of Stein's modernist aesthetic and her harsh critical reception, it does not really explain why she took twenty years to tell her readers that this so-called "color thing" is an important part of her literary compositions and her conceptual methodologies. To be precise, this "color thing" is not even a literary concern because it happens off the page, so to speak, as a kind of "middle writing," or as an imaginary exercise that involves a form of color visualization, which occurs somewhere between the writer's creative imagination, her subjective phenomenology, the physical writing process and the published work. Because this "color thing" does not satisfy the demands for 'close reading' within the discipline of English studies and American literature, some critics have characterized it as a 'decadent' obsession and Stein's associated portraits as decadent modernist writings, when perhaps it should have been defined as a *neuraesthetic* writing practice that helped Stein in her literary brain mapping and consciousness research. It is entirely possible that the harsh criticism that Stein received from American journalists, critics and readers, during the first twenty years of her writing career, may have influenced her decision to remain silent about this "color thing" and her secretive brain mapping experiments. Other defensive statements that Stein makes about her cubist portraiture strategies and their cultural reception in "Portraits and Repetition" would appear to support this view.

This could be part of the reason why she does not explain how her literary experiments with phenomenal color experience, through the cubist "color thing," inform her allegorical representations of the brain's neurophysiological entities and its neuroanatomical features. Stein's response to the harsh criticism she received from early twentieth critics may explain why she may have neglected to mention this color thing, but it does not explain why others have overlooked and excluded this color thing from their analyses of her literary texts and dramatic works, knowing, of course, that it is an important step in her creative processes and an intrinsic part of her cubist portraiture practices. A staggering number of Stein's early and late twentieth-century literary critics neglected to mention this "color thing," even when they were speaking directly about the passages, portraits, and ideas that she cites in "Portraits and Repetition" about her experiments with invisible color spaces and visible color signifiers. For example, in *Gertrude Stein's Theater of the Absolute*, Betsy Ryan claims that the phenomena (i.e. the "color thing") that Stein visualizes with the creative processes of her conscious mind become "word-object[s]" that possess the "quantum force" of "absolute knowledge":

> The human mind, whatever its special capacities, remains solely the mind of Gertrude Stein, and its perceptions of "essences" or of "words that… very exactly related themselves to that thing the thing at which I was looking" are very possibly not perceptions shared by or easily transmitted to her audience. But Stein's artwork, which contains, in effect, the thing within itself, commands that an audience face it or nothing. There is no object other than the word-object to refer to. Ironically, then, it is precisely her objective approach to the essential thing which leads much of the world to regard Stein as incomprehensibly subjective, if not decadent. Her prevailing sentiment "if it can be done why do it" is testament to her dedication to the highest aims in her work, and indicates that her aesthetic may well have been devoted to the impossibility of capturing a thing with the particularity she desired and allowing an audience to see it. (29)

In an unpublished article entitled “Stein’s Literary Genetics: A Cubist’s View of the Human Genome,” I dispute Ryan’s quantum theory of “absolute knowledge,” using James’ evolutionary theories, Fisher’s genetics research on the FOXP2 gene, and Gass’s genetic-biological–phenomenological interpretation of Stein’s late masterpiece, *The Geographical History of America*.

Here, rather differently, my aim is to briefly examine the “color thing” that Ryan has excluded from her analysis of Stein’s absolute theatre and her literary phenomenology. As a conceptual device and as an artistic practice that potentially shapes Stein’s understanding of the brain’s color vision and its linguistic deficits, this “thing” is central to many of the writing experiments that Stein produced in the middle and late periods, experiments that led to the production of new allegorical brain maps, that followed the creation of allegorical brain maps like the ones we find in *Tender Buttons*, or that became silent prototypes for the non-descriptive, cubist brain allegories that Stein produced over a twenty-five year period (c. 1912 to 1937), before attempting to produce an explicit brain map that operated on many semiotic levels simultaneously. (I discuss the provenance and nature of Stein’s cubist allegories in chapter two of this dissertation). The paradoxes that Ryan describes in her analysis of Stein’s “quantum mind” are nevertheless key to understanding Stein’s “color thing,” even if Ryan does not mention this “color thing” in abovementioned passage and even if she does not explain how the elements of conscious thought can remain crystallized as “absolute knowledge” within the wider domain of cultural production, despite the many artistic translations and literary or musical reinterpretations that occur when her plays and operas are staged, performed and embodied by living actors and when these works are received by live audiences in a variety of cultural contexts and historical milieus.

In Ryan's catachrestic rhetoric, Stein's invisible "color thing" is associated with the "perception" of "essences or of "words that… very exactly related themselves to that thing the thing at which I was looking" are very possibly not perceptions shared by or easily transmitted to her audience." Ryan does not misrepresent Stein's ideas; yet her critical discourse forecloses upon the specific concepts that ought to be included in the categories of "perception," "essence," and "knowledge" that Stein uses, in a very deliberate and unusual way, within her discourse. In "Portraits and Repetition," Stein describes her writing experiments with nondescript words from the English language as a kind of anamorphic, literary gaze that utilizes the "color thing" through the relational qualities and 'synaesthetic' properties of the acts of looking, listening, and talking. Yet, at the same time, she also describes her "color thing" as that which defies or resists the 'literary' acts of looking, listening and talking:

> I became more and more excited about how words which were the words that made whatever I looked at look like itself were not the words that had in them any quality of description. And the thing that excited me so very much at that time and still does is that the words or words that make what I looked at be itself were always words that to me very exactly related themselves to that thing the thing at which I was looking, but as often as not had as I say nothing whatsoever to do with what any words would do that described that thing. Those of you that have seen Four Saints in Three Acts must know do know something of what I mean. Of course by the time Four Saints was written I had mastered very much what I was doing then when I wrote Tender Buttons. By the time I wrote the Four Saints I had in hundreds of ways related words, then sentences then paragraphs to the thing at which I was looking and I had also come to have happening at the

> same time looking and listening and talking without any bother about resemblances and remembering. (*Lectures In America* 191)

In the portrait "Lipschitz," Stein insists that the 'absence' of color signifiers, or conversely the abundance of non-descriptive English words, is what underscores or highlights "the relation of color to the words" (192). Quoting from "Portraits and Prayers," Stein observes, "Thus for a considerable amount of time sometimes a great many at a time and sometimes one at a time and sometimes several at a time I continued to do portraits. Around about this time I did a second portrait of Carl Van Vechten, one of Sherwood Anderson, one of Cocteau, and second one of Picasso. They were different from those I did just after doing Tender Buttons. These were less concentrated, they moved more although the movement was definitely connected with color and not so closely connected with talking and listening" (193). As evidence for this "color thing" in the second-phase portraits, Stein presents the second portrait of Carl Van Vechten:

VAN OR TWENTY YEARS AFTER

A SECOND PORTRAIT OF CARL VAN VECHTEN

> Twenty years after, as much as twenty years
> after in as much as twenty years after, after
> twenty years and so on. It is it is it is it is.
> Keep it in sight all right.
> Not to the future but to the fuchsia.
> Tied and untied and that is all there is about
> it. And as tied and as beside, and as beside and
> tied. Tied and untied and beside and as beside
> and as untied and as tied and as untied and as
> beside.

In this portrait, the color signifier "fuchsia" appears at the end of a line comprised of words that are not normally associated with colors, that is, it appears with words that do not normally signify, connote or evoke colors from the visible spectrum: "Not to the future but to the …". Though Ryan does not mention Stein's "color thing" in her analysis of the seemingly decadent, modernist aesthetic of her plays and operas, this is presumably because the phenomena that comprise the "color thing," in her view, "are very possibly not perceptions shared by or easily transmitted to her audience."

Stein's invisible "color thing" may be one of the most discussed phenomena in American literary studies, but it is rarely invoked *as such* by critics, which means that it is rarely called by its proper name and discussed because of its potential revelations. From the research I have conducted thus far, it appears to be the norm that critics avoid mentioning this "color thing" by name, even when it is their purpose to draw attention to the mechanisms that this phenomena operates under in Stein's writing, her phenomenal consciousness, in her playwriting aesthetic, compositional strategies and/or in her portrait subjects' perceived, personality patterns. For instance, in "The Quality of Gertrude Stein's Creativity," Allegra Stewart writes,

> [Stein's] portraits really leave out what everyone else can see, and her "plays" make visible what nobody else can see. The portraits objectify the personality or essential nature of people and things as distilled in the alembic of Gertrude Stein's consciousness, while the plays objectify her imaginative ideas and constructions excited by the motion and arrangements of objects in space. The portraits are impressionistic, the plays, expressionistic. To put it another way, the portraits reflect her receptivity to the substantial, whereas her plays reflect the "play" of her mind with the purely phenomenal. She

> subjectifies the world in portraits and objectifies the contents of her consciousness in plays. (66)

Stewart's view of Stein's compositional practices needs to be supplemented and, in some respects amended, if we are to add color to the literary brain maps that almost no one has been able to see, and if we are to explain the meanings of the colors that Stein uses to paint the human mind's neuroanatomical landscapes in her cubist portraits. Given what Stein says about her "color thing" in "Portraits and Repetition," it appears that her neuroanatomical representations "leave out what everybody else [*cannot*] see" – which are the colors that she associates with the words that are "lacking in any quality of [color description]." By the same token, "her "plays" make [in]visible what nobody else can see": namely, the neural connectivity maps that she illustrates with color words and non-descriptive language, in order to describe the colorful neuroanatomical features and neurophysiological entities that she visualizes with her creative imagination. Stewart also claims, "The portraits objectify the personality or essential nature of people and things as distilled in the alembic of Gertrude Stein's consciousness." While this reading of Stein's conceptual methodologies and modernist aesthetic makes sense from a certain, allegorical perspective – one that recognizes her preoccupation with her human subjects' "bottom natures" in the first-phase literary portraits -- it does not make sense, if one reads the second-phase portraits from the perspective of the color relations that Stein uses to construct her allegorical brain representations and cubist brain maps. In other words, Stewart's remarks do not make sense if we are analyzing the "essential nature" of things that appear within consciousness as creative insights, those secondary experiences that William James associated with the spontaneous variations of the brain's evolutionary processes and the mind's mental evolution.

Stein's "color thing" apparently creates a canvas of invisible color experiences and invisible literary inks that serve, for Stein, as secret templates for her masterpieces' allegorical brain maps and their imaginatively colored qualia spaces. I agree with Ryan's claim that Stein's "objective approach to the essential [color] thing … leads much of the world to regard Stein as incomprehensibly subjective, if not decadent." Even though Stein does not describe her compositional methods as philosophical experiments with *relational qualia*, and even if she does not define her literary experiments with phenomenal color experiences as her "color thing," when she uses her creative imagination to envision the elementary and secondary qualities of color experience as aesthetic modes or neurophysiological entities that produce invisible inks and color spaces on her literary canvases, she clearly is conducting psychological thought experiments without the knowledge of her readers. Were Stein's readers somehow supposed to know that she was thinking of certain colors when she wrote words that were lacking in any "quality of description" in her literary portraits? Was there a way that they could have known that the word "like" might be corresponding to the color "blue" or "mauve" within Stein's creative imagination, or that the word "likely" evoked a particular color experience and its qualitative discrimination within her phenomenal consciousness? Why was Stein anxious about this so-called "color thing"? Was she afraid that her literary readers would neglect her modernist writings, if they knew she was mapping out her passing states of consciousness and her neuroscientific concerns, in relation to indecipherable colors, sounds, words and meanings? Was there any way for Stein's early twentieth century readers to know that sounds sometimes represented sights and sights sometimes represented sounds in her literary portraits, as is the case with her literary experiments with sensory synaesthesia?

Apparently, it is not the case that color possesses less importance in these portraits, than the sounds, emotions and meanings that are being evoked or signified by the words that are "lacking in any quality of description" (*LIA* 192). On the contrary, color seems to be absorbed into some of these literary experiments with the phenomenal qualities of conscious experience, by virtue of its phonemic absences and semiotic overcodings. For example, when Stein is writing about and creating a form of sensory "synaesthesia" in her literary portraits, she ponders the following questions:

> Did one see sound, and what was the relation between color and sound, did it make itself by description by a word that meant it or did it make itself by a word in itself. All this time of course I was not interested in emotion or that anything happened. I was less interested in these things than I ever had been. I lived my life with emotion and with things happening but I was creating in my writing by simply looking. I was as far as I say at that time reducing as far as it was possible to reduce them, talking and listening. I became more and more excited about how words which were the words that made whatever I looked at look like itself were not the words that had in them any quality of description. This excited me very much at the time. (*LIA* 191)

The Compact Oxford English Dictionary captures Stein's sense of the term when it defines "synaesthesia" as "the transfer of a meaning of a word from one kind of sensory experience to another" and, also, when it defines it as "the relationship between speech sounds and the sensory experiences that they represent" (1992). With the first *OED* definition, the experience of seeing sound and the experience of hearing color function as exemplary instances of literary synaesthesia, since these conflated, linguistic experiences meet the criteria which specify that meaning must be transferred from one sensory experience to another. This can occur at the level of the brain's neurophysiological mechanisms, at the level of the human mind's phenomenal experiences, and at the level of a masterpiece's fragmentary prose. That is, in Stein's neuraesthetic compositions, synaesthesia can occur at different levels of allegorical brain representation simultaneously. With respect to the second *OED* definition, "the relationship between speech sounds and the sensory experiences that they represent," Stein explores "the relation between color and sound" as a possible mode of sensory confusion at the level of her dissociative writings. In cubist portraits, such as "Lipschitz" and "A Second Portrait of Carl Van Vechten," Stein explores the relation that exists between the non-colorful description of a human subject's "bottom nature" by a series of repeated words and the sensory experience of color that such words indirectly represent through their association with certain excluded colors and sounds within her creative imagination. In these cases, literary synaesthesia occurs because there is a "relationship between speech sounds and the sensory experiences that they represent" at the level of a portrait's enigmatic signs (1992). "Synaesthesia" can be defined, in these cases, as "the expression of more than one kind of sense impression in one word," which is perhaps what Stein means when she questions whether the "relation between color and sound" constitutes "itself [in writing] by description by a word that meant it" or perhaps "by a word in itself" ("Portraits and Repetition" 191). If you recall, in "Portraits and Repetition," Stein states, "One of the things that made me most anxious at one time was the relation of color to the words exactly meant but had not element in it of description. One portrait I did … of Lipschitz did this color thing better than I had ever before been able to do it" ("Portraits and Prayers," *LIA* 191). This is also a working definition for a special kind of literary synaesthesia, which operates across the boundaries of text, mind and language to produce imaginary color spaces and felt experiences for this creative writer.

With respect to the creative acts, represented subjects and aesthetic means that comprise a masterpiece's representation of the relation that exists between human nature and the human mind, Stein claims, "It is very difficult so difficult that it has always been difficult but even more difficult now to know what is the relation of human nature to the human mind because one has to know what is the relation of the act of creation to the subject the creator uses to create that thing" ("What Are Master-Pieces and Why Are There So Few Of Them," 85). As Stein confirms in "Portraits and Repetition," the absence of color in her portraits could be signifying the presence of potentially important qualia relations, or color relations, which she defines as her "color thing." Yet, this absence of color also makes it difficult for readers to interpret "the relation of the act of creation to the subject the creator uses to create that thing." The color relations that comprise Stein's "color thing" also may define the imaginary phenomenological spaces of her neuroanatomical portraits. In part, the difficulty of reading Stein's literary brain maps comes from the text's "denial of direct reference" (60). According to Wendy Steiner, "This denial of direct reference is a direct reflection of Stein's switch from conventional or symbolic reference to the kind of mimesis used in cubist portraiture. The distinction between the two was a great discovery for her: "I became more and more excited about how words which were the words that made whatever I looked at look like itself were not the words that had in them any quality of description … words that to me very exactly related themselves to that thing the thing at which I was looking … as often as not had as I say nothing whatever to do with what any words would do that described that thing" ("Portraits and Repetition," pp. 191-192)" (*Exact Resemblance to Exact Resemblance* 61). Of course, 'the thing' at which Stein was looking, which Steiner does not mention by name, is what this writer defines as her "color thing." As I've suggested above, this "color thing" could be defined as a phenomenal color space that she envisions with her creative mind while she is in the process of 'painting' a portrait of a human subject with non-descriptive English words that "very exactly related themselves to that thing … at which [she] was looking" (*LIA* 192). With this passage in mind, Steiner argues,

> What Stein intended to achieve by the reification of her words and sentences was not to do away with a referential subject, to obliterate the sign-function of language, but to create a text which would be mimetically adequate to her subject. Each of her sentences was to be a self-contained unit which a particularly intense internal make-up, just as each perceptual 'now' was to be isolated and intense. If each moment of perception was linked to the next only through the continuity of the *quality* of the perception, each sentence was likewise linked to the next not by a continuity of sense or reference but by the constancy of *aesthetic perception* created by the very structure of the sentence itself. (*Exact Resemblance* 60)

Answering the question Stein asked herself during this period of composition and experimentation -- 'does a word make itself by itself --' Wendy Steiner responds by saying "The answer, of course, was that "it made itself by a word in itself," a concrete object open to the senses. As we have already seen with some of the second-phase portraits, the color thing opens itself up to literary experiments with sensory 'synaesthesia.'

Potentially, Stein's color thing operates as a form of cubist portraiture strategy that involves the creative production of esoteric brain representations, mind writings and consciousness mappings. There is a crucial sense in which her colorful brain representations are "mimetically adequate to their subject[s]," as Steiner observes, given that they offer qualitative, literary impressions of subjectively experienced brain states and brain functions.

In the literary portraits that invisibly stage the "color thing," Stein generally uses color words sparingly, in an almost mathematical fashion, so as to provide a 'notational' color key that alerts the reader to the possibility, if not the presence, of special brain mapping strategies that are being used to create a 'neurophysiological imaginary' (to use Meyer's apt expression). Stein does not use color liberally in her second-phase cubist brain maps, with the exception of course being many of the portraits from *Tender Buttons*. Rather, she deploys color words, such as "fuchsia," in a manner that is similar to the way in which Bach uses notation in his musical compositions. Angela Hewitt, the renowned Canadian Bach pianist, recently observed in a BBC interview, that Johann Sebastian Bach infrequently notated the trills and other special sounds that he wanted to have repeated in certain musical pieces, expecting his musicians and conductors to know that they were supposed to reproduce these special sounds after seeing them notated only once or twice within a given composition. Hewitt believes that Bach left ample room for the creative interpretation of these special sounds, within the technical constraints and the aesthetic purview of the "phrasings" that he created for his musical compositions (BBC Interview, May 15, 2008). I suspect that Stein similarly denotes the presence of her "color thing" with the deployment of one or more color words in her second-phase literary portraits. With the second-phase literary portraits that she wrote between 1913 and 1930, Stein seems to have developed a system of literary color notation that allowed her to explore the relation between different sounds, colors and meanings, in relation to the brain regions, functions or states that she was investigating, without having to explicitly mark this "color thing" throughout her compositions at the level of individual words and phrasings.

To be more precise, I propose that Stein derives a formula for her creative composition from her intimate knowledge of Picasso's cubist portraiture techniques and then she later incorporates her critics' reviews into her evolving views of her modernist aesthetic. Through this process of reflection and learning, Stein comes to conceive of her creative process as a mathematical formula that can be used by her readers to decipher the relation that exists between the creative mind's subjectively experienced, internal and external phenomenal realities. In *The Autobiography of Alice B. Toklas*, Stein comments on this quasi-mathematical, quasi-musical, quasi-painterly method of literary composition that she has developed over the years: "It is because of this [intellectual passion for exactitude in the description of inner and outer reality] that her [Gertrude's] work has often been compared to that of mathematicians and by a certain french critic to the work of Bach. Picasso by nature the most endowed had much less clarity of intellectual purpose" (228). The French critic to whom Stein is referring is Marcel Brion. In chapter three of *The Autobiography*, Stein recalls the review that Brion wrote of her work, comparing her refusal of the subconscious and her "absence of variety" with Bach's dark musical fugues, in the following passage: "The sentences of which Marcel Brion, the French critic has written, by exactitude, austerity, absence of variety in light and shade, by refusal of the use of the subconscious Gertrude Stein achieves a symmetry of the musical fugue of Bach" (57). Bach left it to future experts, namely, to the musicians that played his compositions, to know that special sounds, such as the ‘trills,’ needed to be reproduced every time there were certain musical notes and musical phrasings. Angela Hewitt explains that accomplished Bach pianists and musicians know that these special sounds are being called for, on the basis of the few notations that Bach provides in his musical scores, which usually occur at the beginning of musical phrasings. Likewise, Stein may be cuing her readers to recognize her color thing with color words that appear at the beginning or endings of certain poetic phrasing, but she leaves it to her readers to supply the philosophical nuances, literary meanings, artistic associations and scientific hypotheses to flesh out this “color thing” at the level of her cubist portraits, perhaps even to turn the gray matter of her literary prose into a dazzling spectacle of colored neurons, axons, and glia.

To a certain extent, Stein’s surreptitious brain portraits from *Tender Buttons* can be compared to her friend Picasso’s humorous “grey” cubist portraits and his Surrealist drawings. In *Picasso*, Stein claims that “it was during this grey period that Picasso really for the first time showe[d] himself to be a great colorist. There is an infinite variety of grey in these pictures and by the vitality of the painting the greys really become color. After that as Picasso had then really become a colorist his periods were not named after their colors. He commenced, this was 1914, to study colors, the nature of colors, he became interested in making pure colors but the color quality which he found when he painted in grey was a little lost, later when his second naturalistic period was over he commenced again to be enormously interested in color” (45). Picasso’s “grey” period includes the early works that were composed during his Montmartre period, such as the burlesque sketch “La Belle Qui Passe” (1905) that is reminiscent of Toulouse Lautrec’s sketches of the Moulin Rouge dancers and patrons, and the later works that were composed during his Surrealist period, which includes the Surrealist "Femme au Sourire (1929) and "Surrealist Drawing" (1933)" (44-45). (See Figures 1 and 2, respectively). Stein also has a "grey" period that encompasses the second phase cubist literary portraits that she wrote from 1911 to 1926. This "grey period" corresponds with the phenomenological and neuroscientific thought experiments that she calls her "color thing" in "Portraits and Repetition."

In my opinion, Stein's "color thing" corresponds with Picasso's cubist grey portraiture, to the extent that this humorous style of cubist literary portraiture explores the phenomenal qualities, or the qualitative characters of phenomenal color experience, that are being produced by the creative imagination in relation to certain words, sounds, and meanings (*LIA* 192). Picasso's "grey" cubist portraiture becomes synonymous with Stein's "color thing" at the level of certain second phase literary portraits, such as "Lipschitz" and "If I Told Him: A Completed Portrait of Picasso," because the reader must be able to visualize the "infinite variety" of color in these cubist pictures, as Stein did with Picasso's "grey" portraits," and thus appreciate how, "by the vitality of the painting[,] the greys really become color" (*Picasso* 45). Also, the reader must be able to decipher Stein's cubist puns and determine how color functions at the level of these puns to produce scientific meanings, neurophysiological referents and neuroanatomical features for her allegorical brain representations. In certain portraits from *Tender Buttons*, such as "A Seltzer Bottle," Stein's palette consists almost entirely of silvers and lead-colored greys. In chapter one, I explain how this cubist portrait functions allegorically as a 'descriptive study' that correlates with the late nineteenth-century experimental laboratory practices and nerve tissue staining methods, particularly the ones that were developed by Nobel laureates Camillo Golgi and Santiago Ramón y Cajal. In chapter three, I explain how grey brain matter can signify colored brain nuclei and colored brain matter, in accordance with the histological, neurological and medical protocols of Barker, Mall, Sabin and other nineteenth-century brain researchers from Johns Hopkins Medical School. These researchers built three-dimensional models of the brain stem and midbrain region from two-dimensional brain slices and chemically stained microscope slides, just as Gertrude Stein was required to do at Johns Hopkins for her anatomy professors, as part of her graduation requirements. By comparing Picasso's "grey" cubist portraiture with Stein's "color thing," I anticipate forthcoming arguments in my thesis, where I explain how the absence of color in Florence Sabin's three-dimensional brain model does not mean that finished brain models lacked sophisticated color systems in the planning stages. In Sabin's case, the use of red, yellow and blue identifies structures within the medulla, pons and midbrain. For example, Sabin uses the color blue to highlight the *Nucleus funiculi cuneati*, yellow to showcase the *Nucleus ruber* (the red nucleus), and red to illuminate the *Nucleus N. oculomotorii*, in Plate III, which a model of the medulla, pons and midbrain from the lateral aspect. As she points out in her essay, "A Model of the Medulla Oblongata, Pons and Midbrain of a New-born Babe," this simple color system effaces the complex, color systematicity that had once constituted an essential part of her brain mapping process, the process that informed her visualization and conceptualization of these brain regions. Sabin's three-dimensional brain model of the medulla, pons and midbrain makes it possible for me to explain the invisible color system, or the invisible color systematicity, that seems to informing Stein's cubist portrayals of the human brain in *Tender Buttons* and *The Geographical History of America*.

If, along the way, I discuss some of the reasons why Stein decided to keep these brain mapping strategies secret until the publication of *The Geographical History of America,* in 1936, it is to expose the hostility and resistance of twentieth-century literary critics to her literary experiments with phenomenal consciousness, evolutionary psychology and brain science. Generally speaking, my goal is to historicize her literary brain maps and to illuminate her subjective phenomenology to the extent that I can or that it is possible to do so. These neuroanatomical portraits form a crucial part of Stein's "private collection" of literary masterpieces, because even though they belong to the public domain as published works of art, they remain hidden from the public eye, by virtue of the fact that her colored brain maps consist of allegorical representations that require her audiences to know something about her educational background, her institutional experiences, her personal desires, her scientific fantasies and her secretive literary practices. She never speaks openly of these neuroanatomical portraits in her academic lectures, or anywhere else, but leaves many clues as to their existence and their future legacy as modern hieroglyphs. It is, in this sense, that a given text's 'neurophysiological imaginary' (to use Meyer's term) functions for Stein as a precious secret and as an illicit love-interest.

Material has been removed from the thesis because of copyright restrictions. The information removed from page 519 is Figure 1. The removed material is a black and white photocopy of Pablo Picasso's Femme au Sourire (1929). This sketch illustrates Picasso's "grey period." According to Gertrude Stein, "it was during this grey period that Picasso really for the first time showe[d] himself to be a great colorist. There is an infinite variety of grey in these pictures and by the vitality of the painting the greys really become color. After that as Picasso had then really become a colorist his periods were not named after their colors. He commenced, this was 1914, to study colors, the nature of colors, he became interested in making pure colors but the color quality which he found when he painted in grey was a little lost, later when his second naturalistic period was over he commenced again to be enormously interested in color" (45). The original source of this material is Gertrude Stein's *Picasso by Gertrude Stein.* The original source of this material is Gertrude Stein's *Picasso by Gertrude Stein.* Plate 46. Boston: Beacon P, 1959.

Material has been removed from the thesis because of copyright restrictions. The information removed from page 520 is Figure 2. The removed material is a black and white photocopy of Pablo Picasso's Surrealist Drawing (1933). The original source of this material is Gertrude Stein's *Picasso by Gertrude Stein* (Figure 46). This drawing illustrates Picasso's "grey period." According to Gertrude Stein, "it was during this grey period that Picasso really for the first time showe[d] himself to be a great colorist. There is an infinite variety of grey in these pictures and by the vitality of the painting the greys really become color. After that as Picasso had then really become a colorist his periods were not named after their colors. He commenced, this was 1914, to study colors, the nature of colors, he became interested in making pure colors but the color quality which he found when he painted in grey was a little lost, later when his second naturalistic period was over he commenced again to be enormously interested in color" (45). The original source of this material is Gertrude Stein's *Picasso by Gertrude Stein.* Plate 46. Boston: Beacon P, 1959.

Material has been removed from the thesis because of copyright restrictions. The information removed from page 521 is Figure 3. The removed material is a black and white photocopy of Pablo Picasso's Pablo Picasso's La Belle Qui Passe (1905). This drawing illustrates Picasso's "grey period." According to Gertrude Stein, "it was during this grey period that Picasso really for the first time showe[d] himself to be a great colorist. There is an infinite variety of grey in these pictures and by the vitality of the painting the greys really become color. After that as Picasso had then really become a colorist his periods were not named after their colors. He commenced, this was 1914, to study colors, the nature of colors, he became interested in making pure colors but the color quality which he found when he painted in grey was a little lost, later when his second naturalistic period was over he commenced again to be enormously interested in color" (45). The original source of this material is Gertrude Stein, *Picasso by Gertrude Stein.* Plate 47. Boston: Beacon P, 1959.

However, in the 1930s, Stein writes almost obsessively about the phenomenology of consciousness, about color, and about her educational experiences with William James. This could be what she is referring to when she hints broadly that the cubist portrait of the brain-like human mind, in "Part II" of *The Geographical History of America,* is a hot topic, and when she slyly suggests that a special kind of neuroanatomical portraiture makes her "hot," or that it is a hot form of consciousness. I discuss these statements and Stein's forensic analyses of conscious experience in chapter two.

For Stein, these non-explicit neuroanatomical portraits represent 'the love that dare not speak its name,' as much as her lesbian sexuality and sadomasochistic practices serve as an epistemological closet within the coextensive domains of early twentieth-century Parisian society and American culture. At a figurative level, these portraits may be conceptualized as the allegorical others of the colors, sounds, meanings, passions and desires that characterize the object descriptions in *Tender Buttons*. Yet, at the literal level, the color signifiers in these portraits resemble the colored neurons that comprise the "neuronal network architecture" of the "Brainbow connectivity maps" that were produced by Harvard neuroscientists Jeff Lichtman and Joshua Sanes, in 2007, using a modified version of Cre/*lox* genetics technology and confocal fluorescent microscopy (Livet et alia, "Transgenic Strategies" 56). It is perhaps fitting that Stein's consciousness-based, language-centered and color-coded, brain maps have eluded critical notice for the better part of a century, since the scientific knowledge, genetics research, and visual imagery did not exist that would have made it possible for literary readers to be able to analyze these writings, using the mapping technologies, such as the Brainbow system, *f*MRI brain images and the "connectivity maps," or the "human connectomes," that have been developed by scientists at the end of the twentieth century and in the twenty-first century to read the brain with greater precision than ever before.

[4] See, for example, B. F. Skinner's "Has Gertrude Stein a Secret," for a discussion about Stein's palilalia and her automatic writing experiments in William James's Harvard Laboratory, and also Meyer's discussion of Skinner's article in *Irresistible Dictation*. For a discussion of Stein's assumed madness, see Elizabeth Fifer's *Rescued Readings: Gertrude Stein's Difficult Texts*, Alfred Kreymbourg's "Gertrude Stein—Hoax and Hoaxstress: A Study of the Woman Whose 'Tender Buttons' Has Furnished New York with a New Kind of Amusement," and Sara Bay Cheng's *Mama Dada*. For a range of early twentieth century critical responses that address Stein's unfamiliar writing style and novel literary forms, readers may wish to consult Kirk Curnutt's *The Critical Response to Gertrude Stein*.

[5] As I discuss in chapter one, Steven Meyer uses the phrase "invisible nervous system" to describe Stein's metaphorical representations of the brain in "A Long Dress." This work is one of the literary portraits, or descriptive studies, from *Tender Buttons* that is located in the "Objects" section. Stein has also called these object descriptions "poems" and "paintings," as I discuss below in this preface. Because Stein experimenting with literary genres over the course of her career, her critics have trouble assigning names and categories to her literary creations. Throughout this project, I will be calling the writings from *Tender Buttons* literary portraits, or cubist allegories, for the most part, noting that other terms are possible and these terms are mostly interchangeable. It is not a mistake to call a portrait a poem, or a play, or a painting, or a masterpiece, or a descriptive study, or sometimes even a detective story, or an opera. By blurring the conceptual boundaries between literary genres, Stein sought to recreate

American literature and to investigate the perceived, discursive boundaries between genres of discourse, whether they were literary, scientific or artistic in nature.

[6] I hold Paul De Man's *Allegories of Reading* to be exemplary in terms of how we might conceptualize the genetics of language and the color thing in Stein's cubist writings. For example, he argues, "literature cannot be merely received as a definite unit of referential meaning that can be decoded without leaving a residue. The code is unusually conspicuous, complex, and enigmatic; it attracts an inordinate amount of attention to itself, and this attention has to acquire the rigor of a method" (4). The neuroanatomical imaginaries that Stein creates for her cubist writings do not conform to historically and culturally specific, medical discourses and institutional practices, so the "residues" or "traces" that these imaginaries leave behind are ones that cannot be found in nineteenth-century medical textbooks, or in published experiments, or in medical memoirs, or in institutional documents. These imaginaries are products of the creative mind, as well as residues of the creative mind's evolutionary processes, the effects of spontaneous variations in the brain that generate scientific insights, philosophical intuitions and artistic flights of fancy. It is true that these imaginaries may have parallels in external reality, and we may be able to trace discrete elements of these imaginaries to the scientific experiments and the institutional experiences that Stein has transfigured in her mind and in her cubist literature. de Man's conception of allegory thus provides useful ways to approach "the genetic pattern of literary history," for he stresses that "the abandonment of an organic analogism by no means implies the abandonment of a genetic pattern" (80). It is also possible to think of Stein's "neurophysiological imaginaries," to use Meyer's term, as cubist brain allegories, without losing this deconstructionist's promise of a

critical intervention into the "organicist," romantic/Victorian/modern worldview. In other words, I feel that allegory is an apt way to describe Stein's neuroanatomical palimpsests, and I follow Wendy Steiner in using "allegory" to define her cubist writings as phenomenological and pragmatic, aesthetic experiments that illustrate William James's psycholinguistic theories and language metaphors. As further food for thought, de Man observes in "Genesis and Genealogy," "When a contemporary philosopher like Michel Foucault characterizes nineteenth-century late-Romantic historicism as "lodged within the distance between particular histories and universal History, between singular events and the Origin of all things, between evolution and the first division within the source, between forgetting and return," then the vocabulary of source, origin, distance, memory, indicates that we are more than ever dealing with a genetic model defined in terms of an intent oriented towards an "end." The allegorization and ironization of the organic model leaves the genetic pattern unaffected" (80). If we "trouble" the oxymoronic, "nonvitalist organicist" model of neuraesthetic interpretation that Meyer uses in *Irresistible Dictation* to analyze Stein's dissociative writings, then, according to de Man's allegorical methods of critical analysis, we should be able examine the genetic patterns of a text's organic metaphors by deconstructing its essentialist views with comparative analyses of the central nervous systems and neuroanatomical imaginaries that partially constitute these texts.

[7] Wendy Steiner notes that there are "approximately 132 portraits within Stein's oeuvre, written with varying frequency from 1908 to her death in 1946. They may be divided into three distinct periods … the typologizing portraits, written from 1908 to 1911 (with some works appearing as late as 1913), the visually-oriented period, beginning in earnest in 1913 and lasting until approximately 1925 (with a few works as early as 1911), and the last

period, 1926-46, in which the portrait of "self-contained movement" appeared along with works of other styles. This outline differs only slightly from Stein's chronology in "Portraits and Repetition" (65). I basically accept Steiner's genealogical breakdown, as I also use Stein's "chronology in "Portraits and Repetition" to understand the kinds of divisions, or differences, that occur between the different color experiments in the portrait oeuvre.

[8] I am grateful to Dr. Pamela McCallum and Dr. Leo Mos for their comments on this subject. Following their suggestions, I have fleshed out the relationship between Fauvism/Cubism, and between neuroscience and Stein's cubist literature, using Zeki's research on the "neurology of art" from *Inner Vision: An Exploration of the Art and Brain* and *Splendors and Miseries of the Brain*. Though I use Zeki's research sparingly in this manuscript because of time, space and regulatory constraints, I note that there are important commonalities between his approach to the generic perspective, perceptual principle and my articulation of Stein's cubist puns qua brain representations in her cubist portraits. I also acknowledge the importance of V.S. Ramachandran's research on neuraesthetics, the sensory homunculus, mirror neurons, synesthesia and phantom limbs. Interested readers may wish to consult Jonah Lehrer's *Proust Was a Neuroscientist*, for Lehrer's reading of Stein's playful language as an application of the "language instinct"/perceptual principle.

[9] In *The Autobiography of Alice B. Toklas*, Stein explains that her attempts to represent the insides and outsides of phenomenal experience coincided with a trip she took to Spain in the summer of 1912 with her partner, Alice Toklas. In her words: "We enjoyed Granada, we met many amusing people english and spanish and it was there and that that time that Gertrude Stein's style gradually changed. She says hitherto she had been interested only in

the insides of people, their character and what went on inside them, it was during that summer that she first felt a desire to express the rhythm of the visible world. It was a long tormenting process, she looked, she listened and described. She always was, she always is, tormented by the problem of the external and the internal" (130). In *Gertrude Stein and the Literature of the Modern Consciousness*, Norman Weinstein comments, "the key question, repeated endlessly throughout her *Lectures in America*, *How to Write*, and *Geographical History* is: How do I as a writer, come to know of the world what I know? It is helpful to read these expository, critical works less as literary criticism than as personal tracts on epistemology and the phenomenology of the mind" (92). In light of Stein's autobiographical remarks about her literary experiments with phenomenal consciousness and her desire to "express the rhythm of the visible world," Weinstein perhaps states the obvious. However, because some of her literary experiments are based on James's radical empiricist, consciousness research and her experimental brain research at the Johns Hopkins Medical School, it likely is not obvious to someone who is reading her literature for the first time that these are "personal tracts on epistemology and the phenomenology of the mind." Also, it would not be obvious, to first-time readers, that she was trying to represent the creative mind's evolutionary processes, scientific insights and states of consciousness through a "creative metaphysics" (as Wilder calls her metaphysical writing style) that builds upon little-known scientific principles and laboratory experiences, with a fragmented literary style and nonsensical utterances. Steven Meyer adds, "Instead of dwelling solipsistically on what was going on inside him, abstracting feelings and thoughts from their immediate context, James preferred to locate himself on the interface of the inside and the outside, in the perceptual and grammatical realm of the stream of consciousness" (234). Building on Meyer's recognition of James's "neuraesthetic" practices, I will be discussing how one goes about reading consciousness in "Part II" of *The Geographical History of America*, in Chapter Two, using James's theories about the grammatical forms that serve as substantive and transitive states of consciousness, and I will be discussing how one goes about reading Stein's neuraesthetic compositions from the perspective of the science of the reading brain and the reading of science at the level of the represented brain, in Chapter Four, using James's theories about the "cerebral" processes that can be deciphered at the level of sentences and states of consciousness. Throughout this project, I place more emphasis than Meyer does on "psychogenesis," or the process of mental evolution that serves as the foundation for some of psychological principles that James used to study conscious experience and to illustrate the relation between internal and external, phenomenal realities. This is one of the differences between our neuraesthetic reading strategies, though there are others I will point out as this project unfolds.

[10] Zeki assures us that unconscious, neuraesthetic expressions correspond with 'inherited and acquired, brain concepts,' and these brain concepts serve as the motivating, instinctive forces that comprise the "neurology of art." In *Splendors and Miseries of the Brain*, Zeki defines the relationship between inherited and acquired, brain concepts in ways that correspond with William James's psychological descriptions of the relationship that putatively exists between the brain's neurophysiological mechanisms and its secondary, phenomenal qualities. I am proposing that Stein's second- and third-phase portraits unconsciously re-create inherited and acquired "brain concepts" by experimenting with language and showcasing subjective experiences in such ways that these experiences become an intrinsic part of her cubist/fauvist, portraiture strategies and her literary, brain mapping

practices. Zeki's observations about the "neurology of art" correspond, in crucial ways, with James's nineteenth-century research on the subject of mental evolution, or "psychogenesis."

[11] Given the embryonic nature of Stein's neuraesthetic writing strategies in *Tender Buttons* and other early second-phase portraits, it may be difficult for non-specialist readers to see how non-mimetic, cubist brain representations function as conscious neuraesthetic, perceptual principles and brain concepts. If we compare Stein's "color thing" with Cézanne's late compositional techniques, then we find that the enigmatic nature of Stein's "color thing" corresponds with the unfinished qualities of Cézanne's modern paintings. This knowledge refines our understanding about the different kinds of neuraesthetic representations, practices and qualities that comprise abstract colored works, such as Cezanne's impressionist paintings and Stein's cubist writings. In "Unlocking the Mysteries of the Artistic Mind," Jonah Lehrer emphasizes that the perceiver's "mind easily invents the form that [Matisse or] Cézanne's paint barely insinuates. … Although the mountain [in "Mont Sainte-Victoire" is literally invisible -- Cézanne has only implied its presence – its looming gravity anchors the painting. The brain has seamlessly filled in the empty spaces of the canvas. According to Ramachandran, "Mont Sainte-Victoire" is pleasurable precisely because it is so spare. Cézanne's blank spots force the brain to engage in perceptual problem-solving, as it struggles to find meaning in the brushstrokes. "A puzzle picture (or one in which meaning is implied rather than explicit) may paradoxically be more alluring than one in which the message is obvious, observe Ramachandran and Hirstein. "There appears to be an element of 'peekaboo' in some types of art – thereby ensuring that the visual system 'struggles' for a solution and does not give up too easily." In other words, the search for meaning is itself rewarding: The brain likes to solve

problems. We actually enjoy looking for Cézanne's missing mountain" (76). Stein also deploys the perceptual problem-solving principle and the "peekaboo" element when she crafts neuroanatomical imaginaries from non-descriptive phrases, color units and empty spaces. As neuraesthetic readers, we enjoy discovering a text's neuroanatomical imaginary.

A text's neuroanatomical imaginaries and its perceptual principles function simultaneously as brain imaging experiments and as literary brain maps. For example, the cubist brain portrait from *The Geographical History of America* features Stein's literary phenomenology, brain-based epistemology and creative metaphysics, when it calls attention to the colorful, neuroanatomical landscape of its brain-like "human mind." This portrait uses color signifiers, grammatical parataxis, poetic form, metaphysical metaphors and a dissociative writing style to examine the neural architecture and synaptic circuitry of the brain's "white and grey" matter. By using color words in a series to describe the appearance of the brain's colored matter, Stein performs literary surgery on the brain's neural network architecture, with the perceptual principle that is known as the 'generic perspective.' With the phrase, "There is blue and green and green and yellow pale yellow and blue," Stein describes the colored neurons that form the brain's neuronal networks and maps out the neural architecture of unspecified brain regions, whose triple-layered structures resemble the nerve tissue from the cerebellum and retina. By figuratively creating an imaginary laboratory and a neuroanatomical imaginary that explores the human mind's colored brain matter and its subjective phenomenology at the level of language, Stein asks complex questions about the human mind's epistemological, phenomenological and neuroscientific nature. By generating multiple meanings for the brain's colored matter in these coextensive areas of scientific and artistic inquiry, the cubist brain portrait that is Detective Story number VII raises important questions about the role that language plays in producing and exposing neuraesthetic, perceptual principles related to consciousness. It thereby contributes to our knowledge about brain anatomy and brain function, by presenting unprecedented views of the brain's neural architecture and its phenomenal consciousness, through a special kind of neuraesthetic production that I am defining as "qualia-knowledge." I consider the portrait "A Long Dress" to be a prototype for the explicit brain map that Stein creates in Detective Story number VII, since it exhibits similar forms of neuraesthetic expression and comparable forms of qualia-knowledge. Both portraits deploy unconscious and subconscious, peak shift perceptual principles, as well as other perceptual principles and neural principles, such as the generic perspective in the form of cubist puns, to achieve their respective, neuraesthetic aims.

[12] In Meyer's usage, the term "autopoeisis" derives orthographically and conceptually from Lynn Margulis' phrase "physiological autopoiesis," and it originates from her study, "”Big Trouble in Biology: Physiological Autopoiesis versus Mechanistic Neo-Darwinism," which appears in *Slanted Truths: Essays on Gaia, Symbiosis, and Evolution*. However, Meyer also uses the adjective "autopoietic" to describe Stein's so-called "nonvitalist organicism," which he says is "similar to that analyzed by Donna Haraway in *Crystals, Fabrics, and Fields: Metaphors of Organicism in Twentieth Century Developmental Biology*. In this context, Meyer explains his neuraesthetic reading practices as follows: "In Stein's case, the textual content of her work is not just literary (Laurence Sterne et al.)[,] but also philosophical (Emerson, Whitehead), psychological (William James, Ludwig Wittgenstein), and neurophysiological (Lewellys Barker, Gerald Edelman, Francisco Varela). … It is this circumstance that compels an interdisciplinary and comparative study of Stein. … I have attempted to

demonstrate that Stein's compositions … demand equal attention to all four components. That she herself often emphasized the literary aspects of her writing needs to be understood in a historical context in which first her brother Leo, then prospective publishers, and finally reviewers insisted that it wasn't writing at all" (xvii). In Meyer's critical lexicon, the term 'autopoiesis' functions as a cognate, of sorts, for "autogeny" or "autogony," which *The Compact Oxford English Dictionary* defines as a "mode of spontaneous generation," or as that which pertains to anything that is "self-produced" (90). The *OED* lists Haeckel's 1876 *History of Creation* as the source for "autogeny," in reference to the following scientific proposition: "In spontaneous generation … we must distinguish two essentially different kinds, viz. autogeny and plasmogeny. By autogeny we understand the origin of a most simple organic individual in an inorganic formative fluid" (90). The *OED* defines "autogenesis" as [o]rigination within the organism." In Meyer's critical usage, this sense of originating from within the organism that is the literary "master-piece" is retained in the word 'autopoeisis," but he also uses this biological neologism to define Stein's neuraesthetic compositional practices in the radical empiricist tradition established by William James and the philosophy of the organism established by Alfred North Whitehead as a creative writing practice that seeks to represent and mediate between the 'insides' and 'outsides' of phenomenal consciousness.

[13] In *Splendors and Miseries of the Brain*, Zeki writes, "A good example of an inherited [brain] concept is that regulating the generation of color by the brain," In the following passage, Zeki explains the way in which color functions as an inherited brain concept:

> With color, the brain has to organize signals in such a way that a green surface, for example, is perceived as green even when it is viewed in conditions in which it reflects more red than green light

at dawn or at dusk, when there is a lot more of the long (red) wavebands in the light that is reflected from a leaf. Yet if our perception of that leaf as green were to change with every change in the wavelength composition of light reflected from it, then the leaf would no longer be recognizable by its color but by some other attribute. Color would then lose its significance as a reliable biological signalling attribute. The brain has solved this problem by applying a ratio-taking concept to the signals coming from the green surface and from its surrounds, in such a way that the ratio of light of any given waveband, say long-wave (red) light, reflected from the green surface and from its surrounds does not change. … In this way, the brain is able to assign a constant color to a surface and make itself largely independent of the amount of light of any waveband reflected from that surface alone. One may wonder why I call such an organizing principle a brain concept, even though Kant had already done so when he wrote of the mind as applying a concept to perceptions, by which he meant that some kind of principle is applied to incoming signals to make sense of them. Why not call it a brain program or a brain computational process instead, as so many would? I do not do so for two reasons. First, when we consider a sensation like color, we begin to realize that it is generated by the brain and in the brain according to a certain program, which has certain rules because there is a certain concept that is applied to incoming signals. … But we could think of other concepts to apply to the incoming signals that could also result in color vision. Indeed a different concept or principle for organizing signals into the color system of the brain could plausibly even result in a much more efficient color system. We can speculate endlessly about this, but the

> brain uses the one that it has evolved – a ratio-taking system.
> Another reason for referring to these inherited systems that organize signals in particular ways as concepts emerges when we look at other systems, such as the one regulating romantic love. As we shall see, romantic love is also regulated by an inherited concept, though a much more complex and even abstract one. (22-23)

In contrast with the inherited concepts, Zeki defines "acquired brain concepts" as the heterogeneous, neurological mechanisms and the phenomenological means by which the brain gains knowledge about the world. "What is clear, and what I hope to explain," Zeki stresses, " is that formation of acquired concepts, through a marvel of neural engineering, also has strict limitations. The concepts formed are synthetic ones, dependent upon the continual acquisition of experience throughout post-natal life. … It is my conviction that, without understanding something about the knowledge acquiring system of the brain and its limitations, it is difficult to understand not only how the brain functions, but much about what it produces as well. It would, for example, be difficult to understand both art and creativity, since both are ultimately related to the acquisition of knowledge, as I have argued elsewhere, and therefore to the neurological machinery underlying this capacity. Indeed, I would go beyond and say that without understanding something about the concept-forming capacities of the brain, one will fail to comprehend what is at the root of much of human misery" (24-25).

[14] I am not the only one to interpret Stein's "natural phenomena" as paradoxical, literary formulation of biological fantasy, linguistic play and social reality. In "Gertrude Stein's Jewishness, Jewish Social Scientists and the 'Jewish Question," Maria Damon argues that "Stein's Jewishness is, arguably, a language practice," that it "is a topic that is best approached

obliquely, as she herself does: with narrative tentativeness; with an openness toward the inclusion of fragment-clues and minutiae free-floating through her work like sidereal flotsam, as well as toward broad disciplinary inquiries into "the status of the social sciences at the end of the century" and other such currents of humanistic cliché that, when delved into, relinquish their apparent predictability and turn into discoveries perhaps intuited but nonetheless finally surprising" (331). Arguing that Stein's 'Jewishness' can be conceptualized as a language game of sorts, Damon points out that Stein seems to be using the phrase "natural phenomena" to designate racial entities and ethnic categories that are socially constructed identities, but which have biological correlates and discursive resonances in the discourses of the social sciences and humanities: "When Stein writes "Authorize natural phenomena" [in *Landscapes and Geography*], natural phenomena are understood to be that which can be written – that is, constructed creatively, as in "arthur a grammar." Nationalism and claims of naturalism are both systems of meaning created by and not anterior to the "human mind," "never having been meant to be Natural Phenomena" (207) as commonly understood – that is, as bio-essential hardwiring. However, "Natural Phenomena" also include queer girl sex: "Aroused and dedicated to natural phenomena … pearly and seized" (207). What has been declared deviant by racial nationalist logic is as natural a phenomenon as landscapes, geography, and writing" (342). Thus, it is not that critics have failed to understand the complex nature of Stein's literary experiments with phenomenal consciousness and brain representation. On the contrary, Damon draws our attention to the ways in which Stein's playful language "eviscerate[s] the truth claims of the modern(ist) achievements – rationalism and liberal morality – that the philosopher Weininger and the scientist Herskovits continue to cling to" (343).

[15] In *Inner Vision*, Zeki argues: "It follows that one of the functions of art is an extension of the major function of the visual brain, a view that I elaborate throughout this book. And it should not surprise us to find that philosophers and artists often spoke about art in terms that are extremely similar to the language that a modern neurobiologist of vision would use, except that he would substitute 'brain' for 'artist.' It is, for example, striking to compare Helmholtz's statement about 'discounting the illuminant' in colour vision, with the statement of the French artists Albert Gleizes and Jean Metzinger, in their book on Cubism. Discussing Gustave Courbet, they wrote that, 'Unaware of the fact that in order to display a true relation we must be ready *to sacrifice a thousand apparent truths*, he accepted, without the slightest intellectual control, all that his retina presented to him. He did not suspect that the visible world can become the real world only by the operation of the intellect' (my emphasis). I interpret 'intellect' to mean the brain or, better still, the cerebral cortex. In order to represent the real world, the brain (or the artist) must discount ('sacrifice') a great deal of the information reaching it (or him), information which is not essential to is (or his) aim of representing the true character of objects. It is for this reason that I hold the somewhat unusual view that artists are in some sense neurologists, studying the brain with techniques that are unique to them, but studying unknowingly the brain and its organization nevertheless. It was after all Pablo Picasso who, in a prescient statement, almost anticipated the curren*t craze for brain imaging studies when he said, 'It would be very interesting to preserve photographically … the metamorphoses of a picture. Possibly one might then discover* the path followed by the brain in materializing a dream' (my ellipse). To equate artists with the neurologists, even in the remote sense intended here, may surprise many among them since, naturally enough, most know nothing about the brain and a good

many still hold the comm. on but erroneous belief that one sees with the eye rather than with the cerebral cortex. Their language, as well as the language of those who write about art, betrays this view. But however erroneous their views about the seeing organ or the role of the visual brain may be, it is sufficient to glance at their writings to realise the extent to which they have defined the function of art in a way that a modern neurobiologist would not only have understand but feel very sympathetic to. Thus, Matisse once said that, 'Underlying this succession of moments which constitutes the superficial existence of things and beings, and which is continually modifying and transforming them, one can search for a truer, more essential character, which the artist will seize *so that he may give to reality a more lasting interpretation*' (my emphasis). Essentially, this is what the brain does continually – seizing from the continually changing information reaching it the most fundamental, distilling from the successive views the essential character of objects and situations. Its function, to use a phrase employed by Tennessee Williams in another context, is 'To snatch the eternal from the desperately fleeting.' Statements like this are not unique or confined to a few thoughtful artists. One would find similar lines in the writings of many other artists and art critics, as we shall see. Here it is perhaps sufficient to give just one more example. In 1912, the French critic Jacques Rivière wrote: 'The true purpose of painting is to represent objects as they really are, that is to say differently from the way we see them. It tends always to give us their sensible essence, their presence, this is why the image it forms does not resemble their appearance' (my emphasis), because the appearance changes from moment to moment. A neurologist could hardly have bettered that statement in describing the functions of the visual brain. He might say that the function of the brain is to represent objects as they really are, that is to say differently from the way we see them from moment to moment if we were to take into account solely the effect they produce on the retina. Just as the brain searches for constancies and essentials, so does art" (10-11).

[16] For a discussion about color qualia and their relation to language qualia (or to color language qualia, as Dennett puts it), see Daniel C. Dennett's chapter, "Qualia Disqualified," from the book, *Consciousness Explained*. For the most part, I agree with Dennett's arguments about language and its role in constructing the secondary qualities of phenomenal consciousness, at least as far as his multiple drafts of consciousness theory is concerned; however, I disagree with his "qualophobic" views regarding *color language qualia*; it doesn't make sense to disregard language as a form of qualia, to explain away language as a form of qualia, or to treat language qualia as a form of intrinsic brain function, if it always already consists of memetic-genetic components and phenomenal elements that coincide with known features of the brain's neural architecture and its neurophysiological mechanisms. In other words, with the formulation color language qualia, Dennett implicitly recognizes that language and color are both qualia that are linked with the visual brain's neurophysiological mechanisms. Dennett does not acknowledge this problem openly in *Consciousness Explained*; however, he appears to recognize that this constitutes a paradox in his thinking about language-in-consciousness, that there might be a language of genetics, or a genetics of language, that constitutes consciousness through complex neurodevelopmental processes. So, by the time he writes *Sweet Dreams*, he seems to recognize this problem when he substitutes his previous, multiple drafts model for the celebrity model of consciousness; however, the substitution only partially addresses the color language qualia problems that Gertrude Stein produces with her experimental, neuraesthetic compositions.

[17] As Jonah Lehrer notes in *Proust Was a Neuroscientist*, Stein first made this comment to Thornton Wilder in Chicago, during her lecture tour of America in 1934 and 1935. Stein composed the verse, "Rose is a rose is a rose is a rose" for the 1913 poem “Sacred Emily.” A version of this sentence also appears in the 1922 book *Geography and Plays*, as "Do we suppose that all she knows is that a rose is a rose is a rose is a rose." We also find a version of this sentence in *Operas and Plays*, as "she would carve on the tree Rose is a Rose is a Rose is a Rose is a Rose until it went all the way around,” in *The World is Round*, as “A rose tree may be a rose tree may be a rosy rose tree if watered,” in *Alphabets and Birthdays*, as “Indeed a rose is a rose makes a pretty plate," in *Stanzas in Meditation*, as “When I said. A rose is a rose is a rose is a rose. And then later made that into a ring I made poetry and what did I do I caressed completely caressed and addressed a noun,” in *Lectures in America*, as “Civilization begins with a rose. A rose is a rose is a rose is a rose. It continues with blooming and it fastens clearly upon excellent examples,” and in *As Fine as Melanctha*; "Lifting belly can please me because it is an occupation I enjoy. Rose is a rose is a rose is a rose. In print on top." There is also a version of this “aesthetic idiolect” or modernist verse in *Bee Time Vine*. Stein discusses the significance of this verse in *The Autobiography in Alice B. Toklas*, and how Alice Toklas adorns their plates and linens with it. Note that the term, “aesthetic idiolect,” to describe Stein’s verse ‘a rose is a rose is a rose’ comes from Umberto Eco’s *A Theory of Semiotics*, pp. 270-271. Readers may also consult *Wikipedia*, the online dictionary for other citations and possible meanings of this “aesthetic idiolect,” some of which I have cited here, via Lehrer and Wilder’s references to this famous verse.

[18] In a review of Stein’s “Composition as Explanation” that was written for the *Chicago Tribune* on June 19, 1927, Eliot H. Paul writes,

No one cares which part of a canvas was painted first. In music, the problem is equally acute and George Antheil, particularly, has attempted to compose in such a way that, although the music must pass the ear, as it were, in a series of points forming a line by means of memory, the effect shall be architectural and a dimensional analogous to space shall be involved. A musical composition, if properly enjoyed, is enjoyed as a whole, reconstructed *in toto* from memory after having been heard. Its beauty lies in the fact that it does not have to be rearranged but merely remembered. Miss Stein realized that a prose composition, not the time consumed by the things suggesting the composition, determines its form. Writing about a thing which has happened, which is complete and without active time, may be compared to painting. Writing in a continuous present, as Miss Stein does, of things happening and beginning again and again, is more like music, in so far as its formal problems are concerned. So her works have to be performed, and there are few trained or capable performers. (43)

As Paul observes in the passage above, Stein's cubist literature creates architectural and dimensional spaces that can be compared to paintings and musical compositions. He also purports that "a wide range of experiments have been performed with a view to freeing writing from the curse of chronology" (43). The narrative and grammatical constructs that Stein defines as a-temporal elements and as natural phenomena in "Composition as Explanation," serve complex roles in her cubist literature, by acting as architectural structures that define the brain's *N*-dimensional, neural and qualia spaces and also function as emergent, anatomical features.

[19] J. L. Austin, in *How to Do Things With Words*, identifies a domain of "unhappy" or "infelicitous" performance speech acts usually associated

with “empty” or “etoliated” forms of literary or theatrical expression. Austin points out that a nonsensical, “phatic” speech act, such as “cat thoroughly the if,” that is similar to many of the expressions that Stein uses in her modernist writings, functions as a performative speech act. Its non-identical twin is the rhetic speech act, which is the category of speech act that occurs when “the sense or reference is not being taken as clear” (96). An example of the rhetic performative occurs when we place a word in quotation marks or when we invent a neologism that marks a word’s grammatical difference from similar-sounding words that usually define its normative usage. In Austin’s view, these two types of performatives are not reducible to one another: “we can perform a phatic act which is not a rhetic act, though not conversely” (97). Austin says it is useful to make a distinction between phemes and rhemes, in literary contexts and in linguistic studies, because it is possible to repeat someone else’s unintelligible remarks and/or read the words in another language without understanding what they mean; yet it is not possible to establish the sense and reference of a rhetic act when it is not given in the first place as the context of a particular speech act or as an embodied enunciation. As he phrases it, “The pheme is a unit of *language*: its typical fault is to be nonsense—meaningless. But the rheme is a unit of *speech*; its typical fault is to be vague or void or obscure” (98; original emphasis). One of the problems literary scholars frequently encounter, but rarely analyze, when reading Stein’s nonsensical, dissociative writings is the difference between ‘phemes’ and ‘rhemes.’ As Austin notes, many readers do not distinguish between ‘rhemes’ and ‘phemes,’ because they cannot tell the difference between an utterance that is intentionally obscure and one that is intentionally meaningless. Yet, in the disciplines of linguistics and in literature, this difference can be an important one. Asking and answering the following rhetorical question, Austin queries, "Is not a statement which refers to something which does not exist not so much false as void? (*How to Do Things With Words* 20). According to Austin's philosophical logic, "in the definition of the phatic act two things were lumped together: vocabulary and grammar. So we have not assigned a special name to the person who utters, for example, "cat thoroughly the if' or 'the slithy toves did gyre.' Yet a further point arising is the intonation as well as grammar and vocabulary. The phatic act, however, like the phonetic, is essentially mimicable, reproducible (including intonation, winks, gestures, & c). One can mimic not merely the statement in quotation marks 'She has lovely hair', but also the more complex fact that he said it like this: 'She has *lovely* hair' (shrugs)" (96; original emphasis). Austin clarifies the distinction between the two speech acts, as follows: We had made the three rough distinctions between the phonetic act, the phatic act, and the rhetic act. The phonetic act is merely the act of uttering certain noises. The phatic act is the uttering of certain vocables or words, i.e. noises of certain types, belonging to and as belonging to, a certain vocabulary, conforming to and as conforming to a certain grammar. The rhetic act is the performing of an act of using those vocables with a certain more-or-less definite sense and reference. Thus, "He said that 'The cat was on the mat' reports a phatic act,' whereas 'He said that the cat was on the mat' reports a rhetic act. … Obviously, to perform a phatic act I must perform a phonetic act, or, if you like, in performing one I am performing the other" (95-96). With respect to the performative known as 'the pheme,' we might ask which other kinds of linguistic, phenomenal and subjective realities are being performed and performatively constituted by these so-called 'unhappy' or 'infelicitous' speech acts. Liberally using these performatives, in the specific form of cubist puns and modernist verses, Stein's librettos, play scripts and portraits potentially incarnate, reproduce and mime all kinds of subjective experiences and mental or linguistic realities that do not necessarily correspond with social and norms. But this does not mean they are 'abnormal' or 'pathological,' as Stein points out, in her autobiographical writings. Take, for instance, *A Bouquet of Wills*. In this play, the creative mind presumably enunciates nonsensical passages, such as the following one, as a means of articulating a style, or a will-to-style, that is to distinguished from the identificatory, mnemonic and metaphysical predicates of the play's speaking subject(s), who are classified by Stein in her critical writings as universal but abstract forms of human nature and identity: "Go shame a glad and garfield season and beds and bakers and let a horse know, let in by spots spots glued and mounted and nervous and really what, why meals are poked and a gallon a gallon is forever forever what, pickles, salt water stranger beer. No glass is wooden and more deeper collided and a violin a violin is in [in] a smell" (*Operas and Plays* 208). With respect to such enigmatic utterances, Austin might have observed, "we can perform a phatic act which is not a rhetic act, though not conversely. Thus we may repeat someone else's remark or mumble over some sentence, or we may read a Latin sentence without knowing the meaning of the words. The question when one pheme or one rheme is the *same* as another, whether in the 'type' or 'token' sense, and the question of what is one single pheme or rheme, do not so much matter here. But, of course, it is important to remember that the same pheme, e.g. sentence, that is, tokens of the same type, may be used on different occasions with a different sense or reference, and so be a different rheme. When different phemes are used with the same sense and reference, we might speak of rhetically equivalent acts ('the same statement' in one sense) but not of the same rheme or rhetic acts (which are the same statement in another sense which involves the same words" (97-98; original emphasis).

With Broca's aphasics, speech production, understanding, grammar, phonology, naming, and controlling actions are affected, and with Wernicke's aphasics, the brain produces meaningless sentences and nonsense words, even though it maintains grammatical integrity in the sentences that are enunciated by an affected brain. The rhemes and phemes that are produced by Stein in some of her literary portraits, plays and operas can look and sound like the speech patterns produced by patients with the brain lesions in these areas. But Stein did not set out with the aim of recreating aphasic speech patterns, since she claims to be frightened by pathologies of any sort in *Everybody's Autobiography* and *The Autobiography of Alice B. Toklas*. Rather, I am proposing that the second-phase literary portraits, as Steiner calls them, serve as literary experiments that test the brain's myriad reactions to unusual (performative) speech patterns, phenomenal color experiences and color patterns (or mappings), and abstract or practically nonsensical, grammatical constructions, with the aim of discovering the differences between pathological and nonpathological, evolutionary mutations in the brain's visual, language and speech centers associated with the processes of reading and writing. We have seen, in the case of the phemes and memes, that the difference between meaning and sense, purposeful unintelligibility and unintelligible nonsense, the proliferation of unintended meaning and linguistic indeterminacy, can mimic the linguistic qualities of Broca's and Wernicke's aphasias. Stein produced these nonsensical writings for the better part of her career, refusing to give up her experiments with language that was fragmented, nearly meaningless, and frustrating for her readers to listen to or read, precisely because these writings had meaning for her as phenomenological, psychological and neuroscientific thought experiments.

[20] In *Picasso and the Allure of Language*, Irene Small similarly observes, “In her 1938 book *Picasso*, Gertrude Stein remarked on the calligraphic quality of Picasso’s work. “He had a certain way of writing his thoughts,” she wrote, “that is to say of seeing things in a way that he knew he was seeing them.” For Stein, Picasso’s calligraphy was not simply a formal affair. It entailed a certain quality of line, doubtless. But it also meant painting as a kind of writing, a particular way of registering thought on a flat support. In 1938, Stein could not have anticipated the brilliant red lithographic illuminations Picasso would contribute to Pierre Reverdy’s book of poems *Le chant de morts*, published in 1948 [two years after Stein’s death]. In consultation with the publisher Tériade about the author’s artistic handwriting style, Picasso “decided against figurative illustrations, which might repeat the curved quality of the poet’s hand, in favor of abstract decorations in the manner of medieval manuscript illumination. … In her memoirs, Françoise Gilot recalled that Picasso was particularly inspired by three fifteenth-century books he was shown by a bookseller around this time. The idea may have also originated with Tériade, who frequently published illuminations from medieval manuscripts in his magazine *Verve*” (164). Small does not comment on Stein’s fascination with medieval writing and Renaissance poetry in her essay, nor does she connect Picasso’s interest in medieval illumination as a source of inspiration for modern art with Stein’s interest the dissociative writing style of canonical, medieval and Renaissance poets, such as Chaucer and Shakespeare. The point is that Stein might have not been surprised, in the least, at Picasso’s red lithographic illustrations for Reverdy’s book. Later in her essay on Picasso’s calligraphic method, Small notes, “The development of the notebook motif in *Les chant des morts* recalls Reverdy’s 1918 definition of the poetic image as “ the juxtaposition of two more or less

distinct realities," a formulation cited by André Breton in his first Surrealist manifesto of 1914. It is likewise indicative, as per Stein's idea of "calligraphy," of Picasso's creative technique, wherein images are registered as a process of seeing. … According to Steinberg, the horizontal plane of the flatbed picture is "no longer the analogue of a visual experience of nature but of operational processes. It is a surface of inscription and recording. In place of the studio, it offers up the desk. … As a surface of registration, the book's pages testify to the process of their making. Picasso's swirling lines and punctuating blobs re-create the inkblot, the stain, and the scribble, the characteristic signs of hand writing while thinking, its pauses documented in the pooling of ink upon a page (106). Also in *Picasso and the Allure of Language*, Susan Fisher Greenberg notes that "the Steins were Picasso's principal patrons in Paris until 1913, when Leo Stein moved to Settignano, Italy, and their art collections were split up (Gertrude kept the Picassos). The Stein Papers contain letters and postcards from Picasso to the Steins dating from this intense prewar period, when Picasso searched for a new visual language and moved from his Paris studio to small villages in Catalonia and the Pyrenees during the summers" (2). [Much of this correspondence can be found in *Pablo Picasso Gertrude Stein Correspondence*, which has been edited by Laurence Madeline and translated by Lorna Scott Fox). Greenberg points out that the photograph of Stein sitting at her desk surrounded by Picasso's paintings "foregrounds the act of reading, entailed in the comprehension of a book but also of a painting, which can be read like a text. The photograph proposes the idea of a concentration on languages, both verbal and visual, that was crucial to both Stein and Picasso. In a similar way the juxtaposition of Stein's gigantic writing table and the equally present block of Picasso's artworks on the wall prompts us to think about the relationship between those two realms –

horizontal and vertical, and writing and painting, undergirded by friendships with Gertrude Stein and the poets of the *bande à Picasso*, fueled Picasso's Cubist innovation. But, as this exhibition seeks to demonstrate, it continued to inform Picasso's thinking as he developed new friendships between the wars with Surrealist writers, such as André Breton, Michel Leiris, and Paul Éluard. In the mid 1930s, when these friendships deepened, Picasso fervently began to write hundreds of poems, an activity that was interwoven with the making of intensely felt paintings and sculptures, and which continued until 1959. Picasso's continuing interest in the workings of language also generated a surge of innovation, particularly in the graphic arts and book illustration, in the years immediately following the end of World War II in 1945, when he was one of many French intellectuals who joined the Communist Party" (6). To this biographical material, Greenberg adds, "The charged dynamic of one "author" reading and interpreting another author's work, and the tensions between image and text, and between visual and verbal languages, raised by *Saint Matorel* fueled Picasso's innovation in his graphic work in the years after Cubism" (8). Wendy Steiner discusses this relationship at length in *Exact Resemblance to Exact Resemblance*, as well as in *Colors of Rhetoric.* I encourage interested readers to consult these texts for complementary views on the visual rhetoric that Stein and Picasso developed in their cubist works, as a result of their collaborative activities from 1906 to 1934 and their fractious relationship from 1935 to 1947.

[21] In "Participation of the left posterior inferior temporal cortex in writing and mental recall of kanji orthography," Kimihiro Nakamura, Manabu Honda, Tomohisa Okada, Takashi Hanakawa, Keiichiro Toma, Hidenao Fukuyama, Junji Konishi and Hiroshi Shibasaki offer evidence which supports the notion that the posterior inferior temporal cortex plays a crucial

role in the "mental transcription of visually presented … words," in language processing, and in the "neuropsychological mechanisms involved in writing" (*Brain* 123, 954). Based on their functional MRI studies of this brain region, they report that the PITC [posterior inferior temporal cortex] plays a key role in writing kanji through retrieval of visual graphic images, and suggest the language-specific cerebral organization of writing" (954). They explain their research findings, as follows: "Numerous observations have been reported on brain-damaged Japanese patients with dissociation of the skills required to read or write two different orthographic systems: kana (syllobograms) and kanji (morphograms). These observations have led to the idea that the processing of kanji and kana may involve different inter- and intrahemispheric mechanisms (Iwata, 1984; Benson; 1985; Coltheart; 1987; Friedman, 1993)" (954). These scientists note, "the most important finding from the series of analyses in the present study is that the left PITC is active not only in actual writing but in the mental recall of kanji. By contrast, neural activity did not significantly change from the baseline during oral reading or semantic judgement of the same word stimuli. Thus, the observed activation of the PITC should be attributed neither to the motor execution of writing *per se* nor to non-specific neural response to the visual stimuli" (961; original emphasis and spelling). When she was studying "the relation of color" to the non-descriptive words in her literary portraits through her partly visible or invisible "color thing," Stein likely converted James's psychological insights about Broca's and Wernicke's aphasias into the practice of neuraesthetic writing. That is, based on her brain stem research with Dr. Lewellys Barker, at the Johns Hopkins Medical School, which was based on finding somatosensory neural connections between the brain stem, thalamus and the cerebral cortex, Stein instinctively seems to have grasped that the posterior inferior temporal cortex played a crucial role in the "mental transcription of visually presented … words," in language processing, and in the "neuropsychological mechanisms involved in writing" (*Brain* 123, 954; original spelling). In *Proust and the Squid: The Story and Science of the Reading Brain*, Maryanne Wolf points out that the "alphabet reading brain differs substantively from that of the earlier logosyllabary reader in the decreased amount of cortical space it needs in some areas. Specifically, the alphabet reader learns to rely more on the posterior of the left hemisphere, specialized regions with less bihemisphere activation in these visual regions. By contrast, the Chinese (and Sumerians) achieve efficiency by recruiting many areas for specialized, automatic processing across both hemispheres. … Japanese readers offer a particularly interesting example because each reader's brain must learn two different writing systems: one of these is a very efficient syllabary (kana) usually especially for foreign words, names of cities, names of persons, and newer words in Japanese; and the second is an older Chinese-influenced logographic script (kanji). When reading kanji, Japanese readers use pathways similar to those of the Chinese; when reading kana, they use pathways much more similar to alphabet readers. In other words, not only are different pathways utilized by readers of Chinese and English, but different routes can be used within the same brain for reading different types of scripts. And because of the brain's prodigious ability to adapt its design, the reader can become efficient in each language" (61-63). See Figure 6, which is Maryanne Wolf's Figure 3-1, Three Reading Brains, from Proust and the Squid, p. 62. I discuss Wolf's neuroscientific research on the reading brain in chapter four, in relation to Stein's medical research on the nucleus of Darkschewitch and the medulla oblongata in Barker's anatomy laboratory. In this context, I would like to suggest that Stein's interest in Picasso's Oriental-stylized, cubist writing and painting techniques corresponds, almost exactly, with her phenomenological thought experiments and neuraesthetic writing practices in the second-phase literary portraits from the late middle period (1914 to 1926 approximately). With *Tender Buttons*, Stein explored the ways in which cubist portraits activate different brain regions involved in the act of reading. Her literary experiments with the "color thing" in the second-phase portraits that followed *Tender Buttons* targeted the brain regions that were thought to be responsible for producing color anomias, because her neuroscientific and psychological thought experiments with unusual language and color combinations would have activated the occipital-temporal region, the temporal-parietal region, the dorsal-frontal region and the ventral-frontal region that are involved in English sign production, while stimulating the regions of the brain usually reserved for Chinese and Japanese readers, according to the information provided by Kakamura et alia's study of brain-damaged Japanese patients and Wolf's study of "three reading brains." This study of brain-damaged Japanese patients further illuminates Stein's neuraesthetic compositional practices with the color thing, to the extent that it shows how dissociative writing systems trigger differ brain regions involved in the act of reading. If Stein was performing imaginary brain surgeries with her cubist portraits, then her dissociative prose and her color thing likely work at cross purposes, as a means of generating creative pathways in the brain's reading circuits, given her multifarious attempts to produce cognitive obstacles and neurophenomenological aporias that would make it difficult for readers to decipher her portraits' non-descriptive, English prose.

Material has been removed from this thesis because of copyright restrictions. The information removed from page 551 is Figure 6, which is a black and white photocopy of Maryanne Wolf's Figure 3-1, Three Reading Brains, from Proust and the Squid: The Story and Science of the Reading Brain. This figure shows that the "alphabet reading brain differs substantively from that of the earlier logosyllabary reader in the decreased amount of cortical space it needs in some areas. Specifically, the alphabet reader learns to rely more on the posterior of the left hemisphere, specialized regions with less bihemisphere activation in these visual regions. By contrast, the Chinese (and Sumerians) achieve efficiency by recruiting many areas for specialized, automatic processing across both hemispheres. … Japanese readers offer a particularly interesting example because each reader's brain must learn two different writing systems: one of these is a very efficient syllabary (kana) usually especially for foreign words, names of cities, names of persons, and newer words in Japanese; and the second is an older Chinese-influenced logographic script (kanji). When reading kanji, Japanese readers use pathways similar to those of the Chinese; when reading kana, they use pathways much more similar to alphabet readers. In other words, not only are different pathways utilized by readers of Chinese and English, but different routes can be used within the same brain for reading different types of scripts. And because of the brain's prodigious ability to adapt its design, the reader can become efficient in each language" (Wolf, Proust and the Squid 61-63). The original source of this material is Figure 3-1, Three Reading Brains, from Maryanne Wolf's Proust and the Squid: The Story and Science of the Reading Brain. New York: Harper, 2007. N. pag.

[22] I will be following William James, Gerald Edelman and Giulio Tononi's model for understanding the qualitative discriminations between elementary and secondary phenomenal experiences in this thesis, as a means of defining the relationship between the brain, the mind and passing states of consciousness, in this thesis. After defending my thesis at the University of Alberta this spring, I discovered that Semir Zeki employs different kinds of neuraesthetic approaches, in his past three books, to arrive at the some of the same conclusions as I do about the quantitative and qualitative distinctions between 'inherited and acquired, brain concepts. For example, in *Splendors and Miseries of the Brain*, Zeki argues, "Art, love, and beauty are generally considered to be abstract notions even though there is increasing evidence that the experience we have in these areas can be correlated directly with activity in specialized areas in the brain. Of course, much divides the experience of love and beauty from simple sensation, even if there is a link between the two. In seeking for universal principles dictating the organization and functioning of the brain, it seemed important to opt to study systems that are as remote from each other as possible, to learn whether, in spite of the big gulf between them, there is a common thread in terms of brain organization. Can it be that fundamentally the same approach, that of concept formation, is used in simple perception and also in mathematics, art, music and literature? Evidence from these fields suggests that it is. Indeed it is because of this link that there is so close a relationship between ordinary perception on the one hand and art, beauty, love, and creativity on the other, as I will try to show" (3). William James, in chapter twenty-eight of *The Principles of Psychology*, makes a similar connection between brain evolution, neurophysiological functioning and the creation of mathematics, art and literature. I find the commonalities between Zeki's neuraesthetic approach to cubist art and James's radical empiricist,

psychogenetic approach to consciousness research and mental evolution to be useful to my arguments about Stein's neuraesthetic writing practices; however, I do not have time to improve my thesis by incorporating Zeki's insights. However, I will be incorporating these arguments in future essays and drafts of this manuscript.

[23] In other words, Stein explores the "situational constancy" of the visual brain and the reading brain, to use Zeki's terminology, by portraying some of the ambiguities that exist between elementary and secondary phenomenal experiences, in her dissociative writings. As Zeki explains, "situational constancy is a subject that neurology has not yet been studied, indeed the problem itself has not been addressed. We have hardly begun to understand the simpler kinds of constancy, of form or colour for example, and it is not surprising that neurologists should not have even thought of studying so complex a subject, in which there are so many elements" (*Inner Vision* 27). Largely because of James's mentorship at Harvard University in the areas of experimental psychology and psycho-physiological brain research, Stein was able to produce complicated, literary works that studied the brain's abstracting processes. Supporting my embryonic views of how Stein secretly employs past and present, phenomenal experiences to produce brain maps in her second- and third-phase cubist portraits, Zeki points out, "Writing of Cubism, Gleizes and Metzinger tell us that 'Certain forms should remain implicit, so that the mind of the spectator is in the chosen place of their concrete birth' (Zeki, *Inner Vision* 26).

[24] Instead of "language experiments," it might be better to use the Latin phrase "*experimentum linguae,*" because of its philosophical resonances. I am thinking specifically of Giorgio Agamben's use of this phrase in *Infancy and History: On the Destruction of Experience*. Here, Agamben states, "One of the most urgent tasks for contemporary thought is, without doubt,

to redefine the concept of the transcendental in terms of its relation to language. For if it is true that Kant was able to articulate his concept of the transcendental only by omitting the question of language, here 'transcendental' must instead indicate an experience which is undergone only within language, an *experimentum linguae* in the true meaning of the words, in which what is experienced is language itself. In this preface to the second edition of the *Critique of Pure Reason*, Kant presents as an *Experiment der reinen Vernunft* the attempt to consider objects in so far as they are 'only thought.' This, he writes, is an experience which is undergone not with objects, as in the natural sciences, but with concepts and principles which we admit a priori (such objects, he adds, 'must yet be able to be thought!'). Numerous Stein scholars have written about Stein's experiments with language, consciousness and experience. In *Gertrude Stein and Wallace Stevens: the Performance of Modern Consciousness*: Sara J. Ford writes, "As an artist concerned primarily with the "medium" of language, Stein saw language through a primarily Jamesian lens, seeing it as an external force, an entity to which selves must relate and through which selves might therefore be determined. Conventional notions of language as merely an expressive medium, a device by which selves could express themselves, were therefore suspicious. New questions about the degree to which consciousness actually performs language became relevant, and such questions certainly underlie Stein's theatrical investigations. Throughout her career, Stein experimented with language, uncovering its tendency to mask convention, hierarchy, and power and forging out new linguistic forms. In doing so, she experimented with her own ability escape the constricts of conventional language. It is in the theater, however, that Stein can most literally "stage" her negotiations with language. In "playing" [with] language, therefore, Stein is using a necessarily mediating vehicle to impose new forms upon the world of experience" (37). See also Jane Palatini Bower's treatment of the play as "lang-scape" in "*They Watch Me as They Watch This*," Sarah Bay-Cheng's discussion of Stein's multiples in *Mama Dada*, Betsy Alayne Ryan's analysis of Stein's quantum mind realities in Gertrude Stein's *Theater of the Absolute*, Elizabeth Fifer's reading of Stein's "difficult texts" in *Rescued Readings*; each of these critics discusses Stein's play with language and her treatment of language as an experience that reveals important things about human creativity, sexuality, and psychological being. The term "parallelism" is sometimes used to describe William James's pragmatist thought, or his psycho-physiological approach within radical empiricist science. In *Infancy and History*, Agamben contends,

> It is on the overriding of the Kantian opposition between the transcendental and the empirical I, and on the substantialization of the subject in a "psyche," that nineteenth-century psychology constructs its central myth: that of a psycho-somatic I which is the incarnation of the mystical union between *nous* and *psyche* on which ancient metaphysics is founded. … [Scientific psychology] tries to reach the subject by constructing itself as a science of *conscious facts*, which derive from a parallelism between the psychic phenomenon and the concomitant physiological phenomenon (for example, between a psychic state and a cerebral state, or between a sensation and a stimulus). But it is precisely the hypothesis of psychophysiological parallelism which betrays the metaphysical derivation of scientific psychology (which Bergson rightly traced back to the Cartesian opposition of *res cogitans* and *res extensa* at work within man) and the impossibility of apprehending the fact of consciousness, which split in two, simultaneously as a physiological

process and as a consciousness. (40)

With her modernist writings, Stein sought to reconcile the perceived split between the brain's physiological processes and its passing states consciousness; however, more times than not, she did so by foregrounding the kinds of 'splittings' and dissociations that were occurring within consciousness, language and "creative metaphysics" at the level of her 'parallelist' discourse.

[25] Although many philosophers, psychologists and neuroscientists debate the so-called "qualia problem," I am thinking, in particular, of Joseph Levine's argument in *Purple Haze: The Puzzle of Consciousness*. In the "Introduction" to his book, Levine writes, "While the problem of providing an explanation for qualitative character—what makes my sensation a reddish one, as opposed to a greenish one—has been the focus of most of the literature on conscious experience, a major theme of this book is that the deepest problem lies with understanding subjectivity In fact, as will emerge in the course of my argument, the explanatory gap between physical properties and qualitative properties is a symptom of the subjectivity of consciousness" (7). I considered using Levine's distinction between "qualophobes" and "qualophiles," which is the distinction between those scholars who fear "qualia" and those who believe in or even fetishize "qualia," to explicate Stein's experiments with literary qualities of conscious experience in chapter one and, also, to theorize how these literary or linguistic qualities of phenomenal experience could be taking the form of colored and uncolored word-neurons in her neuroanatomical imaginaries; such an approach would expand my analysis of Stein's neuraesthetic presentation of chromophobe" and "chromophile" neurons in "A Long Dress," in chapter one. I plan to extend my analysis of the relationship between the fear and the fetishization (or love) of the qualitative characters

of phenomenal experience and the fear and the love of color on the part of certain neurons in a future draft of this chapter. Certainly, in the debate taking place between Levine, Dennett, Chalmers, Taylor, Edelman and other philosophers about the consciousness, or what I am defining as a "qualia-politics," there is much room for dissension and discussion. Readers may wish to consult Levine's interesting discussion of "qualophilia" and "qualophobia" in *Purple Haze*, chapter five. Also, readers may wish to consult Daniel Dennett's rebuttal of Levine's ideas in *Sweet Dreams* and his "multiple drafts of consciousness" theory in *Consciousness Explained*, for some provocative references to modernist texts and literary models for the conscious mind and for consciousness per se.

[26] See *Wikipedia*: <http://en.wikipedia.org/wiki/Anomic_aphasia>). For a layperson's guide to the color anomies, *Wikipedia* provides a list of scientific sources that can be traced and followed up. See the abovementioned website address for such scientific and cultural references.

[27] In "Perception," Wurtz and Kandel note that the "organization of the output connections from the primary visual cortex [and the secondary visual cortex] is similar to that of the somatic sensory cortex in that there are outputs from all layers except 4C, and in each layer the principal output cells are the pyramidal cells ... The axons of cells above layer 4C project to other cortical areas; those of cells below 4C project to subcortical areas. *The cells in layers 2 and 3 send their output to higher visual cortical regions, such as Brodmann's area 18 (V2, V3 and V4). They also make connections via the corpus callosum to anatomically symmetrical cortical areas on the other side of the brain.* Cells in layer 4B project to the middle temporal area (V5 or MT). *Cells in layer 5 project back to the superior colliculus, the pons, and the pulvinar.* Cells in layer 6 project back to the lateral geniculate nucleus and to the claustrum. *Since cells in each layer of the visual cortex*

probably perform a different task, the laminar position of a cell determines its function properties" (539-540; emphasis added).

[28] In "Language and the Aphasias" from *Principles of Neural Science*, Nina F. Dronkers, Steven Pinker and Antonio Damasio add that transcortical motor and sensory aphasias, which could mimic the color anomias in certain respects, result from damage to areas near Broca's and Wernicke's Areas. They observe, "People with transcortical sensory aphasia have fluent speech with impaired comprehension, and they also have great trouble naming things. This aphasia differs from Wernicke aphasia in the same way that transcortical motor aphasia differs from Broca's aphasia: repetition is spared. In fact, patients with transcortical sensory aphasias may repeat and even make grammatical corrections in phrases and sentences they do not understand, and they can repeat words in foreign languages. The aphasia thus appears to be a deficit in semantic retrieval, with syntactic and phonological abilities still relatively intact. Transcortical motor and sensory aphasias are believed to be caused by damage outside of the perisylvian area, in particular, outside the superior temporal and inferior parietal lobes, which explains the sparing of repetition skills. Transcortical aphasias are thus the complement of conduction aphasia, behaviorally and anatomically. Transcortical sensory aphasia itself appears to be caused by damage to parts of the junction of the temporal, parietal, and occipital lobes, which connect the perisylvian language areas with the parts of the brain underlying word meaning" (1180-1181). See Figure 10 (<u>Positron emission tomography images compare the adjusted mean activity in the brain during separate tasks: naming of unique persons, animals, and tools</u>, from Dronkers, Pinker and Damasio's "Language and the Aphasias," Figure 50-9.

Material has been removed from this thesis because of copyright restrictions. The information removed from page 559 is Figure 10, which is a colored photocopy of Figure 50-9, “Positron emission tomography images compare the adjusted mean activity in the brain during separate tasks: naming of unique persons, animals, and tools,” from Nina F Dronkers, Steven Pinker and Antonio Damasio’s “Language and the Aphasias.” This figure contains the following information about the naming of unique persons, animals and tools, as given in the following caption, courtesy of H. Damasio: “Positron emission tomography images compare the adjusted mean activity in the brain during separate tasks: naming of unique persons, animals, and tools. All sections are axial (horizontal) with left hemisphere structures on the right half of each image. The search volume (the section of the brain sampled in the analysis) includes inferotemporal and temporal pole regions (enclosed by the **dotted lines**). **Red areas** are statistically significant activity after correction for multiple comparisons. There are distinct patterns of activation in the left inferotemporal and temporal pole regions for each task” (1181). The original source of the photocopied thesis material is Figure 50-9 from Nina Dronker, et al, “Language and the Aphasias.” Principles of Neural Science. 4th ed. Ed. Eric R. Kandel, et al. New York: McGraw-Hill, 2000.1181.

[29] Meyer provides the following definitions for the directional terms used by neuroscientists to describe the brain's basic anatomy. Stein also uses this neuroscientific, directional terminology in her published research on the medulla oblongata in Barker's medical textbook, *The Nervous System and its Constituent Neurones*, which I will be discussing in some detail, in chapters one and four. This information may be helpful to readers, who have not read Meyer's book or who are unfamiliar with these neuroanatomical terms and meanings: "The back of the brain and spinal cord is *posterior*. In the case of the brain stem and spinal cord (as well as the body in general), the term *dorsal* is used synonymously with *posterior* … The front of the brain and spinal cord is *anterior* … [and] the term *ventral* is used synonymously." In addition, "when comparing two structures, the structure closer to the midline is said to be *medial* to the other, which is *lateral*," whereas "the terms *proximal* and *distal* refer to relative distances from a reference point, proximal being closer and distal being farther" (*Irresistible Dictation* 78; original emphasis). Stein and her peer, Florence Sabin, were provided with sagittal brain sections or slices, which they studied under a microscope and reconstructed into a three-dimensional model of the upper medulla oblongata, midbrain and pons. Readers unfamiliar with these terms may find the following terms to be helpful: "coronal" [means] the vertical description into front (rostral) and back (caudal); "sagittal" [means the] vertical division into left and right; "midsagittal" [denotes the] vertical division into two equal parts; "horizontal" [signifies] cross-section divisions [that separate] into upper and lower portions; "transverse" [means the] diagonal to cross-plane at curving brainstem; "lateral" [designates the] structures [that turn] away from midline; "medial" [means the] structures toward midline" (Bhatnagar, *Neuroscience for Communicative Disorders* 12).

[30] I will be presenting Meyer's argument about the 'nonsubstantial' quality of Stein's neuraesthetic compositions in a different light, in chapter four, namely, from the standpoint of Picasso's cubist portraiture and Stein's neuroanatomical portraiture). Here, for purely introductory purposes, I am foregrounding the theoretical provenance of my critical ideas and showcasing my neuraesthetic reading strategies, in order to emphasize the differences that exist between Meyer's oxymoronic organicist approach and my performative neuraesthetic approach. For the sake of brevity in this introduction, I am glossing over important aspects of Meyer's argument and James's psychological research for the purposes of introducing key themes and ideas in my project as a whole. However, I discuss these ideas in detail in the body of my thesis.

[31] Readers may wish to consider the following studies, which support James's thesis about the brain's dispersed language centers from the perspective of late twentieth and twenty-first century scientific studies on Broca's region. For example, in "Involvement of the Left and Right Frontal Operculum in Speech and Nonspeech Perception and Production," Martin E. Meyer and Lutz Jäncke state, "The traditional notion of Broca's area as a core centre for language in the brain has been discarded since a plethora of neuroimaging studies has revealed an engagement of this area in a multitude of cognitive and perceptuomotor functions, i.e., visually prompted digit sequence learning (Müller et al., 2002), perception of the rhythm of motion (Binkofkski et al., 2000; Binkofski and Buccino, 2004; Fadigo et al., this volume [*Broca's Region*] Chapter 9; Jäncke et al., 1999) subvocal rhythm encoding and maintenance (Gruber et al., 2000), mapping of nonlinguistic structural information (Hoen et al., in press), visual pattern matching (Fink, this volume, Chapter 16), etc. Evidence in favor of an essential involvement of Broca's area in the "articulatory loop," the subvocal rehearsal system,

stems from a positron emission study by Paulesu et al (1993). Furthermore a review article by Pöppel (1996) provided additional evidence for the close relation between Broca's areas and verbal working memory. Aboitz and colleagues provide a complementary hypothesis proposing that language networks as a specialization of frontoparietal prefrontal circuits involved in cognitive processes such as working memory (Aboitz et al., this volume, Chapter 1). Of particular interest in this context is the notion of "mirror neurons" in the frontal lobe, which have been reported to activate during observation, recognition, and imitation of nonverbal actions (Buccio et al., 2004, Rizzolatti and Luppino, 2001)" (219-220). In "Participation of the left posterior inferior temporal cortex in writing and mental recall of kanji orthography," Kimihiro Nakamura, Manabu Honda, Tomohisa Okada, Takashi Hanakawa, Keiichiro Toma, Hidenao Fukuyama, Junji Konishi and Hiroshi Shibasaki offer evidence which supports the notion that the posterior inferior temporal cortex plays a crucial role in the "mental transcription of visually presented … words," in language processing, and in the "neuropsychological mechanisms involved in writing" (*Brain* 123, 954). Based on their functional MRI study of this brain region, they report that the PITC [posterior inferior temporal cortex] plays a key role in writing kanji through retrieval of visual graphic images, and suggest the language-specific cerebral organization of writing" (954). As they explain their research findings, "Numerous observations have been reported on brain-damaged Japanese patients with dissociation of the skills required to read or write two different orthographic systems: kana (syllobograms) and kanji (morphograms). These observations have led to the idea that the processing of kanji and kana may involve different inter- and intrahemispheric mechanisms (Iwata, 1984; Benson; 1985; Coltheart; 1987; Friedman, 1993)" (954). These scientists note, "the most important finding from the series of analyses in the present study is that the left PITC is active not only in actual writing but in the mental recall of kanji. By contrast, neural activity did not significantly change from the baseline during oral reading or semantic judgment of the same word stimuli. Thus, the observed activation of the PITC should be attributed neither to the motor execution of writing *per se* nor to non-specific neural response to the visual stimuli" (961; original emphasis and spelling). When she was studying "the relation of color" to the non-descriptive words in her literary portraits through her partly visible or invisible "color thing," Stein likely converted James's psychological insights about Broca's and Wernicke's aphasias into the practice of neuraesthetic writing. That is, based on her neuroanatomical research with Dr. Lewellys Barker in regard to the somatosensory neural connections of the brain stem, thalamus and the cerebral cortex, Stein instinctively seems to have grasped that the posterior inferior temporal cortex plays a crucial role in the "mental transcription of visually presented … words," in language processing, and in the "neuropsychological mechanisms involved in writing" (*Brain* 123, 954).

[32] Readers may find it useful to consult Karl Zilles's research on brain localization and brain maps. In *Broca's Region*, as a participant in the Jülich Workshop, he argues, "probability maps are a fundamental[ly] different concept of cytoarchitecture [than] when compared with the maps in the past. The latter suggest that there is a more or less well-defined border. The probability maps tell a different story. You can only choose a probability and then you will see the border at another place. We can only make probability statements about the precise location of the border of a cortical area. This is the only – let's say – the only possible way to speak about cytoarchitecture, and how does probability and structure and function fit together. … For an example in the human brain I refer to the human visual

cortex where you have abrupt changes in cytoarchitecture and corresponding changes in function at the border of the striate to the extrastriate cortex. You can see it in the anatomy of the visual cortex. When you look for such areas in different individuals, however, you will see tremendous variability and therefore when we want to make a general statement about the human cortical brain map, then we can only do it as a probability map" ("Jülich Workshop Excerpts" 273). In much the same way, Stein's cubist puns function as performative speech acts and as probability brain maps, generating scientific meanings, cytoarchitectural coordinates, neuroanatomical possibilities and functional effects for a given brain region or brain representation. As Zilles points out in the Jülich Workshop, there is a great deal of confusion that "comes out when different approaches are used in the different talks [about Broca's region, etc.]. For example, everybody refers to Broca's region, to Broca's complex, to area 44, to area 45, or to area 47. It is my impression that this notion is not well defined, more or less chaotic. It is not just a question of nomenclature, but a problem that goes into the interpretation of data. For instance, when somebody says that "we found in a clinical study something which is related to a dysfunction of Broca's area 47" and later discusses data from areas 45, this cannot be done, because the "area 47" is not defined. It's rather like "anterior and very ventral" relative to the inferior frontal gyrus," whereas the meaning in the second statement is, let's say cortical area 45, or 44, if it's a bit more posterior. In some cases this notion refers to the mean of a group study, whereas in other cases it is a single brain. The reference system, as well as the way the data came into this system, also differ. Sometimes, it's done by a mathematically controlled elastic warping procedure to a common reference space, whereas in other talks it's just a reference to the Talairaich atlas. So we use the definitions of cortical areas in different ways, mixing and matching and then we end up with theories and statements, which become accepted in the community. But, these statements don't really tell us very much. … some people tell me "I'm absolutely not interested in these anatomical issues, it's not necessary. I can do my functional studies. I don't need any anatomical atlas, any anatomical basis." This is one viewpoint, but there may be other participants who are interested in knowing whether the blob they see in images is in a structurally homogeneous brain area, or is distributed over different areas" (271). Though the study of Stein's neuraesthetic writing practices is relatively new, many of the issues that Zilles raises are relevant to her modernist representations of the human brain and the human mind. For instance, Steven Meyer and I both believe that the anatomical issues are important, that it is crucial for literary theorists to know something about Stein's medical training, neuroscientific research and psychological experiments, in order to make sense of whether the "blob they see in [certain] images [within a given work] is in a structurally homogeneous brain area, or is distributed over different areas," as Zilles put it (271). Sergey Avrutin offers the contrary perspective, "coming from work with aphasic patients": "With my linguistic background, I think that the studies with aphasic patients can actually contribute to the *linguistic* theory independently of the exact knowledge where the damage is. Specifically, suppose there are two linguistic theories, theory I and theory II. Theory I claims that certain constructions, X and Y, are grouped together. Theory II claims that these are two distinct linguistic constructions. Data from aphasic patients can actually tell us which theory is true. Here is how. Suppose that the patients perform equally well on both constructions. Then it is evidence for theory I, but not II. In this case, we can circumvent the problem of complete localization. We simply don't care. We would care if we were to focus on localization, but then it becomes a question of how one focuses one's research program. If it is on localization, then localization is important; but if your research aims to contribute to a general understanding of language, then it can be ignored" (*Broca's Region* 272; original spelling). To these statements by Avrutin, Francisco Aboitiz responds, "Well, the statement that we don't care is too strong of course. Neurologists tell me that the issue of localization is a mess, and so you can abstract away and approximate. There are Broca's aphasics[,] which are usually classified according to say, the Boston test, or whatever. Eventually you would like to have of course a very clear connection with localization, to the extent that it exists" (*Broca's Region* 272). Stephano Cappa adds the following points to this conversation: "I think that Sergey's point is perfectly legitimate. It depends from what angle you are doing research. Twenty years of cognitive neuropsychology have been basically ignoring the brain completely. I think this is a perfectly legitimate enterprise. It does not detract from the fact that nowadays, especially with functional imaging, many people are asking different kinds of questions, e.g., how language is represented in the brain. At that point, the precision in the anatomy cannot be avoided. To be fair to the field, 15 or 16 years ago it was impossible to be precise with respect to anatomy, because of positron emission tomography, group studies averaging, a lack of good atlas, etc. Given that, it is appropriate to discuss the data in terms of "slightly more anterior" or "slightly more posterior." I did it, for example, in my talk because if you're not very confident about localization, it's only fair to talk in vague terms like anterior, posterior and so on." The last point that I wish to include in this scientific dialectic about localization, function and language production is that of Gereon Fink, who claims that "the story is even more complicated." He says, "You can't classify many acute stroke patients with lesions of the left hemisphere. They don't fall under Broca's or Wernicke's aphasia or whatever. They are nonclassifiable. After a while, they evolve, e.g. into Broca's aphasics. Thus, when we talk about Broca's aphasia or Wernicke's aphasia, we are talking about something that depends on reconstitution of brain function, on neural plasticity. We often talk about an endpoint, after a lot of changes have happened in the brain, where we have no clue what they are. Such changes occur in the perilesioned areas of the same hemisphere, or in the homologue areas of the other hemisphere. I really think we have to take that into account when we talk about localization of a brain function based on lesions" (*Broca's Region* 273).

[33] Stein's "neuroesthetic" writing practices and phenomenological inquiries correspond directly and indirectly with the psychological laboratory experiments that she carried out at the Harvard Psychological Laboratory from 1893 to 1896, under the supervision of William James and Hugo Münsterberg. These psychological experiments were produced in collaboration with a graduate student named Leon Solomons. For example, in a laboratory experiment that explored "The Saturation of Colors" from the perspective of Weber's law of "least perceptible differences," Stein was actively involved in designing the experiments and in setting up the research parameters, as Solomons acknowledges in his published article in the *Harvard Psychological Review*. Also, these literary experiments indirectly reflect the neuroanatomical research and laboratory experiments that Stein conducted at Johns Hopkins Medical School, from 1897 to 1902, under the supervision of Dr. Franklin Mall and Dr. Lewellys Barker. I use Stein's laboratory experiments on "color saturation" in my analyses of the cubist brain maps from *Tender Buttons* and *The Geographical History of America*. Readers interested in Stein's published studies on color, attention and motor automatism in *The Psychological Review* can consult the

following articles: Solomons, Leon M. "The Saturation of Colors." *The Psychological Review*. Vol. V. Ed. J. McKeen Cattell and J. Mark Baldwin. New York: The MacMillan Company, 1896; pp. 50-56; Solomons, Leon M. and Gertrude Stein. "Normal Motor Automatism." *The Psychological Review*. Vol. V. Ed. J. McKeen Cattell and J. Mark Baldwin. New York: The MacMillan Company, 1896; pp. 492-512; Solomons, Leon M. and Gertrude Stein. "Cultivated Motor Automatism; A Study of Character in its Relation to Attention": *The Psychological Review*. Vol. III. Ed. J. McKeen Cattell and J. Mark Baldwin. New York: The MacMillan Company, 1896; pp. 295-306. Stein was also a subject in J.B. Hylan's experiments on attention, color and consciousness, which is published in *The Psychological Review*, in 1896, as "Fluctuations of the Attention." *The Psychological Review*. Vol. V. Ed. J. McKeen Cattell and J. Mark Baldwin. New York: The MacMillan Company, 1896; pp. 56-63.

[34] Stein was also influenced by Henri Bergson's intuitive philosophy about creative evolution and the creative mind, which we know William James also read and appreciated, because he wrote the introduction to Bergson's *Creative Evolution*. Stein attended Bergson's lectures on *Creative Evolution* at the University of Paris, in 1906. Numerous early twentieth century critics, such as Stein's friend, Mabel Dodge, have written about Bergson's influence upon Stein's modernist writing and her attempts to create new forms of consciousness in her literary art.

[35] When making this provocative claim about Stein's dissociative writings being and/or resembling "conscious artifacts," Meyer is referring to Edelman's experiments with "brain based devices" and "synthetic animals" (324). However, Edelman later adjusts his views of what constitutes a conscious being or an artifact that resembles the human central nervous system. When he writes *Second Nature*: *Brain Science and Human*

Knowledge, he emphatically states, "a conscious artifact would not necessarily have to be alive. Given the presence of a body with sensory and motor systems, what would be necessary is a high degree of complexity in the simulated equivalent of a thalamacortical system with a basal ganglion system. That complexity is presently unrealizable" (139; original spelling). Meyer focuses on a the way in which Stein's dissociative writings simulate higher-order consciousness processes, particularly those related to language production and linguistic experience, mirroring Edelman's point that "such an artifact would have to have a true language, one with syntax as well as semantics," rather than considering the unique, bodily demands and econiche requirements of a quasi-living conscious artifact. In other words, such an artifact would have to have a form of higher-order consciousness" that compared to that of humans or higher mammals (139). What Meyer leaves out of his discussion are Edelman's later statements about the remote likelihood of such artifacts being created by scientists any time soon:

> I suggest someday that a conscious artifact could probably be built. But it remains a remote goal. Even if that goal is reached, such a device would hardly challenge our uniqueness. Remember that the brain is embodied and that we are embedded in an econiche and culture that could hardly be duplicated or even imitated. The human phenotype with all its complexity is what fuels our particular qualia. The likelihood of matching such a phenotype verges on zero. The precious qualities of our own phenomenal state are safe from preemption or displacement. (140)

In making this observation, Edelman is referring to machines with artificial intelligence, not to literary texts comprised of paper, words and ink.[35] So, I think that it is stretch for Meyer to be comparing Stein's creative representations of the human brain to "conscious artifacts" with complex human phenotypes and neural architectures.

[36]I take the term "dissociative rhetoric" from Harold Bloom's "Introduction" to *Gertrude Stein*.

[37] In "The Anatomical Organization of the Central Nervous System," David G. Amaral points out, "While neuroanatomy may seem to provide only a static picture of the nervous system, it can provide profound insight into how the nervous system functions, in the same way that the detailed structure of proteins reveals important principles of protein function. Many of the prevailing ideas about the dynamic mechanisms in the nervous system were forecast by Ramón y Cajal on the basis of images of neurons in stained histological specimens. Indeed, many of the established properties of neuronal connectivity were first discovered using the methods of classical anatomy. Golgi staining first showed the existence of two major classes of nerve cells in the brain: projection neurons, whose axons connect the major regions of the nervous system, and local interneurons, which integrate information within specific nuclei of the brain. Later staining techniques demonstrated the considerable convergence and divergence of projections between brain regions. Today, our understanding of higher brain function depends on refined mapping of neuronal circuits using new anatomical and imaging techniques. Modern neuroanatomical labeling techniques have revealed the topographic organization of projections from one brain region to the next … modern imaging techniques have revolutionized the study of the cognitive functions of the brain and thereby placed neurology and psychiatry on a firmer empirical footing. Positron emission tomography (PET) and magnetic resonance imaging (MRI) have made the functional organization of the human brain visible during behavioral experiments. These techniques, in addition to being important

tools for diagnosing diseases of the central nervous system, have given us a much clearer idea of the brain regions involved in many complex cognitive functions" (*The Principles of Neural Science* 335-336). As I discuss in this project, Stein learned about comparative anatomy and human neuroanatomy at The Johns Hopkins Medical School, which she attended from 1897 to 1902, as a graduate student. Stein's anatomy professor, Lewellys Barker, discusses Golgi and Cajal's contributions to neuroscience in his medical textbook, *The Nervous System and its Constituent Neurones.* In chapter one, I trace some of the institutional, discursive and scientific connections that exist between Stein's literary brain maps and her previous laboratory experiments and anatomy studies at Johns Hopkins.

[38] The above epigraphs are taken from Einstein, in *Einstein In His Own Words*, p. 37, Jacques Derrida in *Of Grammatology*, p. 35, and William James in *The Varieties of Religious Experience*, p.502, respectively.

[39] Given this broad theoretical framework, I propose that we define the unconscious and conscious, neuraesthetic practices, literary artefacts, and theatrical performances that Gertrude Stein uses to compose her brain-based images as a "neurolithistory." This term, if accepted into the lexicon for neuraesthetics, would serve as a subcategory for the pre-existing term "neuroarthistory," which John Onians coined to describe the wide range of human creative expression, from the cave drawings of early man, to the modern paintings of Picasso, to the neuraesthetic film and photographic experiments being produced by Neidich. Onians explicates the meaning of the term "neuroarthistory" in the book by the same name, *Neuroarthistory: From Aristotle to Pliny to Baxandall and Zeki*, as follows:

> Existing social and cultural approaches, which have been so successful when dealing with the successive modifications of a single tradition, had little to offer in the way of help in responding

> to the new challenge. After all, whatever the social and cultural differences between the individuals and groups making and using art at different times and in different places, they all share, and have always shared, a common biology. Being members of a single species that left Africa perhaps only sixty thousand years ago, they all had the same genetic make-up, and this meant that their brains were essentially the same, the formation and operation of their neural apparatus being governed by the same principles. Since they were dependent on their brains for everything they did, knowledge of those principles might aid me [or us] in trying to answer some or all of my new questions. It was to understand those principles that I turned to neuroscience. (Preface xi)

Other approaches to Stein's cubist neuroanatomical portraiture, and, more generally, to the art of literary portrait painting, can be found in Onian's readings of Aristotle, al-Haytham, Leonardo da Vinci, Sigmund Freud, Walter Pater, Ernst Gombrich, Michael Baxandall, and Semir Zeki.

[40] To get this point across about Stein's catachrestic writing strategies, Wilder poses the following rhetorical question in his critical introduction to the 1936 edition of *The Geographical History of America*: "If … Miss Stein is writing metaphysics, why does she not state her ideas in the manner that metaphysicians generally employ? To this question, Wilder offers three answers, the first of which I now turn to: "a creative metaphysician must always invent his own terms. Even though his concepts may have something to do with those of his predecessors – with such concepts as subjective, objective, soul, imagination, and consciousness – she cannot in certain places employ those terms, because they come bringing with them the whole systems of which they were a part. The contemporaries of Kant complained (as the contemporaries of Professor Whitehead are now

complaining) that the philosopher's terminology was arbitrary and obscure" (9).

[41] For the benefit of readers who may be unfamiliar with the terms 'transgene' and "transgenic animal,' I have provided the following definitions from *The Free Dictionary By Farlex*: "A transgene is a gene or genetic material which has been transferred by any of a number of genetic engineering techniques from one organism to another. In its most precise usage, the term transgene describes a segment of DNA containing a gene sequence which has been isolated from one organism and is introduced into a different organism. This non-native segment of DNA may retain the ability to produce RNA or protein in the transgenic organism or it may alter the normal function of the transgenic organism's genetic code. Typically the DNA is incorporated into the organism's germ line. For example, in higher vertebrates this can be accomplished by injecting the foreign DNA into the nucleus of a fertilized ovum. This technique is routinely used to introduce human disease genes or other genes of interest into strains of laboratory mice to study the function or pathology involved with that particular gene."

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vertebrates this can be accomplished by injecting the foreign DNA into the nucleus of a fertilized ovum. This technique is routinely used to introduce human disease genes or other genes of interest into strains of laboratory mice to study the function or pathology involved with that particular gene."

[43] In 2008, Osamu Shimomura of the Marine Biological Laboratory (MBL Woods Hole and Boston University Medical School Massachusetts, MA, USA, and Martin Chalfie of Columbia University and Roger Y. Tsien of the University of California San Diego and the Howard Hughes Medical Institute were awarded the Nobel Prize in Chemistry for the discovery and development of the green fluorescent protein, GFP. Each recipient received one-third of the prize. Details about their research on their protein molecule can be found at www.nobelprize.org. The research that Shimomura, Chalfie and Tsien produced on the green fluorescent protein allowed Jeff Lichtman and Joshua Sanes, of Harvard University, to produce "transgenic strategies" of fluorescent protein expression in the nervous systems of laboratory mice, "allowing the labelling of individual neurons and glia with as many as 90 distinguishable colours" (Livet et alia, "Transgenic strategies for combinatorial expression of fluorescent proteins in the nervous system" 56).

[44] Although I hold Zeki's "Statement on Neuroesthetics" to be of value in my study of Stein's neuroesthetic creations, this does not mean his writings about Renaissance art, the neurobiology of color vision, and modernist literature do not struggle with the contradictory, cultural meanings and conflicting, aesthetic values that other scholars are producing in this emergent field of research. With respect to Stein's cubist brain portraits from *Tender Buttons*, it does not seem entirely appropriate to say that the western tradition of "neuroesthetics" is resurrected every time that her literary "masterpiece" creates "infinite feeling" in one of her readers. Yet, Zeki makes such a claim about Michelangelo's marble sculpture of the

lifeless body of Christ, when he suggests that the famous sculptor was successful in giving cold, inert marble the impression of life, by endowing lifeless materials with human expression and divine qualities that correspond with the "infinite feeling[s]" of "pathos, tenderness, and resignation." In this way, Zeki sought to illustrate how Michelangelo functioned as the Renaissance version of the modern day neuroscientist by stimulating certain regions of the brain that are deemed responsible for generating emotional reactions, sensory experiences, visual percepts and cognitive constructs. To this observation, Joseph would add,

> There is a scientific, neurological, and genetic foundation for religious belief, spirituality, and paranormal phenomenon, including the experience of gods, demons, spirits, souls, and life after death. There are specific regions of the brain which become highly active when dreaming, during trance states, meditation, prayer, or under LSD, and which enable us to experience those realms of reality normally filtered from consciousness, including the reality of god, the spirit, the soul, the life after death. … Limbic system structures such as the amydala, hippocampus, and inferior temporal lobe have been repeatedly shown to subserve and provide the foundations for mystical, spiritual, and religious experience, and the perception, including the "hallucination" of ghosts, demons, spirits and sprites, and belief in demonic or angelic possession (Bear 1979; Daly 1958; Joseph, 1996, Mesulam 1981; Penfield & Perot 1963; Schenk & Bear 1981; Williams 1956). When these brain regions are hyperactivated, "religious" experiences are not uncommon. Of course, there are some who might take this to mean that these experiences are nothing more than hallucinations produced by an abnormal brain. In some instances this is true. However, rather than due to some abnormality, religious

> experience and the seeking of spiritual nourishment is the norm and not the exception. (“Mythologies of Modern Science” 9)

While it is true that Stein playfully explores the subjects of magic, mysticism, spirituality, sainthood, demonology, dissociation, religious experience, traumatic loss and social abjection from the perspective of the conscious, rational mind in a selection of her plays and operas, she also relinquishes authorial control, in these instances, by allowing her librettos and play-scripts to be staged, embodied and performed in front of live, theatre audiences, in a variety of cultural settings and historical contexts. In some of these live theatrical settings, one might surmise that her modernist representations of the human mind become transformed by the architectonics of the theatre experience, such that the performing bodies, the orchestral music, the choreography, the staged vocal encounters and the audience’s interactions with the events on stage collectively reconfigure the ‘original text.’ In this sense, I would agree with Zeki that Stein’s neuroesthetic vision of modern consciousness and of the human brain’s functional neuroanatomy coincides with Michelangelo’s role as neuroscientist in his sculptural creation of the crucified, Christ figure.

Yet, for Stein, the disembodied and disconnected, literary qualities of American writing cannot be separated from the “question” of “serving god and mammon,” however secularized these concepts (or entities) have become for modern thinkers. In “What is English Literature,” she explains the neurotheological, pragmatist logic that informs her literary phenomenology of consciousness and her dissociative writing practices, in the following passage: “If you write the way it has already been written the way writing has already been written then you are serving mammon, because you are living by something some one has already been earning or has earned. If you write as you are to be writing then you are serving as a writer god because you are not earning anything. If anything is to be earned you will not know what earning is therefore you are serving god. But really there is no choice. Nobody chooses" (54). With these provocative statements, we can see that Stein views her dissociative writings as secular, neurotheological and neuraesthetic modes of literary creation that participate in the English and American canonical traditions of literary production by virtue of their disconnected modes of religious practice. When Stein says, "I am not trying to give to myself but to you a feeling of the way English literature feels inside me" (17), this is partly what she is referring to:

> There are two ways of thinking about literature as the history of English literature, the literature as it is a history of it and the literature as it is a history of you. Any one of us and anyway those of us that have always had the habit of reading have our own history of English literature inside us, the history as by reading we have come to know it. Then there is the history as the English people came to do it. Every one's own history of English literature is their own until they tell it to somebody else as I am now telling mine. The history of English Literature's History and that too most of us who have to read do know. There is then also the English people's history of their English literature but then after all that is their affair as far as I'm concerned, as I am deeply concerned, it is none of my business. It is awfully important to know what is and what is not your business. I know that one of the most profoundly exciting moments of my life was when at about sixteen I suddenly concluded that I would not make all knowledge my province. And so my business is how English literature was made inside myself and how English literature was made inside itself. (13-14)

For Stein, English literature "was made inside" herself through the dissociative writing processes that mirror what she sees occurring through the history of English literature (rightly or wrongly, accurately or not). There are other important instances, in Stein's critical and creative writings, where I am inclined to agree with Zeki's view of the modern neuroesthetic practitioner, who fancies him or herself as a Renaissance artist who "is," in a sense, a neuroscientist, exploring the potentials and capacities of the brain, though with different tools." These are the instances where Stein uses Shakespeare's tragedies, especially *Hamlet*, to explicate her views about 'masterpiece creation.'

For example, in "What Are Master-Pieces and Why Are There So Few of Them," Stein refers to Shakespeare's *Hamlet* and indirectly refers to James's Shakespeare's nervous system metaphor, when she describes the triangulated relationship that exists between the act of creation, the represented subject matter, and the means of aesthetic transmission, as a means of explicating the enigmatic relationship that exists between human nature and the human mind in her modernist writings. As she stresses in this lecture, it is not the artist's puzzling and sometimes wondrous representations of the obscure relationship that exist between human nature, identity and memory, on the one hand, and the human mind and entity, on the other, that produces the psychology *of* art, or that *is* the psychology *in* art. In her view, "there is no psychology in it." That is, there is no psychology of art and no psychology in art, only undisclosed or unexamined, neuroesthetic principles that dramatists like Shakespeare, painters like Picasso, and writers like Stein, manipulate in sophisticated ways to explore the relationship between self, the soul, the psyche, the mind, the brain and consciousness.

For Stein, a writer's *neuraesthetic manipulation* of the abstract subjects and the conceptual relations in a given work is what produces the illusion of a psychology that corresponds with culturally intelligible notions of mind, spirit, consciousness and psyche. More specifically, the writer's deft manipulation of language creates the illusion of unusual metaphysical states and phenomenal realities that many mistake for pathological brain conditions and psychological disorders, when, in fact, language creates the theatre of the mind in which any number of psychosocial dramas will be played out, some so incredible that audiences will believe one must attribute the semantic effects to a character's inner thoughts, or to a frightening condition of spiritual malaise. Referring specifically to Picasso's cubist portraiture strategies and to her own non-identificatory, non-mnemonic and non-psychological writing strategies, she explains why it is so difficult for their respective audiences to understand a portrait's symbolically encrypted, neuraesthetic methods of mind representation and brain mapping:

> It is very difficult so difficult that it always has been difficult but even more difficult now to know what is the relation of human nature to the human mind because one has to know what is the relation of the act of creation to the subject the creator uses to create that thing. There is a great deal of nonsense talked about the subject of anything. After all there is always the same subject there are the things you see and there are human beings and animal beings and everybody you might say since the beginning of time knows practically commencing at the beginning and going to the end everything about these things. After all any woman in any village or men either if you like or even children know as much of human psychology as any writer that ever lived. After all there are things you do know each one in his or her way knows all of them and it is

> not this knowledge that makes master-pieces. Not at all not at all at all. Those who recognise master-pieces say it is the reason but it is not. It is not the way that Hamlet reacts to his father's ghost that makes the master-piece, he might have reacted according to Shakespeare in a dozen other ways and everybody would have been as much impressed by the psychology of it. But there is no psychology in it, that is not probably the way any young man could react to the ghost of his father and there is no particular reason why they should. (*What Are Masterpieces* 85)

Stein's reference to Shakespeare's *Hamlet* operates as an obvious way for her to stress that there is "no psychology" in the actual act of literary creation, as well as no memory, no identity, no time and no human nature. With the phrase, "It is very difficult so difficult that it always has been difficult but even more difficult now to know what is the relation of human nature to the human mind because one has to know what is the relation of the act of creation to the subject the creator uses to create that thing," Stein shows there is no a fool-proof formula that readers can use to decipher her "master-pieces," for such a formula would have to systematically account for the recurring relations, abstract categories, acts of creation and subjective processes of meaning production that inform a particular text's cultural, linguistic and textual meanings. As we know, such a formula, or such a theory, could not begin to account for the kinds of unexpected performative and linguistic meanings, reader responses, ideological misrecognitions and other productive miscues that these "difficult" texts generate under normal conditions, even without the added burden of having the reader account for the dramatic production, theatrical performance and audience reception of her plays and operas in varying aesthetic, cultural and historical conditions.

Also with this reference to Hamlet and the ghost, Stein subtly expands upon James's neuraesthetic, Shakespearean metaphor. For future reference, I will call this theory Neural Shakespeare, after Gerald Edelman and Giulio Tononi's evolutionary theory of brain development and mind expansion, which they call "Neural Darwinism." In *A Universe of Consciousness*, Edelman and Tononi revamp William James's Darwinian-inspired, evolutionary hypotheses about the brain adaptation, mental evolution and consciousness discrimination. Neural Darwinism consists of the following selective principles and tenets:

> this theory embraces these selective principles [that require the continual generation of diversity in repertoires, and the differential amplification or reproduction of those repertoire elements or individuals that match those signals better than their competition] and applies them to the functioning of the brain. Its main tenets are (1) the formation during brain development of a primary repertoire of highly variant neuronal groups that contribute to neuroanatomy (developmental selection), (2) the formation during experience of a secondary repertoire of facilitated neural circuits as a result of changes in the strength of connections or synapses (experiential selection), and (3) a process of reentrant signaling along reciprocal connections between and among distributed neuronal groups to assure the spatiotemporal correlation of selected neural events. Together, these three tenets of this global brain theory provide a powerful means of understanding the key neural interactions that contribute to consciousness. (79)

In response to Professor Clifford's claim that a man's will, or his state of mind does not influence physical facts, James argues that there is a "parallelism" between "physical facts" and "mental facts" that can "be fully accounted for by mechanical conditions," by which he means that there is a parallelism between brain's neurophysiological mechanisms, or its neural principles, and its higher order thought processes (i.e. its secondary phenomenal experiences). In his words,

> The movements of our tongues and pens, the flashings of our eyes in conversation, are of course events of a material order, and as such their causal antecedents must be exclusively material. If we knew thoroughly the nervous system of Shakespeare, and as thoroughly all his environing conditions, we should be able to show why at a certain period of his life his hand came to trace on certain sheets of paper those crabbed little black marks which we for shortness' sake call the manuscript of Hamlet. We should understand all thus without the slightest degree acknowledging the existence of the thoughts in Shakespeare's mind. The words and sentences would be taken, not as signs of anything beyond themselves, but as little outward facts, pure and simple. In like manner we might exhaustively write the biography of those two hundred pounds, more or less, of warmish albuminoid matter called Martin Luther, without ever implying that it felt. But, on the other hand, nothing in all this could prevent us from giving an equally complete account of either Luther or Shakespeare's spiritual history, an account in which every gleam of thought and emotion should find its place. The mind-history would run alongside of the body-history of each man, and each point in the one would correspond to, but not react upon, a point in the other. So the melody floats from the harp-string, but neither checks nor quickens its vibrations; so the shadow runs alongside the pedestrian, but in no way influences his steps. (132-133)

Stein thus indirectly acknowledges James's observations about the non-psychological nature of Shakespeare's tragedy: "We should understand all thus without the slightest degree acknowledging the existence of the thoughts in Shakespeare's mind. The words and sentences would be taken, not as signs of anything beyond themselves, but as little outward facts, pure and simple." Stein puts this sentiment somewhat differently, though the underlying meaning remains the same: "It is not the way that Hamlet reacts to his father's ghost that makes the master-piece, he might have reacted according to Shakespeare in a dozen other ways and everybody would have been as much impressed by the psychology of it" (85).

In *The Geographical History of America*, Stein recycles parts of her lecture about "master-pieces" to tell the "very simple story" of the "human mind" in Chapter II. In this chapter, we find the phrase, "Think of the Bible and Homer think of Shakespeare and think of me. There is no remembering and there is no forgetting because memory has to do with human nature and not with the human mind." This passage condenses the ideas from the following passage in "What Are Master-Pieces and Why Are There So Few of Them," into yet another "metaphysical metaphor," as Thornton Wilder calls the relationship between human nature and the human mind:

> And so always it is true that the master-piece has nothing to do with the human mind and the entity that is with a thing in itself and not in relation. The moment it in relation it is common knowledge and anybody can feel and know it and it is not a master-piece. At the same time every one in a curious way sooner or later does feel the reality of a master-piece. The thing in itself of which the human nature is only the clothing does hold the attention. I have meditated a great deal about that. Another curious thing about master-pieces is, nobody when it is created there is in the thing that we call the human mind

> something that makes it hold itself just the same. The manner and habits of Bible times or Greek or Chinese have nothing to do with ours today but the master-pieces exist just the same and they do not exist because of their identity, that is what any one remembering them then remembered them, they do not exist by human nature because everybody knows everything there is to know about human nature, they exist because they came to be as something that is an end in itself and in that respect it is opposed to the business of living which is relation and necessity. That is what a master-piece is not although it may easily be what a master-piece talks about. (*What Are Masterpieces* 88)

In Chapter II of *The Geographical History of America*, Stein adds two extra sentences to show how her academic audiences have responded to her literary theories about the neural principles underlying the phenomenology of consciousness and masterpiece creation: “Everybody says no when I say so but when I say so finally they do not say no. A play of how they do not finally say no when I say no” (109). With these playful jabs at her defiant readers, she turns the didactic discourse of her academic lecture into a delightful form of allegorical play, whereby critical intertexts accrue literal and figurative meanings, in light of the evolutionary theories that she advances in this “chapter” about the human mind’s creative evolution. In this particular context, Shakespeare’s nervous system might be conceptualized as the genetic blueprint for Stein’s literary genome, through which a creative vision of Neural Shakespeare emerges as the neuraesthetic practice of masterpiece creation, consciousness translation and brain mapping.

According to Owen Flanagan, parallelism is a debate that considers “why there are these two utterly independent but parallel chains of events – itself a metaphysically odd state of affairs. No less odd," Flanagan remarks, "than if the two metaphysically distinct kinds interacted. Second, there is the puzzle as to how the two chains keep their perfect symmetry. The only decent answer to this question ever proposed in the philosophical literature has been theological: God flawlessly orchestrates the parallel symmetry – either by setting the mental and physical streams in harmony at the point of creation or birth (Leibniz) or by maintaining the harmony on each and every occasion (Malebranche)" (Consciousness as a Pragmatist Views It" 32). Reading James's Concerning James's Shakespeare metaphor and its parallelist resonances, Owen argues,

> It is not as if I ever truly *choose* any sequence of acts along the mental path, nor that I ever choose to perform any bodily movements. Determinism to one side, even on the supposition that there might be two utterly distinct stories about Shakespeare's writing of Hamlet, one the story of mental sequence, the other the coordinated sequence of bodily movements, this fact hardly favors elimination of the mental story. The reason is simple. The two stories do not explain the same phenomena. Eliminating the mental account of Shakespeare's composition of *Hamlet* eliminates something fundamental that is in need of explanation, namely, the intentional character of Shakespeare's production of *Hamlet* and our intentional appropriation of the written play as about what it is about. Surely from a physical point of view this play called Hamlet is just a series of ink marks on paper, but to Shakespeare and to us it is a story, a meaningful intentional object. Any analysis of a significant human act framed totally in the languages of the natural sciences, neuroscience included, will fail to capture certain facts related to the meaning and significance of that act. A science of mind may well require different

> levels of description, some intentional, some not, in order to answer different explanatory questions. But even on parallelist assumptions, the purely physical chain of events hardly explains the same thing as the mental chain does. For James, the fundamental flaw of parallelism runs even deeper. It is the same as the epiphenomenalist's, namely, the evidence for interaction is overwhelming. It is simply too implausible to assume that Shakespeare's decision to write a play was not causally related to his taking pen in hand, but rather that the two events, the decision to write a play and the movements of his hand over paper, just happened to coincide! (32-33)

[45] I am not suggesting that there is any kind of direct correspondence between Stein's neuraesthetic writing practices and the Brainbow system's sophisticated scientific methodologies. How could there be? Claire Marie published *Tender Buttons* in 1914, Random House published *The Geographical History of America or the Relation of Human Nature to the Human Mind* in 1936, and *Nature* published the Brainbow research and corresponding photographic images in their November 1, 2007 issue, where they illustrated the visual effects of the Brainbow system upon the dentate gyrus, hippocampus and cerebral cortex of a brainbow mouse on their cover page. All the same, there are some uncanny resemblances and some striking commonalities between Stein's literary brain maps and the research that has been produced by the Brainbow system creators, Jeff Lichtman and Joshua Sanes, over the past nine years or so. For example, in the co-authored article, "Can molecules explain long-term potentiation?," Lichtman and Sanes, who are the co-creators of the Brainbow mapping system, use Stein's famous verse, "A rose is a rose is a rose," to introduce parts of their argument related to the subject of 'long-term potentiation.' LTP, or long-term potentiation, can be defined as a process of "synaptic effectiveness"

that can last for "many hours or even days" in nerve cells where there is "an increase in [the] size of postsynaptic potentials during [post]tetanic stimulation" (Shwartz, "Transmitter Release" 274-275). In "Transmitter Release," Shwartz explains, "Synaptic activity can also be altered in most nerve cells by intense activity. In these cells a high-frequency train of action potentials is followed by a period during which action potentials produce successively larger postsynaptic potentials. High-frequency stimulation of the presynaptic neuron (which in some cells can generate 500-1000 action potentials per second) is called tetanic stimulation. The increase in size of the postsynaptic potentials during tetanic stimulation is called *potentiation*; the increase that persists after tetanic stimulation is *posttetanic potentiation*. This enhancement usually lasts several minutes, but it can persist for an hour or more" ("Transmitter Release" 274; original emphasis). By the end of Lichtman and Sanes's article, one of the roses in their subheading, which connotes Stein's famous verse (or "aesthetic idiolect," as Eco calls it) ends up being plucked, in an elegant, figurative gesture that is aimed at deflowering the scientific arguments of other neurobiologists, who do not share their view of At first, these neuroscientists transform Stein's famous phrase from "Sacred Emily," "A rose is a rose is a rose is a rose," into the subheading, "A rose is not a rose is not a rose." This move underscores some of the disjunctions in scientific knowledge they wish to underscore, regarding the different kinds of synaptic responses in "long-term potentiation and depression." In addition, this first subheading figuratively suggests, "different neurons accomplish LTP in different ways"; which is to say, "LTD is not a simple mirror image of LTP" (598), just as a "rose is not a rose is not a rose."

Based on a comprehensive knowledge of Stein's compositional practices, phenomenological experiments, artistic influences and scientific education, a reader might be able to make the leap that would enable him or her to understand that a masterpiece's "aesthetic idiolects" possibly connote the "color thing" and these "idiolects" also possibly represent the visible color spectrum, by virtue of the fact that a phrase's semiotic redundancies, linguistic ambiguities, and expressive surpluses break down into separate wave-lengths of meaning, or light frequencies. Umberto Eco makes this point when he argues that Stein's famous verse, "A rose is a rose is a rose," produces a rainbow-effect through its "*surplus of expression*." He proposes that most first-time readers are not able to 'consciously grasp' a "*surplus of content*" that is only 'vaguely sensed' at the level of language in such verses (270; original emphasis). In *A Theory of Semiotics* he turns to physics and botany to explain the semiotics of Stein's neuraesthetic writing practice, when he could have turned to neuroscience and psychology:

> The feeling of ambiguity [associated with the expression's *excess of redundancy*] is suggested, first of all, by the excess of expressive redundancy, which violates a stylistical norm. Rather as, when white is perceived, the physicist recognizes an excessive simultaneously overlapping of colors, so this stubborn repetition of a banal statement makes one suspect that each time the same expressive items return they mean something different. Neither botany nor logic has ever accustomed one to accept as normal such an uninformative statement, which constitutes a sort of deviation from definitional norms. These two excesses of redundancy (on expression and content planes respectively) produce an increase of informational possibilities; the message has in effect become a source of further and unpredictable information, so that it is now semantically ambiguous. From this point on, the addressee is entitled to suppose that /rose/, in every one of its occurrences, might be connected with different

> connotative subcodes, e.g. the allegorical, the iconological, the iconic. The work is thus ‘open’ to multiple interpretations. … It is indeed difficult to avoid the conclusion that a work of art *communicates too much* and therefore *does not communicate at all*, simply existing as a magic spell that is radically impermeable to all semiotic approach. (270; original emphasis)

The point that Eco is making is a simple one: ‘a color is not a color is not a color’ in Stein’s literary portraiture. This is almost identical to the point that Sanes and Lichtman make in their scientific article: ‘a rose is not a rose is not a rose.’ If you recall, Stein emphasizes, in “Portraits and Repetition,” that the absence of descriptive color signifiers at the level of language does not mean that she is not thinking of “the relation of color to the words exactly meant.” Nondescript English words often signify invisible colors and invisible color relations, or imagined color spaces, in Stein’s literary portraits. Though Eco’s figurative association between Stein’s redundant, literary expressions and the prismatic effects of white light helps us to comprehend the possibility of “semiotic commutation” -- such an association does not explain the brain-based rainbows, or the brainbow-like images, in a number of Stein’s cubist portraits.

In other words, these scientists deploy Stein’s “aesthetic idiolect” as a means of illustrating “the difficulties of providing molecular explanations for cellular neurobiological phenomena” (*Nature Neuroscience* 597).[45] They do not just modify Stein’s “aesthetic idiolect” and then insert into their neurobiological discourse, without carefully manipulating its semiotic resonances and recontextualizing its literary meanings; but, rather, they deploy it in such a way that it accrues scientific meanings and political nuances that are specific to the discipline of neurobiology.

Elegantly and purposefully, Sanes and Lichtman use the modified form of Stein's verse in their subheadings as a mode of conceptual departure, in order to examine the molecular processes of the brain's synaptic circuitry at variance from the findings of their scientific contemporaries. In another subtitle, they use Stein's idiolect to pose the following question, "What is a rose anyway?" The answer they give to this question may be obscure to literary readers but is vital to understanding the chemical processes involved in synapse responses within the brain's neural circuitry:

> LTP investigators view the process as involving two fundamental steps (Fig. 1). In one (induction), appropriate patterns of stimulation predispose the synapse to potentiation. In the other (expression), the synaptic response is actually potentiated. Elegant studies have led to the consensus view that induction occurs postsynaptically and that, at least for some forms of LTP, NMDA receptors, calcium and calcium-activated kinases are critical (see above). Astonishingly, however, the cellular locus of LTP expression remains a matter of controversy: the degree to which LTP results from an increase in transmitter release, an increased postsynaptic response or both is unclear. Clearly, many LTP labs understand that determining the answer to this question is critical, but until a consensus is reached, it seems inevitable that the field will continue to move in many unrelated directions. (601)

It is likely that these scientists cite this famous verse, negate the linguistic roses in it, and convert them into synaptic blooms without having realizing that Stein also expressed an interest in painting neurons, axons and other cellular elements with distinguishable colors, in her modernist masterpieces about the human mind. Under the subtitle, "No rose goes unplucked," Sanes and Lichtman further point out,

> there are social factors that have contributed in complex ways.

> During the late 1980s, large numbers of molecular biologists saw the opportunity to address an issue of extraordinary fascination. In parallel, molecular biology techniques became so accessible that they could be adopted by groups previously restricted to physiological approaches. As a result, the field grew quickly. One might imagine that this plethora of activity would have a salutary effect: promising leads could be followed up quickly, and controversial findings would be put to the test just as quickly. However, perhaps because a unitary cell biological paradigm was lacking, investigators headed off in many directions. Moreover, the Nature of modern Science is that negative results are not valued as highly—that is, as deserving of publication in prestigious journals—as positive results. Therefore, the putative involvement of some candidate molecular mediators remains unchallenged. What may be worse, experts tell us that the prominence of some proponents may actually stifle critical analysis by less-well-known individuals. Therefore, molecules that some leading investigators privately feel to be only peripherally involved in the process remain under active scrutiny by others, who are not 'in the know'. Indeed, although there are numerous reviews on LTP, the lack of candid commentary by experts prevents outsiders from deciding the merits of the various models. (603)

In this passage, we are given a reason for why these scientists write, “A rose is not a rose is not a rose.” In their particular area of “modern Science,” they are following up “negative results” with respect to synaptic responses at the molecular level. For these scientists, Stein’s idiolect qua subheading serves as a rejoinder to fellow neurobiologists to “distinguish modulators and correlates from mediators” in the analysis of “action potential” (604). However, if we switch topics and turn once again to Stein’s allegorical and

epiphanic, brain representations in the portraits from *Tender Buttons* and *The Geographical History of America*, then it matters a great deal that the Brainbow creators see fit to use Stein's "idiolects" in their brain research, for their scientific "play" with her famous literary verse in their neurobiological research legitimates the otherwise, incredible connection that exists between her literary imagination and their scientific creations. No doubt, Stein's anticipation of their neurobiological research and their brainbow mapping strategies in her metaphysical writings and cubist portraits likely derives from her own experiences with the nerve tissue staining methods used at the Johns Hopkins anatomy laboratories of Franklin Mall and Lewellys Barker, which I discuss in chapter one and throughout this project in some detail.
(Lichtman and Sanes's article on 'long term potentiation' was accessed at <http://www.nature.com/neuro/journal/v2/n7/full/nn0799_597.html>.

[46] In making these observations about the kinds of visual ambiguities that can be produced by 'inherited and acquired, brain concepts,' Zeki agrees with the *Oxford English Dictionary's* definition of "ambiguity": namely, that it is something "uncertain, open to more than one interpretation, of doubtful position" (63). According to Zeki, knowledge acquisition and artistic production ought to be viewed as the visual brain's complementary yet basic functions:

> ambiguity should not be thought of as a characteristic of some great works of art. Rather, it is a characteristic of the brain in its knowledge-seeking role, a characteristic that the artist exploits and uses to sublime effect and thus enriches his work. To understand this better, we must … look at the brain, its function and its capacity to form concepts. Such an understanding leads to another, and neurobiological definition of ambiguity that is the symmetrical

> opposite of the dictionary definition. My aim … is to show that there are different levels of "ambiguity" dictated by neurological necessity and built into the physiology of the brain. They all involve the application of brain concepts, whether inherited or acquired, into the image. These different levels may involve a single cortical area with different perceptual specializations or they may involve, in addition, higher cognitive factors such as learning, judgment, memory, and experience. Whether the result of activity in a single area or in different areas, these different levels are tied together by a metaphoric thread whose purpose is the acquisition of knowledge about the world and of making sense of the many signals the brain receives. They are united no less by a single operation, which nevertheless differs from the one condition to another. That operation is the application of brain concepts onto incoming signals. (63-64)

Numerous reviewers have commented on the ambiguity of Stein's nonsensical phrases and repetitive verses, but little has been said, in the literature to date, about the role that ambiguity plays in her neuraesthetic compositions.

By combining Wendy Steiner and Steven Meyer's critical approaches in my neuraesthetic reading of Stein's cubist literature, I arrive at the conclusion that Stein deploys the cubist pun and its semiotic ambiguities for literary brain mapping purposes. With regard to the ambiguities of brain function that can be identified in Michelangelo's *Rondanini Pietá*, Zeki stresses, "the capacity to give multiple interpretations is not a separate faculty invented or used by the artist. It is instead tied to a general capacity of the brain to give several interpretations, to instil meaning by applying several concepts, a capacity that is important for it in its role of acquiring knowledge. It is on this physiological basis that the prized quality of ambiguity of art is built" (91). Stein understood, from both a neurological and an artistic perspective, that knowledge about the brain could be acquired through the production of "master-pieces" that showcased the ambiguity of brain function at the level of language, metaphor, rhetoric and color signification.

[47] These quasi-objects and –subjects have become linked in western scientific discourse with the newly emergent categories of female sexual subjectivity and with the phenomenon of "traumatophilia" through the so-called *maladies of representation* known as hysteria, multiple personality syndrome, post-traumatic stress disorder and homosexuality. In *Sciences of the Flesh*, Dianne Sadoff observes, "As the research laboratory fabricated research subjects as quasi-objects, sexual hybridity spawned modern sexed "identities," which in turn produced postmodern sexualities" (192). With this in mind, I follow Sadoff's methodology from *Sciences of the Flesh*, which maps out some of the complex, discursive relations between competing scientific discourses in western society that addressed the brain-mind-body continuum, in an effort to show the ways in which the abstract, yet pluralistic, style created by Stein exposes, rather than masters, the "otherness" of language, the fading of the subject ("aphanisis"), and the encrypted linguistic history of psychological errors, memory gaps and linguistic "differends."

[48] For example, see Francis Russell's *Three Studies in 20th Century Obscurity* and Elizabeth Fifer's *Rescued Readings: A Reconstruction of Gertrude Stein's Difficult Texts*.

[49] In chapter 3, "The Myth of the 'Seeing Eye,' from *Inner Vision*, Zeki notes, "it is instructive to enquire into the perceptual capacities of the visual processing centers in the brain. The question is not trivial. Many have supposed, either implicitly or explicitly, that processing sites are separate

from perceptual sites, that visual signals are processed in some cortical area and that what has been processed is then relayed to another cortical area, through which we perceive and thus become conscious. Alternatively, once signals are processed, other signals from higher centers of the brain dictate the interpretation of what has been processed, in "top-down" fashion. On this subject, Zeki further notes, "the visual brain consists of many different visual areas, specialized to process different attributes such as form, motion, color, faces and so on. We think of these areas as being specialized to process these different attributes, without being very specific about what processing means since we do not really know much about the detailed neural mechanisms that are involved. But it is worth considering … that [the visual brain's] processing sites are also perceptual sites, that is, sites at which what is processed becomes perceptually explicit without the mandatory involvement of further or "higher" areas, leading us to perceive the attribute that they have processed" (65). With this bold hypothesis, Zeki argues, "Strong evidence that processing sites are also perceptual sites comes from experiments designed in such a way that the same stimulus is delivered to the two eyes separately and is sometimes perceived by the subject and sometimes not, depending on the configuration used, even though in both instances the appropriate signals reach the eye and are relayed to the visual brain" (66). In this chapter, Zeki explicates how colors cancel each other out in the brain, thereby producing a completely different color, based on an experiment that proves perceptual states are intrinsically related to sensory perceptions (66). With respect to this experiment, Zeki writes, "The frontal cortex is active when the stimuli are processed but remain unperceived and inactive when they are consciously perceived, for reasons that are not clear. In fact, there is much evidence, though of a negative nature, that the frontal cortex is not necessarily involved in all perceptual states, the example of color perception given earlier being among the best. This demonstration shows that the cortical perceptual sites are not separate from the cortical processing sites. This is not to imply that other cortical areas are never involved in the perception of houses and faces. There is little doubt that the frontal and parietal lobes of the cortex are involved during the perception of visual stimuli to which more than one interpretation can be given and that the memory system is involved when the identification is that of a particular house or a particular face. The importance of the demonstration lies in showing that there is not a separate site specialized for perceiving, as opposed to processing; this is an important point to bear in mind in what follows. In general, all the evidence suggests that a processing sites becomes a perceptual site when the neural activity in it passes a certain threshold, though no one knows if this heightened activity is due to the recruitment of new cells in the relevant area or to the increased activity of cells that are already engaged in processing" (69). This experiment provides clinical evidence for James's hypotheses about the role that secondary phenomenal qualities play in brain development and mental evolution, which I discuss below.

[50] Readers may wish to consult Kirk Curnutt's edition, *The Critical Response to Gertrude Stein*, to see some of the twentieth-century reviews that comment on the colors and unusual color/word combinations that appear in the various poems/portraits from *Tender Buttons*.

[51] The term "brain based epistemologies" comes from Gerald Edelman's *Second Nature,* p.2.

[52] I have written about these texts in an unpublished manuscript, so I will not be discussing the dramatization of Stein's dissociative mind and brain representations in this project.

[53]But also, I base my arguments about Stein's unconventional representation of the relation between brain function and phenomenal experience on Semir Zeki's neurobiological and neuraesthetic research, because this twenty-first century research supports William James's nineteenth-century consciousness research and his evolutionary hypotheses about human creativity, mental evolution and brain plasticity. In *Splendors and Miseries of the Brain*, Semir Zeki tries to answer the difficult question Edelman and Tononi pose in *A Universe of Consciousness*, about psychogenetic scientific practice in the discipline of neuroscience, from the perspectives of evolutionary theory, brain science and neuraesthetic literary analyses. Zeki's masterly approach to the difficult, interdisciplinary study of literary representation, cubist illustration and brain function reinforces my embryonic concepts of Stein's brain mapping experiments, because he expands upon William James's nineteenth-century radical empiricist consciousness research, without acknowledging James's contribution to his field of study. Also, he upholds the importance of modernist, interartistic writing experiments in relation to current brain imaging studies and neurobiological research, without acknowledging Stein's brain research at Johns Hopkins or the existence of her neuraesthetic compositional practices. Even in his latest book, Zeki doubts that there are many artists who know much about the brain, or who thought about the brain when they were composing their works of art. Nonetheless, Zeki claims that "Synthetic concepts [that can be equated with the "brain ideal," or with the brain's conception of perfection in love, art, justice, beauty and knowledge] are commonly difficult to experience, particularly since they often depart significantly from individual experience. One way of getting closer to a brain concept lies in creating a work, be it of art or music or literature. Even here is commonly a mismatch between the brain concept and the artistic

product" (57). Reinforcing William James's beliefs about the roles that innate and acquired brain capacities play in mental evolution, Zeki goes on to say, "There are of course all creative efforts, and all creativity depends upon a host of factors, among them a brain capacity – for drawing or writing music or playing tennis – and a host of other factors such as drive that must ultimately depend upon neural organization about which we know little. There is little doubt in my mind that one of the factors determining creativity is the attempt to satisfy the dis-satisfied brain concept. Hence, a permanent dissatisfaction is one of the most powerful ingredients driving creativity. Once one satisfies the brain concept, creativity diminishes rapidly" (*Splendors and Miseries of the Brain* 57). With these observations, Zeki offers a powerful explanation for why it is that artists like Stein produce literary works that fail to satisfy the brain concepts that consciously and unconsciously inspire them. Using a similar logic as James does in "Necessary Truths and the Effects of Experience," he also indirectly explains why artists try to simulate synthetic brain concepts with their abstract works of art; they do so in order to foreground and thus to comprehend the "mismatch between the brain concept and the artistic product." At the same time, he notes that the drive to close the gap between brain function and artistic production is what drives creativity, that the need to satisfy perpetually dis-satisfied brain concepts' is a powerful force that may override conscious efforts to thwart this drive or process and that this drive ought to be distinguished from the Platonic ideal and from the cultural ideals and norms that exist alongside inherited brain concepts, in the form of acquired brain concepts. Clarifying what he means about the difference between synthetic brain concepts and cultural or philosophical ideas, Zeki writes,

> I consider … that the brain does form concepts of particular things

as well as concepts for more abstract notions such as love, beauty, honor and justice that preoccupied Plato. I consider, too, that these concepts, which constitute the ideals formed in the brain, have no existence outside the individual although they may be influenced by external events. In a sense, therefore, Plato believed that knowledge is derived from abstractions; the Ideal is an abstract entity that represents a universal value; knowledge of it can only be obtained through a thought process. My view, and I suppose the general view of neurobiologists, would be the opposite: that sensory data are submitted to abstractive processes in the brain from which a synthetic concept (the Ideal) is built up. We can, therefore, summarize a fundamental difference between the Platonic system and the one I am proposing here. There is, in the neurobiological system, no universal Ideal of beauty, or of the form of the object, or of a landscape. Each one of these is tailored according to individual experience, and varies from one individual to the next. Another fundamental difference between Ideal as the synthetic concept of the brain and Plato's Theory of Ideals is that while Plato's Ideals are immutable, the synthetic concept changes with time and with the accretion of experience. If one is searching for universals and for immutability, then one must look to the inherited concepts that organize the input of the brain and generate experiences, not the synthetic concepts. Whether we look at color or love, we find that there is a universal element dictating these experiences that varies little, if at all, from one culture to the next or with time. The system for generating colors is immutable, so is the one for generating love. According to the evidence that we obtain from reading the literature of love, the fundamental concept behind the emotion of love – that of "unity of love" – is also immutable. (46-47)

This passage explains why Stein's neuraesthetic compositions become more intelligible over time, not less so. Zeki's neuraesthetic approach to studying modern literature and art also helps to explain why Stein's cubist brain portrait in *The Geographical History of America* improves upon previous brain and mind representations, such as the ones we find in *Tender Buttons*: namely, this explicit brain portrait enhances Stein's comprehension of the inherited and acquired, brain concepts that produce color vision. Also, this portrait enables Stein and other scientific researchers to see how color stains can be used in innovative ways to label neurons within brain's neural network architecture.

[54] It is important to cite a few of James's definitions of radical empiricism in "Does Consciousness Exist?, to avoid confusion as to what this philosopher did and did not profess about the conjunctive and disjunctive relations between states of consciousness in his early twentieth-century writings on the subject, which differ from his late nineteenth-century century treatment of the subject in "Necessary Truths and the Effects of Experience." According to James, in "Does Consciousness Exist," "Empiricism is known as the opposite of rationalism. Rationalism tends to emphasize universals and to make whole prior to parts in the order of logic as well as in that of being. Empiricism, on the contrary, lays the explanatory stress upon the part, the element, the individual, and treats the whole as a collection and the universal as an abstraction. My description of things, accordingly starts with the parts and makes of the whole a being of the second order. It is essentially a mosaic philosophy, a philosophy of plural facts, like that of Hume and his descendants, who refer these facts neither to Substances in which they inhere nor to an Absolute Mind that creates them as its objects. … Now, ordinary empiricism, in spite of the fact that

conjunctive and disjunctive relations present themselves as being fully co-ordinate parts of experience, has always shown a tendency to do away with the connections of things, and to insist most on the disjunctions. Berkeley's nominalism, Hume's statement that whatever things we distinguish are as 'loose and separate' as if they had 'no manner of connection.' James Mill's denial that similars have anything 'really' in common, the resolution of the causal tie into habitual sequence, John Mill's account of both physical things and selves as composed of discontinuous possibilities, and the general pulverization of all Experience by association and the mind-dust theory, are examples of what I mean. The natural result of such a world-picture has been the efforts of rationalism to correct its incoherencies by the addition of trans- experiential agents of unification, substances, intellectual categories and powers, or Selves; whereas, if empiricism had only been radical and taken everything that comes without disfavor, conjunction as well as separation, each at its face value, the results would have called for no such artificial correction. Radical empiricism, as I understand it, does full justice to conjunctive relations, without, however, treating them as rationalism always tends to treat them, as being true in some supernal way, as if the unity of things and their variety belonged to different orders of truth and vitality altogether. Relations are of different degrees of intimacy. Merely to be 'with' one another in a universe of discourse is the most external relation that terms can have, and seems to involve nothing whatever as to farther consequences. Simultaneity and time-interval come next, and then space-adjacency and distance. After them, similarity and difference, carrying the possibility of many inferences. Then relations of activity, tying terms into series involving change, tendency, resistance, and the causal order generally. Finally, the relation[s] experienced between terms that form states of mind, and are immediately conscious of continuing each other. The organization of the Self as a system of memories, purposes, strivings, fulfilments or disappointments, is incidental to this most intimate of all relations, the terms of which seem in many cases actually to compenetrate and suffuse each other's being. Philosophy has always turned on grammatical particles. With, near, next, like, from, towards, against, because, for, through, my --these words designate types of conjunctive relation arranged in a roughly ascending order of intimacy and inclusiveness. A priori, we can imagine a universe of withness but no nextness; or one of nextness but no likeness, or of likeness with no activity, or of activity with no purpose, or of purpose with no ego. These would be universes, each with its own grade of unity. The universe of human experience is, by one or another of its parts, of each and all these grades" (41-45; emphases removed).

[55] Note that I am using the 1997 Dover Publications edition, and I am reproducing the words as they appear on the page.

[56] In particular, I am thinking of the "transgene," the "pseudogene," and the so-called "language gene." I discuss Stein's 'literary genetics' in chapter four, in relation to the science of the reading brain and her brain research at Johns Hopkins. I have already introduced the Brainbow transgene. Briefly, I will introduce the pseudogene and in chapter four I will explain how Stein predicts the neurodevelopmental and psycholinguistic effects of the so-called language gene, FOXP2. In "The Real Life of Pseudogenes," Mark Gerstein and Deyou Zheng point out that "the bones of long-dead genes – known as pseudogenes – litter our chromosomes. But like other fossils, they illuminate the evolutionary history of today's more familiar forms, and emerging evidence indicates that a few of these DNA dinosaurs may not be quite so dead after all" (*Scientific American* (August 2006) 49). Stein's impressions of the earth's geography may have led her to view the human

genome as something that was "developing and destroying" itself, as a "phenomen[on] of nature" that was capable of producing *genetic skeletons*, even as it created new life forms and replicated existing life forms. For example, the ways in which that Stein speaks of the disconnected relation between human nature and the human mind in *The Geographical History of America*, especially when she describes human nature and animal nature being equivalent entities, eerily forecasts Mark Gerstein and Deyou Zheng's description and depiction of the "pseudogene" in "The Real Life of the Pseudogene":

> Only the far more recent completion of sequencing projects covering the full genomes of humans and other organisms allowed geneticists to get an aerial view of the genomic landscape and to appreciate how riddled with such oddities it is. The human genome is made up of more than three billion pairs of nucleotides, the building blocks of DNA molecules. Yet less than 2 percent of our genomic DNA directly encodes proteins. Perhaps a third is noncoding sequences within genes, called introns. The remaining tracts between genes constitute the majority of our DNA, and much of it is effectively genomic dark matter. It is in these seemingly barren expanses that most pseudogenes are randomly scattered like rusted car parts on the landscape – and in surprising numbers. (50).

[57]In the chapter "Qualia and Discrimination," from A Universe of Consciousness, Edelman and Tononi "discuss what is perhaps the most daunting problem of consciousness: the problem of qualia" (157). Here, they explain their Jamesian-influenced, "brain-based epistemology" in relation to the scientific problem that may be defined as the nature of the relationship between qualia and neural content, in the following: "The specific quality, or "quale," of subjective experience – of color, of warmth,

pain, a loud sound – has seemed beyond scientific explanation. First, to experience qualia, one must have a body and brain that support neural processes of the kind described in previous chapters. In no case can a theory or description substitute for an individual's experience of a quale, no matter how correct such a theory is in describing its underlying mechanisms. Second, each differentiable conscious experience represents a different quale, whether it is primarily a sensation, an image, a thought, or even a mood and whether, in retrospect, it appears simple or composite. Third, each quale corresponds to a different state of the dynamic core, which can be differentiated from billions of other states within a neural space comprising a large number of dimensions. The relevant dimensions are given by the number of neuronal groups whose activities, integrated through reentrant interactions, constitute a dynamic core of high complexity. Qualia are therefore high-dimensional discriminations. Fourth, the development of the earliest qualia occurs largely on the basis of multimodal, body-centered discriminations carried out by the proprioceptive, kinesthetic, and autonomic systems that are present in the embryo and infant's brain, particularly in the brain stem. All subsequent qualia can be referable to this initial set of discriminations, which constitute the basis of the most primitive self" (157). As Edelman and Tononi point out, the brain stem plays a key role in the development of the "earliest qualia." Stein's interest in the relation between her previous brain stem research on the medulla oblongata and its colored brain nuclei and her psychological research in James's Harvard laboratory, with color and forms of color consciousness, probably led her to created colored brain maps in many of her cubist portraits. I will be using Edelman and Tononi's neuroscientific definitions for qualia throughout my project, as a means of defining Stein's literary representations of subjective experience, particularly when I am analyzing her literary depiction of the creative mind's subjective phenomenology and its relation to brain representation in *The Geographical History of America*.

[58] This is what Foucault says about the "disciplines" that he defines as an '*anatomo-politics of the human body*' and 'a *bio-politics of the human population*" in *A History of Sexuality*: *An Introduction: Volume One*:

> In concrete terms, starting in the seventeenth century, … [the government's] power over life evolved in two basic forms: these forms were not antithetical, however; they constituted rather two poles of development linked together by a whole intermediary cluster of relations. One of these poles – the first to be formed, it seems – centered on the body as a machine: its disciplining, the optimization of its capabilities, the extortion of its forces, the parallel increase of its usefulness and its docility, its integration into systems of efficient and economic controls, all this was ensured by the procedures of power that characterized the *disciplines*: an *anatomo-politics of the human body*. The second, formed somewhat later, focused on the species body, the body imbued with the mechanics of life and serving as the basis of the biological processes: propagation, births and mortality, the level of health, life expectancy and longevity, with all the conditions that can cause these to vary. Their supervision was effected through an entire series of interventions and *regulatory controls*: a *bio-politics of the population*. The disciplines of the body and the regulations of the population constituted the two poles around which the organization of power over life was deployed. The setting up, in the course of the classical age, of this great bipolar technology—anatomic and biological, individualizing and specifying, directed toward the performances of the body, with attention to the processes of life – characterized a power whose highest function was

> perhaps no longer to kill, but to invest life through and through.
> (139).

One way that Stein rewrites the nineteenth century's "memoro-politics" and contributes to a twentieth century "qualia-politics" was by intervening in the scientific discourses of the evolutionary empiricists, the priori transcendentalists and the radical empiricists. Her aesthetic mandate is not an identity politics, as she points out in "What Are Master-Pieces and Why Are There So Few of Them," but a qualia-politics that creates new forms of consciousness. In a 1913 review of Stein's modernist writing that is entitled "Speculations, or Post-Impressionism in Prose," Mabel Dodge explains how Stein uses Pablo Picasso's cubist portraiture strategies and Henri Bergson's intuitive philosophy to compose portraits that "impel language to induce new states of consciousness, and in doing so language becomes with her a creative art rather than a mirror of history. In her impressionist writing she uses familiar words to create perceptions, conditions and states of being, never before quite consciously experienced[;] she does this by using words that appeal to her as having the meaning that they *seem* to have" (51). In this review, Dodge stresses, "Gertrude Stein is doing with words what Picasso is doing with paint" (51). According to Dodge, who was Stein's literary patron and close friend, these cubist portraits are "working proof[s] of the Bergson theory of intuition" (52). From this review and others like it, we can see that Stein's modernist writings do not merely mirror the nineteenth-century's memory politics and their ideological meanings (either by playing with the notion of schizophrenia, multiple personality disorder or some other pathological brain disease or psychological disorder such as post-traumatic stress disorder). To the contrary, her literary qualialects and her qualia-politics playfully interrogate the (psycho) genetic fallacies that are engrained in certain philosophical debates about consciousness (i.e. in

Bergson's notion of the creative mind) and in the ideological practices that indubitably are associated with the scientific representation of the human brain and mind.

[59]In *Purple Haze: The Puzzle of Consciousness*, Levine maps out the dimensions of the qualia-politics in the twenty-first century neuroscience, philosophy and psychology by explicating the distinction between the opposing positions of the "qualophiles" and "qualophobes" in the following passage: "Both claim that there is an aspect of mental life, conscious experience, which is left out of the standard materialist theory of the mind. The bold qualophile maintains that it is left out in the sense that it constitutes a domain of phenomena outside the natural, physical order. The modest qualophile maintains, on the contrary, that it must be located within that order, but the problem is that materialist theories don't explain how that is so. Both, of course, agree on the metaphysical reality of conscious experience, and that it is a phenomenon to which we have a kind of special, first person epistemic access. But, again, whereas the bold qualophile draws the conclusion that this access provides insight into the essential nature of conscious experience, and in an incorrigible manner, the modest qualophile only maintains that the nature of this access is as puzzling as that to which it provides access. We can draw no positive metaphysical conclusions, and it is always possible that which is presented within first-person experience embodies errors of all sorts. Still, we have this experience, we have first-person access to it, and this requires explanation" (129). Levine recognizes that his own modest qualophilia, when viewed from the philosophical perspectives of the reductivist and eliminativist, comes down to this fact: The problem with qualophiles is that they don't know enough science; they can't see that what they're after is in fact visible on the horizon. The very phenomenon the qualophile is pointing at when she goes "But how do you

explain *this*?" is just what the materialist theory has an account of" (129; original emphasis). For those new to this debate between qualophobes and qualophiles, Levine's following commentary may be valuable in terms of explaining some of the terms and conditions that different neuroscientists and philosophers are using to theorize the subjective nature of conscious experience: "On the face of it, of course, the qualophile's denial of conscious experience seems ludicrous. After all, what could be more obvious than the fact that we have conscious sensory experiences? How could you deny that there is something it's like to see red, smell a rose, or feel pain? What possible illusion could we be suffering from in thinking these are all genuine properties of our experience? … As I see it, qualophobic strategies basically break down into five types: (1) assimilating modest and bold qualophilia; (2) accusations of theoretical irrelevance; (3) displacing the question from experience to what we say and judge about experience; (4) skeptical arguments; and finally, (5) denigrating the first-person perspective. Though I've characterized these as five different strategies, to me it's more useful to see them as stages in a single dialectic. Even calling them "stages" is misleading because as the dialectic develops, various stages are constantly revisited" (131).

[60] One can track how Meyer's changing views on the neuron doctrine, as given in the "Preface" and chapter one of *Irresistible Dictation*, may have affected his neuraesthetic approaches to the subject of biological realism.

[61] With regard to the "Major Structures of the Mesencephalon," John Pinel, the editor and author of *A Colorful Introduction to the Anatomy of the Human Brain,* observes, "The tegmentum is the portion of the brain ventral to the tectum. I contains the *cerebral aqueduct*, which connects the third and fourth ventricles; the midbrain portion of the *reticular formation*; and the nuclei of cranial nerves 3 and 4. I like to think of the tegmentum as the

colorful part of the brain because it contains three important nuclear structures that are named after colors: the **red nucleus** (so named because it is faintly pink), the **periaqueductal gray** (so named because it is gray matter located around the cerebral acqueduct), and the **substantia nigra** (which means *black substance*; so named because many of its neurons contain a dark pigment). The red nucleus and substantia nigra are important structures in the sensorimotor system; the periaqueductal gray (PAG) is part of a circuit that suppresses pain and controls defensive behavior" (96; original emphasis). In the section on "neuroglia," *The Human Brain Coloring Book* helpfully notes, the Latin word "fasciculus" means "small bundle" (2-6).

[62] This information comes from the following website address: http://nobelprize.org/nobel_prizes/medicine/laureates/1906/cajal-lecture.html.

[63] For the basic information on "gray" and "white" matter, one can consult an introductory manual, such as Angus Gellatly and Oscar Zarate's *Introducing Mind and Brain*, to understand, "where a lot of cell bodies are packed closely together they appear as "grey matter," or cortex" (32). Approximately "42 percent of the human neocortex is white matter – more than any other primate's" and the "human cerebral cortex is three times larger" than that of chimps" (Jessica Kovler, Discover's *The Brain* 29). Where the tissue is mainly long myelinated axons connecting different communities of cells (known as nuclei), it appears as "white matter" (32; bold emphasis removed). The brain's "white matter" gets its color from myelin, the layer of fatty tissue that covers each neuron's axon. In the picture that *Discover* provides of the myelin tissue in the human brain (Exhibit A), a microscope that magnifies the white matter eight thousand times reveals its flesh color, in a photograph that captures the cross-section

magnification of an axon fiber. At this high degree of magnification, the brain's "white matter" looks like a piece of rare, salmon steak. Gertrude Stein would not have been able to see the underlying flesh tones of myelinated axon fibers with her 19th century laboratory microscope, but this does not stop her from questioning whether the color white is really white in *The Geographical History of America*, which I will discuss below.

[64] Ryan Draft's digital, photographic image of a brainbow mouse's motor axons provides a visual model for thinking about Stein's unnaturally colored, word neurons and their neuraesthetic significance. Before I suggest a reading based on this anachronistic connection, I would like to introduce some recent research that has been conducted by three-dimensional, confocal microscopy by the inventor of the Brainbow system, Jeff Lichtman, and his scientific peers in the field of transgenic brain mapping and neurobiological research. Hopefully, this brief introduction, in addition to the other references in this thesis to this area of research, will give you an idea of the visual effects that can be produced by genetically engineered, neuron coloration strategies and confocal microscopy. Lichtman and his colleagues point out that there are commonalities between nineteenth-century nerve tissue staining practices and twenty-first century neuron coloring strategies. After all, the neurons and axons have not changed that much in the past one hundred years, and they have not changed in terms of how much color they will absorb from external sources, in terms of the battles they will wage with one another, and in terms of the creative scientific research that is being conducted by scientists of a given period to understand the complex synaptic connections and regenerative capacities of different neurons within the central nervous system.

As Cai et alia stress in "Repulsive force based snake model to segment and trace neuronal axons in 3D microscopy image stacks," "The branching patterns of axons and dendrites are fundamental structural properties that affect the synaptic connectivity of axons. Although today three-dimensional images of fluorescently labeled processes can be obtained to study axonal branching, there are no robust methods of tracing individual axons."[64] To address the problem of producing clear images of branching axons and dendrites, Lichtman describes how they developed a "new method [that] segments all the axonal profiles in a 2D image and then uses the results obtained from that image as prior information to help segment the adjacent 2D image. In this way, the segmentation successfully connects axonal profiles over hundreds of images in a 3D image stack. Individual axons can then be extracted based on the segmentation results. The utility and performance of the method are demonstrated using 3D axonal images obtained from transgenic mice that express fluorescent protein" (Cai et alia, "Repulsive force based snake model to segment and trace neuronal axons in 3D microscopy image stacks" <http://lib.bioinfo.pl/auth:Lichtman, JW>).

In "A Long Dress," it seems that Stein is representing the brain's axons with phrases such as "the serene length" and "a long line." By extension, the color words in this neuroanatomical portrait also could be portraying the brain's axons and their synaptic connections. Assuming that Stein is visualizing something 'along the lines' of the individually colored axons in Ryan Draft's photograph of a brainbow mouse's motor axons (see Figure 23), then it is possible she also may have predicted the black background we see in Draft's photograph. In one of the strains of transgenic mice that Lichtman and Sanes engineered at the Harvard Laboratory, "all of the branches of a single neuron glow bright yellow against a dark background-making it easy to see what cells these axons are communicating with," Patricia Thomas writes in *MCB News*. "In another line of mice, Lichtman has been able to record a dramatic competition between a yellow axon and a blue one, as two neurons fight to maintain a synapse on the same target cell. This struggle lasted for days, with the lead going back and forth, until one suitor vanquished the other. What the winner did next came as a total surprise. "The remaining neuron simultaneously took over the same synaptic sites that had been occupied by the axon that left, Lichtman notes. "It looked like the invasion of one neuron into the territory of another." Another study revealed that losers are eventually consoled: a neuron that fails on one front will eventually make a match elsewhere. Like people, Lichtman says, "all neurons win some competitions and lose others."[64]

Following this scientific reasoning, it could be that Stein was visualizing yellow- blue- and green-colored axons with the phrase, "only a yellow and green are blue." Alternatively, it could be that "A Long Dress" is commenting on the psychology experiments at Harvard University that mix colors to trick the imagination into discerning "least perceptible differences," as she once did in the experiment she designed with Leon Solomons on the saturation of colors, or it could be that the color-mixing process here is what produces a blue-colored axon or neuron within her imaginary neuroscientific laboratory experiments. With the phrase, "a pink is scarlet," Stein could be visualizing pink- and scarlet-colored axons amidst the other individually colored neurons in the brain's neuroanatomical landscape. Without Draft's photographic image, this would be difficult to imagine. However, in Figure 23, we can see how the grey-colored axons look "pink" against the scarlet-colored axons that form "projections," or "trackways," with the other colored axons in his photograph. With the phrase, "a bow is every color," Stein perhaps was visualizing the way that the terminal "boutons," or the endpoints of an axon, would look if they could be stained with distinguishable colors. As we perhaps know from widely available, published materials on subjects related to neurobiology and neurochemistry, these “boutons” form the “end portions of the axon and contain many vesicles that release neurotransmitters between the end of the axon and the surface of the nerve cell” (Bhatnagar, *Neuroscience for the Study of Communication Disorders* 13).

In conjunction with the synaptic energy that Meyer brings to our attention in the opening phrase of this object description, “What is the current that makes machinery, that makes it crackle, what is the current that presents a long line and a necessary waist,” the last two sentences and the phrase, “a bow is every color” suggests to me that Stein may be describing individually colored axons in the second part of her neuroanatomical portrait, beginning and ending with the question, “Where is the serene length, it is there and a dark place is not a dark place, only a red and white are black, only a yellow and green are blue, a pink is scarlet, a bow is every color” (8). The last two sentences in “A Long Dress” imply that Stein’s aim may be to represent the boutons (or the endpoints of axons) in “every color.” Hence, it could be that she is describing individually colored axons with the phrase “the serene length,” in addition to portraying individually colored neurons with her color words and unusual color combinations. The last two sentences, “A line just distinguishes it. A line just distinguishes it,” suggest that perhaps these axons have terminated their synapses at some unspecified, postsynaptic neuron, for we do not see or hear anything after this line of communication has been relinquished (*Tender Buttons* 8). Subhash Chandra Bhatnagar, in *Neuroscience for the Study of Communication Disorders*,” explains that the “synapse includes the boutons, synaptic cleft, and receptor site of the next nerve cell. A neuron that ends at the synapse is a presynaptic nerve cell. A neuron that receives an impulse from a presynaptic neuron is a postsynaptic neuron” (13).

In the article, “In vivo imaging of presynaptic terminals and postsynaptic sites in the mouse submandibular ganglion,” Corey McCann and Jeff Lichtman observe, “Neuron-neuron synapses have thus far been much less accessible. We therefore developed techniques for imaging interneuronal synapses in an accessible ganglion in the peripheral nervous system. In the submandibular ganglion, individual preganglionic axons establish large numbers of axo-somatic synapses with postganglionic neurons. To visualize these sites of synaptic contact, presynaptic axons were imaged by using transgenic mice that express fluorescent protein in preganglionic neurons. The postsynaptic sites were visualized by labeling the acetylcholine receptor (AChR) alpha7 subunit with fluorescently tagged BTX. We developed in vivo methods to acquire three-dimensional image stacks of the axons and postsynaptic sites and then follow them over time. The submandibular ganglion is an ideal site to study the formation, elimination, and maintenance of synaptic connections between neurons in vivo” (<http://lib.bioinfo.pl/auth:Lichtman, JW>).

This description of the neuroimaging techniques that these scientists developed, so as to photograph “presynaptic axons” with a confocal microscope that could “read” expressed fluorescent proteins in the axons, neurons and glia of the “brainbow” mice, may not mean much to literary theorists, or to Stein readers; however, the point that I would like to stress is that the ability to “visualize these sites of synaptic contact” is partially because of the “Brainbow system.” If, as Meyer claims, Stein is doing this kind of synaptic visualization in early masterpieces like “A Long Dress,” then it seems remarkable that she may have predicted the brilliant colors that could be expressed by the neurons, axons and glia, based on her knowledge of clinical microscopy and brain science. At the moment, the Brainbow techniques cannot be used on humans; it can only be used to ‘genetically label’ individual axons, neurons and glial cells with fluorescent proteins in the nervous systems of transgenic animals, but, specifically, in the nervous systems of ‘brainbow mice’ that have been genetically modified for this purpose, in Jeff Lichtman’s Harvard laboratory. With Ryan Draft’s enhanced photographic image, we literally can see how individually colored axons pop out against a dark background. I believe that it was Stein’s desire to see the brain’s synaptic connections, through some form of neuron coloring and axon coloring process; in 1913, when she was in the process of creating *Tender Buttons*, the genetic technologies and the neuroscientific knowledge clearly did not exist to create brainbow-mapped nervous systems, so Stein produced these colorful maps and their neuroanatomical imaginaries with language, whereby neural impulses and synaptic connections could be imagined as colourful lines occurring in “a dark place that is not a dark place” (8).

[65] The four epigraphs above come from the following sources (in descending order): Bergson’s *The Creative Mind*, p.19, *Hegel’s Phenomenology of Spirit*, p.54. *Picasso by Gertrude Stein*, p. 41 and Stein’s dedication to Carl Van Vechten in *Portraits and Prayers,* N. pag.

[66] I have added this information about brain processing and Fauvist art to show that Stein’s reflections upon Fauvism, Cubism and experimental writing have neuraesthetic implications. While the binding problem that Zeki alludes to in his analysis of Matisse’s pointillist rendering of the beach scene puzzles those who have devoted some time to its neuraesthetic study, neurobiologists like Zeki have difficulty explaining how the brain reconstitutes the color points and other discontinuous elements, in order to comprise a picture that contains visible phenomena with culturally intelligible meanings.

[67] See Dennett's heterophenomenological approach and his "multiple drafts of consciousness argument" in *Consciousness Explained*.

[68] In *Picasso and the Allure of Language*, Susan Greenberg Fisher points out that Picasso did not cease painting and drawing during this period, as Stein claims. In "Seated Woman," she writes: "In April 1935 Picasso, aged fifty-three, stopped painting and devoted himself to writing. He announced his activity to Jaime Sabartés: "I abandon sculpture engraving and painting to dedicate myself entirely to song." He resumed his daily activity of painting one year later, in April 1936, while in Antibes. There he produced a painting almost every day that month, in a group of works based on his mistress Marie-Thérèse Walter that includes th[e] painting, *Seated Woman* of April 26. By then, Picasso had written over one hundred poems in Spanish and French. He wrote until 1959, leaving more than 340 poetic works, and he also penned two full-length plays, *Le désir attrapé par la queue* (Desire Caught by the Tail; 1941), which was the first read in 1944 at the Paris apartment of Michel Leiris, and *Les quattres petites filles* (Four Little Girls; 1948). Picasso's decision to prioritize writing in 1935 and 1936 has been variously linked by scholars to the emotional difficulties stemming from his separation from Olga Koklova, his wife since 1918, and his deep concern at this time over the rise of Fascism and the Spanish Civil War" (129).

[69] It is precisely because the pathological condition known as melancholia functions allegorically to "magically" incorporate what cannot be consciously avowed or recognized, it also works, in its theoretical application and as a mode of literary criticism, to organize or amalgamate singularities of various sorts – aesthetic, historical, linguistic and political – into some culturally intelligible shape, into what we tentatively might call the "subject of history." The criticism that brings the elusive "subject of

history" into relief is part and parcel of the phenomenon that Derrida recognizes as "half-mourning," the state or interval suspended somewhere between melancholia and mourning in which the "end" of metaphysics begins to take place. The beginnings and endings of theory and the production of discursive loopholes through which the subject of history can only be retroactively construed are pivotal to the thinking of the primal scene of history that Lukacher elaborates in his book, *Primal Scenes*. Beginning with Freud (whose notion of the primal scene as a screen memory that consists of memory fragments and experiences that formatively, yet only retroactively, constitute the "character" of the individual subject) and moving through Heidegger (who proposed that "to overcome metaphysics would mean to incorporate metaphysics, perhaps with the hope, but not with the certainty, of elevating it to a new reality" (*The End of Philosophy* 84), Lukacher is able to forge productive new links between psychic and philosophical forms of intertextual "memory." Specifically, Lukacher extends the work of these two fundamental thinkers by incorporating the work of other secondary, equally crucial, theorists such as Derrida: in particular, Derrida's work on the relation between metaphysics and mourning in "Ja, ou le faux-bond," where Derrida argues that theory and criticism entail "both the work *of* mourning and the work *about* mourning, the work of mourning in all its forms: reappropriation, interiorization through introjection or incorporation, or between the two (half-mourning again), idealization, nomination, etc." (98; original emphasis). Thus Lukacher arrives, in the last three chapters of his book, at the suggestion that "the subject of history is not the human subject – whether defined as an individual, a class, or a species – but rather the intertextual process itself" (13). Lukacher's project, however brilliantly conceived, does not and perhaps cannot examine reflexively the "work of mourning" that founds its own historically based, theoretical presuppositions. Indeed, as Lukacher would agree, such an examination could only take place through the further juxtaposition of another set of intertexts that could "retorque" existing theoretical lines of inquiry, such that the subject of history, once again, could be "unmasked," thus making new forms of recollection and (re-) membering possible for the reader of these intertextual "subjects."

[70] Here it might be useful to recall, through Lukacher's writing on the subject of mourning and melancholia, the connection between the Heideggerian notion of the subject's individualization as a form of "fundamental torsion" and the Freudian notion of individualization as a form of unconscious incorporation, whereby the pathological mourning process acts as a melancholic and phantasmatic form of preserving the other within/as the self. As with the Lacanian figure of the Borromean knot, the torsion which signals the "closure" of metaphysics is also what creates the melancholic subject, that is, as that which reveals this subject to be a temporally and spatially reconfigurable entity, a symbolic entity that continually seeks to cross the line over into the Real where the imaginary fullness of Being exists. Hence, the "work of mourning," and the testing of reality that ultimately defines such theoretical and psychic work can assume the form of "a kind of historical event" (Lukacher, *Primal Scenes* 13). What invariably haunts Lukacher's project is, somewhat paradoxically, what it is that he so desperately attempts to recuperate: a form of textual unconscious whose proportions can only be intuited precisely through the fundamental incapacity to recognize *what it is* that is "lost" is the loss that is being intertextually re-enacted through fragmented reconstructions of traumatic memories, events and subjects. In the Preface to *Primal Scenes*, Lukacher proposes to "demonstrate across a broad range of texts, how the

notions of memory, the event, and the subject have '[lost] their constructive force and become nothing'" (13). By juxtaposing the intellectual contributions of writers such as Hegel, Marx, Freud, and Heidegger (to name only a few), with the creative texts of Shakespeare, Balzac, Dickens and Henry James, he examines how the constructive "nothingness" emerges from these narratives as an unconscious force, or as a melancholic "subtext" that resembles the work of mourning in certain striking ways: that is, he examines how this "nothing" emerges as an historical real that inaugurates the melancholia of historiography proper.

In a crucial sense, this meta-critical enterprise is itself inherently melancholic, precisely in the way that Freud understood the melancholic process of incorporation, as implicated in the "loss of a more ideal kind" (253). According to Freud in "Mourning and Melancholia," this ideal or idealized loss, which implies a phantasmatic projection and ambivalent identification on the part of the subject, can occur "even if the patient is aware of the loss which has given rise to his melancholia, but only in the sense that he knows *whom* he has lost but not *what* he has lost in him (254; original emphasis). Caught in a suspended state of "half-mourning" – between knowing and not knowing the proper objects of its own theoretical inquiry – Freudian theory creates a double bind, in which the subject of history and the historicity of the subject come to define each other in ways that are not entirely coextensive with each other. Indeed, they relationally define each other through a much more unstable and amorphous, historically produced desire to "see" the "'event' that cannot be thought outside the question of intertextuality," as it is produced through the lens of an artistic or literary style (Lukacher, *Primal Scenes* 13). This historical allegory of desire may take place along two intersecting axes, where the point of connection may signify a nexus or node in which "knowing" and "not knowing" collide, as in the representation of unconscious affect. This mode of representation, straddling the metaphysical boundaries of intelligibility, might be conceived as a "style," perhaps even as a traumatic style whose visual effects exist as a form of conceptual eclipse, where the address of the "Other" occurs through the interstices created partially by the subject's conscious or unconsciousness desire to create distinctive, if not entirely legible, cultural idioms or idiolects. In this way, Lukacher's deconstructive "nothing" could be usefully compared with Lyotard's "something" and with Stein's description of Picasso's cubist poetry as a form of subjective emptying, artistic zombism and unconscious mourning (or melancholia), as that which emerges only belatedly, through certain kinds of creative writing and artistic expression, to mark the place where nothing in particular is remembered, yet where something persists as a gap in ordinary memory and as a challenge to human nature's culturally intelligible sensory mappings and bodily meanings.

[71] Related partly through the words of art critic John Golding, Zeki points out that "the 'supreme originality' of *Les Demoiselles* [*d'Avignon*, 1906-1907] lies in the impression that 'Here it is as if Picasso had walked 180 [degrees] around his subject and had synthesised his impressions into a single image' resulting in what has been called a 'simultaneous vision.' Gertrude Stein notes, in Picasso, that this painting exemplifies Picasso's rose period and that the African-inspired facial masks represent a kind of mental crutch for Picasso. In Stein's cubist writings, we must also imagine that Stein is asking us to "walk around" her linguistic signifiers at 180-degree angles, or even at a 360-degree angle, to appreciate the phenomenal realities that form her abstract representations of the brain's neural architecture and its organic matter. In "a later, representative, painting entitled *Man with a Violin*," Zeki observes, "Picasso depicted his subject

from so many different points of view, that the final result is only recognisable as a violin player through its title. The brain of course regularly views these different views in an orderly way, allowing it to recognise and obtain knowledge about what it is viewing. The attempt by Cubism to mimic what the brain does was, in the neurobiological sense, a failure – an heroic failure perhaps, but a failure nevertheless. This is not perhaps the way others, and most of all artists, see it. It is perhaps not the way Picasso himself saw it and it does not adequately characterise the aims of the later, Synthetic Cubism" (55).

[72] Could Bucknell's statement also mean, perhaps, that Stein has found a way to mime phallogocentric language in a way that cannot be 'undone'? That is, are Stein's critical mimes, which take the form of linguistic abstractions, semantic transvaluations, and conceptual refigurations, completely irreversible from a phallogocentric point of view? And if so, then what implications does this irreversibility have for theories of performativity and feminist analyses, particularly those which assume that linguistic performativity works relatively evenly across a cultural or historical domain of signification, or that discursive knots or obstacles in the form of 'unhappy' or 'infelicitous' performatives operate as temporal aporias (i.e. through Stein's adoption of James' 'continuous present') that may have the *effect* of preventing back-translation and conceptual historiography? Or, perhaps, is it the case that we are looking in all the wrong places? When Stein's "dissociative rhetoric" and her critical mimes constitute micro-traumatic situations for her readers, listeners and spectators (the three categories of 'audience' reception she refers to in "Plays"), as I believe is the case with her early plays and operas, does the mime that 'resorbs' the speaker (and author) into a phallogocentric economy of language always already bespeak a wider sphere of cultural production,

whereby ‘new’ sexualities, as Laplanche calls them, emerge precisely as ‘spandrels’ (or unanticipated, linguistic adaptations) *on the* bridges constructed by her acts of *bricolage* and *bricoleur*, or by her acts of discursive seduction and sexual sublimation? That is, are Stein’s critical mimes, which take the form of linguistic abstractions, semantic transvaluations, and conceptual refigurations, completely irreversible from a phallogocentric point of view? And if so, then what implications does this irreversibility have for theories of performativity and feminist analyses, particularly those which assume that linguistic performativity works relatively evenly across a cultural or historical domain of signification, or that discursive knots or obstacles in the form of ‘unhappy’ or ‘infelicitous’ performatives operate as temporal aporias (i.e. through Stein’s adoption of James’ ‘continuous present’) that may have the *effect* of preventing back-translation and conceptual historiography? Or, perhaps, is it the case that we are looking in all the wrong places? When Stein’s “dissociative rhetoric” and her critical mimes constitute micro-traumatic situations for her readers, listeners and spectators (the three categories of ‘audience’ reception she refers to in “Plays”), as I believe is the case with her early plays and operas, does the mime that ‘resorbs’ the speaker (and author) into a phallogocentric economy of language always already bespeak a wider sphere of cultural production, whereby ‘new’ sexualities, as Laplanche calls them, emerge precisely as ‘spandrels’ (or unanticipated, linguistic adaptations) *on the* bridges constructed by her acts of *bricolage* and *bricoleur*, or by her acts of discursive seduction and sexual sublimation?

Could it be that other ‘burlesque solutions’ between singularities and universals are being imagined or created as a result of performative links that are being forged between various impossible images in Stein’s texts, links that occur through her 'exacting' experiments with performative, linguistic failures and with special kinds of theatrical etiolations?

[73] See Steiner's *Colors of Rhetoric* for a comprehensive treatment of color, style and language in Stein's cubist historiography and historical art forms. Steiner wrote this book after *Exact Resemblance to Exact Resemblance*, realizing that that she had missed an important dimension of interart[istic] analysis by leaving out the dimensions of color and color signification. In her "Preface" to *Colors of Rhetoric*, Steiner writes, "Some years ago I gave a talk at Harvard comparing Gertrude Stein's writing to cubist painting. It was a chapter of a book of mine then in press, and I was pleased to be able to explain in what I considered a tough, precise fashion what others had dealt with more impressionistically. But when a member of the audience asked why I should want to set up such a comparison in the first place, I had nothing to reply. Apparently the interart analogy did not speak for itself. … "The colors of rhetoric" is a figure of speech that itself signifies "figures of speech." Chaucer's Franklin, in the epigraph above, uses the embellishment to insist on the plainness of his own words, contrasting the "legitimate" colors of nature and paint to those of language. The tale that he tells through this paradoxical plainness argues for both the virtue of conforming words to reality and the generosity of excusing people from this burden. It also implies that if rhetorical figures could only be like paint, there would be no problem in speaking truth in art, for nature's and man's painting faithfully reflect their meaning and their creator. Words, in contrast, carry no mark of either their creator or their origins, and their ambiguity opens verbal art to shifting interpretations. Through a series of paradoxes and equivocations (examined in the appendix), the plain Franklin shows the importance of the painting-literature comparison to the issue of artistic truth-telling" (xi). Painting with words creates ambiguities at the level of the brain's neural

architecture that Stein does not attempt to resolve in her neuroanatomical imaginaries and in her cubist portraits; her ultimate aesthetic aim is the creation of unprecedented, neural networks and unexpected, neurophenomenological analogies with the English language.

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painting-literature comparison to the issue of artistic truth-telling" (xi). Painting with words creates ambiguities at the level of the brain's neural architecture that Stein does not attempt to resolve in her neuroanatomical imaginaries and in her cubist portraits; her ultimate aesthetic aim is the creation of unprecedented, neural networks and unexpected, neurophenomenological analogies with the English language.

[75] See James's argument about the connection between the brain's secondary, phenomenal qualities and its neurophysiological connections in "The Automaton-Theory," from *The Principles of Psychology, Volume I.* In this chapter, he proposes, "If neural action is as complicated as mind; and if in the sympathetic system and lower spinal cord we see what, so far as we know, is unconscious neural action executing deeds that to all outward intent may be called intelligent; what is there to hinder us from supposed that even where we know consciousness to be there, the still more complicated neural action which we believe to be its inseparable companion is alone and of itself the real agent of whatever intelligent deeds may appear? "As actions of a certain degree of complexity are brought about by mere mechanism, why may not actions of a still greater degree of complexity be the result of a more refined mechanism?" The conception of reflex action is surely one of the best conquests of physiological theory; why not be radical with it? Why not say that just as the spinal cord is a machine with few reflexes, so the hemispheres are a machine with many, and that that is all the difference? The principle of continuity would press us to accept this view" (129).

[76] Readers interested in reading Kerr's full Live Science report can access his article, "Brain Cells Colored to Create 'Brainbow,'" from which this quotation is taken, at the following internet address: <http://www.livescience.com/animals/071031-brainbow.html>.

[77] In “Introduction to Confocal Microscopy” Nikon provides the following information, which you may find useful (The Harvard Department of MCB is the original source for this link): I have cited the entire text, as follows: “The key to the confocal approach is the use of spatial filtering to eliminate out-of-focus light or flare in specimens that are thicker than the plane of focus. There has been a tremendous explosion in the popularity of confocal microscopy in recent years, due in part to the relative ease with which extremely high-quality images can be obtained from specimens prepared for conventional optical microscopy, and in its great number of applications in many areas of current research interest. Basic Concepts - Current instruments are highly evolved from the earliest versions, but the principle of confocal imaging advanced by Marvin Minsky, and patented in 1957, is employed in all modern confocal microscopes. In a conventional widefield microscope, the entire specimen is bathed in light from a mercury or xenon source, and the image can be viewed directly by eye or projected onto an image capture device or photographic film. In contrast, the method of image formation in a confocal microscope is fundamentally different. Illumination is achieved by scanning one or more focused beams of light, usually from a laser or arc-discharge source, across the specimen. This point of illumination is brought to focus in the specimen by the objective lens, and laterally scanned using some form of scanning device under computer control. The sequences of points of light from the specimen are detected by a photomultiplier tube (PMT) through a pinhole (or in some cases, a slit), and the output from the PMT is built into an image and displayed by the computer. Although unstained specimens can be viewed using light reflected back from the specimen, they usually are labeled with one or more fluorescent probes.

Imaging Modes - A number of different imaging modes are used in the application of confocal microscopy to a vast variety of specimen types. They all rely on the ability of the technique to produce high-resolution images, termed optical sections, in sequence through relatively thick sections or whole-mount specimens. Based on the optical section as the basic image unit, data can be collected from fixed and stained specimens in single, double, triple, or multiple-wavelength illumination modes, and the images collected with the various illumination and labeling strategies will be in register with each other. Live cell imaging and time-lapse sequences are possible, and digital image processing methods applied to sequences of images allow z-series and three-dimensional representation of specimens, as well as the time-sequence presentation of 3D data as four-dimensional imaging. Reflected light imaging was the mode used in early confocal instruments, but any of the transmitted light imaging modes commonly employed in microscopy can be utilized in the laser scanning confocal microscope.

Specimen Preparation and Imaging - The procedures for preparing and imaging specimens in the confocal microscope are largely derived from those that have been developed over many years for use with the conventional wide field microscope. In the biomedical sciences, a major application of confocal microscopy involves imaging either fixed or living cells and tissues that have usually been labeled with one or more fluorescent probes. A large number of fluorescent probes are available that, when incorporated in relatively simple protocols, specifically stain certain cellular organelles and structures. Among the plethora of available probes are dyes that label nuclei, the Golgi apparatus, the endoplasmic reticulum, and mitochondria, and also dyes such as fluorescently labeled phalloidins that target polymerized acting in cells. Regardless of the specimen preparation protocol employed, a primary benefit of the manner in which confocal microscopy is carried out is the flexibility in image display and analysis that results from the simultaneous collection of multiple images, in digital form, into a computer.

Critical Aspects of Confocal Microscopy - Quantitative three-dimensional imaging in fluorescence microscopy is often complicated by artifacts due to specimen preparation, controllable and uncontrollable experimental variables, or configuration problems with the microscope. This article, written by Dr. James B. Pawley, catalogs the most common extraneous factors that often serve to obscure results collected in fluorescence widefield and confocal microscopy. Among the topics discussed are the laser system, optical component alignment, objective magnification, bleaching artifacts, aberrations, immersion oil, coverslip thickness, quantum efficiency, and the specimen embedding medium.

Aberrations in Multicolor Confocal Microscopy - Refinements in design have simplified confocal microscopy to the extent that it has become a standard research tool in cell biology. However, as confocal microscopes have become more powerful, they have also become more demanding of their optical components. In fact, optical aberrations that cause subtle defects in image quality in widefield microscopy can have devastating effects in confocal microscopy. Unfortunately, the exacting optical requirements of confocal microscopy are often hidden by the optical system that guarantees a sharp image, even when the microscope is performing poorly. Optics manufacturers provide a wide range of microscope objectives, each designed for specific applications. This report demonstrates how the trade-offs involved in objective design can affect confocal microscopy.

Three-Color Imaging for Confocal Microscopy - The laser scanning confocal microscope (LSCM) is routinely used to produce digital images of single-, double-, and triple-labeled fluorescent samples. The use of red, green and blue (RGB) color is most informative for displaying the distribution of up to three fluorescent probes labeling a cell, where any co-localization is observed as a different additive color when the images are colorized and merged into a single three-color image. In this section we present a simplified version of a previously published method for producing three-color confocal images using the popular image manipulation program, Adobe Photoshop. In addition, several applications of the three-color merging protocol for displaying confocal images are discussed. Note that these digital methods are not confined to images produced using the LSCM and can be applied to digital images imported into Photoshop from many different sources.

Basics of Confocal Reflection Microscopy - Confocal reflection microscopy can be utilized to gather additional information from a specimen with relatively little extra effort, since the technique requires minimum specimen preparation and instrument re-configuration. In addition, information from unstained tissues is readily available with confocal reflection microscopy, as is data from tissues labeled with probes that reflect light. The method can also be utilized in combination with more common classical fluorescence techniques. Examples of the latter application are detection of unlabeled cells in a population of fluorescently labeled cells and for imaging the interactions between fluorescently labeled cells growing on opaque, patterned substrata" (<http://www.microscopyu.com/articles/confocal/>.)

[78] <http://www.fineartsurrey.com/artTypeDetail.php?aid+39>.)

[79]<http://www.fineartsurrey.com/artTypeDetail.php?aid+25>.) This website also provides the following information for American abstract expressionist

art: “1940-1955 - A term referring to an Sources: Robert Atkins, "Art Speak"; Ralph Mayer, "A Dictionary of Art Terms and Techniques"; Kimberley Reynolds & Richard Seddon, "Illustrated Dictionary of Art Terms". (LPD) Artists include: Jackson Pollock Willem de Kooning Franz Kline Robert Motherwell Arshile Gorky Josef Hoffmann Mark Rothko Clyfford Still William Baziotes Adolph Gottlieb Barnett Newman.”

[80] For more information on the Fauves and Fauvism, see the Fine Art Surrey website at <http://www.fineartsurrey.com/artTypeDetail.php?aid+19>.

[81] This papyrus and its bird/brain/surgery images anticipates my concluding chapter, wherein I incorporate Maryanne Wolf's "reading pyramid," which is an illustration of the brain’s reading circuits explains the genetics, neural circuitry, brain organization, cognitive processes and the reading behaviors, or theories/practices, that scientists and others can use to derive meaning from literary texts, or other kinds of “readings.” In this case, the Edwin Smith Surgical Papyrus works dually, as a useful image to explain Stein's enigmatic bird images—i.e., they were used in ancient hieratic Egyptian writings as part of the brain hieroglyph and may explain Stein’s frequent references to Egyptian hieroglyphic writings. Also, they are part of the consciousness of the difficult reading process that one must undergo when learning to read the science of the brain from challenging, modernist perspectives. In this chapter, the figure of the Edwin Smith Surgical Papyrus links the Egyptian pyramids and Stein's modernist hieroglyphics, or rather I should say, it potentially links her detective stories about birds, brains and literary surgeries with other medical narratives in potentially illuminating ways. Dr. Wilkins, from *Journal of Neurosurgery*, releases the following information about this important find: “The Edwin Smith Surgical Papyrus, dating from the seventeenth century B.C., is one of the oldest of all known medical papyri. It differs fundamentally from the others

in the following ways: 1. The seventeen columns on the recto comprise part of a surgical treatise, the first thus far discovered in the ancient Orient, whether in Egypt or Asia. It is therefore the oldest known surgical treatise. 2. This surgical treatise consists exclusively of cases, not recipes. The treatise is systematically organized in an arrangement of cases, which begin with injuries of the head and proceed downward through the body, like a modern treatise on anatomy. 3. The treatment of these injuries is rational and chiefly surgical; there is resort to magic in only one case out of the forty-eight cases preserved. 4. Each case is classified by one of three different verdicts: (1) favorable, (2) uncertain, or (3) unfavorable. The third verdict, expressed in the words, 'an ailment not to be treated,' is found in no other Egyptian medical treatise. 5. This unfavorable verdict occurring fourteen times in the Edwin Smith Papyrus marks a group of cases (besides one more case) which the surgeon cannot cure and which he is led to discuss by his scientific interest in the phenomena disclosed by his examination." It is of special interest to the neurosurgeon because it contains the first descriptions of the cranial sutures, the meninges, the external surface of the brain, the cerebrospinal fluid, and the intracranial pulsations. It also contains the first accounts of surgical stitching and of various types of dressings. Brain injuries are noticed to be associated with changes in the function of other parts of the body, especially the lower limbs, and hemiplegic contractures are described in Case 8. Changes in bodily functions are also described in association with injuries of the cervical spine. Case 31 contains the first description of quadriplegic, urinary incontinence, priapism, and seminal emission following cervical vertebral dislocation. The Egyptologist who brought this manuscript to light, Edwin Smith, was born in Connecticut in 1822, the year that Egyptian hieroglyphic was first deciphered. In Luxor, Egypt, in 1862, Smith bought an ancient

manuscript roll which lacked some of its outer portions. Two months later the same vandals sold him the remaining fragments glued onto a dummy roll. Although Smith recognized the fraud, pieced the two together, and made an attempt at translation, it was not until 1930 that James H. Breasted translated the treatise and established its importance. Breasted was then Director of the University of Chicago Oriental Institute, and had been requested by the New York Historical Society to translate the papyrus, which the Society had received in 1906 from Edwin Smith's daughter. According to Breasted, the Edwin Smith Papyrus is a copy of an ancient composite manuscript which contained, in addition to the original author's text (3000-2500 B.C.), a commentary added a few hundred years later in the form of 69 explanatory notes (glosses). It contains 48 systematically arranged case histories, beginning with injuries of the head and proceeding downward to the thorax and spine, where the document unfortunately breaks off. These cases are typical rather than individual, and each presentation of a case is divided into title, examination, diagnosis, and treatment. There is a definite differentiation between rational surgical treatments and the much less employed medico-magical measures. Significantly, trepanation is not mentioned." The following article is reprinted with Dr. Wilkins' permission from Journal of Neurosurgery, March 1964, pages 240-244."
(<http://www.neurosurgery.org/cybermuseum/pre20th/epapyrus.html)>.)

[82] Dr. Wilkins, from the *Journal of Neurosurgery*, reports the following information about this important find: "The Edwin Smith Surgical Papyrus, dating from the seventeenth century B.C., is one of the oldest of all known medical papyri. It differs fundamentally from the others in the following ways: 1. The seventeen columns on the recto comprise part of a surgical treatise, the first thus far discovered in the ancient Orient, whether in Egypt

or Asia. It is therefore the oldest known surgical treatise." According to James Breasted, this "Papyrus is a copy of an ancient composite manuscript which contained, in addition to the original author's text (3000-2500 B.C.), a commentary added a few hundred years later in the form of 69 explanatory notes (glosses). It contains 48 systematically arranged case histories, beginning with injuries of the head and proceeding downward to the thorax and spine, where the document unfortunately breaks off. These cases are typical rather than individual, and each presentation of a case is divided into title, examination, diagnosis, and treatment. There is a definite differentiation between rational surgical treatments and the much less employed medico-magical measures. Significantly, trepanation is not mentioned." According to James Breasted, [This] "[p]apyrus is a copy of an ancient composite manuscript which contained, in addition to the original author's text (3000-2500 B.C.), a commentary added a few hundred years later in the form of 69 explanatory notes (glosses). It contains 48 systematically arranged case histories, beginning with injuries of the head and proceeding downward to the thorax and spine, where the document unfortunately breaks off. These cases are typical rather than individual, and each presentation of a case is divided into title, examination, diagnosis, and treatment. There is a definite differentiation between rational surgical treatments and the much less employed medico-magical measures. Significantly, trepanation is not mentioned." The following article is reprinted with Dr. Wilkins' permission from the *Journal of Neurosurgery*, March 1964, pages 240-244.

[83] Sara Ford cites this passage in *Gertrude Stein and Wallace Stevens: The Performance of Modern Consciousness*, on page 8. You may wish to consult her argument about the significance of these birds in this book. The passage comes from James's article, "On Some Omissions of Introspective

Psychology.” Steven Meyer also addresses James’s treatments of this subject in *Irresistible Dictations*.

[84] The epigraphs at the top of this page come from the following texts, according the order in which they appear: *A Universe of Consciousness*, p.29, *Phenomenology*, p. 48, *Bodies That Matter*, “Introduction” p.5.

[85] In this reading, I downplay the musical meanings of the colors blue, yellow, and green, so as to keep things simple. I do not want to get into an overly complicated argument about sensory synaesthesia at this point, but I have written about the musical score of Stein’s operas in other contexts, so I do believe that neuraesthetic musicality, or “musicophilia” (as Oliver Sacks calls the relation between music and the brain), is a legitimate and important concern. If you are interested in this subject, you may wish to consult *Steven Watson’s Prepare For Saints: Gertrude Stein, Virgil Thomson and the Mainstreaming of American Modernism*, *Brad Bucknell’s Literary Modernism and Musical Aesthetics* and Oliver Sacks’s *Musicophilia: Tales of Music and the Brain*.

[86]This information can be accessed at the following website: (<http://www. olympusamerica.com/cpg_section/cpg_headlineDetails.asp?pressNo=564>.)

[87] For basic information on “gray” and “white” matter, one can consult an introductory manual, such as Angus Gellatly and Oscar Zarate’s *Introducing Mind and Brain*, to understand that, “where a lot of cell bodies are packed closely together they appear as “grey matter,” or cortex” (32). Approximately “42 percent of the human neocortex is white matter – more than any other primate’s” and the “human cerebral cortex is three times larger” than that of chimps” (Jessica Kovler, Discover’s *The Brain* 29). Where the tissue is mainly long myelinated axons connecting different communities of cells (known as nuclei), it appears as “white matter” (32; bold emphasis removed). The brain’s “white matter” gets its color from

myelin, the layer of fatty tissue that covers each neuron's axon. In the picture that *Discover* provides of the myelin tissue in the human brain (Exhibit A), a microscope that magnifies the white matter eight thousand times reveals its flesh color, in a photograph that captures the cross-section magnification of an axon fiber. At this high degree of magnification, the brain's "white matter" looks like a piece of rare, salmon steak. Gertrude Stein would not have been able to see the underlying flesh tones of myelinated axon fibers with her 19th century microscope, but this does not stop her from questioning whether the white brain matter is really white in *The Geographical History of America*. In "White Matter Matters," R. Douglas Fields notes, "New studies show that the extent of white matter varies in people who have different mental experiences or who have certain dysfunctions. It also changes within one person's brain as he or she learns or practices a skill such as playing a piano. Even though the neurons in gray matter execute mental and physical activities, the functioning of white matter may be just as critical to how people master mental and social skills, as well as to why it is hard for old dogs to learn new tricks. The myelin that gives white matter its color has always posed mysteries. For more than a century scientists looked at neurons through their microscopes and saw long fibres, the axons, extending from a neuronal cell body to a neighboring one, like an outstretched, elongated finger. Each axon was found to be coated with a thick crystalline gel. Anatomists surmised that the fatty covering must insulate axons like rubber sheathing along a copper wire. Strangely, however, many axons, especially the smallest filaments, were not coated at all. And even along insulated fibers, gaps in the insulation appeared every millimeter or so. The bare spots came to be known as nodes of Ranvier, after French anatomist Louis-Antoine Ranvier, who first described them. Modern investigation has revealed that nerve impulses race down axons on the order of 100 times faster when they are coated with myelin-- and that myelin is laid on axons somewhat like electrical tape, wrapped up to 150 times between every node. The substance is manufactured in sheets by two types of glial cells. These cells are not neurons, but they are prevalent in the brain and in the nervous system [see "The Other Half of the Brain," by R. Douglas Fields; *Scientific American*, April 2004]. An octopus-shaped glial cell called an oligodendrocyte does the wrapping. Electrical signals, unable to leak out through the sheath, jump swiftly down the axon from node to node. In nerves outside the brain and spinal cord, a sausage-shaped glial cell called a Schwann cell forms myelin" (*Scientific American* (March 2008) 55-56). Importantly, Fields notes, "The wrapping occurs at different ages. Myelin is prevalent in only a few brain regions at birth, expands in spurts and is not fully laid until 25 or 30 in certain places. Myelination generally proceeds in a wave from the back of the cerebral cortex (shirt collar) to its front (forehead) as we grow into adulthood. The frontal lobes are the last place where myelination occurs. These regions are responsible for higher-level reasoning, planning and judgment—skills that only come with experience" (56-57). If we read 'myelination' at the level of Stein's neuroanatomical portraiture and English grammar, such a process could be indicating two things: 1) that the featured part of brain-like human mind of *The Geographical History of America* is at the back of the cerebral cortex, in an area such as the cerebellum or perhaps near the nucleus of Darkschewitch (where Stein performed her neuroanatomical experiments on the postmortem brains of human embryos and babies at Johns Hopkins), indicates an embryonic state of human reason and higher-level reasoning (as in the myelination that would occur in these brain regions in infants and young children), or an advanced degree of "higher-level reasoning, planning and judgment—skills that only come with experience," as Fields notes; 2) that the featured part of the brain-like human brain in *The Geographical History of America* comes from the neocortex, or from the forebrain section of the cerebral cortex (which corresponds with the "white" and "grey" matter that this masterpiece interrogates from the subjective perspective of the "human mind)), thereby implying that this masterpiece's human mind belongs to an adult, to someone who has developed an advanced level of "higher-level reasoning, planning and judgment." This is an important distinction to make because such a reading would determine if Stein was using the obscure, error-ridden embryonic models of the brain stem from her medical studies at Johns Hopkins in this neuroanatomical portrait of the human mind. My reading of this masterpiece's colored neurons and their myelinated connections suggests that Stein is not relying solely upon her previous laboratory experiences and brain dissections at Johns Hopkins, but is advancing radically new neuroscientific insights about the brain's neuroanatomical features through this work's graphic 'neural' illustrations and 'catachrestic,' microscopic perspectives.

[88] Santiago Ramón y Cajal shared the Nobel Prize for 1906 with Camillo Golgi for their work on the structure of the nervous system. The Nobel Prize website offers the following information about Cajal's scientific publications and neuroanatomical research: In 1880 he began to publish scientific works, of which the following are the most important: Manual de Histología normal y Técnica micrográfica (Manual of normal histology and micrographic technique), 1889 (2nd ed., 1893). A summary of this manual recast with additions, appeared under the title Elementos de Histología, etc. (Elements of histology, etc.), 1897; Manual de Anatomía patológica general (Manual of general pathological anatomy), 1890 (3rd ed., 1900). In addition may be cited: Les nouvelles idées sur la fine anatomie des centres nerveux (New ideas on the fine anatomy of the nerve centres), 1894; Textura del

sistema nervioso del hombre y de los vertebrados (Textbook on the nervous system of man and the vertebrates), 1897-1899; Die Retina der Wirbelthiere (The retina of vertebrates), 1894. (<http://nobelprize.org/nobel_prizes/medicine/laureates/1906/cajal-bio.html>).

[89] See Sporns, Kötter and Tononi, on the nature of single neuron studies in "The Human Connectome," as cited in this chapter.

[90] See Gerald Edelman and Giulio Tononi's discussion of these "prototypical" and "paradigmatic" qualia in *A Universe of Consciousness*, chapter thirteen, "Qualia and Discrimination." I take these adjectives from their discussion of the brain's qualitative discriminations, but note that there are many other excellent sources to draw upon. With respect to the so-called "problem of qualia" (157), they ask, "Why should the firing of those particular neurons in area IT generate the quale redness, with its specific subjective quality and meaning, but not, for instance, the quale greenness, or the quale pain? And why should it generate a quale at all, when the firings of neurons in the retina or in the lateral geniculate nucleus appear to generate nothing in the way of subjective feelings? … Should we conclude that the units in the simulated area IT of that model can generate a primitive perception of color, a disembodied quale of red, blue or yellow? And if not, what are they missing? A special biological ingredient? Or a special location in the brain?" (163). I haven't pursued this question in this chapter, other than to discuss the possible evolutionary implications of brain colors and their relation to cortical color processing activities and phenomenal experiences. I highly recommend this chapter to readers who wish to know more about the "high-dimensional discriminations" that Edelman and Tononi define as "qualia" (127).

[91] In terms of brain-based, philosophical research that explores the phenomenal qualities of conscious experience, Gerald Edelman and Giulio

Tononi note that there is “the identity theory, the central state theory, neutral monism, logical behaviorism, token physicalism and type physicalism, token epiphenomenalism and type epiphenomenalism, anomalous monism, emergent materialism, eliminative materialism, various brands of functionalism, and many others” (*A Universe of Consciousness* 6). Before these theories were produced in the late twentieth century, these scientists point out that philosophers of the mind and neuroscientists often relied upon Descartes’ dualism, “Spinoza’s dual-aspect theory, Malebranche’s occasionalism, Leibniz’s parallelism and his doctrine of preestablished harmony” to support their hypotheses about the relation that exists between the brain’s “neural space” and its “qualia space” (6, 164).

[92] The three epigraphs come from Henri Bergson, *Creative Evolution,* Chapter II, p. 40; 2, William James’s *The Varieties of Religious Experience*, p. 72, and Gertrude Stein’s “Poetry and Grammar,” 209.

[93] Essentially, I agree with Meyer’s claim that “Mapping, in Stein’s hands, did not look like the mapping of the previous century, or even or the previous generation, because she was determined, as the cliché has it, to go where no man had gone before. To the degree that a map looked like something that was recognizable, it was an imitation of another map rather than the product of actual exploration – which, to an Emersonian way of thinking, was always a matter of self-exploration, of “mixing the outside with the inside,” whatever else was ostensibly being mapped.” (262). However, in opposition to this claim, I think that the color-coded brain mapping Stein did, in works such as *Tender Buttons* and *The Geographical History of America*, derived from scientific experiences, neuroscientific insights and creative experiments with language and art, not on “the self-conscious … pursuit of truth” (263), unless, of course, it is the kind of “necessary truth” that James discusses in *The Principles of Psychology*,

whereby one examines the relation that exists between the human brain's evolutionary processes and its conscious experiences, in order to arrive at an understanding of the creative processes within phenomenal consciousness, be they scientific insights, philosophical intuitions or artistic visions.

[94] I will be citing Stein's letters from the Harvard collection, as they cited in Meyer's *Irresistible Dictation*. In this book, Meyer argues that Dr. Florence Sabin's *Atlas of the Medulla and Midbrain* illustrates the same brain stem region, as Stein's three-dimensional brain model of the midbrain region, from the perspective of "a series of *horizontal* sections passing [longitudinally] through the medulla, pons, and midbrain of a new-born babe," with "a second set of sections, cut transversally, or perpendicular to the first set, [which] represented "almost the same stage of medullation" and served "as a check upon every point of the model" (p.13)" (96). To acquire a sense of how original Stein's neuroanatomical discoveries were at the end of the nineteenth-century, it helps to remember that it "was only during the last decade of the nineteenth century that the terminology we use today was introduced. The term 'neuron' was introduced in 1891. The axis cylinder was then named the 'axon' by Rudolph von Kollicker, and the protoplasmic processes were called 'dendrites' by Wilhelm His. Also during this decade[,] Sir Charles Sherrington described the junction between nerve and muscle, and named it the 'synapse' from the Greek roots *syn*, meaning 'together,' and *haptein*, meaning 'to clasp') in 1897" (MC, The Discovery of the Neuron" 5; <http://neurophilosophy.wordpress.com/2006/08/29/the-discovery-of-the-neuron/>).

[95] I have added this section on Neidich and Bryson's contributions to the debate about the meanings of the sensory homunculus from a twenty-first

century neuraesthetic perspective, after it was brought to my attention that this research complemented the research I was doing on Stein's three-dimensional brain model. I thank my examiners for their valuable input.

[96] Freud's work on the sensory homunculus comes to mind here.

[97] Irene Small and Susan Greenberg Fisher discuss the significance of Picasso's colored words in *Picasso and the Allure of Language*.

[98] Once again, I would recommend the wide selection of literary reviews in Curnutt's *The Critical Response to Gertrude Stein*.

99 Endnote does not exist at the level of the text; this is a space holder, which is compensating for a slight, computer glitch.

[100] Stein spent the first part of her writing career literally mincing words, splitting proper names, dividing "human types," fragmenting images, disrupting meanings, destroying paradigms, disconnecting minds and bodies, dissociating conscious and unconscious thought processes, separating the "internal" from the "external" and, above all else, dividing public opinion about the nature of her modernist aesthetic. In *Wars I Have Seen*, Stein proclaims, "I was there to begin to kill what was not dead, the nineteenth century which was so sure of evolution and prayers, and Esperanto and their ideas" (61). *The Geographical History of America* takes the modernist, literary practice of destruction, dissociation, and disconnection into new directions with its *literary genetics*, *creative metaphysics* and *qualia-politics*.

[101]Nobel Laureate James D. Watson emphasizes that all kinds morphological and structural homologies "extend down to genes and DNA. And, as with morphological homologies, these molecular homologies make sense only through evolutionary reasoning" ("Foreword" xi). In his foreword to *Darwin: The Indelible Stamp*, Nobel Laureate James D. Watson writes,

> It may astonish those think that evolutionary studies are carried out in the dusty rooms of museums amid all those specimens collected so many years ago, that the most impressive data supporting the laws of evolution come from the studies of the past forty years in molecular genetics. The clearest evidence for the common ancestry of all living organisms comes from the universality of the Genetic Code which provides the translation the information in a gene and the protein encoded by a gene. The Code provides the means to interpret the nucleotides – the As, Ts, Gs, and Cs—of a DNA molecule in terms of the amino acids – the alanines, leucines, valines and so on – of the protein. With some variations, the code is the same for viruses, bacteria, worms, human beings, beetles, mice and slugs. The most extreme example is that bacteria can be given a human gene and they will make the human protein! What an extraordinary vindication of Darwin's ideas. A.S. Romer was one of the great morphologists of the 20th century and his classic book, *The Vertebrate Body*, was the mainstay of zoology classes from 1949. In his discussion of homology, he wrote that it was likely that morphological homology between structures "… might well depend upon the degree of the identity of the genes concerned in their production. But this is not a matter of practical import … it is improbable that our range of knowledge will ever be broadened to the necessary degree." Scientists should know better than to make such predictions. Now we do possess that knowledge --homologies extend down to genes and DNA. And, as with morphological homologies, these molecular homologies make sense only through evolutionary reasoning" (xi).

Watson's insights about the ways in which molecular geneticists have substantiated Darwin's "laws of evolution" apply to *The Geographical*

History of America's creatively represented, evolutionary hypotheses and scientific insights. If, indeed, there are "molecular homologies" to be discerned alongside other morphological and structural homologies in this text, then we may be able to deduce these molecular homologies through Stein's neuraesthetic modes of evolutionary reasoning.

[102] The list and order of scientists responsible for FOXP2's discovery is taken from Simon E. Fisher's "Tangled Webs: Tracing the Connections Between Genes and Cognition," p. 277.

[103] Jonas Lehrer offers an interpretation the "literary genome" that some readers may find interesting. In *Proust Was a Neuroscientist*, Lehrer argues, "The invention of neural plasticity, which is encoded by the genome, lets each of us transcend our genome. We *emerge*, characterlike, from the vague alphabet of our text. Of course, to accept the freedom inherent in the human brain – to know that the individual is *not* genetically predestined – is also to accept the fact that we have no single solutions. Every day one of us is given the gift of new neurons and plastic cortical cells; only we can decide what our brains will become. The best metaphor for our DNA is literature. Like all classic literary texts, our genome is defined not by the certainty of its meaning, but by its linguistic instability, its ability to encourage a multiplicity of interpretations. What makes a novel or poem immortal is its innate complexity, the way every reader discovers in the same words a different story" (47; original emphasis). In essence, this is what Lehrer means by the term "literary genome." Lehrer would also describe his mode of literary criticism as belonging to empirical aesthetics and, specifically, to the emergent discipline of "neuroesthetics." In his Prelude, Lehrer writes, "the moral of this book is that we are made of art and science. We are such stuff as dreams are made on, but we are also just stuff. We now know enough about the brain to know that its mystery will always remain. Like a

work of art, we exceed our materials. Science needs art to frame the mystery, but art needs science so that not everything is a mystery. Neither truth alone is our solution, for our reality exists in plural. I hope these stories of artistic discovery demonstrate that any description of the brain requires both cultures, art and science" (x).

[104] In Rhawn Joseph's expert opinion, "the "language gene" [FOXP2] did not randomly evolve through random mutations. It existed prior to the evolution of humans and prior to the evolution of language, in a silent, non-activated state" (108). Prior to making this claim in "The Death of Darwinism: Purpose, Progress, Silent Genes, and Multi-Regional Human Metamorphosis," Joseph observes that "this gene is found in the genome of other mammals, such as mice, rats, dogs, cats, chimpanzees, and so on, but in a non-activated, protein-protected form" (107). Not only does the language gene in these mammals bear the capacity for future expression, but, as Dr. Anthony P. Monaco of the University of Oxford discovered, FOXP2 can be deactivated in human beings, which means that humans can lose speech, grammar, and motor abilities as a result of its neurodevelopmental effects upon the brain's language, motor and speech centers. Joseph explains, in "Mythologies of Modern Science," how the language gene was "first discovered, [in its] non-activated form, in a large London family who are incapable of speech. FOXP2 is believed to switch on other genes during the development of the brain thus giving rise to the neural circuitry which supports human language" (17). In this study, Joseph cites Paabo's genetic research as evidence supporting his anti-Darwinian theory of evolutionary metamorphosis. "According to Dr. Paabo, the FOXP2 gene has remained largely unaltered through the evolution of animals. However, in humans, this formerly silent gene became activated through changes in the shape of its protective protein coat. Protein prevents

the activation of genes, and removal or alteration in the shape of this protein overcoat, allows for the gene to be activated" (17). Because of this genetic discovery and other neuroscientific findings concerning the evolution of language in the last two decades, Joseph believes that "Darwinian theology" cannot account for the organization, origin and expression of human DNA. In his view, this is because Darwin's theory of natural selection cannot explain the "regulatory constraints" placed upon the human genome and its vertebrate-specific protein domains and motifs" (16). In contrast with Darwin's theory of evolution, Joseph proposes his own theory of "evolutionary metamorphosis," which is based upon his analysis of FOXP2's intronic mutations and genomic implications:

> Contrary to Darwinism, and as the evidence increasingly indicates, the metamorphosis of life has been genetically predetermined and precoded, has unfolded in accordance with specific genetic plans and DNA-based instructions, and has been striving (and is still striving) toward fulfilling specific genetic goals. Just as the DNA of an embryo is genetically programmed to produce a fetus, neonate, infant, child, and an adult, the first life forms on this planet contained the DNA for producing all manner of life, including man and woman. Life has not "evolved" randomly, but in a step-wise, progressive, highly predictable, molecular-clock like fashion. (13, 16)

Taking this line of reasoning yet further, he proposes:

> Although the mantra "random variations" is the basis for Darwinian theology, the human genome and vertebrate-specific protein domains and motifs have been created according to specific regulatory constraints, and have been built by rearranging preexisting components into a richer collection of domain architectures (IHGSC, 2001). (*Neurotheology* 16-17)

I have discussed Joseph's "evolutionary metamorphosis" theory and its neurotheological implications for Stein's evolutionary reasoning and cubist literature in an unpublished essay, which is entitled "Gertrude Stein's Literary Genetics."

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