Rethinking Ontology in Science Studies: The Return of Dialectics

by

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Abstract

This thesis is framed in terms of a larger project — articulating a dialectical materialist conception of STS based, largely, on the work of Marx and Engels. Here, "materialist" is to be understood as a commitment to the proposition that being precedes thought in the order of ontological primacy; it is a dialectical approach to the traditional epistemological and ontological problematic presented as an inversion of the idealist dialectic of Hegel. Specific emphasis will be placed on the work of Engels (as he is responsible for most of the pair's thoughts on scientific methodology) and his work *The Dialectics of Nature*. The overall goal is twofold. Firstly, it is to articulate and defend the general form of Engels' materialist dialectics. And secondly, as a function of said rehabilitation, it is to make the case that the theory provides a firmer epistemological and ontological base for STS in contrast with the popular flat ontological "new materialist" approaches gaining traction in the literature, with specific emphasis on actor-network theory (ANT). This will be accomplished through an exploration of the literature on social constructivism in STS leading into the development of ANTs oppositional "constructivism". To that end, I examine a case in disability studies to demonstrate the utility of understanding social construction in dialectical terms. Finally, an exploration of what I take to be some of the strengths of the dialectical materialist approach to STS more broadly will be explored in the final chapter in contrast to the general trend in new materialist scholarship to move away from subjectivity and anthropocentric notions of reality and scientific practice.

Preface

This thesis is an original work by Spencer Hayden. No part of this thesis has been previously published.

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Glossary of Abbreviations

1. **STS**: *Science and Technology Studies*
2. **HM**: *Historical Materialism*
3. **DM**: *Dialectical Materialism*
4. **ANT**: Actor-Network Theory
5. **DS:** Disability Studies
6. **CDS:** Critical Disability Studies

"Dialectical philosophers have thus far only explained science. The problem, however, is to change it."[1]

Chapter 1: An Overview

1.1 Science and Technology Studies: An Overview

Skimming through *The Handbook of Science and Technology Studies*, one will no doubt come away with the distinct notion that STS[2] is characterized, at least in part, by its rejection of "positivism". In his own article on a critical theory of technology, Andrew Feenberg[3] characterizes STS by its adherence to "antideterminism and antipositivism"[4], both of which relate to the core of this thesis. This is not to say, however, that all approaches to the study of science and its philosophy which reject positivism are, by default, part of the broad extension of STS. The following quote from the authors from the consistently updated handbook on STS provides a clear and concise overview of the enigmatic nature of the "program".

> While the metaphor of a map may seem attractive and something to strive for, as it promises to put some order in place, to draw boundaries, and to indicate directions, STS has been very good at resisting clear-cut mapping enterprises so far. The field, if that term can even capture the richness and diversity of work adopting the label STS, has always been much more a complex choreography of elements and identities. Texts often "belong" to multiple categories and classifications. They claim and are claimed as STS; yet they frequently also belong to sociology, political science, anthropology, or other academic territories.[5]

[1] Richard Levins and Richard C Lewontin, *The Dialectical Biologist* (repr., Harvard University Press, 1985), 288.
[2] Hereafter used as shorthand for Science and Technology Studies
[3] A philosopher of technology and STS studies at SFU
[4] Clark A. Miller. et al., *The Handbook of Science and Technology Studies*, 4th ed. (repr., MIT Press, 2017), 636.
[5] Ibid., 3.

STS may, perhaps, best be understood not as a unified program but, rather, as a discursive approach to the study of science as a socially embedded productive practice. That STS approaches science and technology from a historical and sociological point of view separates it from what is commonly deemed "positivism", which is associated less with the historical circumstances of production and more with ahistorical criteria for justification. For STS theorists, "all knowledge is local and reflects the specific historical moment."[6] The rational reconstruction of the one true scientific methodology which provides a clear demarcation between "science" on the one hand and "everything else" (chiefly metaphysics) on the other formed a dominant paradigm prior to the rise of post-positivist approaches in the Edinburgh School (SSK) which culminated in the birth of STS[7].

1.2 Positivism and Demarcation

Having established one of its core tenets as a reaction to and rejection of positivism in the philosophy of science, STS naturally found itself pushing up against an entrenched paradigm. The mid-20th century saw the apex of historical development for the positivist project in the philosophy of science and "analytic" philosophy writ large. The positivism of the mid 20th century took on a transmuted form from that of the positivism of Auguste Compte — often considered the founder of western positivism in the mid 19th century. Compte's positivism was characterized by a deep historicism committed to the order and progress of nature and society.

[6] Ibid., 1.
[7] The Edinburgh School encompassed a group of sociologists of science in the 1970s interested in the sociology of scientific knowledge. It is most often associated with the "strong program", or the thesis that all scientific knowledge ought to be explained in terms of the social conditions of its production and acceptance rather than just that of incorrect theories.

For Compte, "Positivism consists essentially of a Philosophy and a Polity."[8] And the two must be understood through sociology. That Compte places sociology within his historicized scientific hierarchy as "more important than any other…,"[9] demonstrates that there was, already, a clear paradigm shift which occurred between the original positivism of Compte and the positivism of the logical/empirical positivism of the Vienna Circle a century later.[10] This new positivist paradigm was not concerned explicitly with the history nor sociology of science. Rather, this positivism concerned itself with the theoretical and methodological demarcation between metaphysics and science. This perennial problem in analytic circles is often referred to as the "demarcation problem", though it has considerably less force following the decline of positivism. Various influential critiques brought about this decline arising from various sectors of the philosophical discipline, including internal critiques.[11] By striving to eliminate the historical vagaries from philosophy and metaphysics, positivism inadvertently ended up placing a straitjacket *on the sciences as well*. Without a clear demarcation between the sciences and metaphysics, positivism was incapable of restricting the one without placing overly strict methodological, and ahistorical, limits on the other, whether intentionally or not. It was the work of one Thomas Kuhn in 1962 titled *The Structure of Scientific Revolutions*, however, that definitively ushered in the postpositivist era in the philosophy of science. For Kuhn, scientific methodology cannot be reduced to a formal logical analysis based on axiomatic principles of objectivity. To understand scientific methodology, we must look at the actual history of scientific

[8] Auguste Comte and John Henry Bridges, *A General View of Positivism* (repr., Cambridge: Cambridge University Press, 2009), 1.
[9] Ibid.
[10] This is often associated (in relation to the philosophy of science) with thinkers such as Rudolph Carnap, Otto Neurath, and Carl Hempel. It should be noted that not all of those involved with the movement were equally committed to this caricature. Neurath, in particular, was no fan of reduction.
[11] Particularly influential critiques relating to the philosophy of science came from Karl Popper and Willard Quine.

practice, in which social factors play an important role in development of new scientific "paradigms" arising from previous methods. Kuhn marks the return of sociology to the study of science.

1.3 Nothing New Under the Sun: Engels and Natural Dialectics

Nearly a century earlier, Friedrich Engels, in collaboration with Karl Marx, reacted to the anti-historical and reductionist forms of science (including radical empiricism) that he saw going on around him. Postpositivism did not begin in 1964. Engels frames his approach to natural (material) dialectics as a reaction to what he terms the "metaphysical"[12] or static 18th and early 19th century scientific thought, which is characterized by its reliance on the dual assumptions of ahistorical rationality as well as the fixed essence of nature (the universe and its inhabitants do not fundamentally change once coming into being).[13] In opposition to this, Engels proposes a general return to dialectical thinking using Hegel as a jumping off point. This dialectical approach to nature understands it in terms of motion and change; motion is a mode of matter, not an external modification of it.[14] Engels describes the rational dialectic as "the science of universal interconnection,"[15] and its laws are to be discovered in nature, through investigation — both present *and historic*. It is neither *a priori* metaphysics nor a form of positivism, for always Engels stresses the importance of "theoretical" (philosophical) considerations in the absence of purely empirical determination. And "theory" is always a historical product while perception is,

[12] Friedrich Engels, *Dialectics of Nature* (repr., London: Wellred, 2012), 63.
[13] Ibid., 24.
[14] Engels is committed to the law of the "conservation of matter" for this reason, though his views have been surpassed by our updated understanding of the law of conservation of energy (or matter) that comes along with Einstein.
[15] Ibid., 17.

strictly, not. As such, its greatest strength lies in abolishing the dualisms that plague theoretical analysis, including within STS, such as the separation between subject and object, or history and nature. Even mechanical materialists end up positing a transcendent subject against passive matter (nature), which it attempts to appropriate in thought. The tendency of this manner of thinking is to bifurcate the world into two distinct realms: the mental and the physical, the former having a transcendental epistemological priority over the latter.

1.4 Postpositivms, STS, and Actor Network Theory

Fast-forward again to the mid 1980s, and a new approach to the relationship between materiality and the social (between subject and object) has gained popularity in the general move away from transcendental epistemological investigations — flat ontologies. Particularly popular within the field of STS (and science studies more broadly) is Bruno Latour and John Law's Actor Network Theory (ANT). A word of caution, however, is needed. Latour himself wavers on the use of the term "theory" to refer to ANT. In his 1998 speech at Lancaster University, he opined that, "There are four things that do not work with actor-network theory; the word actor, the word network, the word theory and the hyphen."[16] These "theories" are radically non-anthropocentric and explicitly metaphysical (focused on things themselves), rejecting both process-based explanations (including historical explanations) along with their general critique of sociology. This return to the "real", to a form of "materiality", has been taken up within STS, and within the social sciences more broadly as a "new materialism" opposed to both the mechanical materialism which Engels rails against in his work as well as dialectical conceptions.

[16] Bruno Latour, "On Recalling Ant", *The Sociological Review* 47, no. 1 (1999): 15, doi:10.1111/j.1467-954x.1999.tb03480.x.

ANT is notable, within STS, as presenting itself as much more than a mere description of the processes by which scientific knowledge is generated. It is explicitly a metaphysical theory which generates "quaint"[17] ontological commitments. Much like the dialectical materialist approach to ontology, ANT is opposed to the dualistic distinctions which have dominated philosophical discourse in modernity. By separating the subject from the object, the Cartesian model of cognition presents itself in an *essentially* anthropocentric manner. The human subject is qualitatively distinct from and epistemically privileged over nature, onto which it acts. ANT seeks to abolish this hierarchy entirely — it is a flat ontology. On the nature of this radical metaphysical equality, Latour writes, that "every entity, including the self, society, nature, every relation, every action, can be understood as a 'choice' or a 'selection' of finer and finer embranchments going from abstract structure - actants - to concrete ones – actors."[18]ANT, thus, is committed to an ontology of networks of actors, outside of which there is nothing. Social forces cannot be used to explain the production of scientific knowledge, because there are no such things as social forces external to the network of actors and actants. The "social" gets reassembled within the confines of the network, and this reassembling is also a widening of extension. Everything which participates in the network is part of the "social" aspect of that network, including ideas, customs, materials, methodologies, etc.…. By reducing everything to relations within a network, ANT theorists take themselves to be, ultimately, providing a more robust and *less* reductionist ontology.[19]

STS has, however, been poorly served by these flat approaches to ontology. It is my view that it is time for a new approach, or, rather, the fresh application of an old one. STS deserves a

[17]Bruno Latour, "On Actor-Network Theory: A Few Clarifications", *Nomos Verlagsgesellschaft Mbh* 47, no. 4 (1996): 369.
[18] Ibid., 373.
[19] Ibid., 370.

better materialism — a dialectical one. The key is *thinking of nature dialectically rather than humans mechanically or as relations*. Dialectical materialism is neither scientistic positivism nor new materialism, and this is its strength.

1.5 Dialectical Materialism and STS: A New Materialist Synthesis

With all this being said, one may very well wonder "Why STS?" STS provides crucial insights into the ethical, epistemological, and aesthetic realm of value and their effects on the production process which Marxist methodology largely ignores in favor of a view of class that is at times myopic as it relates to the production of scientific theory. On this, I agree with Joost Kircz when he writes that "classic 'Marxist' treatises on this subject put too great an emphasis on the economic, military, and political aspects that mould and constrain science, and too little on the ideological and conceptional components of the development of ideas."[20] And no other field of science studies is as interested in the foundational sorts of questions relating to a genuine sociology of knowledge as STS, which DM theorists share.

There is more to this synthesis than mere methodological sufficiency, however. Hitherto, scholarship in STS has largely avoided committing itself to an ontology or metaphysics, with ANT being a notable exception. ANT, along with the rise of various "new materialist" paradigms, have brought an ontology to science studies from the side of philosophy. These approaches, however, are explicitly metaphysical and, in the case of ANT, give rise to peculiar ontological commitments, of which our best scientific theories themselves may make no mention. Science studies as envisaged by ANT (and several new materialist ontologies) raise

[20] Kircz, Joost. "Engels and Natural Science: A Starting Point." *Science & Society* 62, no. 1 (1998): 64.

difficult questions concerning the relationship between science studies (as a branch of philosophy) and the sciences themselves; it remains to be seen whether these can be answered. The solution is not to cede the entirety of ontology to the practice of scientists either; the continuing importance of philosophy cannot be overstated. If every methodology assumes an ontology, then I will argue that DM accommodates several of turns that have occurred in science studies considering the postpositivist era better than ANT or new materialist approaches.

The argumentative form of the dialectical materialist synthesis with STS that I am calling for will have three major stages.

1) Seeing as a general defense of the acceptability of dialectical materialism on its own is a necessary requirement for the success of a synthesis, in the second chapter of this thesis, I will explain the general form of the dialectical materialist mode of thought as envisaged by Engels in his works and defend some of its core notions. Though many of Engel's own examples of the workings of dialectics in nature are now clearly outdated, the general critical dialectical materialism which it describes is still valuable.
2) With the defense of the general acceptability and relevance of dialectical materialism out of the way, the third chapter will focus on comparing the dialectical materialist ontology and epistemology with that of ANT from the point of view of one of the most debated topics within STS — social constructionism. ANT and other new materialist ontologies, correctly, identify a series of problematic dualisms at work in many strongly sociological conceptions of social construction[21], namely the dualisms between nature/culture, human/non-human, and mind/matter. What all these

[21] Sociological conception meaning (*at least*) our representations of the world are always fundamentally products of social forces.

ontologies have in common, is that they foreground "an appreciation for just what it means to exist as a material individual with biological needs for survival yet inhabiting a world of natural and artificial objects, well-honed micropowers of governmentality, and the more anonymous but no less compelling effects of international economic structures."[22] Like dialectical materialism, they are all anti-reductionist ontologies in nature. As well, they also reject any anthropocentric favoring of human subjectivity. This leads them to reject the traditional social constructionist conception in which collective human subjectivity constructs materiality (the real). There are no such things as immaterial subjects or strictly social forces — it is a monist ontology like dialectical materialism. Social construction, for ANT theorists, is a process of co-construction between contingent and interconnected materialities, wherein the boundaries between objects in networks cannot be determined as strictly "social" or "material".

I will argue in this chapter that this conception of social construction is insufficient, and that dialectical materialism can make sense of the ontology and epistemology of a constructed world better than new materialism. To accomplish this, I will make use of a case study at the crossroads of the literature in both disability studies as well as ANT within STS. In doing so, I articulate DM, in contrast to ANT, as a specific form of materialism — abstract (critical) vs concrete (speculative).

Abstract materialism is being used here to draw attention to the fact that DM retains an emphasis on the relationship between thought and being (and their forms of motion), on the conditions for the possibility of things. Therefore, I have termed

[22] Diana H Coole and Samantha Frost, *New Materialisms* (repr., Durham [NC]: Duke University Press, 2010), 28.

dialectical materialism a "critical" materialism, as it still, broadly, situates itself within the Kantian tradition, despite being critical of the *a priori* nature of that which mediates the relationship between "thing-in-themselves" and the phenomenal world. In contrast to the abstract critical materialism of DM, I will refer to the materialism of ANT and other new materialist ontologies as concrete and speculative. They are "concrete" because they are concerned with things themselves (or actants themselves in the case of ANT) and, largely, resist the urge to explore relationships between concepts and things, or contexts and things, by reflecting on them. Actants are not taken up in thought through abstraction. Their relationality is an immediate one. This is also why I have termed this type of ontology or materialism "speculative". Speculative here is being used in direct contrast to *critical* where the former is unconcerned with the conditions of possibility of being's relationship to us and its mediation and more with things outside of said mediation. In this sense, I am using speculative quite closely to Quentin Meillassoux's notion of speculation, having to do with the move away from philosophies focused on the correlation of thought and being and towards being itself, towards the "*great outdoors*, the *absolute* outside of pre-critical thinkers: that outside which was not relative to us, and which was given as indifferent to its own givenness to be what it is, existing in itself regardless of whether we are thinking of it or not; that outside which thought could explore with the legitimate feeling of being on foreign territory – of being entirely elsewhere."[23]

[23] Quentin Meillassoux and Ray Brassier, *After Finitude* (repr., Continuum International Publishing Group, 2009), 7.

This critical approach is applied to the notion of disability as it relates to the case study to demonstrate the possibility of a new "social model" of disability rooted in a dialectical materialism, rather than the concrete materialism of ANT.

3) The final chapter of the thesis will be dedicated to exploring what I take to be the prime reason that new materialist ontologies are not suitable with a well-functioning sociology of science. Despite their claims to abandon the dualisms of the Cartesian mode of thought (and the reductionism that comes along with it), *new materialist ontologies are all radical objectual ontologies*. What I mean by this is that they resolve the alienation between subject and object by subsuming subjectivity entirely into the world of objects — everything is an object or relation without a special status. In doing so, they severely hamstring their own capability to perform political analysis (insofar as subjectivity is understood as equated with activity), as well as historical analysis. What STS needs is not another, yet more intricately sophisticated, monistic object ontology. Rather, I will argue that the process ontology[24] of dialectical materialism is better suited to the aims of science studies, and comes with several epistemological, metaphysical, and methodological benefits. These include:
    - A *qualified* non-anthropocentric approach that does not fully abandon human thinking or concern.
    - A unified ontology devoid of the dualisms plaguing the Cartesian approach.
    - Insight about the relationship between *philosophy of science* and *science* proper
    - A tying together of knowledge and human freedom/emancipation — scientific optimism.

[24] This is distinct from Whitehead's process philosophy.

If the future of science studies is to be placed on solid metaphysical and empirical ground, then "new materialism" is not the materialist basket in which to place all of STS's eggs. Instead, I argue for a return of a materialism much older, and much more politically precarious — dialectical materialism. Seriously accounting for the political in science requires the courage to overcome political unease with Marxism in the postpositivist era.

Chapter 2: Natural Dialectics

2.1 The Laws of the Dialectic

Natural dialectics, "dialectical materialism", has its origin in the work of Friedrich Engels[25], specifically his unfinished *Dialectics of Nature* as well as *Anti-Dühring.* These are the two works in the traditional "Marxist" canon which deal explicitly with the relationship between the Marxist conception of nature and the natural sciences through a dialectical conception of matter. Though Engels never uses the phrase himself in either text[26], "dialectical materialism" will be used to refer to the conception of nature and matter in both texts. While materialism has a more popular history, dialectics are often neglected both within philosophy and the natural sciences. It is with an explanation of dialectics as it relates to materialism that an exploration of dialectical materialism ought to begin.

What differentiates the dialectical approach to matter from what Engels refers to as the "metaphysical" approach is the relationship between objects, networks of objects, and change. He refers to *his* interpretation of dialectics as the "science of universal interconnection"[27], where

[25] It was a socialist acquaintance of Marx that first used the term to describe his own synthesis of the views of Hegel and Feuerbach — Joseph Dietzgen.
[26] Engels often refers to his position in opposition to the subjective dialectics of Hegel as "rational dialectics" rather than dialectical materialism.
[27] Engels, *Dialectics of Nature,* 17.

the interconnection between things precedes the possibility of the intelligibility of their isolated identities. Dialectics, in opposition to metaphysics, is not about objects but processes, which implies a historical dimension to the fundamental study of being. In switching from an object centered view of the universe to a process centered view, the primacy of necessity as opposed to contingency is also reversed. A philosophy which takes the historical as of prime importance necessarily takes up contingent truth as an important part of first philosophy, of being itself. Therefore Aristotle, a paradigmatic example of someone espousing Engels' "traditional metaphysics", both lacked a philosophy of history as well as actively denigrated its importance. In *the Poetics,* Aristotle compares history to poetry and finds the latter bearing greater philosophical content:

> It is, moreover, evident from what has been said, that it is not the function of the poet to relate what has happened, but what may happen- what is possible according to the law of probability or necessity. The poet and the historian differ not by writing in verse or in prose. The work of Herodotus might be put into verse, and it would still be a species of history, with meter no less than without it. The true difference is that one relates what has happened, the other what may happen. Poetry, therefore, is a more philosophical and a higher thing than history: for poetry tends to express the universal, history the particular.[28]

History is about what has happened, not what may happen *whatsoever the circumstances*.

The emphasis DM places on the primary role of history often leads to confusion between *dialectical* materialism and *historical* materialism. What is the difference? Though the jury is still very much out on where to draw the line between the two, if at all, Engels does provide us with a clear definition of historical materialism in his 1880 work titled *Socialism: Utopian and Scientific*. According to him, historical materialism is used to designate that view that seeks, "the ultimate cause and the great moving power of all important historic events in the economic

[28] William Harmon, *Classic Writings on Poetry* (repr., New York: Columbia University Press, 2005), 41.

development of society, in the changes in the modes of production and exchange, in the consequent division of society into distinct classes, and in the struggles of these classes against one another."[29]

Historical materialism is a distinct method of sociological and historical investigation in line with Marx and Engel's broader commitments in political economy. What is not present in Marx's, or subsequent writers', works is a discussion of the inherently dialectical character of reality more generally speaking — *of the dialectics of nature*. This is what distinguishes historical materialism and dialectical materialism, the former being a proper subset of the latter. These terms are often conflated by academics in the west, which has the unfortunate side-effect, whether intentional or not, of reducing the meaning of dialectical materialism to the meaning of historical materialism, which enjoys greater popularity for a variety of academic and political reasons.

Though HM is rightly concerned with history and materiality, it is dialectical materialism which unites them as part of one organic whole. In other words, DM seeks to abolish the distinction between history and nature which would make the distinction between HM and DM possible in the first place. As such, DM ends up subsuming HM when properly understood. This unity, however, is not achieved through a substance monism nor a neutral monism. Both positions, like many forms of new materialisms, are fundamentally metaphysical when interpreted within a dialectical framework, which is exactly the sort of position which Engels rejects in favour of DM and is also the sort of thinking being objected to as a foundation for STS broadly in this thesis.

[29] Friedrich Engels, *Socialism, Utopian and Scientific* (repr., Chicago: C.H. Kerr & company, 1880), 23.

"History" has a specific meaning when used by Engels, and others in the dialectical tradition, which is best framed in terms of a response to the sorts of dualisms inherent in the thought of both René Descartes and Immanuel Kant. For both thinkers, there is an ontological and epistemological separation between thought and being (mind and reality) which reflects itself in subsequent dualisms. In particular, the separation between thought and reality, for Kant, is mirrored by the separation between history and nature. History (the realm of the noumena) is properly the domain of the social, of the spontaneous and free realm of thought, while nature (the realm of the phenomena) is determined and mechanical. This turn from naïve realism to a critical epistemology focused on how we know prior to what we know, in part, characterizes modern philosophy.

DM is not a return to a naïve realism, however. The DM theorist is still concerned with the relationship between being and thought. Matter is the condition for the possibility of rational thinking, which is itself understood as historically changing through its various forms of motion.[30] In order to make this move away from Kant while still retaining the concern with questions of the relationship between thought and being, Engels draws most heavily on the work of G.W.F. Hegel to expound his theory of history. For Engels, as for Hegel, there is no distinct separation between subjects and objects, which leads to the demolition of the sort of history/nature dualism inherent in the modern humanistic way of thinking mentioned prior. By sidestepping the skeptical debate concerning the status of our knowledge as it relates to the world, DM is free to posit an organic unity between the laws governing thought and the laws governing history — they are not distinct domains. Engels describes this organic monistic view of reality as such:

[30] What this means for the DM notion of critique will be explored in the next section.

> that in nature, amid the welter of innumerable changes, the same dialectical laws of motion force their way through as those which in history govern the apparent fortuitousness of events; the same laws which similarly form the thread running through the history of the development of human thought and gradually rise to consciousness in thinking man.[31]

These "laws of the dialectic" are the same as applied to human history as they are for natural history, making DM's conception of reality non-anthropocentric in this qualified sense. Man is not the measure of what is; the logic of our thoughts are an organic outgrowth of the logic of nature and reality more broadly speaking. This does not mean, however, that DM is committed to an uncritical or naïve realism about the world but, rather, it rejects the terms of the debate itself. When subject and object as well as history and nature are no longer viewed from opposite sides of an epistemological chasm, questions concerning the integrity of the infrastructure spanning that divide are moot.

This distinction between nature and history serves, then, as a fruitful jumping off point for an explanation of DM as the science of universal interconnection. Often, we think of the relationship between history and nature in terms which pre-suppose an anthropocentric division of reality into subject and object, social and natural. On this view, while it makes sense to say that humans engage in or *have* history, it makes less sense to say that nature does. Nature happens in time, but not in history. All talk of natural events is necessarily parsed in tensed terminology, though we overstep in qualifying these events in anthropocentric, historical terms. To attribute history to nature is a category error. History is the realm of the social and of the intentional, not the mechanistic; it is made and does not happen.

[31]Friedrich Engels, *Anti-Dühring. Herr Eugen Dühring's Revolution in Science* (trans., Progress Publishers, 1947), Preface.

This bifurcation entails a methodological dualism as it concerns the natural and the social (anthropocentric). The social ought to be investigated using different criteria than the natural, which may be investigated mechanically. In contrast to the mechanical/reductionist explanations appropriate to nature, the social realm ought to be explained in terms which accounts for the "spontaneity" of human subjectivity apart from determined nature. Overcoming this distinction between subject and object, and history and nature along with it, is a goal of both DM and ANT, though both approach it from different angles. For dialectical materialists, nature and history are unified as part of one progressively unfolding material process. In this way, it positions itself as a reaction to the "vulgar materialism" of the 19th century French mechanistic materialists.[32] Rather than bridging the gap by thinking of humans mechanically, we ought to think of nature and humankind dialectically. This requires thinking of the laws governing their interconnections and change rather than division and permanence.

Unlike metaphysics, dialectics, as Engels sees it, is not an *apriori* first philosophy. The laws of universal interconnection are to be supported by empirical investigation. He writes that, when it comes to other notions of dialectics rooted in subjectivity, "The mistake lies in the fact that these laws are foisted on nature and history as laws of thought, and not deduced from them".[33] Here, Engels is specifically critically referencing the dialectics of Hegel as insufficiently objective or rooted in nature. That being said, the three laws of "objective" or natural dialectics which he arrives at for DM draw nearly exclusively from Hegel's works.

> All three are developed by Hegel in his idealist fashion as mere laws of *thought*: the first, in the first part of his *Logic*, in the *Doctrine of Being*; the second fills the whole of the

[32] Of note, and a paradigmatic example, is the work of Julien Offray de La Mettrie. His book titled *L'homme Machine* marks a turning point for materialism by extending Descartes' mechanistic methodology to the whole of nature, thus reducing the number of substances to one.
[33] Engels, *Dialectics of Nature*, 63.

> second and by far the most important part of his *Logic,* the *Doctrine of Essence*; finally the third figures as the fundamental law for the construction of the whole system.[34]

The laws all concern matter historically, *matter as change*.

They are, in order:

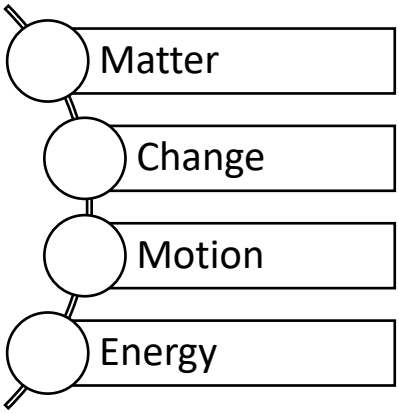
1) The transformation of quantity into quality
2) The interpenetration of opposites
3) The negation of the negation

Of these three, Engels spends the most time emphasizing the first, which will also be given the greatest treatment here. My aim, however, is neither to provide a complete defense of the laws as is nor to simply reformulate them into another series of three laws using more contemporary scientific examples. Much of what Engels says is vague and unrefined, and he often uses cherry picked examples to support his desired conclusions. Rather, my aim is to demonstrate, using a modified formulation of one of his laws, the general viability and essence of what he is trying to get at, minus the Hegelian baggage. And that is, as Helena Sheehan elegantly puts it, "a developmental and integrative way of thinking grounded in a developmental and integrative ontology."[35] This developmental and integrated ontology is explicitly anti-positivist insofar as that is understood to entail opposition to *apriori* knowledge and an acceptance of reductionism. This is best illustrated using the first law of the dialectic.

The transformation of quantity into quality (and vice versa) is defined by Engels as the fact that "qualitative changes can only occur by the quantitative addition or subtraction of matter

[34] Ibid.
[35] Helena Sheehan, *Marxism and The Philosophy of Science* (repr., Atlantic Highlands, N.J.: Humanities Press, 1993), 41.

or motion (so-called energy)."[36] This principle asserts the absolute supremacy of the material in the causal order of reality. Where there is qualitative change in reality (at any level of organization, including the social), there must have been a quantitative change in the material base of society — either of matter or motion (energy for Engels). Before moving on, it is worth drawing attention here to the rather obvious error which Engels makes with regards to modern physics, specifically post Einsteinian physics. For Engels, as was orthodoxy in the 19th century, mass conservation and energy conservation were distinct analytical notions. However, it is clear from his writings that, insofar as he equates motion with energy, he does not view mass and energy as *actually* distinct in nature — see figure 2.1. Not only, then, is the law fully compatible with the modern reformulation of the two conservation laws into one conservation of mass/energy law under the principle of mass-energy equivalence, but it also anticipates certain developments in the future unified conceptualization of mass and energy.



All are equivalent at one point or another in the dialectical process.

Figure 2.1

Engels provides a few examples of this process from chemistry and physics, which he views as the most exact sciences, but it is chemistry which he deems "the science of the qualitative changes of bodies as a result of changed quantitative composition."[37] And it is from

[36] Engels, *Dialectics of Nature,* 64.
[37] Ibid., 66.

this field which Engels provides a series of rapid-fire examples, some more successful than others. The most convincing examples of the transformation of quantity into quality come in the form of oxygen molecules. Engels notes that O2 and O3 (ozone) have extraordinarily different qualitative properties, though they contain the same basic building blocks.[38] What qualitative differences exist between the diatomic and triatomic allotropes vary with the quantitative change in the number of atoms as well as their arrangement, which is itself a function of that same number. Of course, not every single qualitative variation is *explained* by quantitative change; however, that is not the purpose of the "law". The law is a general methodological principle informing investigation. It may turn out that certain things in nature, according to our best theories, behave in seemingly undialectical manners. On the side of the philosophy/science divide, dialectics sits firmly on the side of philosophy. That does not make it any less valid, nor does it make it un-scientific. Engels is keen to point out that the relationship between philosophy and science is not one which can be overcome, nor should we attempt to completely give-in to either side of the divide. He writes that, "Natural scientists believe that they free themselves from philosophy by ignoring it or abusing it...[but] they cannot make any headway without thought...[and] hence they are no less in bondage to philosophy, but unfortunately in most cases to the worst philosophy".[39] Though theory (philosophy) cannot be escaped by retreating into scientism, Engels would have also wanted his own ideas to be updated in light of our best science and clarified where they could be. The relationship between science and philosophy is, after all, a two-way street.

My proposal for a modified transformation of quantity into quality addresses two concerns arising from the original formulation in Engel's text.

[38] Ibid., 67.
[39] Ibid., 213.

1) Overextended and underdetermined conception of "quality"

2) Insufficient criteria for objecthood

The first concern is raised by the possibility of including too many things as changes in qualities, specifically because Engels leaves the notion entirely undefined himself. Certainly, a staunch philosophical materialist would not mean to include qualitative changes which are extrinsic to a thing. For example, one's being loved by another makes one "loved". However, the move from being "unloved" to "loved" involves no noticeable quantitative (material) change. This should not be considered a disconfirming example of a [quality → quality] transformation, however. I propose that quality be defined as "something internal to an object for which it would no longer exist *as what it is* without it".[40]

The second concern is related to and interconnected with the first. Some may object to Engels' conception of change on the grounds that it does not seem to apply well to certain classes of objects; objects generated by culturally specific ontologies are particularly relevant here. Suppose that the domain includes objects recognized by religious groups as having theological and existential import, such as a cross. A significant qualitative change (which seems to meet my first criterion) occurs when a bronze cross is bent in such a way as to remove such significance, but this ought not be considered a change in quality without change in quantity. I propose a general assent criterion for a rational observer to accept an object as legitimate.

Putting these two together, we end up with my modified version of the "law":

Modified Transformation of Quantity into Quality*: Things, as would be assented to by a non-biased rational observer, do not become something else nor alter their internal (non-*

[40] There are similarities here between this and a non-modal conception of essence, and this is not unintentional. The modal claims that can be drawn from this formulation, however, are much weaker than anything anti-metaphysical dialecticians ought to object to.

relational) properties without a corresponding quantitative change. Nor do novel qualities *in general* come into existence without said change.

This is explicitly an anti-reductionist approach to both epistemology and ontology (they are not separated for the dialectical materialist), for each time a new quality appears, it is an instance of emergence. When a qualitative change occurs due to a quantitative change, that qualitative level of reality cannot necessarily be explained in terms of the quantities composing it — the whole is greater than the sum of its parts.

There are several examples one could draw from in the scientific literature, both natural and social, which demonstrate the general utility of this mode of thought, though I will briefly focus on two. From the natural sciences, Dr. Vera M. Kolb has proposed a new way of looking at the origin of life from abiotic matter via Engels' notion of the transformation of quality into quantity. Often the debate surrounding the origins of life is mired by definitions of life which conform too closely to our own chemical composition. According to Dr. Kolb, a suitable formula for extraterrestrial life may be aided using one of Engels' laws. She proposes that we define life as "a new quality brought upon an organic chemical system by a dialectic change resulting from an increase in the quantity of complexity of the system. This new quality is characterized by the ability of temporal self-maintenance and self-preservation."[41] This definition would still be accommodated by the second stipulation of my modified "law".

As well, there have been efforts to apply dialectical materialist thinking in the social sciences, particularly anthropology. Robert Carneiro has argued for introducing the principle in terms of population growth and the emergence of structural changes in the forms of societies. He

[41] Vera M. Kolb, "On the Applicability of The Principle of The Quantity-To-Quality Transition to Chemical Evolution That Led to Life", *International Journal of Astrobiology* 4, no. 3-4 (2005): 227, doi:10.1017/s1473550405002818.

writes that "An increase in the sheer number of persons in a society, whether we're dealing with a village or a state, can, when that increase exceeds a certain threshold, give rise to new forms of organization."[42] Not only is population itself important, but Carneiro points to studies which have demonstrated a strong correlation between the emergence of states and increasing population densities, particularly the work of Robert F. Stevenson in his book *Population and Political Systems in Tropical Africa*.[43]

So far, however, there has been little discussion of the social as such in relation to DM, as it has been intentionally put off for this moment. The transformation of quality into quantity and its modified version are meant to apply as a method of analysis to every level of reality in a progressively complex chain from subatomic particles to complex social systems, including economic systems and systems of knowledge production. When a qualitative leap is made, the gap between levels of explanation for one qualitative domain and another cannot be bridged through reduction. (See figure 2.2).

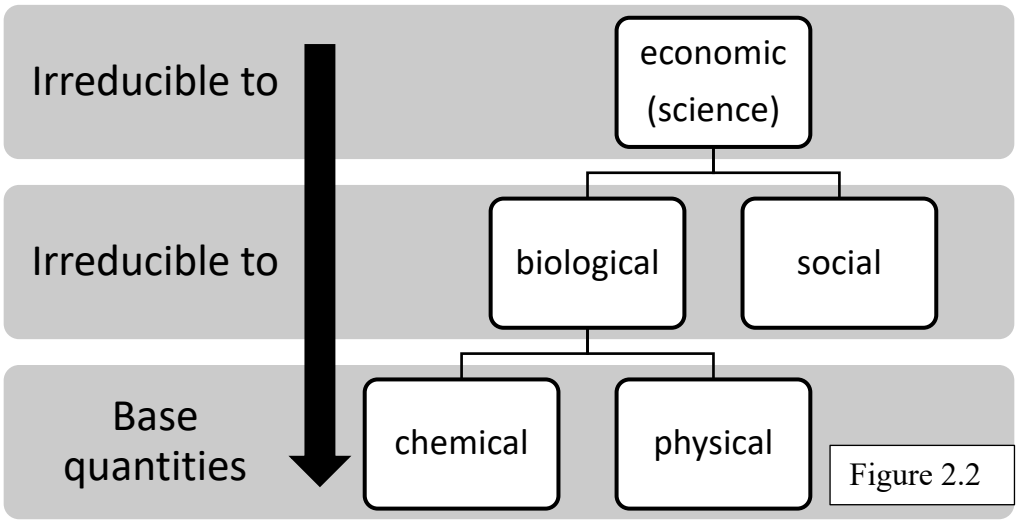


Figure 2.2

[42] R. L. Carneiro, "The Transition from Quantity to Quality: A Neglected Causal Mechanism in Accounting for Social Evolution", *Proceedings of The National Academy of Sciences* 97, no. 23 (2000): 12927, doi:10.1073/pnas.240462397.
[43] Ibid., 12930.

My goal with DM as it relates to STS is to make good on the promise of Latour, to reassemble the social within science studies. The way forward, however, cannot be to deflate away the social as ANT does; it is to reassert the irreducible necessity of the social as a higher order function of the material, acting in a dynamic (dialectical) relationship with it.

2.2 The Nature of Critique

The prime importance, however, of the dialectical method is not reducible to any of its laws, nor is it immediately clearly derivable from them. This is the importance of the notion of critique, which runs through the foundation of the entire project that both Marx and Engels are engaged in from the point of view of philosophy, science, and political economy.[44] Indeed, in Marx's letter to Arnold Ruge in 1843, he described his, as well as his comrades', program as "the *ruthless criticism of the existing order".* [45] And while Marx would take up this critique specifically within the realm of political economy and history, Engels was responsible for the critique of nature, in which the full possibility of the critique of the "existing order" lies.

Critique, for the DM theorist, is nothing other than the extension of the Kantian project to into the material realm. Unlike Kant, however, for whom critique involves the critique of *experience* in the form of the pure concepts of the understanding, DM extends critique to the whole of reality, not just reality as immediately circumscribed in "experience".[46] Of this, Engels is extraordinarily clear:

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[44] Despite some attempts to separate the projects of these thinkers, it is my opinion that their projects remained, essentially, united — though they often focused on different specific issues. In this case, the Engelsian project of applying dialectical thought to all of reality is the ontological expression of Marx's desire to provide a critique of the existing order insofar as dialectical materialism grounds a thorough critique of political economy.

[45] Karl Marx, "Letters: Letter from Marx to Arnold Ruge", *Marxists.Org*, 1844, https://www.marxists.org/archive/marx/works/1843/letters/43_09-alt.htm.

[46] Whereas Hegel merely historicizes the *ideal* concepts of understanding of Kant, Engels locates the possibility for a general critique of everything currently existing in the material conditions of society, in nature itself.

> To know what can be discovered by our thinking, it is no use, a hundred years after Kant, to try and find out the range of thought from the critique of reason or the investigation of the instrument of knowing…What can be discovered by our thought is more evident from what it has already discovered and is every day still discovering. And that is already enough both as regards quantity and quality. On the other hand, the investigation of the *forms* of thought, the thought determinations, is very profitable and necessary, and since Aristotle this has been systematically undertaken only by Hegel.[47]

What Engels is alluding to here is a domain outside of critical discourse. In his attempt to tame the overexuberance of the faculty of pure thought, Kant too narrowly circumscribed the domain of rationality, thereby allowing for spontaneous and even mystical[48] explanations to arise where reason must remain silent — in the domain of the "thing-in-itself". It is just this notion that a thoroughly critical materialism, however, rejects.

> The last form of this outlook is the "thing-in-itself". In the first place, 'this assertion that we cannot know the thing-in-itself (Hegel, *Enzyklopadie,* paragraph 44) passes out of the realm of science into that of fantasy. Secondly, it does not add a word to our scientific knowledge, for if we cannot occupy ourselves with things, they do not exist for us. And, thirdly, it is a mere phrase and is never applied… But scientists take care not to apply the phrase about the thing-in-itself in natural science, they permit themselves this only in passing into philosophy. This is the best proof how little seriously they take it and what little value it has itself. If they did take it seriously, what would be the good of investigating anything?[49]

Matter is not a thing-in-itself or a transcendent substance but an abstraction from its forms of motion, which are given to us in experience through reason. Labour is what plays the role of the device that mediates between that which seemingly transcends us and the historical and cultural worlds (worlds of thought). The full practical implications of the thoroughgoing nature of critique implied by Engels' position will be used in the following chapter in contrast to what I will term the "concrete" and "speculative" materialism of the ANT theorists in relation to a case study at the crossroads of the STS, ANT, and disability studies literature.

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[47] Engels, *Dialectics of Nature*, 243-244.
[48] I'm thinking here specifically of his recourse to demonstrating the existence of God and the afterlife by using practical reason instead of theoretical reason in the *Critique of Practical Reason*.
[49] Engels, *Dialectics of Nature*, 244-245.

Chapter 3: Applying Dialectical Materialism to Social Constructivism

3.1 STS and Social Constructivism

3.1.1 Introducing Social Construction

In this chapter, I will be applying DM to a case study in the literature on disability studies, which often finds itself within the broader literature in STS dealing with social constructivism. The nature of social construction within the field has itself changed drastically since its introduction into the social scientific lexicon by Berger and Luckmann in the 1960s in their seminal work *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. For them, social construction is directly tied to the project of an empirical sociology of knowledge; one which is concerned less with epistemological or theoretical questions concerning methodology and more with what sorts of knowledge layfolk *actually take to constitute reality*. The project of the sociology of knowledge, then, just is the empirical articulation of the circumstances under which different knowledge is taken by different peoples to constitute genuine claims about reality. They write that "a 'sociology of knowledge' will have to deal not only with the empirical variety of 'knowledge' in human societies but also with the processes by which *any* body of 'knowledge' comes to be socially established *as* 'reality'."[50]

This is not to say that Berger and Luckmann eschew philosophical thinking to place sociology firmly within "the sciences", in an unqualified sense of the term. Far from it, they

[50] Peter L Berger and Thomas Luckmann, *The Social Construction of Reality* (repr., London: Penguin Books, 1991), 15.

embrace the relationship between philosophy, sociology, and the philosophy of science, which they see as vital to any adequate account of the sociology of knowledge and social construction — often borrowing work from philosophy and political economy as often as sociology and psychology. In particular, the work of Marx has a particularly important influence on their own conception of the construction of the social organism as a *dialectical* process taking place between the individual (as subjectivity) and nature (as objectivity), though society also manifests itself as a type of intermediary subject/object in this whole relation. By this, they mean that the individual is themself a biological objectivity "separate" from society; humans are incapable of producing bioelectricity no matter how beneficial this may be from a public policy standpoint as it related to climate change, though society also shapes one's biological (objective) potential. They use the example of life expectancy to illustrate this aspect of the dialectic. Though life is certainly determined by objective biological factors, societal factors influence the possible range of expression of these factors; those who are lower class individuals tend to have shorter average lifespans.[51]

As well, the dialectical process[52] is conceived of as applied to the relationship between knowledge production and knowledge as a factor of social production.

> The important principle for our general considerations is that the relationship between knowledge and its social base is a dialectical one, that is, knowledge is a social product and knowledge is a factor in social change.[53]

This dialectical movement is one in which knowledge is conceived of both as a determined product of social practice (socially constructed) as well as a pseudo-autonomous agent which acts back on the social forces which gave rise to it. Though sociological facts are constructed,

[51] Ibid., 202.
[52] One could be forgiven for thinking that the authors had written a book on dialectics by accident with how frequently the concept is employed.
[53] Ibid., 104.

their content itself often returns to construct reality. For example, facts about the specific sorts of social behaviours determined by a given social structure may have a causal role in determining public policy with regards to these behaviours. In doing so, social "reality" is constructed by the application of the product of that same reality. This forms a dialectical loop between knowledge and social change.[54]

Though there are several more intricacies to their full position[55], this twofold dialectical conception of the construction of reality is the backbone of their position. It is, at this point, imperative that I differentiate Berger and Luckmann's position from that of DM and my own. By borrowing so heavily from the Marxist tradition, one may find themselves, after having finished reading the previous chapter on natural dialectics, unclear as to the distinction between dialectical materialism and the humanistic sociology of knowledge on display here. At no point is the relationship with DM in their work more apparent than in their summary of the total process by which knowledge comes to be constructed by as well as construct humans and reality.

> Man is biologically predestined to construct and to inhabit a world with others. This world becomes for him the dominant and definite reality. Its limits are set by nature, but, once constructed, this world acts back upon nature. In the dialectic between nature and the socially constructed world the human organism itself is transformed. In this same dialectic man produces reality and thereby produces himself.[56]

Though there are striking similarities between this and Engel's notion of DM, it would be a mistake to identify one with the other. In fact, Berger and Luckmann appear to take up the ideological line of "Western Marxism", for which the dialectics of nature are anathema. John Bellamy Foster gives an excellent overview of this position.

> For 'Western Marxism' — a term introduced by Maurice Merleau-Ponty in 1955 in his *Adventures of the Dialectic* (1973) to describe the philosophical tendency stemming

[54] Ibid., 104.
[55] They also draw heavily on the work of George Mead, Max Weber, and Émile Durkheim.
[56] Ibid., 204.

> from Georg Lukács' *History and Class Consciousness* (1971; originally published in 1923) — no concept internal to Marxism has been more antithetical to the genuine development of historical materialism than the 'dialectics of nature'. Commonly attributed to Engels rather than Marx, this concept is often seen as the *differentia specifica* that beginning in the 1920s separated the official Marxism of the Soviet Union from Western Marxism.[57]

According to this line of thought, Engels participated in a gross abuse of the inherently sociological, anthropological, and humanistic interpretation of dialectics which Marx meant to articulate with historical materialism by applying the dialectical method to nature itself.

Evidence of Berger and Luckmann's adherence to this sort of interpretation of Marx comes in several forms. Firstly, the authors do not mention Engels' contribution to materialist dialectics whatsoever, despite using the concept liberally in their own theory. Second, they make heavy use of the concept of "reification"[58] in their explanation of dialectics as it relates to the solidification of different knowledge under the division of labour.[59] Finally, the authors rather explicitly deny that their position on social construction (and dialectics by extension) implies idealism or *materialism of any sort*.

> Consequently, social change must always be understood as standing in a dialectical relationship to the 'history of ideas'. Both 'idealistic' and 'materialistic' understandings of the relationship overlook this dialectic, and thus distort history.[60]

The very notion of a "history of ideas" is methodologically incompatible with DM, for which history applies to nature as a single unfolding material process, in which ideas have an insignificant ontological status. The authors take it one step further, stating that "all symbolic

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[57] John Bellamy Foster, "The Dialectics of Nature and Marxist Ecology", *Dialectics for The New Century*, 2008, 50-82, doi:10.1057/9780230583818_4.

[58] Reification is generally associated with the work of György Lukács, who is often taken as a paradigmatic thinker of the "western" or "humanist" Marxist traditions. These are often at odds with the work of Engels and with natural dialectics in general.

[59] Berger and Luckmann, *Social Construction of Reality*, 106-109.

[60] Ibid., 146.

universes and all legitimations are human products; their existence has its base in the lives of concrete individuals, and has no empirical status apart from these lives".[61] In other words, the ontological question is a non-starter from the point of view of the sociology of knowledge and social construction. Giving an empirical account of the conditions for the construction, reification, and continued existence of knowledge (in all its various forms) is enough for social theory. Any theory of knowledge, social construction, and reality which does not address the ontological relationship between Being and thought is no friend of DM, nor other more ontologically (less sociologically) rooted approaches to the social construction of knowledge and reality within science studies.

Since its inception, this humanistic sociological approach has been modified and preserved within STS as it relates to the social construction of technology as well as criticized by various sorts of metaphysical theories seeking to eliminate the notion of the "social" as a given quality (ANT). To demonstrate the superiority of DM as a means of understanding the social construction of knowledge, society, and reality, I will draw on literature within STS and disability studies concerning the construction of disability. Approaches covered will be compared to a dialectical materialist account of the construction of the phenomena. Before jumping into the case study section, these anti-social and highly metaphysical systems will be explained in their relation to more traditional conceptions of social construction.

Berger and Luckmann were not STS theorists themselves. So, the importation of the constructivist aspects of their work into mainstream STS discourse needs a bit of historiographical explanation. According to Michael Lynch, there was a decisive move from the sociological conception of construction forwarded by Berger and Luckmann to a more open-

[61] Ibid., 146.

ended conception which sought "the deconstruction of the distinction between nature and society—the very distinction that originally circumscribed the domain of social construction."[62] Recall that for Berger and Luckmann, the dialectical interaction between nature and society presumed, at bare minimum, a conceptual distinction between the two domains. We both shape and are shaped by nature, and our knowledge of nature is shaped by us as it shapes us in turn. It is the contention of Lynch that such a view need not commit one to any sort of radical relativism regarding the contents of scientific knowledge, even if it may be appropriate to draw similar deconstructive conclusions about other constructed entities or propositions.[63] By collapsing the metaphysical distinction between society and nature, while still holding onto a constructivist account of knowledge and reality, these ontologies opened the door for the "thoroughgoing enculturation and politicization of nature."[64] Lynch has it out particularly for the work of Bruno Latour and his Actor-Network Theory (ANT), which he sees as the paradigmatic example of this sort of "pan-constructivist" ontology in STS. However, Lynch does a poor job of articulating Latour's position on his own theory, which leads him to the conclusion that his position (an inherently conservative one) is in direct conflict with ANT as well as any approach in STS which allows for the "intrusion" of construction into the domain of science — nature. In reality, Latour's ANT takes him to quite a similar conservative place with regards to the "politicization" of reality, as well as the content of the sciences. Whatever radical content was there to be found in the original conception of social construction by Berger and Luckmann is absent from ANT.

[62] Lynch, "Social Constructivism in Science and Technology Studies", 107.
[63] It isn't clear that their position is free from such concerns any more than the more "radical" constructivist theories which he goes on to deride. Berger and Luckmann, at several points in their text, lean quite heavily on the notion that questions of ontology should be left to the philosophers, not to sociologists of knowledge. Nor do they think that these questions are the particularly interesting ones.
[64] Ibid., 9

By reassembling the social, Latour loses sight of the utility of social theory — changing things which need not be as they are.

3.1.2 Actor Network Theory: Reassembling or Eliminating the Social?

Latour is not singularly responsible for the development of ANT, though his work is most often associated with its development. He has written several books and articles which touch on themes pertinent to the theory, and it is in his 2005 work *Reassembling the Social* where he lays out a systematic explanation of his views on both social constructionism as well as ANT. The grouping of the two notions makes sense insofar as ANT grew out of a certain frustration that Latour[65] had with the social constructivism that had taken root in STS hitherto. Latour takes issue with what he calls the "sociology of the social"[66] as his characterization of all approaches to sociology of science and knowledge predominating prior to ANT. He labels these as such due to his concern with the presumption of the domain of the social as something solid, which can explain the construction of anything. It is "the social", according to Latour, which needs to be put into question. Rather than start with the social as an explanatory force, sociality is to be explained by tracing the "re-association and reassembling"[67] of the objects in the world. These associations and "assemblages" however, are not merely relations between those objects traditionally understood to possess the capacity for sociality. The social, as Lynch pointed out, is expanded to include all objects, even those of nature. On this conception, the social is not a type of thing nor a domain; it is a "type of connection".[68] And this connection need not be between

[65] As well as Michel Callon, Madelaine Akrich, and John Law.
[66] Bruno Latour, *Reassembling the Social* (repr., Oxford; New York: Oxford University Press, 2005), 9.
[67] Ibid., 7.
[68] Ibid., 5.

objects typically grouped together as social. Thus, ANT falls into the camp of "flat ontologies". A flat ontology is any ontology that treats all objects as having equal metaphysical status, unlike ontologies which seek to undermine or overmine objects by explaining them away in terms of something higher up in the hierarchy of reality.[69] Individual actors as they relate to one another in assemblages are ontologically fundamental for ANT, and these actors are all on the same ontological playing field as one another. For example, an assemblage may consist of values, natural products, human actors, and artificial products. None of these are reducible to any another, nor are values less "real" than nature due to their inherent sociological status. All actors have the capability of being really social or non-social insofar as they enter into identifiable (meaningful) assemblages. This is the notion of sociality that forms the basis of ANT, despite its seemingly counterintuitive premises.

> At first, this definition seems absurd since it risks diluting sociology to mean any type of aggregate from chemical bonds to legal ties, from atomic forces to corporate bodies, from physiological to political assemblies. But this is precisely the point that this alternative branch of social theory wishes to make as all those heterogeneous elements might be assembled anew in some given state of affairs.[70]

What does this all mean for "social" constructivism according to Latour, and other ANT theorists? Seeing as the social has been eliminated in the traditional sense, Latour reconceives of social constructivism by removing the qualifier. Gone is "social constructionism", and in its place we now find Latour's "constructivism."[71] Despite his extension of constructivism (through his inflation of the possible domain of the social) to encompass the construction of diverse assemblages whatsoever (these include knowledge of reality as well as the assemblages

[69] Here the words "overmine" and "undermine" refer specifically to the thought and work of notorious object-oriented ontologist (OOO) theorist, Graham Harman.
[70] Ibid., 5.
[71] Bruno Latour, "The Promises of Constructivism", in *Chasing Technology: Matrix of Materiality* (Indiana University Press).

constituting that reality), Latour takes a conservative position on the role of the sociologist of knowledge and science when it comes to constructivism and the tracing of assemblages within ANT. Far from the sort of radical deconstructive project that Lynch mistakes ANT for, Latour's constructivism is committed to the renunciation of deconstructive projects, which he sees as antithetical to the project of tracing and stabilizing constructed assemblages. He goes as far as to compare deconstructivists to what he terms "fundamentalists", those for whom reality is less real if it has been touched by human labour (constructed).

> The reason is that critical minds share at least one thing with fundamentalists, their harsh enemies: they too believe that if something is built, that alone is a proof that it is so weak that it should be deconstructed until one reaches the ultimate ideal they all share, namely what has not been built at all by any human hand.[72]

As opposed to both the fundamentalists as well as the deconstructivists, Latour sees the project of his constructivism[73] as one that reinforces those constructed assemblages where and when it can track them. The consequence of discovering construction, contra the fundamentalists as well as the deconstructivists, is not to ascertain knowledge of the weakness of the constructed reality, but to reinforce its strength where possible. It is a truism that all knowledge is a construction; all knowledge involves labour. It is the outcome of a productive human process. For Latour, ANT and constructivism should shift the focus of inquiry away from questions concerning whether something is constructed to questions concerning the nature of the construction. It is not a question of whether some scientific fact is or is not constructed but, rather, a question of whether it is well constructed, enough to be considered objective and "real".[74] Unlike for the fundamentalists and deconstructivists, Latour has no problem bringing together the notions of

[72] Ibid., 41.
[73] He personally prefers the term compositionism to describe his own counter position, though he ultimately sticks with constructivism due to its prevalence in the literature.
[74] Ibid., 34.

labour and autonomy. Just as a building is more autonomous and "real" by virtue of the better or worse labour process that brought it into existence, so too are scientific facts more autonomous (necessary) and "real" in virtue of labour. Latour frames this in terms of the sort of question one might receive in a Continental Theory 101 course. For example, "'Is constructed reality constructed or real?' Answer: 'Both'."[75]

In summary, Latour provides us with three rough criteria with which we can gauge whether a thinker ought to be included in the ANT tradition:

1) Non-humans must be granted agency in the relations which they enter. (strong non-anthropocentrism).
2) The direction of sociological explanation: An ANT theorist will begin with individuals and end with the social. Non-ANT theorists begin with and end with sociality.
3) The focus of any constructivist analysis: If the thinker's emphasis is on social construction to disrupt and deconstruct that which is found to be socially constructed, then they are not an ANT theorist. On the other hand, if their aim is to reassemble and reinforce that which is constructed, they may well fall into the ANT camp.[76]

Particularly troubling within the explanation of ANT just given is the inherently conservative project which gets bandied about as a sop to the ravenous "fundamentalists". One need not be a radical deconstructivist to identify the potentially problematic ramifications of this turn in STS and studies in social construction. Nor is the solution to return to the sorts of purely sociological explanations of construction that allowed for the flourishing of deconstructive approaches in the first place. Dialectical materialism can bridge the gap between Latour's fundamentalists and deconstructivists (between labour and autonomy) without obliterating the political utility of the

[75] Ibid., 35.
[76] Latour, *Reassembling the Social,* 10.

theory. With this explanation out of the way, it is time to move onto some specific examples from the literature utilizing both sorts of approaches in comparison to that of dialectical materialism.

3.2 The Social Construction of Disability

3.2.1 The Meaning of Construction

The specific example I want to address is the social construction of the notion of "disability". For the purposes of this thesis, the anti-constructivist "bio-medical"[77] model will not be considered as a live option; the emphasis is on constructivist approaches. Though there is no one dominant approach in the literature, there is an increasing trend in disability studies, outside of STS, to explain disability in term of the social processes and institutions which give rise to it — which construct it. This notion is commonly unified in the literature as the "social model" of disability. And though it is not often presented as a constructivist theory within the sociology of science, knowledge, or technology, it has clear connections with the themes raised by constructivist theorists (both social and of the ANT variety) within STS. Indeed, insofar as disability is understood to be constructed in relation to political institutions, economics, science, and technology, STS provides a uniquely comprehensive framework to analyze these relations. Most of the work in STS so far, however, has taken the flat ontological route, specifically being associated with ANT. It is my supposition that, while STS ought to be home for disability studies, it is DM which makes the best sense of its theoretical and practical concerns as they relate to the construction of disability.

[77] This model is associated most closely with the work of Christopher Boorse and his biostatistical model of health (BST). To put it succinctly, bio-medicalists about disability locate the root of disability in the abnormal function of the human body. Disabilities are pathological realities, not the result of social circumstances or institutional constructions.

3.2.2 From Bio-Med to Critical Disability Studies

As STS and ANT scholar Vasilis Galis notes, the general historical arcs of both disability studies and STS have been remarkably similar.

> Disability studies and STS have followed somewhat parallel paths in the history of ideas. From a positivist approach to their research objects to a strong social constructivism, both disciplines have moved to postmodern conceptualizations of science, technology and disability.[78]

The first movement, as noted, will be of little concern to this thesis. Neither STS nor disability studies are much concerned with approaches that do not consider that which may broadly be construed as "social". For the purposes of this section of the thesis, however, Galis' overall historical topography will be presumed, both for STS and for disability studies. As has been discussed in prior chapters, within science studies, there has been a shift from positivistic approaches to those focusing on the importance of sociological explanation, even when describing content. This same shift was mirrored in disability studies with the shift from bio-medical accounts of disability, focused on the notion of health as normality, to social constructivist approaches — specifically a general framework often labelled "the social model". This social model of disability is most often associated with the work of Mike Oliver, who began the project of a dedicated disability studies as separate from the medical sciences with his questioning of the distinction between impairment and disability by the Union of the Physically Impaired Against Segregation in the mid 1970s.[79]

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[78] Vasilis Galis, "Enacting Disability: How Can Science and Technology Studies Inform Disability Studies?", *Disability & Society* 26, no. 7 (2011): 825, doi:10.1080/09687599.2011.618737.

[79] Mike Oliver, "The Individual and Social Models of Disability", (Presentation, repr., Joint Workshop of the Living Options Group and the Research Unit of the Royal College of Physicians, 1990).

It is the second movement that is of greater interest, particularly as it concerns the general compatibility of disability studies with STS more broadly speaking. This second movement, from social constructivism to "postmodernism", is just the move from the social constructivism of Berger and Luckmann to the approach described by Latour and other ANT theorists. Though Galis, perhaps, overstates the significance within STS of this shift, something like it has no doubt occurred. What is less clear, however, is the nature of the shift in disability studies towards what Galis terms "postmodernism". While it is true that there has been a flourishing of alternatives to the social model in the literature, not all of these have been aligned with ANT, nor other flat ontologies within STS. The most easily identifiable split for the academic study of disability has been between "disability studies" (DS) and "critical disability studies" (CDS)[80]. There are several different characterizations of what it is, exactly, that divides these two approaches, though Dr. Geoffrey Reaume[81] provides a clear definition of what generally unites CDS scholars.

> Critical disability studies view disability as both a lived reality in which the experiences of people with disabilities are central to interpreting their place in the world, and as a social and political definition based on societal power relations.[82]

The emphasis which CDS places on lived aspects of disability (or impairment) as opposed to social aspects certainly places it at odds with the social model of disability within DS but does not align it with ANT or other new materialist ontologies in science studies. CDS in general is explicitly not concerned with ontology or a specific conception of materiality. Where these new ontological approaches in STS (postmodern approaches) do align with CDS is with the common

[80] Galis himself is most often associated with CDS rather DS.
[81] Dr. Reaume works in the field of CDS at York University in Ontario, Canada.
[82] Geoffrey Reaume, "Understanding Critical Disability Studies", *Canadian Medical Association Journal* 186, no. 16 (2014): 1248, doi:10.1503/cmaj.141236.

rejection of "Marxist" approaches to ontology or methodology in the social sciences in favour of pluralism.

In this rather narrow and vacuous sense, CDS is in line with the "postmodern" approaches to social construction which ANT and other new materialist ontologies within STS have taken up, however, this does not point to their general compatibility. As Vehmas and Watson note, CDS tends to draw on the work of thinkers in the poststructuralist tradition including Derrida, Butler, and Foucault.[83] The deconstructive nature of these thinkers' positions, though, stands in stark contrast to the sort of goals for ANT (and constructivist ontology in general) which Latour describes. The marriage between the social study of science, technology, and society with current discourse in DS and CDS is not, then, naturally served by appeals to ANT or new materialism within STS. From the definitions given above, however, neither is DM anymore naturally suited to addressing the sorts of questions that some CDS theorists are interested in, specifically those that relate to experience. With that being said, CDS is neither exhausted by its appeals to the experiential dimension of disability nor is it a specific appeal to an ontology that marks a stark break with previous ways of conceptualizing society. If anything, CDS is a method which is open to application in conjunction with various ontologies. Take, for example, the following quote from authors working in CDS aiming to characterize the "field".

> Critical Disability Studies has to be an interdisciplinary field that is fit for purpose today (and going forward into the future). And theories generated should also be fit for purpose. But this should not demean, simplify or ignore what has gone on before. One would hope that critical studies of disability retain ontological memories and honour epistemological

[83] Simo Vehmas and Nick Watson, "Moral Wrongs, Disadvantages, And Disability: A Critique of Critical Disability Studies", *Disability & Society* 29, no. 4 (2013): 639, doi:10.1080/09687599.2013.831751.

> origins of earlier theoretical contributions that drew attention to disability's political, cultural and sociological character.[84]

CDS should be viewed, then, as an extension and refinement of the social model or approach to disability rather than a complete rejection of it. Galis' comparison between the move in science studies and the move in disability studies does not quite hold, one being ontological/metaphysical and the other a pluralism about both method and questions. The connections between DS/CDS and STS, however, are no doubt clear. And it is DM, rather than ANT, which can capture most sufficiently what is important about the relationship between technology, politics, economics (class), and the construction of disability — of becoming truly critical. This is only possible, however, because of the specific abstract, dialectical materialist conception of reality that it posits. A thoroughgoingly critical disability studies, then, cannot wash its hands of ontology or the notion of the social in the concrete and abstract sense. The implications of this will be explored with respect to the construction of disability.

3.2.3 ANT and the Construction of Disability

The most prominent supporter in the literature of an ANT approach to disability specifically is Vasilis Galis[85], for whom ANT acts as a tool to engage more meaningfully with the intersections between technology, science, and politics.[86] It is also, however, an ontological approach, which Galis notes.[87] And ontologies are often poor tools; they are wont to give rise to

[84] Dan Goodley et al., "Provocations for Critical Disability Studies", *Disability & Society* 34, no. 6 (2019): 976, doi:10.1080/09687599.2019.1566889.

[85] Myriam Winance, as well, has used ANT in her analyses of disability within STS.
[86] Reaume, "Understanding critical disability studies", 1248.
[87] Galis, "Enacting Disability", 825.

two new problems for every one they solve. This is the case with ANT, for which a myriad of difficult ethical, political, and metaphysical problems are created when employed in conjunction with disability studies. These will be addressed as they arise.

According to Galis, this new approach to disability studies is characterized by an ordering of disability as "a simultaneous biological, sociomaterial and semiotic effect produced by heterogeneous objects".[88] Recall that, for Latour, the distinction between the social and the non-social is collapsed, such that all explanations of the relationships between assemblages of objects (whatever their ontological status) count as "social" explanations. In the case of ANT as applied to disability, all the relevant actors in the social network which comprises the disabled person's reality must be examined, without theoretical priority being given to any one actant over another on *a priori* methodological grounds. The impaired body itself, political actors, the built and natural environments, the state, and the meanings associated with "disability" all work together, through their own agencies, to mutually construct "disability". What this position, ultimately, ontologically leads to is the view that "the study of disability should depart from the assumption that the impaired body is imminent in reality, and *vice versa*".[89] This unique approach amounts to is what is often called, "material semiotics".[90] This means that the ontological foundation of objects (in this case disability) is to be found in a combination of the sorts of things traditionally relegated exclusively to the dualistic domains of either meaning or matter. What is material is itself constructed from a more fundamental order of which there is no distinction between entities based on their typical association with culture or nature. A better characterization of this

[88] Ibid., 829.
[89] Ibid., 830.
[90] Ibid.

view, though, is what I will later refer to as "ontological materialism"[91] in opposition to both metaphysical and dialectical materialism.

With this general explanation of ANT as applied to disability studies within STS in mind, I will now turn to a specific case study in STS scholarship concerning the construction of disability from the point of view of ANT.

3.2.4 The Case of Mrs. Atti

Myriam Winance, in her defense of an ANT conception of disability, uses the example of Mrs. Atti to demonstrate the strengths of a relational ontology as it concerns the construction of disability *as an effect* between semiotic, political, economic, and bodily relations. In this particular case, Mrs. Atti is described as a thirty-nine-year-old woman with the physical impairment of spinal muscular atrophy, which has "made her body floppy and is gradually deforming it".[92] As a result of her impairment, she can now only "move her right-hand thumb on a 5 cm^2 surface and move her body by slightly rocking her torso."[93] Because of this neurodegenerative impairment, Mrs. Atti requires a specialized wheelchair to interface with the world, through which the total range of possible autonomous action available to her is greatly enhanced. Winance notes that, far from being trapped in a totally helpless state, Mrs. Atti lives

[91] I will variously characterize the ANT conception of materiality as: ontological, concrete, and speculative. In the opening chapter I remarked on what I mean by drawing the general distinction between speculative materialism and critical materialism, which has to do with a general stance on transcendental philosophy whatsoever and is not the designation of a specific ontology per say. Theoretically speaking, many concepts of materialism might fall under what I have labelled either speculative or critical materialisms revolving around their approach to this question. The need to characterize ANT not just as a concrete and speculative materialism but also as an *ontological* materialism arises from the fact that it views the "material" and the "social" as co-constructed designations for a more fundamental ontological order. That is, general ontological inquiry comes before any pronouncements about materiality or sociality rather than before.
[92] Myriam Winance, "Trying Out the Wheelchair", *Science, Technology, & Human Values* 31, no. 1 (2006): 52, doi:10.1177/0162243905280023.
[93] Ibid., 52-53.

an active and full life: she is a teacher, raises her child, and manages to travel.[94] This raises the question of the nature of action for Mrs. Atti. When she makes use of the various technical instruments adapted to her impaired body to travel or look after her child, to *whom* or to *what* ought we to attribute this action?[95] For ANT theorists, like Winance, the answer is never singular; agency is a diffuse phenomenon. Whenever and wherever Mrs. Atti engages in purposeful action "her action is distributed between herself, her computer, and her professional auxiliary."[96] The question of action, then, is intimately entwined with that of the very notion of ability/disability for ANT.

To say that someone is "disabled" is to make a claim about the nature of the range of possible actions which the network of relations in which they find themselves either makes possible or limits. Disability is the *effect* of a certain type of assembly of actors, though this implies no normativity. That is, there is nothing about the tracing of the relation constitutive of the effect of disability which, *prima facie*, casts the disabled in a negative light. In this way, the specific network approach taken by ANT squares well with the social model of disability to which it reacts. Both are decidedly "constructivist" about disability and make no claims to the superiority of "normality".[97] Where the ANT approach differs from the approach taken by traditional social model theorists inspired by early work in constructivist theory lies in the notion of materiality, which is what is at stake in the move both within STS as well as DS/CDS to "postmodernism". Coincidentally, it is the notion of materiality which Winance concerns herself with during her initial analysis of the enabling relation between Mrs. Atti and her wheelchair. It

[94] Ibid., 53.
[95] Ibid.
[96] Ibid.
[97] Both clash with medical/biological accounts of disability for which disability cannot be understood apart from a normative notion of health or average ability.

is clear from her discussion that what ANT means by "materiality" is not the same as either social model theorists working in DS nor what Engels conceives of matter as in his, and Marx's, dialectical account.

Winance begins her analysis of materiality and disability from the point of view of ANT with reference to the process by which Mrs. Atti goes about acquiring a new wheelchair, one which will not cause her the horrendous back pain at the end of each day that her previous mobility aid was responsible for.[98] This selection process is a back and forth between the new wheelchair, which must be consistently adjusted to conform to the specific contingencies of Mrs. Atti's body and dispositions, is referred to by Winance as one of "material adjustment."[99] In this process of material adjustment, "the links between Mrs. Atti and her wheelchair are at stake."[100] This is to say that the process of adjustment is a potentially traumatic one concerning Mrs. Atti's identity. Even though the current set of relations which support her are causing her discomfort and limiting her space of action, they are still constitutive of her material and personal composition. There is always the frightening possibility that all the king's care officers and all the king's ergotherapists will be unable to put Mrs. Atti back together again. This point by Winance is wholly in line with ANT's general rejection of social construction as a means of critique. Recall Latour's hostility to the deconstructive project he sees as inherent in traditional approaches to social constructivism. The point of tracing the relations which form the disabled body/identity of Mrs. Atti is not to highlight the weakness in them to overcome them through discourse. Rather, to say that Mrs. Atti's disabled state is constructed is to make a claim about

[98] Ibid., 55.
[99] Ibid.
[100] Ibid., 56.

the strength of the relations holding her together. The "reality" of different actors in the network is presumed and reinforced by the strength with which they can form stable assemblages.

As Mrs. Atti's new wheelchair is constructed and adjusted with the help of the relevant technicians, both the wheelchair and Mrs. Atti are transformed. The process is one of *negotiation*; it is a give and take which, if done properly, results in a "body-in-a-wheelchair"[101] as an effect. It is this "body-in-a-wheelchair" which can act to a greater or lesser extent and is co-extensive with Mrs. Atti's identity as an autonomous force. The force of the ties constitutive of the give and take relationship between Mrs. Atti and her wheelchair is what Winance, and ANT theorists in general, mean when they speak of "materiality".

> Materiality refers neither to the body of the person nor to the wheelchair but to the force or the resistance of their conjunction. It refers at once to the body and the wheelchair, which are set up through "sound" ties. Little by little, through the confrontation involved in testing and subsequently in use, the ties binding Mrs. Atti to her wheelchair are drawn.[102]

This relational conception of materiality, however, is not sufficient for the sorts of work which Winance and other ANT scholars expect of it within STS, DS, or CDS. What this account, ultimately, amounts to is an abandonment of an understanding of materiality as a relationship between thought and being. That is, the relational conception of materiality proposed by ANT requires a wholesale rejection of the critical project typified in the work of Immanuel Kant and further elaborated by Hegel, Marx, and other modern contemporaries. ANT theorists ask us to abandon investigation into the conditions of thought in favour of a speculative ontological materialism in which any forceful combination of actants has just as much a claim to materiality, and reality, as any other. Mrs. Atti herself is nothing more than the effect of a more or less strong assemblage, and she could fall apart at any moment should the wrong shift occur in their

[101] Ibid., 57.
[102] Ibid., 58.

relationship, even a shift between semiotic "parts". There is something disconcerting about the notion that our personal substance or being (and identity) is contingent on the give and take relationship between quite literally *everything*, depending on how far these networks extend, and the level of their integration. This relational, and naively ontological, notion of materialism is not the only sort of relational approach to materiality, though. I will introduce the similarities and differences between DM and ANT and evaluate the shortcomings of the latter with respect to the former.

3.2.5 Mapping Materialisms

The two types of relational materialisms that I will be referring to throughout this section are concrete[103] and abstract[104], in opposition to one another. ANT adheres, as described by Wynance in the case of Mrs. Atti, to what I am terming the "concrete" approach to matter which rejects the divide between the subject and object at the heart of most epistemological thought and, generally, places all entities on an ontological par. I call this "concrete" materialism as distinct from both what I would term "metaphysical" materialism as well as abstract or dialectical materialism. In the case of metaphysical materialism, matter is conceived of as the fundamental "stuff" of reality, out of which everything is composed. A potential problem for this conception of matter arises due to its conception of matter as chiefly metaphysical; the "what it is" or definition of matter is always open for negotiation within either philosophical or scientific theories.

Materialism is not, though, *simply* a theoretical position, and this is where crude metaphysical conceptions of it go astray. The concrete, *speculative*, materialism of ANT and

[103] This is also referred to as ontological as well as speculative.
[104] This is alternatively referred to as critical.

various new materialisms arising in STS in the last decades do not fall prey to the same concerns. Recall that for Latour the social is not regarded as a type of "stuff" in relation to other stuffs (biological, physical, chemical, etc.). In the same way, neither is the material a type of stuff among stuffs out of which things are constructed. Materiality is about relation and force, not about the metaphysical nature of objects or substances. The question of the nature of the material is, then, not one which ANT or new materialist theorists are generally concerned with, thus opposing them to metaphysical accounts of materiality.

Neither, however, is this concrete speculative materialism to be confused with the same relational materiality proposed by the abstract dialectical conception of matter. This is because the ontological materialism of ANT, and various other forms of new materialism, rejects framing materiality in epistemological terms, as a function of critique. For the ANT theorist, thinking about the conditions for the possibility of something stymies its reality. In doing so, one moves away from the reality of the actants and risks positing occult motivations to actions. It is a reemphasizing the importance of ontology over transcendental epistemology. Indeed, Latour himself refers to this in his exploration of what has gone wrong with the notion of critique in recent decades that highlights what is at stake in the speculative approach for an ANT theorist. To do this, he uses Alfred Whitehead as an example of the "anti-critical" philosophy that he supports over approaches that have dominated the field since Kant.

> Whitehead is the only one who, instead of taking the path of critique and directing his attention away from facts to what makes them possible as Kant did; or adding something to their bare bones as Husserl did; or avoiding the fate of their domination, their Gestell, as much as possible as Heidegger did; tried to get closer to them or, more exactly, to see through them the reality that requested a new respectful realist attitude.[105]

[105] Bruno Latour, "Why Has Critique Run Out of Steam? From Matters of Fact to Matters of Concern", *Critical Inquiry* 30, no. 2 (2004): 244, doi:10.1086/421123.

In the case of DM, however, the epistemological role of materiality is central to its function — critique. Recall here my earlier discussion of Engel's position in section 2.1; here I will demonstrate exactly the critical nature of Engels' dialectical materialism. Unlike metaphysical materialism, DM is not primarily concerned with the status of the stuffness of matter. DM theorists take all sorts of things to be "material" which are not typically considered "physical": class, value, money, etc. In this sense, there are similarities between the DM approach to matter with that of what has quickly become a dominant position in analytic philosophy of science — physicalism. However, it is not clear whether Engel's account may be justifiably considered physicalist in light of debates surrounding weak and strong emergence in the philosophy of science. Insofar as money, class, value, etc. are entirely irreducible to anything more fundamental, then Engel's dialectical materialism appears to take a strong emergentist approach to reality, which is not compatible with physicalism at all. To view the problem in these terms, however, is to misunderstand what the nature of materialism is for DM theorists. What is at stake for DM in articulating itself as a *materialist* ontology is the relationship between what we, humans, think and what we can do. Knowing and doing are united for DM; the materiality of the world is our guide to understanding what shapes us and what we can, in principle, shape in both thought and action.

All this is to say that DM is, unlike both metaphysical materialisms as well and ontological materialisms, not neutral. To discuss materiality is to discuss the possibility of thought as nothing other than a historical mode of the material. Materiality, when properly understood, provides us with a kinematics of the world, social life, and history, which strictly ontological approaches to materiality do not. By neglecting the fact that materiality must be accounted for in epistemological terms, concrete ontological approaches to materiality have,

effectively, reintroduced the notion of a "view from nowhere" into their ontology. In doing so, the primacy of thought is, far from being transgressed, reinforced in an uncritical and dogmatic manner. Returning to the case of Mrs. Atti discussed by Winance, I will now examine the merits of DM in relation to the construction of disability with reference to her case.

3.3 Why Natural Dialectics?

3.3.1 Labour, Abstraction, and Explanation

When we talk about the notions of ability and disability, they often get lost in abstraction — which the turn to ontological materialism seeks to overcome. DS and CDS, insofar as they are concerned with the construction of disability at the local level do seem to gain from this conception of relational ontological materiality at first glance. The material and the concrete are often taken together for ANT theorists. That is, the materialism of ANT is not merely one of relation, taken in the abstract, but of *concrete relation*.[106] This is, in my estimation, what truly separates ANT from other ontological materialisms that have sprouted up within STS in recent years as well as what inclines it naturally towards case study of different "agencies" as a form of methodology.

In the case of Mrs. Atti, Winance's ANT discussion draws exclusively on tracing the concrete relations between actors which give rise to the abled body-in-a-wheelchair which, almost exclusively, deals with examining highly local networks, making it easy to follow the

[106] By "concrete relation" I mean that the actors/actants in ANT are themselves always concrete despite their status as always already caught up in relations. That is, they are essentially relational. To pull an individuality out of them is itself a process of abstraction away from relations.

immediate "causes" of abled and disabled bodies.[107] In the relation between Mrs. Atti and her wheelchair, all the relevant actors in the network form part of the genetic explanation for her disabled body and abled body-in-a wheelchair which arises out of the assemblage of actants.

> The trying-out session consists of fitting the device and positioning and repositioning the different parts of Mrs. Atti's body—her head, legs, arms, feet, buttocks, and back—and comparing different impressions to find the most comfortable position. This collective research involves the patient, the people helping her, and the device.[108]

Mrs. Atti is, herself, aware of what in the network leads to a disabling effect for her in the process of adjustment, when she herself, or others, begin to alter the relations that compose her constructed autonomy. Whatever explanation of the creation of disability and ability may be given within the framework of ANT's ontological materialism, it can *only come by doing damage to materiality itself.* In effect, whatever explanatory power the ontological materialism of ANT has with regards to networks of assemblages is severely damaged by the conservative impulse generated by its conception of sematic-material constructs. If materiality is something always at stake in our discovery of it, it presents itself as something parasitic on the possibility of a genetic reconstruction of disability rather than helping inform it.

There remains, then, the question of what significance the concrete relational materiality of ANT can play in giving an account of disability (both theoretical and practical) over and above ostension. What does the concrete relational materialism of ANT add to our explanatory power in terms of disability/ability? The answer can only be, in a certain sense, *nothing*. I discussed briefly in the previous section (3.2.5) that what distinguishes the ontological materialism of ANT from DM is its rejection of a definition of materiality and/or matter in terms

[107] Some caution is warranted here, however. ANT is not committed to the thesis that we can know with any sort of certainty what "causes" the existence of any one being or event. Everything is both over and underdetermined for Latour.
[108] Winance, "Trying out the Wheelchair", 56.

of knowledge, in epistemological terms. For Mrs. Atti, one may come to understand her materiality better at one and the same time that one comes to understand the concrete relations which hold her together. Insofar as the network resists change or fails to bring about a similarly concrete autonomous "thing", we explain both enabling and disabling relations as well as materiality, which is itself something to be explained. By rejecting both the material and social as "stuffs" from which all of reality is composed as well as rejecting a conception of materiality as a condition for knowledge, for acquittance[109], materiality loses both its ontological and epistemic force.

In contrast, for DM, materiality is the precondition for explanation whatsoever — the condition of the possibility of the knowledge of all forms of reality. How, then, does a dialectical approach to materiality inform a general explanation of the construction of disability in a way which neither metaphysical nor concrete materialism allow? The answer lies in the conception of the social which the abstract, or general, approach to materialism in DM opens — "pre-sociality". By "pre-social", I do not mean to equate the position of DM with positivistic accounts of materiality or nature which aim for knowledge of reality "in-itself", prior to social, cultural, or conceptual modification. Rather, the account of the social inherent in DM is pre-social insofar as it accepts that there are aspects of human existence which are "outside" of or external to thought or of culture, despite being conditioned by them.[110] Nowhere is this clearer than in Engel's

[109] In effect, rejecting the material as an immanent transcendental.

[110] Marx often discusses the relationship between thought and being in Hegelian terms, where he addresses it at all. His most thorough treatment comes in his *Economic and Philosophic Manuscripts of 1844* (published posthumously in 1932) in which he uses the notion of an external relation between things as constituting their reality. To be "ideal" is just to exist without an external relation, to exist entirely for oneself. There is significant controversy surrounding the exact way to interpret Marx's own conception of materiality; however, so I will stick with Engels' work to avoid engaging with that specific debate.

exploration of the origins of humanity rooted in a dialectical relationship between mind and matter, mediated by labour.

In his essay titled "The Part Played by Labour in the Transition from Ape to Man", Engels describes the ontological and epistemological relationship between thought and being within a DM framework, which subsequently gives rise to a unique understanding of both materiality and sociality as existing in a dialectical relationship with one another, the former making possible the latter. What this means is that, in contrast with Aristotle and others, what defines human existence is not rationality or thought. One is not a human being because one is a thinking animal. Rather, one is human insofar as one transforms the world around them and, in so doing, is a participant in their own creation. It is not incorrect to say that, for Engels, "labour created man himself."[111]

The abstract materialism of DM makes possible the sort of analysis which Engels does of the relationship between nature and society in his essay. Once one understands materialism to mean, at bottom, the claim that the reality of thought is nothing over and above the reality of being itself, then the relationship between society (or culture) and nature can be reconceptualized as an organic unity. Of course, this is exactly what ANT claims to do in rejecting the distinction between nature and culture, between materiality and sociality, with its concrete conception of matter. The difference, however, lies in the concrete nature of the way in which ANT conceptualizes this relationship as, ironically, leading to an ahistorical conception of the construction of any socio-material assemblage. By this, I mean that, in failing to recognize the role of materiality as an immanent transcendental mediated by labour, ANT can never speak of a material or social "context" in which something happens that is not itself just another concrete

[111] Engels, *Dialectics of Nature*, 172.

agency in a web of other over and underdetermined agencies, which is greatly limiting from an explanatory perspective when describing the social construction of a specific phenomenon. In contrast, by recognizing the material as the *immanent* transcendental from which all thought is made possible, DM always concerns itself with the historical context of the relationship between nature and culture, because a given material context conditions and is conditioned by the social existence of humans.

Though any explanation of disability is going to be rooted in real, concrete, material circumstances, these circumstances *are themselves products*, which means that disability as such has a history that is at once both material and social. Again, on the surface, there is a similarity here with ANT and concrete approaches to materialism in how they understand disability in this dual, or relational, way. For Mrs. Atti, on Winance's ANT analysis, her disability is not something essential to her being (naturalistic), nor is it something that can be explained away in terms of a nebulously defined "social". In the same way, for DM, disability must be understood in terms of the relationship between materiality and sociality, though in a historical, contextual, sense. A fundamental point of departure, however, is that ANT does not understand this relationship to be contextual (historical). Any "context" out of which something arises posits something which itself must be demonstrated for an ANT theorist. When using DM, a more complete picture of the construction of disability is possible.

Mrs. Atti's disability is grounded in a *specific material context*, and DM asks us to conceive of the question in a much broader sense. Rather than focusing on the immediate, concrete, relations between ontologically indiscrete actors "constructing" disability as a network effect, one which can be, in principle, undone by destabilizing the network, DM understands that, for any meaningful explanation of disability to be given, a much broader (abstract) approach

to materiality and the social must be taken. In this case, whatever Mrs. Atti experiences as disability can be explained by an appeal to the material conditions for the possibility of disability arising as themselves conditioned by the social circumstances Mrs. Atti finds herself in. In this sense, DM provides us with the possibility of a critique[112] of disability that is immanent rather than transcendent, because the transcendental principle (materiality) is itself brought down to earth and can be modified by that which it makes possible.

The conditions for the possibility of Mrs. Atti's disability are both material and social, though they are grounded in the "real". That is, disability is not an identity for the DM theorist, but is necessarily a relationship that connects something internal to something external — it is "objective" in this sense. That externality, that materiality, however, is always already conditioned. Engels often discusses the dialectical relationship between nature and culture, between the material and ideal, in terms of the development of the human mind as a product of nature and culture in which labour, the material relationship, is the original starting point.

> First labour, after it, and then with it speech — these were the two most essential stimuli under the influence of which the brain of the ape gradually changed into that of man, which for all its similarity is far larger and more perfect.[113]

Humans, according to Engels, did not first think of using tools or building shelter only to subsequently act on such an impulse, to realize it. Instead, the exact opposite relationship between thought and being is taken to constitute the evolution of humanity itself. We first, as parts of nature (of being), labour to satisfy material needs, needs which arise as something outside of us, needs which we seem to have no immediate control over. And, in this process of

[112] The recognition of the immanent and historical character of matter (nature) as the condition out of which all social and phenomenal reality arises is the grounds for a critique of the entire existing order of things by recognizing the contradictions between their conditions for their possibility and what they claim to represent (essence vs appearance).
[113] Ibid., 176.

satisfying these needs, we transform both ourselves as well as the nature of our own externality, of our own material conditions. The mind, and its contents, along with every facet of the human body are both *products* and *producers* of what DM theorists would call the "material", or real. This means that what constitutes disability, for a DM theorist, changes as humans transform both themselves as well as the external material circumstances surrounding them.

Disability has a history, and we can locate Mrs. Atti's case within this history to both contextualize it as well understand the conditions which would alter its *general social form*. In doing so, we, in thought (abstract), reveal the dynamic structural relations that produce disability in concrete reality. What should be noted, though, is that this does not imply, for DM theorists, that a mere understanding of the problem is sufficient to alter it. Contra Latour, recognition of the "constructed"[114] nature of the relations does not imply that they are weak or readily fungible. Thus, it must be kept in mind that, though a dialectical materialist critique of any given situation begins in the understanding, it may never terminate there. To quote Marx's (in)famous passage from the *Contribution to the Critique of Hegel's Philosophy of Right*:

> The weapon of criticism cannot, of course, replace criticism by weapons, material force must be overthrown by material force; but theory also becomes a material force as soon as it has gripped the masses. Theory is capable of gripping the masses as soon as it demonstrates *ad hominem*, and it demonstrates *ad hominem* as soon as it becomes radical. To be radical is to grasp the root of the matter. But for man the root is man himself.[115]

It may very well be the case that the material and social relations holding together the construction of disability are themselves quite strong. And in this case, DM points towards the materialization of critique itself as a weapon for social change. Thus, the "social" is not something that can be written off or deflated away in a genuinely critical approach to either

[114] Here it may be more appropriate to use the term "produced".
[115] Karl Marx and Joseph O'Malley, *Critique of Hegel's Philosophy of Right* (repr., Cambridge: Cambridge University Press, 1970), 5.

theory or praxis. It is here to stay. But what role does the social play in constructing disability, materially, considering a DM understanding of reality?

3.3.2 Disability and Capital: The Return of the Social

Disability is always contextual and must be understood in terms of the material relations which give rise to it in any given epoch. In this sense, the social model of disability which the ANT approach has evolved as a critique of was, largely, correct from a dialectical materialist point of view. Disability has no sense without appeal to social structures, and to the broader context in which disability gets constructed. The following quote comes from a prominent thinker (and activist), Vic Finkelstein, working within a certain understanding of the social model.

> I believe that we cannot understand or deal with disability without dealing with the essential nature of society itself. To do this disabled people must find ways of engaging in the class struggle where the historical direction of society is fought, won or lost. It is in this arena that the boundaries of knowledge that have put disabled people aside from the 'normal' can and have to be openly questioned.[116]

Finkelstein, here, is notable for a specific conception of the social model of disability that does focus on the contextual factors influencing the construction of disability as constitutive of disability itself. On Finkelstein's social model, a critical, and radical, political project is implied — like with dialectical materialism. However, and as Finkelstein notes, the social model is not a general theory of disability, and so its key terms have been taken up by other thinkers in less radical directions. Specifically, Finkelstein is critical of the "rights" based conception of the social model of disability that has become popular with efforts to modernize it.[117]

[116] Vic Finkelstein, "The Social Model of Disability Repossessed", (Presentation, repr., The Manchester Coalition of Disabled People, 2001)., 5.
[117] Ibid.

The argument, then, is not that the social model of disability is incompatible with dialectical materialism. Rather, DM ought to be understood as the ontological force behind the possibility of a critical social model of disability insofar as a thoroughgoing critical approach to all of reality is what is implicit in the ontology of DM. I am calling for a renewed interest in a "social" model of disability rooted in a dialectical materialist account of nature, history, and thought. Doing so demonstrates the strength of DM as it benefits an already existing paradigm in disability studies, and within STS more broadly.

One reason for the movement away from the social model towards something like the concrete relational "materialism" of ANT was the emphasis that it placed on the being of a social substance, out of which we can describe the construction of social phenomena. In a certain sense, ANT was correct about this. What does it mean to say that disability is primarily "social"? Why explain something already contentious, disability, in terms of something equally contentious, society? What the critique made by ANT theorists fails to reckon with is the conception of the "social" that arises out of a dialectical conception of nature as a unified whole. For Engels' abstract materialism, neither materiality nor sociality are defined in terms of their ontological character — in terms of what they are composed of. Engels is clear about his resistance to conceive of the material in terms of a unique substance, or in terms that attempt to describe the nature of that which is "material".

> The two forms of existence of matter are naturally nothing without matter, empty concepts, abstractions which exist only in our minds. But, of course, we are supposed not to know what matter and motion are! Of course not, for matter as such and motion as such have not yet been seen or otherwise experienced by anyone, only the various existing material things and forms of motions. Matter is nothing but the totality of material things from which this concept is abstracted and motion as such nothing but the totality of all sensuously perceptible forms of motion; words like matter and motion are nothing but *abbreviations* in which we comprehend many different sensuous perceptible things according to their common properties. Hence matter and motion *can* be known in

> no other way than by investigation of the separate material things and forms of motion, and by knowing these, we also *pro tanto* know matter and motion *as such.*[118]

I deliberately used the term "abstract" materialism to describe his conception of rational dialectics because of the way in which he characterizes the relationship between matter and form. In a certain sense, the Engelsian position is an inverted Platonism. We understand the ideal, the form of matter, neither by direct investigation of the ideal, nor by philosophical intuition. Rather than moving, as Plato does, from the heavens to Earth, the abstract dialectical materialism espoused by Engels moves *from the Earth to the heavens*. Likewise, we understand the "social" in terms of those aspects of reality which we group together as social, which gives rise to sociality as an abstract form in thought. Though ANT agrees with DM on the first movement, focus on the Earth, the "concrete", it does not take up the second movement — abstraction. According to it, to abstract a materiality or a sociality from its individual instances is to introduce a problematic anthropocentric understanding of reality which only serves to reinforce the supremacy of the human subject and move away from reality rather than further towards it.

This process of reflection[119], however, is essential to the dialectical materialist understanding of reality and materiality. It also recognizes that the human subject is a part of the material order itself, thereby conceiving of itself in non-anthropocentric terms without eliminating the importance of the question of the relation between subject and object. In a qualified sense, there is *only nature*, only the material, for the DM theorist. Thus, a social model of disability based on DM avoids the critiques that ANT generally levies against it on two

[118] Engels, Dialectics of Nature, 239.
[119] Here I am not using the term in an overly technical sense. I mean it to represent the process in thought by which we come to understand the abstract forms of things and, eventually, their unity with the forms of motion of matter, history, and society.

fronts.[120] Firstly, it avoids the positing the "social" as a substance or material out of which reality may be constructed. This answers Latour's criticism in 3.1.2 that lead him to posit his constructivism in place of social constructionism. Secondly, DM does avoid the charge of anthropocentrism often bandied about by ANT theorists by placing the thinking subject within nature, as a moment of nature thinking itself and acting back on itself.[121] Though the full implication of both aspects of DM will be completely explored in the following chapter, what is important to point out here is the movement from abstraction to *criticism*. Using reason to ruthlessly criticize everything that exists is only possible on the assumption that everything that exists is *amenable or commensurable with reason*. Abstracting to the form of the movement of a socially constructed phenomenon like disability from the concrete social instances in which it exists is part of what makes DM much better suited at both explaining as well as critiquing it in comparison with ANT. Abstract materialism is really a critical materialism. In its place, the concrete materialism of ANT is much closer to being speculative with regards its object, disability, due to its inability to move very far beyond a direct engagement with the concrete conditions in which disability is enacted. ANT can be critical only in a combative sense of the

[120] There are certainly several other critiques of the social model(s) of disability coming from other paradigms equally opposed to the social model as well as the medical model. Though, these have tended to focus on issues concerning the experience of disability as being crucial for understanding disability itself and have pointed to the inability of a social model to account for all the data surrounding disability (in this case individual subjective experiences) as being a limit to the model. In this thesis, however, I am focusing on a specific response to ANT and the ways that DM solves some of the issues that it sees in the social model, and with social constructionism in STS more broadly. It is not my claim that DM will make the social model account for all the things that every criticism of the social model has taken issues with.

[121] It should be noted here that the dialectical approach to nature taken by Engels (and quite likely Marx himself) is not a form of Aristotelian organicism. The "social individual" necessarily maintains a sense of identity throughout all social relations in a way that makes it possible for "humanity as such" to use reflection to reorganise itself. A truly ontological organicism would make radical critique impossible, for the impossibility of taking apart society and putting back together in a way that preserves order and identity necessarily follows from the notion of a fully co-determined organic unity. In this sense, dialectical materialism is *anti-collectivist*. The overcoming in both thought and reality of the contingent determinations of the mind is the historical destiny of the Engelsian ego, not its eternal limit.

word, and the extent of its critique explicitly never claims to reach all of reality and history. Insofar as dialectical understanding is concerned with the forms of motion of matter, history, and thought within a unified ontology, critique is expanded to all of reality, to the world of things in themselves, rather than just to the world of the social.

A social model of disability informed by a dialectical materialist understanding of nature, then, is not one which understands the social to exist as something with a history independent of the history of the material, of nature. To understand disability as something chiefly "social", we must also understand its roots in natural history, of which humans take a part. For example, when we look at the case of Mrs. Atti, what is it about her situation that allows us to say that she is "disabled" not merely as a function of her biology (of her impairment) but also as a function of the socio-material situation that she finds herself embedded in? The ANT analysis of her disability was found lacking precisely because it was unable to give us an explanation of disability in terms of materiality or social structures. A DM theorist, however, understands humanity as being primarily embedded in nature, the unfolding of which in relation to society is accomplished as a process of dual transformation through labour, which is a group effort. "Ability" and "disability" can only be understood in terms of the dynamic interaction between that which is external (pre-social) and that which is both conditioned and conditioning (the social). Disability is, thus, *always an abstraction*[122] from the ideological conception of adequate functioning as rooted in humanity's overall level of ability, which is a function of the overall development of the productive forces in society.

From the point of view of DM, it makes no sense to talk about Mrs. Atti as being "disabled" as a function of strictly the concrete relations that inform the assemblage constituting

[122] Contra ANT.

"her". Indeed, if ability and disability were simply individual functions of the concrete relations one finds themselves engaged in, then all people are more or less abled simply in virtue of the relationships that they find themselves in both with other subjects as well as inanimate objects. And, indeed, this is the point of the ANT conception of disability. Disability, like reality, can be realized by multiple different arrangements of actions. This, however, does not explain disability as a general phenomenon. Why is it that Mrs. Atti is disabled while persons living in non-industrialized societies without any biological impairments are not, typically, considered disabled despite not being able to accomplish all the things that Mrs. Atti is accustomed to accomplishing daily, even with her impairments? Is Mrs. Atti "more" or less disabled than a person in this hypothetical society who has full control over their musculoskeletal system but lacks the ability to teach or to produce in the way which Mrs. Atti is capable? ANT is not capable of answering these questions, because they do not make sense within the ANT framework. They do, however, make sense to a dialectical materialist. No person is "disabled" strictly in terms of their own nature either biologically or from the standpoint of social relations as they correspond to a single individual (concrete relations). If this were the case, we could speak of a disabled person quite outside any material-social "context". This does not make sense, however. Labour, the intercourse between humans and externality (nature) does not and has not typically occurred in isolation. If Crusoe was simply teleported into existence on his island with several impairments that affected his general mobility, would we be right or wrong to label him disabled? The question does not seem to make much sense from the point of view of a dialectical materialist, because the intercourse between nature and humanity is always already social, and so the character of labour in society, and with it, disability. This analysis is critical precisely because it recognizes the contradictions between the different levels of organization of what is

real — between essence and appearance. Referring to chapter 2.2, this is what Engels was concerned about in his criticism of Kant; that which conditions the relationship between essence and appearance cannot be given purely in thought *a priori*. It is not helpful to think about the difference between disability in its phenomenal existence and "actual" existence as limited by the limits of our cognitive apparatus. For the critical dialectical materialist, however, both the real and the phenomenal are given to us in "experience". Through our mediation of our social existence through labour, we come to understand the contradictions inherent in the different forms of reality, which cannot necessarily be sustained. The conditions for the possibility of disability can themselves be altered by the order which they condition, by "the social".

We ought to understand Mrs. Atti's disability, then, as rising from the material circumstances that she finds herself in. Firstly, Mrs. Atti exists in a capitalist society, in which the productive forces are developed in such a way as to make a certain organization of society the most amenable to the continued maintenance of the productive forces at their current level — this a proletariat society. Selling one's labour on the open market to those who own the means of production for wages to sustain oneself is the means of existence for most of society. This forms the way in which society maintains itself and organizes its relationship with nature, with that which imposes itself upon it as external necessity. The external necessity of capitalism has produced a specific social order in which participation in the productive processes requires a specific set of capacities, favoring mobility and autonomy. Those who are not capable of participating in this order are labelled "disabled", and the grouping together of these individuals has given us the concept of disability as it currently stands. What this means is that "disability" as a meaningful concept has no history apart from the history and development of the material construction of disabled individuals in time. Mrs. Atti's disability can be explained in terms of

her general inability to participate in society's social production and reproduction *in this historical epoch*.

Individual questions about whether Mrs. Atti is disabled by the wheelchair as it is adjusted in this or that direction with this or that part miss the point. Disability is an inherently normative notion, which means that being disabled implies some goal or norm in relation to which adjusting her wheelchair moves her closer to. If the answer is that she is less "disabled" because she is in less pain, which allows for her more freedom of movement to paint or to teach, then we admit that there is something "abled" about painting or teaching, but only insofar as those things allow for earning a living under the current economic order. However, if all one could do with an adjustment of a technical device was paint lovely paintings which no one ever saw and for which one was never paid, would we still consider such a person as having substantially decreased their "disability"? I would suspect not. What constitutes disability is not simply a matter of range of things one can do in relation to one's own desires[123], nor can it be explained simply in terms of a general range of actions one can take. The concrete approach to disability taken up by ANT does not explain disability[124], it merely kicks the can down the road.

3.3.3 Constructionism and Beyond

It appears, then, that the fears of those working within STS and disability studies about the nature of the "social" and its bearing on debates in social constructivism discourse may be unfounded insofar as they believe they necessitate a specific type of anti-social ontology. Having demonstrated the utility of a DM approach in the STS literature on social constructionism, which

[123] It is for this reason that I find general accounts of disability that take the subjective experience of being disabled as unconvincing. It is very possible, on my understanding to be "disabled" while not feeling oneself so. As well, and likely less common, the converse is also a possibility.
[124] And how could it? Disability, like subjectivity, is an affect which is unique in all its instances. Attempts to define it would break the rules of ANT.

is often at the centre stage of debate in the "field", I now turn, in the final chapter of the thesis, to questions concerning the broader application of DM within STS scholarship, as an alternative to approaches I have termed "ontological", based on its supported merits across a range of metrics, drawing on arguments and conclusions from both preceding chapters.

Chapter 4: Science Studies in the Material World

4.1 Subjectivity in a Post-Anthropocentric World

What has gone wrong with ANT and social constructionism reflects what I see as the chief error plaguing science studies more broadly considering the various reconceptualizations of matter that have arisen in the literature — the "overcoming" of subjectivity. In this sense, the various new materialist approaches to ontology fit squarely within a post-phenomenological philosophical tradition, one which embraces the speculative and, largely, rejects critique insofar as critique prescribes the conditions for the possibility of experience, meaning, or sense in general. I have explored some of the implication of this move in the conceptualization of materiality from the point of view of ANT, though many of the ontologies that rather broadly fall under the label "new materialism" also make use of this turn away from subjectivity. This is not to say, however, that DM is a return to understanding the world in terms of the subject, or in anthropocentric terms. Many of the criticisms which have arisen in the literature from the side of new materialists of more traditional materialist ontologies still hold for DM, though it seeks to resolve them in a different fashion. What DM refuses to do, unlike various types of new materialisms, is to give up on the notion of critique along with subjectivity, whether that be a Cartesian (solipsistic) subject or an intersubjective embedded subject. Subjectivity may be less important than it once was, but philosophers should not take this as a blank check to reify all their biases onto the world, or to

engage in speculative philosophy. This final chapter will explore some of the implications of the ways in which a critical materialist ontology (DM) makes sense of the subject in light of the post-subjective turn without sacrificing a thoroughgoing critical approach to *all of reality*. In doing so, I aim to demonstrate the superiority of the dialectical way of thinking the social subject beyond the confines of the debates concerning social construction.

4.2 The Benefits of Dialectical Thought

4.2.1 Anthropocentrism and Empiricism

There has been a decided turn in the literature from approaches which may be broadly characterized as "anthropocentric" towards those which are not or may claim the label "post-anthropocentric". I have explored the ways, already, in which ANT has positioned itself within this debate as a non-anthropocentric ontology, though it is hardly the only contender in the literature. What I want to argue here is that, largely, this move to a non-anthropocentric ontology within STS is correct in principle though confused in practice by the sorts of "materialist" ontologies being generated in the literature.

What these ontologies get right is the general move away from an emphasis on questions in the social sciences which can only be answered using a distinct social scientific methodology, one which is sensitive to the irreducibly intentional character of both human action and experience as opposed to the quantitative laws generated by empirical investigation.[125] And with ANT in particular, this move away from an anthropocentric view of the sciences (and of knowledge in general) is taken to an extreme end. Recall that, for ANT, there is neither a

[125] I am referencing here, specifically, the trend in the social sciences to reduce reliance on empirical investigation of social subjects in favor of methods that can be *broadly* classified as introspective beginning with the phenomenological work of Alfred Schütz. He went on to greatly influence both Berger and Luckmann (two significant founders of the first fully developed conception of a sociology of knowledge), both of whom have been referenced in this thesis.

Cartesian subject *nor an embedded social subject*. The move to a post-anthropocentric view of reality is far more than the overcoming of Cartesianism, as is often the understatement made by new materialist thinkers working in STS; a socially embedded subject is just as anthropocentric. Though the Cartesian subject stands above nature, the intersubjective ego of Schütz's interpretation of Husserl's lifeworld (Lebenswelt), or a pre-predicative subject in general, is simply an invasion of meaning into the world of objects. Locating "meanings" prior to both action and thought is the exact sort of thinking which ANT rejects, and rightly so. But why is this rejection so important?

To reject either the solipsistic or intersubjective (contextual) subject as the starting point of social scientific analysis whatsoever is to reject certain types of constraints on the reach of what is in principle knowable by social scientific investigation, by rationality acting in conjunction with empirical evidence. Therefore, as noted in chapter three, most of the work in ANT comes in the form of *empirical* case studies. In making the subject nothing more than an effect of more primordial concrete relations, the social domain of meanings is opened for empirical investigation; meaning is quite literally *out there, among things*. A certain type of a return to the empirical as a return to investigating reality qua reality is not just demonstrated in ANT, but in most thought that may be broadly characterized as "New Materialist" in the literature as well. For example, in the co-authored foundational text on new materialism, *New Materialisms: Ontology, Agency, and Politics*, the authors describe the general trend in materialist scholarship within the humanities and social sciences.

> ...we are also aware that an allergy to "the real" that is characteristic of its more linguistic or discursive forms - whereby overtures to material reality are dismissed as an insidious foundationalism - has had the consequence of dissuading critical inquirers from the more empirical kinds of investigation that material processes and structures require.[126]

[126] Coole, and Frost, *New Materialisms*, 6.

The problem with many of these attempts at constructing a radically anti-anthropocentric "materialism", however, is that they end up abandoning the critical role of rationality, of focusing on the conditions for the givenness of things, in their search for a return to the "real". One need not, however, abandon criticism to embrace materiality. And this is exactly the sort of move that DM asks one to make.

Just like for many new materialist ontologies, DM rejects the identification of a unique privileging of the subjective point of view (and of the conditions for the possibility of knowledge) in a move that seems to open the door to a potential speculative turn. However, this is not the case for DM for two important reasons. Firstly, DM takes it as almost axiomatic that there is something external to the subjective side of the dialectic which is not itself a moment of subjectivity or an idea. Therefore, Engels is clear about the importance of the empirical investigation of nature out of which the "ideas" of dialectical logic are derived. DM is not an *a priori* system of thought forced onto reality from without. Secondly, DM views the subject as radically integrated with all of nature. The human "social subject" is nothing so ontologically distinct from nature that it would warrant a fundamentally distinct methodology of understanding either the social subject or nature. Because of both points combined, critique is not merely an important point for DM; it runs through its entire conception of reality. It is through reflection that we come to understand *our* relationship to nature (and Being) within the whole of reality as an unfolding process, because we recognize the development of our own self-consciousness as an unfolding process.

The tying together of "human" and "natural" history is the means in reflection by which a radical critique of everything existing takes place. It is in this sense that DM must be understood to be non-anthropocentric. A total rejection of history (and reflection on the relationship between

thought and being) as foundational for ontology is where ANT and other new materialist "materialisms" go wrong. It is here that they launch themselves into speculation and move away from the possibility of establishing a critical materialism. In describing her approach, which largely mirrors that of Donna Haraway, Karen Bared describes this move away from reflection in no uncertain terms as central to a certain version of new materialism.

> I would argue that these approaches also bring to the forefront important questions of ontology, materiality, and agency, while social constructivist approaches get caught up in the geometrical optics of reflection where, much like the infinite play of images between two facing mirrors, the epistemological gets bounced back and forth, but nothing more is seen. Moving away from the representationalist trap of geometrical optics, I shift the focus to physical optics, to questions of diffraction rather than reflection.

Diffraction is a process closer to speculation in which one examines reality in terms of the effects of differences, which exist prior to reflection (or refraction) in the mind. In the end, however, new materialism does not escape anthropocentric notions if it aims to maintain its critical force. It ends up reifying aspects of social existence as prior "materialities" that are essential to the maintenance of social and ontological orders without claiming an anthropocentric title. Often the authors working with various new materialisms come off as trying to convince the reader that, despite what it may seem, they truly are properly *postmodern*.[127] Referencing the authors of the big book of new materialism once again, they have the following to say about the prospect of understanding their projects as "critical new materialisms".

> Alongside ethical concerns about subjectivity, normative concerns about social justice, cultural concerns about postmodern diversity, and discursive concerns about the construction of gender or ethnicity, this entails paying attention to the material, historical, and sociological structures of international political economy that lend context as well as practical inertia to identities that entail unequal life chances. It calls for a detailed phenomenology of diverse lives as they are actually lived - often in ways that are at odds with abstract normative theories or official ideologies.[128]

[127] The authors of the book tend to use this term in a variety of contexts without ever defining it.
[128] Coole and Frost, *New Materialisms*, 27.

The DM critique of all of material reality does not result in the same sort of speculative ontological flattening in its concern for either the real or the empirical. And, in this sense, its anti-anthropocentrism is superior to that of other forms of new materialism.

For DM, then, the best of both worlds is maintained. The new materialist critique of the anthropocentric and anti-empirical tendencies of much of the earlier work in the social scientific studies of the sciences is answered by DM, which is willing to move beyond "the subject" whether it be solipsistic or intersubjective. However, it does not imply the same leveling speculative ontology inherent in many new materialist approaches. This is not to say, however, that this is the only benefit in the social study of science of a dialectical materialism in opposition to various forms of new or speculative materialisms. As discussed here, there is a connection between approaches in the social sciences which posit an irreducibly "human" element as characteristic of the field and a rejection of a unified methodology for investigating reality. Methodological divides (between the natural and social sciences) or pluralism in general are not *prima facie* wrong. However, the move from harder anthropocentric ontologies and methodologies does provide us with a unique opportunity to examine the possibility of more unified ontologies that generate greater methodological consistency across various disciplines, including between philosophy and "science".

4.2.2 Dialectics and the Unity of Knowledge

Recall from chapter two that Engels defines dialectical thought in terms of the science of universal interconnection or "the science of the most general laws of all motion".[129] Whereas most "representationalist" accounts of reality are concerned with the content of thought and its match

[129] Engels, *Dialectics of Nature*, 271.

with reality, DM is concerned with the *forms* of thought as being congruent with the *forms* of matter. And it is this emphasis on formal congruency as a criterion of truth which inclines me to label this approach an abstract materialism, though this does not imply that the nature of truth for the DM theorist is static, far from it. The relevant congruent forms to be studied are forms of *motion.* In studying these forms of motion, we come to an understanding of the general unity of the forms of thought with the forms of matter. And this just is the nature of truth for the DM theorist. To "prove" the correctness of the specific hypothesis requires the practical testing of it against "reality" (its material form).[130] This process can never *merely occur in thought*, because thought itself is always realized in motion. The forms of motion of nature, history (society), and thought are only separable analytically due to various historical contingencies. And it is this separation which has led to problems with the separation between various branches of thought, including the infamous divide between science proper and philosophy.

The remedy to these artificial conceptual distinctions is to begin one's analysis from the point of view of reflection on the forms of motion in both matter and history. Reflection on thought ought to only come because of this overall process. This focus on the abstract unity of form does bring along with it specific ontological considerations, however. While the DM theorist does not simply reduce all content to what is most easily manipulable for the purpose of theory, they do necessarily assume the intelligibility or commensurability of all things which exist with each other in one immanent reality. Why must this be so? Form is neither a general explanatory principle nor an active causal principle for a DM theorist. If that were the case, then they would become a certain type of idealist (where idealism is understood to imply that the most "real" or "active" principle is

[130] Ibid., 234-235.

not what is immanent). Rather, the unity of form is a result of the general immanent unity of all things out of which a recognition of forms arises.

This specific organic immanentist conception of reality necessitates a specific methodological monism when it comes to the various ways of thinking about and studying the nature of reality. Specifically, all explanations must begin from an analysis of the concrete circumstances, though (unlike with ANT), *they never end there*. Abstraction to the form is necessary for an understanding, not of content (*not of what something is*) but of the inner motion of the thing and the relationship between its form of motion with that of everything else. Truth is about where things are going, not what they are.[131] Engels makes this point when he discusses the nature of truth as a function of abstraction.

> If we know the forms of motion of matter (for which it is true there is still very much lacking, in view of the short time that natural science has existed), then we know matter itself, and there with our knowledge is complete. (Grove's whole misunderstanding about causality rests on the fact that he does not succeed in arriving at the category of reciprocal action; he has the thing, but not the abstract thought, and hence the confusion.[132]

The seeming reality of difference between the domains of truth is only an illusion. What is true of the forms of thought must be true of the forms of society (history), which in turn must also be true of the forms of matter. The forms of abstract motion form the basis for the unity of all knowledge, which are grounded in the unity of reality as a single immanent material becoming.

Reflection on these specific forms of motion and their interrelation is what Engels refers to as "theory" (or thinking in general) and which may never be escaped from in the various specializations of the sciences based on their contents. This is because all things are, at bottom, ultimately unified by their being what undergirds materials forms of motion, which thought about

[131] Recall here from chapter two the distinction that Engels makes between "metaphysics" and "dialectics".
[132] Ibid., 235.

motion must be reconcilable with. In this sense, DM is opposed to positions that reject the importance of thought for scientific analysis, though not empirical investigation in general. Engels is often, wrongly, accused of being a positivist for whom thinking and meaning ought to find their highest expression in empiricism. However, this misunderstands what he believes about the overcoming of metaphysics in the process of unifying philosophy and the sciences. Indeed, he is quite adamant about his rejection of any naïve view which would undermine the authority of thinking in favor of an uncritical scientism. Recall the following quote discussed in shortened form in section 2.1:

> Natural scientists believe that they free themselves from philosophy by ignoring it or abusing it. They cannot, however, make any headway without thought, and for thought they need thought determinations. But they take these categories unreflectingly from the common consciousness of so-called educated persons, which is dominated by the relics of long obsolete philosophies or from the little bit of philosophy compulsorily listened to at the University...or from uncritical and unsystematic reading of philosophical writings of all kinds.[133]

The view of science that Engels is elucidating is nothing other than dialectics as the universal science of thought, which itself must be understood as unfolding according to the same laws of motion as reality.

In practice, the benefit that this conception of knowledge gives to science studies is a particular methodology for studying the history of knowledge as a mirror of the forms of the history of the development of human society and of nature itself. All of these are reflected in one another. Rather than beginning with an analysis of the thoughts of individual scientists, Engels would have us begin any social scientific study with a concrete analysis of the material and historical motions which give rise to and sustain certain forms of scientific thought as products

[133] Ibid., 208.

of intellectual labour.[134] For example, Engels often points to the development of the different sciences out of philosophy in terms of a reaction in thought to the dialectical unfolding of human and natural history, which are joined through labor. The development of philosophy, or thought, being a prior movement, which differentiates the forms of motion of thought from the forms of motion of action itself. The sad irony of all of history is that self-consciousness of reality (matter) in the form of thought can only ever be achieved by an illusory differentiation between the forms of motion of matter, of history, and of thinking itself. In this sense, Engels retains a similar notion of alienation from Hegel, though he inverts it. Being is not self-alienated consciousness, but consciousness is self-alienated being. Beginning to recognize the social conditions or "context" in which thinking about both thought and reality occur as themselves concrete manifestations of the same logic of motion inherent in all thinking itself serves to build the first workings of a formal bridge between the study of science and science proper as well as work in STS. Often, fields talk past one another. For example, scholars Juan Moreno and Dominique Vinck describe the relationship between philosophy and STS as cordial but alienated.

> Interactions between these two fields can be viewed from two starting points: from STS towards philosophy, or from philosophy towards STS. The distance between these fields has been greater from philosophy towards STS, since from the inception of their field, STS scholars have created a variety of approaches to and dialogues with philosophical traditions.[135]

DM as an approach to both ontology and epistemology can serve as a bridge between these different lines of thought, unifying them under a single interpretive framework.

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[134] It is important to note again here how Engels places great significance on empirical science without reducing all of thought to scientific rationality. Dialectics is the science of thought, not science itself. In this sense, Engels, as well as DM in general, may be said to maintain something like a "first philosophy".
[135] Juan Carlos Moreno and Dominique Vinck, "Encounters Between Philosophy of Science, Philosophy of Technology And STS", *Revue D'anthropologie des Connaissances* 15, no. 2 (2021): 3, doi:10.4000/rac.23127.

Returning to the notion of context, though, it is crucial to point out that this is neither the same as beginning from a social "context" in terms of subjective or intentional account nor does it parallel the move that ANT and new materialism both generally like to make by eliminating the subject or the social entirely. Subjectivity, autonomy, and society do not *happen to* the practicing scientist or technological engineer. If one recalls from the previous section, DM is incapable of making this move precisely because it is not post-anthropocentric if one understands that as using thinking to get away from thought. Dialectics is the science of thought as the science of the self-consciousness of matter. One cannot, in principle, get away from the recognition of the equality between the form of thought and the form of matter, which is exactly what new materialism asks one to do. The structure of the unity of knowledge is made explicit by the dialectical conception of reality. In doing so, though, DM, like new materialism, rejects the primacy of experience or meaning in social scientific explanations. What is not rejected is *thought*.

We begin, then, by thinking of the social subject firstly in their concrete relations, similarly to the ANT theorist. Real persons in their actual material and historical relationships with one another forms the basis for an understanding of the development of scientific thought as a particular moment of thought in general. New materialisms are unable to come to terms with the relationship between thought in general (some may call this philosophy) and its historical manifestations because of the general fear inherent in this line of thinking of materiality to the notion of any convergence between thought in general and either the form or content of immanent reality, or that which is contingent. The idea that explicating a congruence between thought and reality implies the introduction of necessity into one's system of reality is correct, though hardly the horrifying prospect that some make take it to be. I for one am willing to sacrifice the possibility of a comprehensible pure immanent otherness (true spontaneity) when it comes to science studies

if it means gaining a comprehensive framework for understanding the unity of reality and thought in a non-idealist fashion. The abstract and dialectical approach to materialism can provide us with the ontology necessary to generate the foundation for this sort of epistemological project.

4.2.3 Science, Knowledge, and Freedom

Finally, I want to point to what I believe is the strongest reason to assert a dialectical conception of materiality with relation to the study of science as the production of knowledge — a kinematics of freedom and autonomy tied to increased understanding. In the previous section I discussed the unified or monistic ontology that DM generates, and this is important to understanding not just the unity of knowledge through forms of motions, but also to DM's understanding of the relationship between science, knowledge, and human freedom. Because science is merely a specific productive (historical) manifestation of understanding, it is caught up in the same process of historical unfolding that Engels sees as fundamental to all understanding. It is with an explanation of this general process that I will begin.

What is important to understand about history, for Engels, is that it is, like for Hegel, a movement towards ever increasing freedom. This is not, however, the process by which we come to a greater self-understanding, or by which our particular will is perfectly aligned with the universal. Rather, freedom is the process by which we come to rationally control both our relationship with nature as well as each other.[136] As this unfolds in the sphere of production, however, I will refer here to the work of Karl Marx on what the dialectical conception of

[136] Here I am using the word "control" because Engels often uses it himself to describe this process. However, a better term may be "regulation". The point is to bring the actions of society (production) into greater harmony with the dialectical unfolding of nature, not to dominate it. The move is to increasingly recognize the oneness of all of reality, including the human dimension, as one process of unfolding. It is in this sense that we may label this non-anthropocentric, for the human subject is not granted a privileged place over and above nature. Subjectivity whatsoever, though, cannot be dissolved back into being.

production entails. I find his explanation of the dialectical character of production arising from the unity of subject and object (thought and being) to be particularly enlightening in relation to Engels' general proclamations about the historically progressive role of production. Marx lists three moments of the dialectical process of production as important.

> Thus production produces consumption (1) by creating the material for it; (2) by determining the manner of consumption; and (3) by creating the products, initially posited by it as objects, in the form of a need felt by the consumer. It thus produces the object of consumption, the manner of consumption and the motive of consumption.[137]

Of these three, the first two are most relevant to the notion of expanding freedom through production. This is a process of expanding "freedom" because the increasing ability to rationally regulate our relationship with that which external to us (matter) determines the form of the expression of the content of our individual as well as collective wills. Doing away with the philosophical language, this point can be expressed using the example of the *need* for shelter. The satisfaction of the need for shelter expresses itself as something internal, as a manifestation of the will. The will, in this case, has a distinct content or need to be expressed, the acquisition of shelter. But it cannot do this without externalizing itself in the field of nature through production. The nature of the possible range of forms of expression of the need for shelter changes with the historical development of production. For example, the forms that the will may express itself in to satisfy the need of shelter in a hunter-gatherer society will vary wildly from those in a post-industrial capitalist one.[138]

Production creates use; use is how will is expressed. It is through production, then, that we gain an ever-increasing control over the structured expression of our needs. No longer does

[137] Karl Marx and Martin Nicolaus, *Grundrisse* (repr., New York: Vintage Books, 1973), 92.

the expression of our will confront us as something foreign, but it is brought ever increasingly under our control. This manifests itself in content of knowledge as an increase in understanding the dialectical structure of reality empirically through the content of the sciences. Engels describes the process as a dual one involving both production and understanding mutually reinforcing each other.

> And, in fact, with every day that passes we are acquiring a better understanding of these laws and getting to perceive both the more immediate and the more remote consequences of our interference with the traditional course of nature. In particular, after the mighty advances made by the natural sciences in the present century, we are more than ever in a position to realise, and hence to control, also the more remote natural consequences of at least our day-to-day production activities. But the more this progresses the more will men not only feel but also know their oneness with nature, and the more impossible will become the senseless and unnatural idea of a contrast between mind and matter, man and nature, soul and body, such as arose after the decline of classical antiquity in Europe and obtained its highest elaboration in Christianity.[139]

What is more interesting, and relevant for my purposes, however, is the fact that scientific knowledge is itself a product, which is rooted in a desire (manifestation to the will) to both understand and alter reality. The DM analysis of the relationship between nature, production, and need is not limited to understanding the dialectical movement as one in which rationality expresses itself merely in the form of increased "control" over the will and its relationship to nature, but also to society.[140] In this sense, DM is rationalist to its core. The enemy of freedom is uncertainty, and this extends to the social realm. True freedom is only realized when the production and organization of community itself can be brought under rational control, when the conditions of our total social existence no longer precede us.[141] And all of this has implication for science as it stands

[139] Ibid., 183.
[140] Recall that these are not fundamentally separate ontologically speaking.
[141] It is for this reason that I tend to view Engels (and Marx for that matter) as vehemently opposed to any notion of the social as a pre-predicative context of meaning which resists reason. If one is going to be a thoroughgoing critical materialist, then one cannot stop their analysis at a mysterious pre-rational context.

under capitalism while pointing towards a freer future for science rooted in a thorough transformation of society at the productive and relational level.

Because scientific knowledge is a product, our satisfaction of it as a type of understanding is constrained by the forms in which it is allowed to be produced. And under capitalism, for example, knowledge takes the form of a commodity[142] with both a use value and an exchange value. The use value of the knowledge commodity can vary wildly and even be entirely reducible, on occasion, to its exchange value. This process, under capitalism, can be illustrated by reference to two specific examples. Firstly, this occurs when and where there are instances of use values in commodities that manifests itself as nothing more than its ability to generate revenue in exchange. For example, companies have been pouring money into leveraging new AI developments to realize higher returns on investments in the stock market.[143] In this case, the use value of knowledge commodity is determined entirely by its ability to generate further exchange value and is necessarily bound up with the generation of *economic value*. However, knowledge as a commodity under capitalism often presents itself as being directly attentive to the needs of individuals or of the collective whole. This is quite rarely the case, and even in "emergency" circumstances, industry and government rarely give up on the profit motive entirely in favour of production directly for use or need. Take the case of the development of the COVID-19 vaccine during the global pandemic beginning in the fall of 2019 and currently ravaging public health across the globe. While it is inarguably a good thing that governments and industry the world around have poured billions of dollars into researching and developing effective vaccines against the virus, these vaccines are

[142] I use the language "takes the form of" here to make it clear that it is not my position that scientific knowledge is *actually* a commodity in a Marxian sense. Borrowing from David Ricardo, reproducibility in principle is essential to his analysis of the general commodity form under capitalism. It is not immediately clear to me whether the propositions composing the theories of science can be said to be reproducible "in principle" or in what way. A discussion of this would be far beyond the scope of this thesis.

[143] Mike Thomas, "How AI Trading Technology Is Making Stock Market Investors Smarter", Built In, 2021, https://builtin.com/artificial-intelligence/ai-trading-stock-market-tech.

still largely being produced with exchange value in mind, despite the obvious emergency necessity of the use value they represent. The two most widely recognized mRNA vaccines (Moderna and Pfizer) are patented by the corporations producing them and, despite both receiving federal money to support their development, were both produced with economic exchange value in mind. Indeed, Pfizer itself has reported record profits from the production and distribution of their mRNA vaccine despite the emphasis on use value that this emergency necessitates.[144] In this case, it is not clear whether an emphasis on the importance of economic value in the production of knowledge led to the stifling of pursuit of lines of inquiry that would have proven less economically valuable though more societally beneficially in the vaccine fight against COVID-19. However, pointing out that this was a real possibility in a worldwide emergency of this magnitude is enough to make my point about just how engrained economic value is in the structure of production and consumption of scientific knowledge, of understanding itself, when considered using a dialectical framework. A DM analysis reminds us that the general form of production of knowledge is partly constitutive of the content or expression of that knowledge. And it is worth pointing out that the form of production of scientific knowledge is generalized under capitalism.

That neither we as a society nor individual scientists ultimately have rational control over this general form is the fundamental unfreedom tied to science as it relates to capitalism; neither understanding for understanding's sake nor understanding for generation of use value is the primary goal guiding the production of scientific knowledge. This limits both the organizational structure of science (science is *organized* to produce value) as well as understanding itself (insofar as the *use* or "consumption" of science is integral to understanding). In this sense, science is less

[144] Rebecca Robbins and Peter Goodman, "Pfizer Reaps Hundreds Of Millions In Profits From Covid Vaccine", Nytimes.Com, 2021, https://www.nytimes.com/2021/05/04/business/pfizer-covid-vaccine-profits.html.

"free" under capitalism because we are not capable of controlling the general form of its production and consumption nor organization. It is not utilized to serve the ends of knowledge nor of producing useful things for society in general. Though these things do, in fact, happen, they are not representative of the general form which science takes towards knowledge production in a capitalist society. Although a good chunk of the funding that goes into the production of science in the industrialized capitalist world is provided by the state, this does not guarantee that the funding is not tied to the production of value in the market rather than in a general use sense. In the Canadian context, of the three major federal funding bodies (CIHR, SSHRC, and NSERC) it is NSERC (Natural Science and Engineering Research Council) that most often has its funding priorities realigned by various governments to suit the needs of the business and industrial sectors of the economy. And though the increasing marketisation of science certainly made headlines under the Stephen Harper administration in the early 2010s, there is evidence that this was not merely an anomaly connected to a particular political ideology. Justin Trudeau's recent budgets have also come under fire for doing the same thing using different language. For example, the recent establishment of the Strategic Science Fund (SSF) to dole out federal money to "third party organizations" has also drawn fire for essentially being a giveaway to the private sector for "stimulating innovation".[145]

What this means from the point of view of a DM analysis is that there is a clear pathway forward for science if it wishes to free itself and increase its own rationality while also increasing our own epistemic freedom. In a society in which the product of the scientist as knowledge does not confront them always as the production of a value for potential marketability, science is "free"

[145] Desdemona Khan, "Opinion | Funding Science Research: Where Is Canada Going?", Thestar.Com, 2021, https://www.thestar.com/opinion/contributors/2019/06/12/funding-science-research-where-is-canada-going.html.

to set the boundaries of its own epistemic horizon. Production creates consumption, and the consumption of knowledge is understanding. In this process, we, as a species, also gain a greater ability to control our relationship with both nature and society in general through this increased understanding, which is essential to the process by which humanity ever increasingly exerts its conscious rational control over nature, society, and the consequences of its own actions. In this sense, but only within the context of bringing the production of scientific knowledge under a specific form of rational social control, DM points towards an inherently positive role for science to play in the evolution of humanity. As we bring the production of knowledge ever increasingly under control, we gain a greater understanding of how we can bring nature and all our social relations under this very same control. Production and science are dialectically reinforcing. In this way, though DM provides a general critique of science, it is rooted in a wider material critique of all of society and its relationship to nature and matter that touches upon knowledge as production as well as the role of technology (as the result of science's use and exchange values) in this dialectical relationship. This makes it a suitable candidate for STS, for which the relationship between science, society, and technology forms a core of the field of interest.

And it manages to provide this general framework in a way that newer conceptions of materiality do not allow. While it is true that DM gets away from simplistic conceptions of the subject and its relationship to objects and Being, it never does fully evade the question or the problem. Ignoring the problem of the correlation is not an option that anyone seeking a genuinely critical approach to reality can sustain. And yet, that is exactly what some new materialists would ask us to do. That this is a problem in the first place is a recognition of the fact that philosophy (thinking) must always be about what is at issue for us. Freedom, necessity, and autonomy can be understood without appeal to immaterial (spiritual) notions or to irreducible normativity. But this

can only come by recognizing the fundamental unity of the subject and the object in the way that DM does. Neither ANT nor new materialisms in general provide us with an account of science and its general relationship to knowledge, society, and freedom. Pointing more specifically towards ANT, freedom and autonomy are *effects* of the entire material process of production and are spread across the various heterogenous intentionalities of the entire assemblage of actors in any given material context. This means that an overall critical analysis of the relationship between thought, production, and autonomy are not possible within an ANT new materialist framework. I believe that what little is gained by this approach in terms of a concrete analysis of the relationship involved in material life is well offset by the tradeoffs mentioned in this chapter that are made by rejecting a dialectical critical materialism in favor of concrete speculative materialisms.

Conclusion

In summary, in embracing the mid 19th century critiques of positivism and scientism that played a role in the subsequent characterization of science as an epistemic social product amongst other epistemic social products, thinkers within what would later become known as STS came to return to fundamental questions concerning ontology and the relationship between humanity (culture) and nature. This move was one back towards ontology in the social sciences because it called into question the divide between nature and culture that stood at the heart of previous approaches to understanding science, including positivism. I have argued in this this thesis, however, that this shift, though well intentioned, *was certainly not necessary* as a response to the positivism and scientism running rampant in the 20th century. The dialectical thinking of the mid to late 19th century is more than capable of dealing with similar concerns about the hard distinction between nature and culture (humanity), the emphasis on an

anthropocentric social science, and rejection of reductionism that various new flat ontologies and new materialisms have with positivist approaches to the study of science. Particularly, the work of Friedrich Engels on a dialectical *materialist* conception of all of reality and of science is useful for articulating an alternative approach to ontology and epistemology in the battle of competing materialisms that have gained traction in STS in recent decades — despite its relative neglect in the social sciences broadly speaking.

Of course, DM is not controversial without reason. And a general defense of its basic principles was necessary as a prerequisite for any argument concerning its comparison to other less contentious flavors of materialism. The main takeaway from the discussion of what DM is from the second chapter is that it is neither a dogmatic assertion of the concrete nature of matter nor a discovery of ironclad dialectical laws that are derived *a priori* and are true at all times and places. The main insight that DM provides us with is the critical materialist ontology and epistemology that it generates rooted in a unified dialectical conception of nature. Critical is the term that I used to draw a connection between the *general* project of Kant, that seeks the conditions for the possibility of experience, and that of Engels, for whom the relationality between being and thought, between things as they really are and as they appear, is of great importance. Unlike for Kant, however, there is no hard separation between nature and humanity. Dialectics is about breaking with the sort of metaphysical framework that makes this separation, and the epistemological difficulties arising from it, possible in the first place. Of course, it is the case that something exists prior to thought, something which undergirds it, and from which though arises. However, this does not circumscribe the possibility of either knowing or changing that which is given in experience beyond a specific *a priori* limit. Because the conditions themselves are given in experience (and imminent), they are subject to change themselves, and

are dialectically related to the orders that arise from them. It is the form of motion of these orders that represents the universal aspect of natural dialectics and gives it both an ontological and epistemological character. It is true that the reality that DM posits is one that, like new materialist approaches, rejects the distinction between nature and culture. However, it does not do this by speculating about the nature of things irrespective of their givenness to us or conditions of givenness to us. Thought, without making a clear commitment about individual subjectivities, is shaped by as well as shapes the other levels of organization of reality. It is always in tension with the conditions from which it arises and can never be fully collapsed back into being or things themselves. Therefore, DM is, at bottom, also a theory of change. The epistemological dimension of DM comes from the recognition that the forms of motion of reality are what matter in terms of knowledge; this is where adequate universality and stability come from to support an epistemological project.

In comparison to DM, however, I proposed ANT as a paradigmatic example of the sort of non-critical, speculative, approach to materialism and ontology in STS that needed to be challenged. To do so, I drew on research in a highly influential area of STS scholarship, social construction theory, to demonstrate the differences between the two approaches. Specifically, work at the crossroads of STS and disability studies has been gaining popularity in the literature when it comes to the notion of the construction of disability, and it was in this intersection that I found a foothold to explore a DM critique of ANT. The takeaway here was that the specific turn of ANT as a new materialist approach from critical questions concerning the material/ontological conditions for disability as such to concrete questions concerning disability as an actant amongst

actants[146] left too little room to explore the sorts of things that are important to an analysis of the construction and function of disability, including: the social and material context of disability, the history of disability, and the conditions for changing the expression of disability in social and material reality.

Finally, I demonstrated some of the benefits of abandoning the approaches that I have labelled new materialist (including ANT), or flat ontological, for DM within STS. DM is compatible with the turn away from positivism and anthropocentrism that has characterized much of the recent scholarship in STS, though it does not require us to abandon the critical attitude that these ontologies often do. DM focuses on the importance of the empirical without sacrificing the relationship between being and thought as such, which need not be considered anthropocentric. As well, the unified ontology and, more importantly, epistemology that it generates is conducive to exploring the relationship between philosophy and science proper at the theoretical level, which ANT and new materialisms are less naturally suited to accomplish. The chief benefit, however, of taking a DM rather than ANT or new materialist approach to STS comes in the form of the historically integrated and progressive conception of science that it gives us, specifically as it relates to value of scientific knowledge as a catalyst for ever-increasing rational regulation of our relationship with nature[147], thereby increasing our freedom.

What I have offered in this thesis, then, is a choice — dialectical materialism or ontological and speculative materialisms. And we must *choose*. At stake is nothing less than our basic conception of Being and our fundamental relationship to it which informs our inquiries in all other areas. It is not possible that the ANT theorist is right as well as the dialectical

[146] These sorts of questions take disability as the product of actants, which itself is just another actant. The disabled subject is, in a sense, transformed into an object for which we have access to its givenness — hence the speculative label on my part.

materialist. Nor is it possible that Karen Barad or Jane Bennett is correct about the performative or vitalist character of matter while holding onto dialectics. It is my hope that this thesis sparks interest in thinking about matter in a post-positivist way in science studies without sacrificing humanity or philosophy. It is not my contention, however, that dialectical materialism ought to be swallowed whole by STS or science studies in general. It is a controversial way of looking at the world that may very well leave out several important features of reality (including experience). I described some of these shortcomings in chapter two of this thesis from a scientific and analytic point of view and did my best to remedy them. A full reconstruction of the specific laws that Engels sees as constituting dialectical materialist thought, though, is far beyond the scope of this thesis. With that being said, the overall emphasis on critical nature of dialectical materialism need not be abandoned simply because of controversy concerning individual "laws". The laws are not what are important; the thoroughgoing critical materialism arising from the dialectical conception of the relationship between Being and thought united under laws of motion is. And if science studies are so intent on making appeals to ontology in the forms of various (new) materialisms, then dialectical materialism offers a promising materialist foundation in contrast. Predicting the exact sorts of lines of research that will arise out of bringing dialectical thought back into science studies is difficult given the extraordinarily heterogenous nature of the "field". Whatever does result, however, will be fruitful.

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