The way we move: rethinking city spaces with user-generated data

by

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Abstract

Since the inception of Google Maps in 2005, there has been plenty of discussion about how this type of mapping technology has changed the way individuals orient themselves and whether or not the use of technology like Google Maps changes the way we see the world. In short, it has. However, digital mapping technology is the latest iteration of how mapping has changed. The use of technology does not diminish the personal experiences that we have in the city. Instead, we are now able to study the GPS data that individuals plot in the city. This allows for a data set that reveals different layers of the city, particularly how we move through them. This research uses running routes collected from Mapmyrun. The user-generated data creates a map that informs place and changes the structure of the city. This user study examines the shift in cartography toward a decentralized model where many mapmakers recreate the city map by using their mobile devices to track the pathways that they deem worthwhile. This study follows the traditions of mapping found in psychogeography and mental mapping, along with Michel de Certeau's definition of tactics and strategies, guide my discussion on how runners create meaningful place. This thesis aims to illustrate how data provided by digital mapping technology revealed different layers of the city. Digital apps are changing how we're making meaning of our space by providing different value sets for us to interpret. The creation of place is personal. My analysis on Mapmyrun contributes to the discussion of creating place in a digital space.

Dedication

For my dad, who instilled in me his love of maps.

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Introduction

Why Edmonton? It's the city I was born in and one that I have been rebranding for myself for most of my adult life. The general narrative of the city has been changing in the last 10 years particularly with how people are interacting with the city with their mobile phones and GPS devices. Since the inception of Google Maps in 2005, there has been plenty of discussions about how this type of mapping technology has changed the way individuals orient themselves and whether or not the use of technology like Google Maps changes the way we see the world[1]. In short, it has. Digital mapping technology is the latest iteration of how mapping has changed. Although mapping technology may have changed the way individuals navigate through the city, the use of technology does not diminish the personal experiences that we have in the city. Instead, being able to study the GPS data that individuals plot in the city allows for a data set that reveals different layers of the city, particularly how we move through them.

Exploring Maps

There have always been maps. The etymology of the word started in the early 16th century from the medieval term "mappa mundi," which means "sheet of the world.' Some record distance, others record thoughts. Some tell stories and some show you the path between point 1 and point 2. Regardless of the intent, we've always made maps. Nowadays when we think of maps, we think of it looking like this:

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[1] See Brotton 2012, chapter 12
Garfield 2012, epilogue
Thomas Mcmullan, http://www.theguardian.com/technology/2014/dec/02/how-digital-maps-changing-the-way-we-understand-world

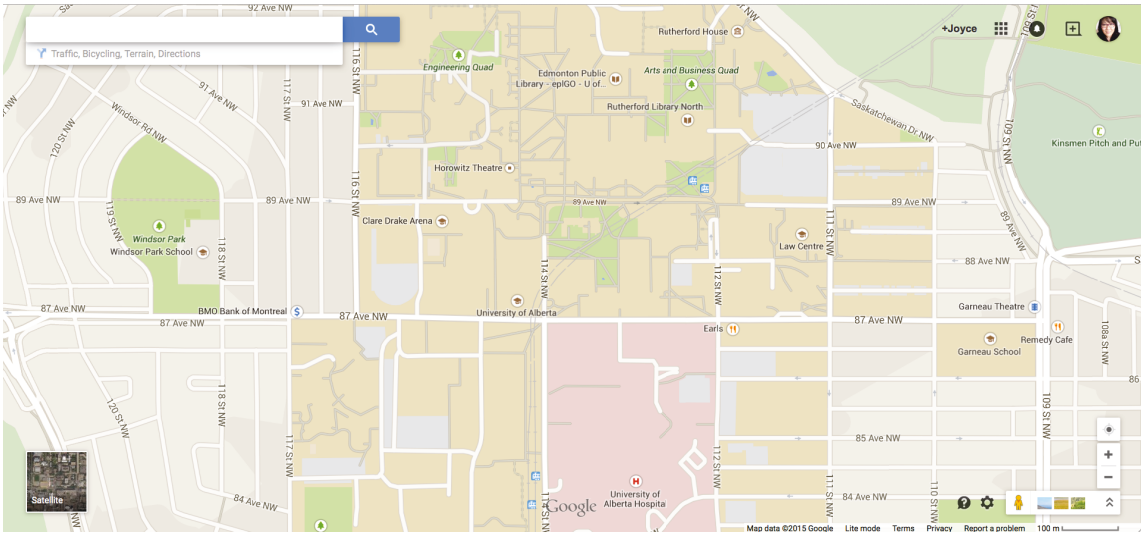

Figure 1.1: Screenshot of Google Maps

But, in fact, it can look like this —

Figure 1.2: T and O Map, downloaded from Wikipedia Commons

Or this –

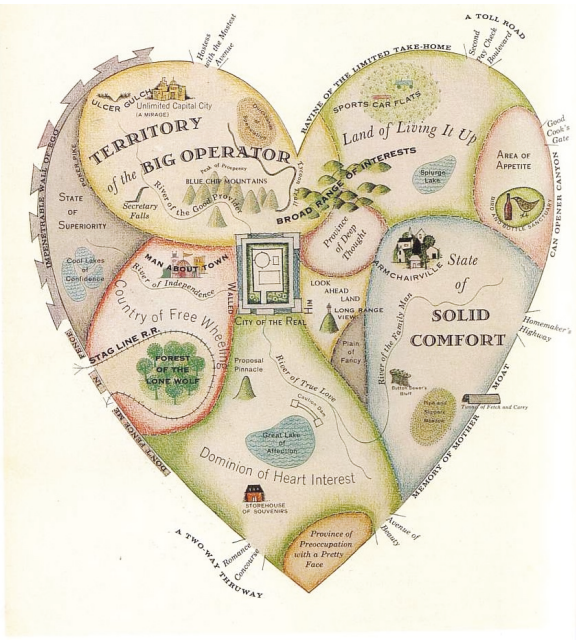

Figure 1.3: *Geographical Guide to a Man's Heart with Obstacles and Entrances*: by Jo Lowrey

The current definition of a map is, "a diagram or collection of data showing the spatial arrangement or distribution of something over an area" (oxforddictionaries.com). Maps are most commonly understood to be Cartesian, empirical objects. Cartography is known as the study and practice of crafting representations of the Earth upon a flat surface. The orientation of a map is currently understood as having north at the top, south at the bottom, east on the right and west on the left. For many cultures, a map has been the perfect tool to capture a tangible representation of the world. As Dr. Gartner from Esri states, "Maps can be understood as tools to order information by their spatial context" (esri.com). And, while the cartographic process has seen significant progress, the principles remain unchanged. The most important principle is that maps are an abstraction of reality.

Most people typically associate maps with navigation and use the traditional street map as a tool for wayfinding. Denis Wood describes this type of map as one that you would buy at a gas station and keep folded up in the glove compartment. This type of folded map is no longer considered the conventional map. With the advent of Google Maps in 2005 and the proliferation of GPS-enabled devices, digital maps have replaced the conventional paper map (for many western map users). The digital map is now the traditional, recognizable map. However, mapping technology is constantly evolving. Google Maps is just the latest iteration that continues a process of change in how people use maps to orient themselves within a given space. The extensive use of digital technology does not necessarily diminish the personal experience of a particular space any more than previous mapping technologies did, even if new maps do influence experiences in new and interesting ways. Mapmakers inscribe into their maps the values and cultural biases of their historical moment. For example, the Mercator projection distorts the layout of the Earth's surface (Brotton 218). No map accurately or objectively reproduces the space it represents. Instead, a map represents the mapmaker's particular understanding of that space at a particular time. This in turn informs and affirms the map users' understanding of that space.

An alternative approach to mapping is known as "psychogeography" which focuses on a record of the emotions and behaviour that individuals experience within locations familiar to them. These records or mental maps show what each person considers important within a specific space. British author Will Self pondered over the increasing irrelevance of geography in an era of digital maps and GPS. "We live out our lives in cities that blot out natural features, while we resort to mechanical transport to annihilate distances and gradients. Disorientation is a luxury that only we in the affluent west can truly afford" (109).

However, the use of technology does not diminish the personal experiences that we have in the city. Instead, the ability to collect and study the GPS data created by individuals as they use these technologies reveal different layers of the city and, in particular, the ways people move through them.

James Surowiecki's *The Wisdom of Crowds* looks at the process of taking the collective opinion of a group of individuals instead of relying on one single response to an answer. This type of crowdsourcing works well when we look at websites like Wikipedia, Yelp and Tripadvisor. Rating sites like Tripadvisor and Yelp are prime examples where data that comes from a collective knowledge can prove a point more effectively. Surowiecki demonstrates how, under the right circumstances, a collective group of people are "remarkably intelligent, and are often smarter than the smartest people in them"(xiii). I am applying this idea to the formation of a better understanding of a city when we collect a group's worth of maps that are being formed by geolocative smartphone apps. Location based social network apps like Foursquare, Twitter, Instagram and Facebook, are not traditional mapping apps, but they do have a location based, check-in setting and some even have a map that aggregates all of your locations.

For the purposes of this study, I downloaded over 400 .kml files of runs that users uploaded to a running app called Mapmyrun. Initially, my interest lay in seeing how a map made with crowdsourced GPS data would differ from a standard map and reshape our view of the city. This interest still informs this study, but my focus shifted to how the dynamics of user-generated content informs place and changes the structure of the city. My research contributes to the scholarly discourse by further examining the shift in cartography toward a decentralized model where many mapmakers recreate the city map by using their mobile

devices to track the pathways that they deem worthwhile. To accomplish this, I use Michel de Certeau's theories as a guide in understanding how the shift to digital mapping changes the way people understand and navigate space. De Certeau's theorization of what he terms tactics and strategies aid my discussion of how runners create meaningful place by charting their own path instead of taking the prescribed path from a standard map. To do so, I will define de Certeau's tactics and strategies, as well as the terms "space" and "place".

I will analyze data collected from MapMyRun as well my main case study. I will also use supporting case studies involved in similar research to connect the theories to actual instances of how people use digital maps. My methodology in this study combines theory and empirical examples to continue the discussion on how digital technology influences the way we read and understand maps. Finally, this thesis will look at other works that have addressed digital technologies and mapping practices. Using this model, this study will aim to address the following questions:

1. To what extent has our understanding and reading of maps changed with GPS data?
2. How do individuals create their our own place on a map?
3. How does user-generated data inform us of how individuals move through the city?

Chapter 1. Literature Review

I start by establishing my theoretical framework. For the purposes of my study, I focus my discussion on de Certeau's theory of space and place along with his theory of tactics and strategies. There are decisions in the city that were made for us by an established power structure. This is what de Certeau calls strategies. Tactics however, refute the strategy to regain personal power. These tactics create meaning in a place. It is also important to establish that I view the city as a "place." Space is a set of coordinates, while

place is an area that becomes populated by meanings. A sense of place is filled with unique experience created by individuals and communities who are situated in that place. By defining the city as a place, I can then discuss how user-generated data can reveal how individuals are finding their place. De Certeau's theory acts as the lens for my discussion on maps created by user-generated data.

The objective of this chapter also provides a foundation for how to read maps. I base my discussion on Jerry Brotton's work *A history of the world in 12 maps* to review the origins of maps, how they have evolved, how some are symbolic, and how these maps inform us on current mapping practices. I will also discuss current mapping practices and how the same biases and cultural agendas of mapmaking remain the same as symbolic and indexical mapping practices in the past. I place specific focus on mapping projects created by Denis Wood, Ingrid Burrington and Becky Cooper. Their projects are significant to the discussion of how the approach and focus of mapping has shifted from the omnipotent cartographer to the individual.

Finally, the discussion of mental maps is a common thread throughout this thesis. I will define mental mapping using Kevin Lynch's *Image of the City.* This background will allow for the discussion of how his work has been able to transition from paper maps to digital maps.

Chapter 2. Case Studies

This second chapter positions my study with other relevant case studies about digital technology and mapping today. I take an in-depth look on the Livehoods Project by Norman Sadeh's research group, Fabian Neuhaus' UrbanDiary and the University of Alberta's Edmonton Pipelines. Each of these projects contributes to a new method of mapmaking based on crowdsourced GPS data.

The Livehoods project focuses on how neighbourhoods are defined. Based at Carnegie Mellon, researchers use social media (Foursquare, in particular) data to plot how individuals categorize the neighbourhoods in their city. While Livehoods looked at how social media check-ins reorganize the city structure, Neuhaus's UrbanDiary ran a user study combining mental mapping with GPS tracking. His motivation was to reveal the rhythm and patterns of the city by tracking inhabitant's movements. Both of these projects leverage individual user-generated data to create a different perspective of the city.

The third case study that I discuss is Edmonton Pipelines. While they are a multidisciplinary group that covers multiple projects, they have done significant work on urban narratives and digital cities. While not all of them are crowdsourced projects, or user-generated projects, their discussion on urban theories and digital technologies inform my discussion on how digital mapping is now an integral part of how we construct meaning in a city space.

Finally, I compare the Motorola Mobility study with Mapbox's Eric Fischer's interactive city maps. I am comparing these two particular studies because their approach was similar but their conclusions were quite different. The concluding argument for the Motorola study was that mobile technology did not reflect what was important to participants in the city. They came to this conclusion because the most popular location-based services were not reflected on their participants' mental maps. However, Eric Fischer's interactive maps were more representative of individual desires due to the method he collected his data. This served as the missing factor to the Motorola study.

Chapter 3. Mapmyrun

This last chapter will present my case study of the Mapmyrun app and the data collected from the runners using this app. My question is: what does Edmonton look like to

runners? In this chapter, I answer this question by discussing the user-generated running routes I collected from Edmonton runners on the application Mapmyrun. Mapmyrun is not the same type of social media data that the previous case studies collect, but they provide a similar richness in data. By layering all the running routes together, a different shape of Edmonton takes shape. Using de Certeau as my theoretical lens, I analysis run paths generated by specific users who adapt and transform the boundaries of the streets to their own needs. By compiling and mapping this data set, I am able to study the structure and composition of the city. The data reveals a specific shape to the city that is based solely on Edmonton runners' perceptions.

In a larger world of ideas, this project speaks to the constantly evolving world of mapping. Digital mapping has changed how we understand maps, how we read maps and especially how we make them. The conversation on mapping has shifted to the individual mapper. By collecting GPS data from MapMyRun, I can discern the ways in which we create our own place by using our own paths as we move through the city. The data shows that people who run don't always run where the city suggests, whether it's a city planner, planning committee, city boundaries or otherwise. The blue dot that indicates, "you are here" makes each individual his or her own mapmaker.

This thesis examines how digital maps created by crowdsourcing GPS data have replaced the cartographer with a personal and individualized mapping experience. The emphasis has shifted away from a centralized body to the individual person who is tracking their own path. GPS data, geolocation devices and the ability to look at the aggregate has changed the way maps are being made, particularly when we look at maps from specific communities, like a running committee in Edmonton. Much work has been done around the concepts of personal geography and alternative forms of mapping. The individual will walk

an alternative path and record what was meaningful to them after the fact instead of a cartographer. However, a discussion on the aggregate of these individual paths made with a GPS device is one that we're only beginning to have. This discussion focuses on the shift to individuals being their personal cartographer in the world of digital mapping. Edmonton Pipelines describes the city as a place and the movement of the city creates stories that are beneath the surface. This description of mapping rings true with my own work as I explore our relationships with the city, and the process by which we create place using GPS data collected from our mobile phones. This type of study follows the traditions of mapping found in psychogeography and mental mapping, but with a focus on using technology to map the city.

Chapter 1

Literature Review

De Certeau - Tactics and Strategies

Many medieval maps, including the ones that I discuss, are drawn to have an omnipotent way of looking down on a society. This places the map-reader in the position of looking at a map from the perspective of a deity. This is the same view that Michel de Certeau took by looking down on New York City from the 110th floor of the World Trade Centre. This view is what he calls a false perception because this is not the way citizens interact with a city on a daily basis. The city is very much a legible text, but the legibility changes with the individual. Rebecca Solnit identifies maps as "an invitation in ways that texts and pictures are not. You can enter a map, alter it, add to it, plan with it. A map is a ticket to actual territory" (8). Throughout my discussion of mental maps, I focus on very specific components and images of the city that come to mind immediately. Our perceptions of Edmonton might have varying similarities, but it will always look a little different. As evidenced by the following chapters, none of our maps will look like what Edmonton looks like on Google Maps. Solnit says it best that no two people live in quite the same city (8).

For the purposes of my study, I use space and place with de Certeau's theory of tactics and strategies as a guiding principle. De Certeau tells us "Space is a practiced place. Thus the street geometrically defined by urban planning is transformed into a space of

walkers" (117). De Certeau's theory of tactics and strategies provides the theoretical framework for my discussion of how inhabitants create place for themselves in a city.

As I will discuss in my history of maps section, a single cartographer is responsible for the map of the world. Their perception of the world represented the views on an entire society. Several studies in neogeography reveal that, even now, individuals are still bound to decisions in the city that pre-existed them (Dickinson). There are decisions in the city that were made for us by an established power structure. De Certeau calls this a strategy set by the government, corporations, and/or institutions (36). This governing body also produces systems of knowledge like city planning and cartography. De Certeau argues that strategies are permanent and inflexible. He states,

> in sum, strategies are actions which, thanks to the establishment of a place of power, elaborate theoretical places capable of articulating an ensemble of physical places in which forces are distributed. (38)

For a city, strategies look like a street sign or a one-way street (itpedia.nyu.edu). They also look like streets, sidewalks and prescribed pedestrian paths. Strategies organize the city. For example, without city strategies, drivers would be in a state of disorder because there would be no traffic lights. Tactics, however, react to that environment that was created. Instead of walking on the pedestrian sidewalk, people create a path for themselves. These can be seen as desire lines where a path is created on a patch of grass or a field of snow. Walkers who resist the main path (the strategy) create an alternative path (the tactic) that wasn't intended to be a route. However, tactics and strategies can inform each other. De Certeau links storytelling with everyday tactics to form a place, (108) but strategies also provide a specific type of knowledge to a space. While it's true that we all have our own individual images of a location, it is not completely arbitrary or individualized. If it were, we

wouldn't be able to set up a meeting spot with another person. A perfectly personalized mental map would be incomprehensible to another person. We wouldn't be able to drive to any location or be able to describe to someone else where you are.

Tactics are generated by "circumstances in which the precise instant of an intervention transform into a favourable situation" (38). They improvise and manipulate the space to reorganize the space. De Certeau says,

> They are sentences that remain unpredictable within the space ordered by the organizing techniques of systems…these traverses remain heterogeneous to the systems they infiltrate and in which they sketch out the guileful ruses of different interests and desires. (34)

de Certeau's text argues that place is not confined and determined by buildings and roads (159). By using de Certeau's theories, we can explore how place is created based on individual experiences and environments. As mentioned, "space is a practiced place…thus the street geometrically defined by urban planning is transformed into a space by walkers" (8). Place is defined by people walking through the city and projecting their own interpretation on what they believe to be boundaries in the city and the streets. This is where de Certeau's philosophy and digital mapping meet. De Certeau watched people walk through the city grid to define a sense of reality, but also to resist dominance. Using GPS data we can study how individuals trace their footsteps through the city — whether it's on or off the grid of the city. Some may follow the path laid out in front of them; some create their own paths while others start working together to create desire lines. Lippard also argues "each time we enter a new place, we become one of the ingredients of an existing hybridity…by entering that hybrid, we change it; and in each situation we may play a different role" (5). Here, Lippard suggests that mobility and place are connected as every

walker has a different method, tactic and sense of direction.

De Certeau compares the view from the 110th floor of the World Trade Center to the omnipotent view in Renaissance paintings. The Renaissance painters "represented the city as seen in a perspective that no eye had yet enjoyed" (de Certeau 92). This view, however, does not represent the lived and traversed experience of the city. While we may look at a map of the city from an omnipotent perspective, we live and move through the city from the ground. De Certeau wrote *Walking in the City* and *The Practice of Everyday Life* when a paper map was the norm. Sybil Lammes aptly calls paper maps, "frozen representations" (3). The way we experience the city is subjective. However, the static paper map is depersonalized and renders an objective environment. Lammes notes a tension with how maps represent environments as static and unchanged (85). However, each person's experience traveling through a place is personal and dynamic. The digital maps that we create now realize de Certeau's argument of a city based on movement. He states, "pedestrian movements form one of these real systems whose existence in fact make up the city" (97).

Digital maps created by individuals can contest city-planned routes because the technology allows for a record of how the individual is moving through the landscape. Individuals may move through the city using routes that are planned for them, but they also choose alternative routes and the study of that aggregate shows us different trends and patterns that form from people walking down the street. The Edmonton Pipelines project states that we are no longer content with "simply walking, commuting or driving in our cities anymore." Now, many of us "accomplish these things while we accomplish them on mobile devices and GPS enabled maps" (Cobb, Engel, Laforest and Zwicker 65).

Space and Place

For the purposes of my research, I must first establish that I am discussing the city as a place. I am defining "space" as a set of coordinates, while "place" is an area that becomes populated by meanings, memories, and experiences that are left behind by individuals. A place is built on perceptions, has movements and can always change. A place is experienced by an individual and is created by stories and memories. Space is an objective concept, in this circumstance. Geographer Yi-Fu Tuan argues that a space requires movement from one place to another place and vice versa. I believe that a set of coordinates is a space until individuals start creating layers of meaning in that space. When meaning is assigned to a space that is when it turns into a place. Sense of place depends on how people interact with their environment and how those interactions become an experience. Tuan claims that space has temporal insinuations while place has physical insinuations (179). A sense of place is filled with stories, memories, and unique experiences created by individuals and communities who are situated in that place. Tuan's claim highlights the point that place is made when the individual creates meaningful moments in that space.

Location data acts as a marker for where an individual visited or passed through, at one point. In lieu of carving their initials in a tree or marking their handprint in cement, they made a geospatial mark that says, "I was here." Mobile users with location data are now able to walk through a space and create those coordinates themselves, rather than following coordinates of others. Drawing from Richard Elliott's work on memory and the city, the navigation of a city raises "questions of negotiation between citizen and city, between dweller and dwelling place" (73). Tuan places emphasis on exploring space and place through the body. We make sense of our world spatially by moving through it (Tuan 54).

Lucy Lippard's definition of "place" guides my discussion of space and place. "Space defines landscape, where space combined with memory defines place" (9). Lippard states that every landscape is a hermetic narrative, that "finding a fitting place for oneself in the world is finding a place for oneself in a story" (33). In *The Lure of the Local* a place is not simply nostalgia, but built on a sense of community and a deeper connection to that particular place. My discussion stems from the idea of creating layers in a static space based on GPS data and digital maps. Lippard's *The Lure of the Local* argues that reading a landscape in the geographical sense means reading the history in the landforms and built structures, behind which lie the stories of the people who made that history (Mitchell 217). GPS tracking devices are now the norm and we are able to track our movements through the city. Not only that, but we are also able to see the movements of other people in the city. Each path represents a different layer of meaning based on decisions and motivations those individuals made to walk through the city. Those movements are different, as are the memories and stories associated with those movements. As I continue my discussion, this is also how individuals create their own tactics as they navigate through the city.

According to Peter Birch from Google Earth, maps function as two methods. The first method is to find your way. The other is the opposite: "to create a sense of reality and a completely comprehensive representation of the world" (Lane 5). Space as a physical location is inauthentic while place is emotional and personally significant. Yi-Fu Tuan refers to place as "humanized space" (54). Place is central to human behaviour, thoughts and decisions of an individual. It represents the mental maps people create of locations and whether they like it, find it desirable, uncomfortable or any type of emotion connected with that part of the city. Place is the relationships that individuals form with these locations. Ian Muehlenhaus quotes Doreen Massey's depiction of place as a:

> network of social relations which have over time been constructed, laid down, interacted with one another, decayed, and renewed. Some of these relations will be, as it were, contained within the place; others will stretch beyond it, tying any particular locale into wider relations and processes in which other places are implicated too. (4)

Given how Massey defines place, we know that place changes because of the social relationships that build it. These places are connected with each other and are able to grow over time. However, places are never permanent. Different experiences within that place create different connections and new places can replace former ones. They are constantly changing. Affection, personal identity and a collective memory create people's emotional ties to a place. To understand an individual's' sense of place, we need to explore their daily routines and frequented places. Crowdsourced GPS location data allows us to study those places and, the process of mapping the data, allows us the ability to analyze those places and the movement through the city that made it meaningful.

History of Maps

How do digital maps make meaning? In order to answer this question, it's important to discuss the origins of maps and how they have evolved. The map is greater than the sum of its parts and by learning how to properly analyze the map, you also learn the motivations behind the map. Maps exercise different kinds of power over society and this next section will discuss how that has changed over time. In this section, I discuss the symbolic representation in maps as examples of how they are tools that contain the beliefs of the day.

Maps "organize information and illustrate relationship" (Kilston 108) and our readings of the maps unlock stories that the map is trying to tell us. These types of stories

could range from historical representations of a culture, places where people go on first dates, or even a map of where all the public bike racks are located.

In this next section, I focus on a selection of symbolic maps from several time periods. By reading these maps, we are able to distinguish the culture's preoccupations inscribed in that particular map. Brotton describes mapmaking as a subjective process based on imagination and a culture's belief of the world. Maps "offer a spatial understanding of events in the human world; but it is often also about time as it asks viewers to observe how these events unfold one after another. We look at maps visually, but we can also read them as a series of different stories" (Brotton 6). The symbolic maps provide a foundation for how to read the map. These close readings serve as a background for my analysis on the GPS data maps in the next section. It also supports the question: how do digital maps make meaning? In order to understand how maps have changed with mobile phones and GPS apps, it is important to look at key maps from the past. "The construction of a world map in the middle ages was a literary and a theological exercise, not a geographical one" (Whitfield 14) Whitfield impresses upon us that the map, while also a tool for many other uses, is also a tool for storytelling, particularly one that is pedagogical of the society at the time.

At first glance, a map could be a physical representation of the shape and size of a country or a continent in relation to other countries and continents. However, it is the details within the map that tell the story. I chose maps from different time periods, cultures and religious backgrounds. This will present a broad scope of how different cultures were presented on a map. How did they see the world around them? How is that revealed on their map? Maps are more than just an accurate representation of a location, or a way to navigate from point A to point (though it's important to note that some maps do just that). Philosophers like Gaston Bachelard and Henri Lefebvre question how we understand and

live within a particular space. While Bachelard look at spaces that are more inline with things like attics, cellars, drawers, Lefebvre took a Marxist approach on the creation of public space could enable or constrain personal identity. These discussions began an argument that space "had a history" (Brotton 399). JB Harley in *Deconstructing the Map* voices his frustrations that cartographers create maps without any reference to the social world. Maps are "too important to be left to the cartographers alone...we should encourage an epistemological shift in the way we interpret the nature of cartography (Brotton 400).

Brotton claims to explain the history of the world in twelve maps. He believes that maps offer a spatial understanding of world events. Maps are not only used for navigation, they are also used to represent traces of cultural identity and power. These traces are still present in today's maps even though we might think of them as aids for wayfinding. The Peters projection versus the Mercator projection is a prime example of a map that we recognise for wayfinding, but distorts the size and shape of the continents in favour of accuracy for navigation. German historian Arno Peters developed his own world map (based on James Gall's projection) that he claims has a more accurate size of the world's land area. Peters' criticized the Mercator projection as Eurocentric and created a projection that more accurately portrayed the size of Africa and South America. The Mercator projection, on the other hand, projects regions according to their distance from the equator. The Mercator projection was the most suitable for ship navigation and remains the most commonly used world map, including Google Maps, OpenStreetMap and MapQuest.

The Babylonian Map of the World is a stone tablet made in 700-500 B.C. This tablet represents the kingdom of Babylonia. It is considered the first known map of the world, while also the oldest map still in existence. In the following image of the Babylonian Map, you can see an outer circle that represents the ocean while the inner circle represents their

world. The triangle shape around the outer circle represents mythological creatures and the unknown. The city of Babylon is placed in the middle of the inner circle as their way of proclaiming their position in the world (11).

Figure 1.4
Babylonian map of the world, courtesy of British Museum.

This map is a key example of this type of map that places the civilization of origin as the centre of the universe because the real purpose of the map explains the Babylonian view of the mythological world. This map shows us the Babylonian culture's identity and how they see themselves compared to the rest of the world. This map also reveals the subjective position of the mapmaker. According to Jerry Brotton, the Babylonian map was made so viewers could look down at the world and have an omnipotent perspective of the world. The Babylonians considered themselves the civilization of the world and that viewpoint is represented on the map with Babylon placed in the centre of it. By being in the centre, the Babylonians were reassuring themselves of their power. But, to everyone else, this placement was a message of power and domination. Access to maps at that time was not universal. They were a source of power. The ability to read a map was considered a

privileged position reserved for those who wielded power or control. This is no different from GPS data now, which also privileges a particular group of people. In 2014, running maps created by GPS data were criticised by the Washington Post for being biased to rich people with smart phones who use running apps. They say,

> "These [map] results are to be expected. People who can afford to do so tend to prefer living near parks and rivers, where runners also like to run, and the poor are less likely to be able to afford luxuries such as smart phones and fitness apps" (knowmore.washingtonpost.com).

This is partially true, because runners would need a mobile phone to track their runs. The article in Washington Post may have criticized that the maps are biased, but the fact is, most maps if not all maps have biases. The Babylonian map shows the power of the empire by placing Babylonia in the centre of the world. The GPS data maps also favour a very specific group of people. Untappedcities.com criticizes Washington Post's argument because they assumed the maps were meant to be accurate. They write, "maps can be powerful tools for exploring human behaviour, but it's critical that any and all assumptions that go into the making of the map are revealed to the viewer. Before you jump to conclusions about what a map means, you should have a good understanding both of what's on the map and what's below the surface" (untappedcities.com).

Finally, an important map to discuss is the Hereford Mappamundi made in 1282. The word "mappamundi" means cloth of the world. All mappamundi are meant to be schematic, conceptual and never meant for navigation or representing any type of landmass. The Hereford mappamundi is a T-O circular map of the world with one sphere surrounded by water. A T and O map is a medieval, circular map with the letter T inside the O. The T divides the earth into three parts: Europa, Asia and Africa. East is at the top, with Asia taking up two thirds of the whole sphere. Africa is at the south with its boundaries touching Asia and

Europe is to the west and Scandinavia to the North. The O represents the ocean surrounding the continents (Brotton 100). When you look at this map, you understand immediately that this is not a map that is meant for navigation. The mappamundi shows Jerusalem at the centre of the map with the crucifix directly above it. Like the other maps I've mentioned, Mappamundi maps don't show the map-readers how to navigate. Instead, similar to the Babylonian map of the world, the mappamundi is schematic and made to portray the society's (represented by the mapmaker) principles and beliefs.

Brotton describes mapmaking as a subjective process based on imagination and a culture's belief of the world. He says, "maps offer a spatial understanding of events in the human world...We look at maps visually, but we can also read them as a series of different stories" (6). For example, 12th century Islamic mapmaker Al-Idrisi created a circular map of the world that unified elements of Christianity and Islam together as opposed to endorsing one religion over the other. However, by the 13th century, both religions began demanding maps that advocated their respective religious beliefs. Soon, maps that portrayed religious belief were favoured over maps with geographical accuracy (Brotton, 80-81). These indexical maps reaffirm that whether it's historical or current maps, they reflect the societies in which they are made. We can now look at maps through smartphones, computers and other devices, these new forms of maps still represent the same type of ambitions, and cultural prejudices that existed on maps made of parchment or stone tablets. The precise and accurate representations of the physical space are not always the concern or the intended outcome of the mapmaker.

For my own research, the run maps track a very specific demographic of people who:

1. Carry a mobile phone

2. are serious enough about running that they would track it on their runs on their phone.

It is important to consider the digital divide with these two points. While the Washington Post blog failed to recognize that maps are not objective, they do point out that runners who don't have access to mobile phone are omitted from the map. However, this might not strictly suggest those who don't have access to technology or a re in a lower financial bracket are omitted. Those who choose not to use the app or mobile phones are excluded from the map.

Not only do the maps track a specific community of people, there are also selection biases on running locations, the time of day, the season, and the tracks themselves. Some runners may only want to share particular runs and keep the others private. This all goes to show that all maps have a bias, whether it's the specific mapmaker or a crowdsourced map that tracks human behaviour.

Modern Mapping

> As Guinevere Harrison says,
>
> digital mapping programs continue a cartographic legacy that has existed for centuries. Embedded within this technology is the promise of the god's eye view, the projection of our human desire to reduce the complexity of life on the planet to manageable proportions.(317)

We are looking for meaning in the space around us, just like those in the past. The running maps, as I've mentioned, represent only a specific subset of people. In this circumstance, the maps represented runners who use Mapmyrun between the dates of January 2012-

December 2013. Other digital maps will have different focal points and are preoccupied with their own specific groups of people. Brotton criticized Google for releasing a statement that location data means that we will be the last generation to get lost. Brotton states that if we are the last generation to know what it means to be lost, then we may also be" the last generation to know what it means to see mapmakers generated by a range of individuals, states and organizations" (436).

Digital maps, while also used for navigation, are also introducing new themes and values aside from getting from A to B. This is similar to the indexical map, as both types of maps have embedded ideologies. They are a record of how a group of people understood and organized the space around them. Maps evolve based on the particular culture and politics and not merely because of technical improvements for accuracy. Maps like the mappamundi and Al-Idrisi are dictated by ideology, while the Mercator map was dictated by scientific research and accuracy for ship navigation. Others like the Peters projection in 1973 was a reaction to the Mercator project and wished to create a map accurate to landmass. The digital maps that we currently produce also carry their own biases. Our approach to mapping has not changed. Maps still carry political power even if we think of them as neutral objects in the current context.

I disagree with Brotton's sentiment that we may be the last generation of mapmakers because digital technology has not only given a much larger group of people an access to maps, but also the ability to map themselves in their space. Geographer Denis Wood's maps are a good example of maps not only generated by an individual, but maps that are meant for a unique purpose and read and understood by a specific group of people. Wood maps the stories that exist beneath the surface. His discussion about maps started in the 70s with his dissertation "I don't want to but I will" and since then he has built maps

based on the aggregate of different types of data to continue his discussion about the power of maps and the storytelling of maps. For his *Everything Sings* collection, Wood created maps of the following:

- which houses had the sound of barking dogs.
- maps off where street lamps were,
- mailman routes,
- bus routes,
- houses where the landlords lived elsewhere,
- utility maps,
- graffiti maps,
- every traffic sign in his neighbourhood,
- maps that showed pools of light cast by each one of the street lamps at night,
- which houses had Halloween pumpkins on their porch.
- how many times addresses appeared in the newsletter

Wood wanted the maps to create a more accurate portrayal of his neighbourhood as a living organism built on layers of activity instead of a map that recreated the city blocks. Those maps, with the city blocks, are what Ira Glass call " the dull salarymen who clock in early and spend their days telling you where stuff is" (thisamericanlife.org).

When Wood's maps are displayed as a collection, the neighbourhood becomes its own entity. This collection of maps become a much more accurate portrayal of what it feels like to live the Boylan Heights neighbourhood. The shape of the underlying geographic map starts looking familiar and the story starts coming out from the individual pieces. The aggregate of these maps provides a better view of the social geography of the neighbourhood than a static traditional map, or individual mental maps. What Wood's maps are able to show us is

that once a space is inhabited and people start moving through it, that space becomes place. For an outside person, a map of the neighbourhood would tell you nothing more than the layout of where the houses are located. It would not be able to tell them the elements that give that place meaning.

As another example, the Loneliness Map by Ingrid Burrington shows the missed connections of lonely individuals in the city as found on Craigslist. “Missed Connections” is a section on Craigslist where individuals would post seeing someone that piqued their interest but lost the opportunity to approach them. Burrington chronicled this section to answer the question - what is the loneliest place in any given city and how can that be measured? This ultimately led to the Map of Missed Connections. Burrington charted more than 1000 posts a week and categorized them by locations, methods of travel, time of the missed connection, and more. In doing so, she created a thorough map of New York City and their missed connections. This map, like Denis Wood’s maps are useless for any type of navigation, but is far from useless as a representation of the city. Once again, this type of map portrays a layer of the city that would otherwise go unnoticed. And, by plotting all the “missed connection” locations, Burrington reveals a very specific story of the city. This type of map also defies Brotton’s statement that our generation would not know an individual mapmaker outside of Google Maps. The Loneliness Map and others like it portray the movement of the city as a place with “different layers of stories beneath the surface.” Lammes describes this practice as “being engaged in playful spatial practices through which personal stories are being developed” (qtd. in Wilcott).

The most meaningful collection for me is Becky Cooper’s Mapping Manhattan. She says, “all maps tell stories. Stories of their mapmakers. Stories about the circumstances of

their creation. Stories about their intended use. They're all biased in some way" (1). Cooper asked strangers to fill out simple, unmarked maps of Manhattan with whatever best captured their experience of the city. Some plotted heartbreak sites, while others documented a sighting of Salvador Dali. Some drew detailed maps while others put a single X that said, "Met my wife." Cooper's project revealed that when individuals are asked to map where they are, they respond with who they are. "Maps are the places where memories go not to die, but to live forever," Cooper says (brainpickings.org). A city is composed of people's individual memories working together. These maps are produced through emotions and senses that come up from an individual's environment. Feelings of desire, happiness and loneliness, for example are the focal points for mental maps, psychogeographic maps, and other new forms of mapping that attempt to map their own place. And, while this particular project with Cooper's maps are paper maps, this type of project is a key example of how individual mapmakers can collectively create different layers of place in a city. Given these examples, Brotton's claim that we are the "last generation to know what it means to be mapmakers generated by a range of individuals, states and organizations" (436) prove to be inaccurate — particularly given that we can now attach geographical coordinates to photos, breaking news, even chart gas prices. The result of this is a "collective gathering of situated knowledge and personal experiences digitally linked to locations around the world" (Harrison 65).

Harrison and others call user-generated cartography as neogeography where cartographers are creating their own types of maps. The co founders of the term "neogeography," Jason Wilson and Di-Ann Eisnor describe it as an "expressive, personal and/or artistic" technique to create and publish maps instead of a "scientific standard"(25). Furthermore, Andrew Turner describes neogeography as "storytelling, ephemeral location

markers, and emergence of new wayfinding schemes have repeated themselves with various rounds of technology and culture" (33). What makes neogeography such a key term for my research is that it allows people to map their own world and their own place on their own terms. According to Harrison, community, identity, a sense of place and tradition are all factors that determine who we are and how we see the world (79).

Mental Maps

I initially started my research thinking of GPS generated maps as mental maps. I discovered, however that the crowdsourced MapMyRun data I collected are not mental maps. The run maps could be considered mental maps if the individual went for a run and then went home and drew the path that they ran. How people generate place and how they feel that sense of belonging in place is a broader concept than the concept of a mental map. However, Lynch's studies are influential as a starting point to creating personal connections to certain places in the city. Lynch was an American urban planner who conducted a study in the 1960s about how people lived in a city and formed mental pictures of their physical surroundings.

Lynch conducted a 5-year study in Boston, Los Angeles and New Jersey in order to examine how people visualised or imagined their cities. He observes how individuals find their way through the city (known as wayfinding), what aspects of the city is important for wayfinding, and what specific aspects of the city are significant to the individual. Lynch explores mental images to gain a sense of place and to construct a composed ensemble that retained in memory can be used to map and remap the city along flexible and changing trajectories. Lynch states, "most often our perception of the city is not sustained, but rather

partial, fragmentary, mixed with other concerns. Nearly every sense is in operation, and the image is the composite of them all" (Lynch 1960).

De Certeau and Lynch both discuss how the image of a city is formed. Every individual has a spatial memory of his or her city. Mental mapping is the individual's perception of how they navigate through it. We all view the world in a small, specialized window. By creating a mental map, we assemble the parts that are the most important to us. Every map is a small slice of information or visualization about the world. Since city space spans much wider than what an observer can engage with, Lynch argues that every inhabitant of a city begins to create different forms of associations with separate parts of the city. (1) As stated above, these associations are the images that the inhabitant creates of the city. These images are created based on memory, past experiences, different associations to the place, be it an emotional or a physical one. This could be akin to remembering which landmark you drove past before making a turn, or having a meaningful moment in a certain location that becomes incorporated in your mental map. The process of creating a relationship with the city as a "two way process between the observer and his environment" (Lynch, 6). A location could be meaningful to one person, but an arbitrary space to another.

As stated, the environmental image is created when the observer creates a connection to a particular place, be it an emotional connection or a physical one. An individual's personal map is a visual representation of their connection and understanding to that space. Inhabitants of a city begin to form their own stories of the city and use their own activities that help populate their mental map. Lynch believes that urban planners should design a city that allows for personalized mapping, learning and shaping. He says,

"we must consider not just the city as a thing in itself, but the city being perceived by its inhabitants" (3). If a city follows the three movements that he proposes (mapping learning, shaping), then people should firstly be able to create a clear mental map of their environment, then they would be able to navigate through this environment without any issue, and finally, they will be able to so start creating meaning behind how they're moving through this space and what is important to them in this space. This belief is actualized in the following chapters on case studies and Mapmyrun.

Lynch uses the term "mental mapping" to explore mental images and how the images are constructed by the decisions that the person would make to navigate through the city. Each person's mental map contributes to a distorted structure of the city with flexible and changing pathways. Lynch's study on environmental images serves to inform my own work in user-generated mapping. Forming a place means that you develop a familiarity. A mental map becomes a narrative that we create partly from geography and partly from experience to start creating an understanding of place.

In 1976, Stanley Milgram conducted a study based on Lynch's work with inhabitants in Paris to study their mental presentation of their city and asked participants to list places of interest in Paris. From there, Milgram aggregated the results, and created an "attraction map" of Paris with landmark names appearing in a larger font according to the number of subjects who mentioned each. His guiding principle is that reality and image are imperfectly linked and that concepts that people have of the city are not ideas or images that can be accurately represented in real life. The concepts that people have of the city are based on images and what Milgram calls non-verbal spatial ideas. His second principle was that the private and public aspects of an inhabitant's life become connected with streets and landmarks. This identity is generated in part by our connection to this place, or more

accurately, our mental map of that place. The third aspect of the mental mapping for Milgram is that the properties of these mentally mapped places can and are expected to change form their spatial coordinates. Both Lynch and Milgram show that people's mental maps of cities go beyond the actual physical layout of the city. Individuals base their travels on areas and streets that are meaningful to them but may not be the most direct or logical path to take. These routes and place resonate with them in emotional and personal levels that were motivated by past encounters, memories, events and familiarity.

The idea of mental mapping represent ways that individuals map out their own routes of their own understandings of city space. Mental maps have been used in different forms of spatial research. There are studies, such as Lynch's, which focus on the formation of a city, patterns of movement that people prefer, qualities of what would be considered an environment of landmarks, streets, familiar patterns and routes.

Digital technology allows a focus on Lynch's environmental image at street level. Each mental map represents a different type of city. Digital maps create these types of cities in a deeper level where they layer different meanings onto a map. It is showing the user different ways that they are engaging with the city. Space exists, but we create place out of our own memory. In Fran Tonkiss' study on spatial humanities, she calls the city a perceptual place. She states, "the city is not only or always determined by larger social or economic structures…it is organized by their own mental maps and particular spatial practices" (6). While Lynch's study predates locative technology, Lynch remains relevant because his concepts of mental mapping continue to inform how we create a place in the city. Martijn De Waal asks, "can we design locative media in such a way to promote a richer experience of place, rather than just getting us where we want to go as efficiently as possible?" (mobilecity.nl) Yes, we can. What digital maps accomplish and what I will be

discussing in subsequent pages are that new narratives and layers of understanding of the city can emerge with these new technologies. There are countless networks that are being mapped around the city that represent very specific pockets of the city.

Conclusion

In this chapter, I have discussed maps as ideologies, strategies and tactics, space and place and mental mapping. These 4 ideas form the basis of my case studies and my analysis on Mapmyrun.

To answer how digital maps make meaning, it was important to discuss how mapmaking has evolved. As stated previously, the map is greater than the sum of its parts. By learning how to analyze the map, we also learn the motivations of the mapmaker. This background helps to inform the discussion on modern mapmaking and the shift from one cartographer who spoke for an entire society to the individual cartographers who leant their perspective to a collective map.

In my discussion on de Certeau, I conclude that walking through the city and creating a place is a tactic in reaction to city strategies. De Certeau's philosophy and digital mapping converge because using GPS data, we can study how individuals move through the city. This discussion is supported by Lynch's work on mental mapping, creating environmental images and understanding a place. In the following chapters, I apply Lynch and de Certeau as my guiding principles to discuss how user-generated data visualizes how individuals navigate through the city.

Chapter 2

Case Studies

Joanna Mikulski from nextcity.org describes the current cartographic practices as a "mapping renaissance [that changes] the way we see cities" (nextcity.org). In this next chapter I am exploring several projects that are part of a new form of mapping by plotting user-generated data. These projects visualize how we can better understand the way individuals navigate the city. "As the world is undergoing an explosion of big data, it's the multi-dimensional map interact that will play the key role for displaying connected intelligence" (imusgeographics.com). By mapping the city with different layers, the data tells a more detailed story from the street level than from a top down perspective.

In Chapter 1, I explored how people talk about and analyze maps. This chapter explores how individuals are creating entirely new kinds of maps. These are ongoing projects by scholars in multidisciplinary areas that have helped inform my analysis of the Mapmyrun map.

The Livehoods Project

The Livehoods project by Norman Sadeh reorganizes city neighbourhoods based on the check-ins on Foursquare. These check-ins are mapped and create different boundaries and shapes in city neighbourhoods to shed light on the different factors that shape the urban landscape. Sadeh's research group at Carnegie Mellon measures the patterns of people who

checked-in to an area and what other areas they may have visited. Their hypothesis: "the character of an urban area is defined not just by the types of places found there, but also by the people that make it part of their daily life" (livehoods.org). The project shows that neighbourhood boundaries are dynamic and chance based on the activities of the inhabitants. Researchers aggregate the check-in patterns to compute relationships between check-in venues. These relationships can then be used to community made borders in the urban landscape. For example, two stores that are next to each other would be categorized as being in the same neighbourhood on a city map, but that does not mean an individual would visit both of them. Those two stores are in the same neighbourhood, but they are not necessarily in the same Livehood. While the neighbourhood is a fixed boundary of streets, a Livehood is the tactic that is transient and everchanging. Neighbourhoods evolve over time and that movement is indicators of how people operate in a city. The Livehoods boundaries are dynamic and change as the activities of the citizens change within them. Sadeh explains,

> like neighbourhoods, Livehoods are a representation of the organizational structure of the city. However, Livehoods are different from neighbourhoods. They give us an on-the-ground view of a city's structure, helping us reconceptualize the dynamics of a city based on the way people actually use it. (livehoods.org)

The Livehoods project asks – what makes a neighbourhood? By looking at the city through social networking data, they discovered two perspectives of city neighbourhoods. The first perspective is enclosed by a fixed set of municipal boundaries. The second are the areas in the city that are created by the people who move through it. Justin Cranshaw states that fixed boundaries don't always reflect the nature of the cultural perceptions people have of the city. (Cranshaw et al 58) This perspective evolves from both Lynch and Milgram's work on mental maps and the internal perceptions individuals have of different areas and

boundaries in their neighbourhoods. As Lynch states, every citizen has his image of the city that is soaked in memories and meanings (1). The Livehoods project created an algorithm to track the changes in boundaries in any given neighbourhood. A neighbourhood isn't defined by the street addresses that contains it, but by the people who live there. Livehoods believes that the landscape, culture and people change as you walk from one point to the next and their algorithm is built to extract that knowledge from these neighbourhoods.

On a static map, a neighbourhood might look like a cluster of blocks placed next to each other. Neighbourhoods, boundaries and places shifted based on the movement of the inhabitants. It is a "sudden change of ambiance in a street within the space of a few meters; the evident division of a city into zones of distinct psychic atmospheres" (Debord 3) This work draws on Lynch's investigation of the structure and function of cities (1960), individual perceptions of local surroundings (Lippard 1997) and Milgram's belief that "the importance of social interactions for the creation of the local character" (qtd. in Cranshaw et al 59)

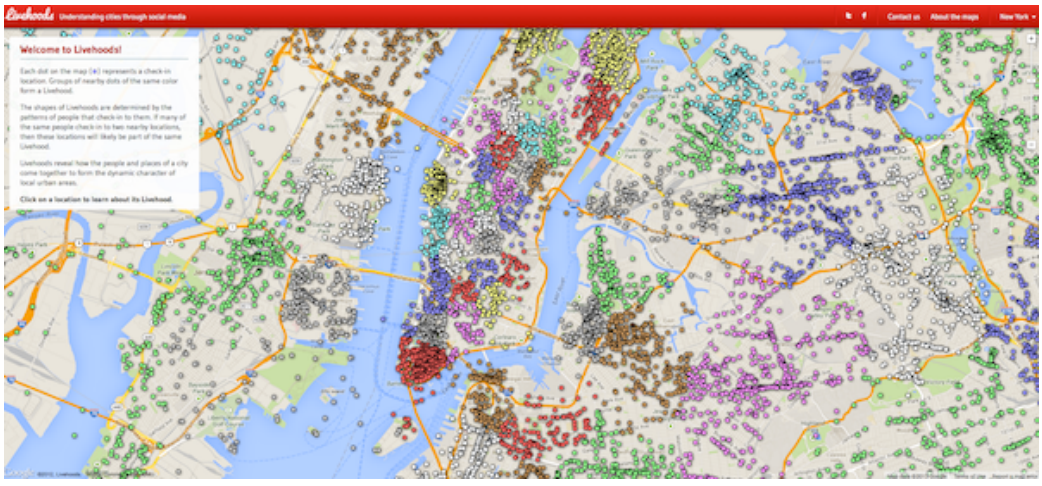

Figure 2.1 Screencapture of Livehoods courtesy of livehoods.org

Of course, there are biases to any study and this one is no exception. Based on the Livehoods website, American cities are more open to using foursquare than Canadian cities. There are

also selection biases towards what kind of users are checking in since Foursquare is used by a specific subset of people. More importantly, people don't check into places they don't want others to know they went.

The Livehoods project contributes to the argument that mapping user-generated data is teaching us how inhabitants understand the city. It also supports the argument that communities are formed by individual tactics. Neighbourhoods are an organizational structure of the city — Livehoods are different form neighbourhoods. The Livehoods that are created in the city are exclusive to one particular group, while being irrelevant to another group. Similar to the symbolic maps that I discussed in Chapter 1, digital mapping participates in the same desire of individuals to put themselves on a map. As Guinevere Harrsion says, "despite the hype heralding [digital mapping] as a cartographic revolution, digital mapping programs continue a cultural legacy that has existed for centuries (65). She quotes historian and cartographer David Woodward to explain that the Earth's services is far too complex for us to visualize. Therefore, in order to reduce the earth to a manageable proportion, we map it. (65) While the digital maps and the symbolic maps that I discussed have the same desires, there is a significant difference in how the map was created and how we read the map is that the symbolic maps from the past were created by one cartographer who spoke for the community and represented the culture.

The type of check-ins that Livehoods collect are now available on most social media sites (Instagram, Twitter, Facebook, Foursquare). The possibilities of what the check-ins can reveal extends to transportation, urban planning, public health, tourism, etc. Contrary to traditional organization of neighbourhoods that seem stagnant, this type of map shows the collective activity patterns of people in the city. The social media check-ins helps

reconceptualize boundaries and neighbourhoods in a city. Each Livehood is shaped by peoples' behaviours. Digital maps allow for a new behaviour of mapping. Individuals and different communities are etching their own tactics onto the map. With mobile phone and geolocative tools, this behaviour has proliferated over time and a more personal form of mapping and meaning making in digital cartography.

UrbanDiary

Our first point of contact with a new city street and/or neighbourhood is arguably pre-planned for us because we rely on a standard city map that tells us where we are, or figures out a route between point A and point B. However, that route will change over time when the city becomes more familiar and personal for the individual. As mentioned previously, Lynch states that every inhabitant of a city creates different forms of associations with the city based on different experiences and memories (1). Fabian Neuhaus' study, UrbanDiary uses GPS devices to study temporal urbanism. My own data collection is similar to Neuhaus' in process. We both collect individually recorded GPS data of a normal activity. In Neuhaus' case, he collected "expressions of everyday life and routine" (316). Neuhaus' research looks at how preplanned routes change for an individual over time.

According to Neuhaus' UrbanDiary, GPS devices can be used to visualize individual and collective routes within a city and how the perception of space changes with time, speed of transport and mode of transportation (319). He called this GPS data in London a "collective product of patterns in time" (315). Neuhaus' participants wore a GPS device that tracked their daily journey through the city over the course of two months. By participating in this project, participants were recording their personal spatial diary and their routines

were analyzed for patterns and habits that manifested over the course of the two months. Neuhaus' purpose was to link a collection of habits and routines to space and time and create a collective diary map for London. In doing so, he created a series of maps that illustrates a city based on personal experience and locations that are important to his participants. Lynch states, "…our perception of the city is not sustained, but rather partial, fragmentary, mixed with other concerns. Nearly every sense is in operation, and the image is the composite of them all (2). The image below is a map of central London created by the data generated of Neuhaus' participants. The shape on the left is Neuhaus' map while the image on the right is a standard map of central London. The map created by Neuhaus shows clusters of activity (depicted by white lines) while other parts of the city appear as if they are areas of the city that are unexplored.

UrbanDiary	Central London
 Figure 2.2	 Figure 2.3

I have chosen to discuss the UrbanDiary project due to its parallels with my Mapmyrun data. Both projects are motivated to move beyond a static map and look at how a city is shaped by its inhabitants. The maps are all representations of an individual's

decisions. On a collective level, one person's individual track is not useful or meaningful to anyone other than the person who recorded it. However, when you gather the individual maps and layer the different routes together, a unique network emerges and a different city is formed based solely on the decisions of the colletive. These all tell us more about the collective than any individual. James Surowiecki calls this process the "wisdom of the crowds" where we take the collective opinion of a group of individuals instead of relying on one response to an answer (2004). Surowiecki demonstrates how, under the right circumstances, a collective group of people are "remarkably intelligent, and are often starter than the smartest people in them" (xiii). I am applying this idea to the formation of a better understanding of a city when we collect a group's worth of data that are being formed by geolocative smartphone apps and by social media geolocation apps.

Neuhaus calls the collective map "the spatial dairy of the urban environment [that] ultimately represents the rhythm of the city which we seek to explore" (23). The personal maps show perception of space and creation of place based on memory, experience and affordances. By layering these different maps, new insights into people's motivations for choosing a route and individual methods of orientation can be explored. The different types of maps created by crowdsourced GPS data speaks to Lynch's statement that the boundaries of a neighbourhood are defined by the dweller and not the city planner (202). New forms of mapping are taking place because of the data that is now available. Through the preliminary findings from Neuhaus' study, he discusses two levels of interest in the mapping process. The first is at the level of the individual and their personal routine and activity. The other is the collective level where patterns and rhythms start developing towards a spatial society. Neuhaus references Charles Trowbridge as being a pioneer for mental mapping starting in 1913. According to Neuhaus, Trowbridge concluded two groups of navigators:

> Some people have imaginary maps in their heads centered upon the location of their homes. They are able to navigate a certain distance on familiar ground, but they would lose orientation in unfamiliar ground. The other group was more described as "egocentric" and orientated to their own position at the moment with a better ability to navigate in unfamiliar territory. (320)

DeCerteau's tactics and strategies continue to be a tool for us to analyze these types of user-generated maps. Strategies are shown by how a city map is structured, along with the routes and neighbourhoods that individuals form on their own. Strategies "produce, tabulate and impose spaces" whereas tactics "use, manipulate and divert them" (30).

Edmonton Pipelines

What is a map? And what does that have to do with human perceptions of place? All maps carry different types of biases. Research conducted by Mark Graham in neogeography argues that places have always been palimpsests. "The countless layers of any place come together in specific times and spaces and have bearing on the cultural, economic, interpretations…and meanings of place" (422). Digital mapping adds another element to the equation — we are now capable of studying how individuals navigate through space on a mass level. The narratives that individuals create and the places they carve out for themselves are updated in real time. Jo-Ann Eisnor found that adding user-generated data to the map allows them to be

> "more accessible, more understandable, more welcoming. This kind of information going far beyond geopolitical boundaries and really allowing people to feel like they world is more accessible, because they are looking at it in a frame that is relevant to them" (76).

Digital mapping allows millions of users to share their location instantly and create data that we can use to map their tactics. Not only that, but these apps, whether directly or indirectly, encourage users to map those places. Whether it's Instagram asking you where you took or photo or apps like Mapmyrun that explicitly tracks your paths.

Projects conducted by the Edmonton Pipelines combine urban theories and digital technologies to narrate the city of Edmonton (edmontonpipelines.org). They argue that the space between the digital and the urban is shrinking. The digital screen is transforming how we look at ourselves through the city and the historical ties we have to the places we live in (Cobb, Engel, Laforest, Zwicker 64). These types of personalized maps contain information about how people perceive, create and move through a space. It is a personal experience based on temporal perceptions that are based on the affordances of that time and space. The Edmonton Pipelines project is a prime example of how individuals create their own place on a map. Digital mapping and the ability to track your location have become an integral part of the way we construct meaning and a sense of belonging in city space (Engel 2). Previous research on mental mapping and psychogeography shows that mapping based on the individual is not a new practice. However, with the Google map continuously expanding, Edmonton Pipelines visualizes through different studies on the city how the individual impacts the mapmaking process. Inhabitants are "performing maps that perform the world for us" through commuting, biking, walking and other ways of traversing the city (Cobb, Engel, Laforest, Zwicker 64).

The interaction between digital mapping and the community creates the memories, stories and depth that a place is based upon. Zwicker and Laforest states "not only is the representation of urban experience being transformed by technology, but so is the way we look at ourselves through the city" (edmontonpipelines.org). With digital technology, we

have the ability to analyze different layers of data. This allows us new insight into how we interact with and experience a city.

This new form of mapping allows for perceptions and feelings about a place to be translated onto a map. The identity of a city is made up by the different elements in that neighbourhood, which then can also be broken down into even more specific elements in that place. While Lefebvre's definition of "space" is how I would define "place" (based on Lippard), his argument that space is a social product, or how a complex social construction affects spatial practices and perceptions, still hold true (Schmid 27).

> "What we are most likely confronted with here is a sort of instant infinity…the map's legend, the conventional signs of map-making and map-reading — that are liable to change, but also the objects represented, the lens through which they are viewed and the scale used. We are confronted not by one social space but by many indeed, by an unlimited multiplicity or unaccountable set of social spaces" (Lefebvre).

Edmonton Pipelines studies how technology impacts the urban experience, but also the way we see ourselves in the city. The act of locating yourself in a place is now connected to the way you identify with yourself in a place. Both de Certeau and Lefebvre's theories challenge authority and the view from above by acknowledging the connection between lived experience with place and space.

The Edmonton Pipelines project recognizes that digital mapping is now an integral part of our lives and this changes the way we understand how spaces are produced, analyzed and differentiated. De Certeau considers spatial stories as performances while the walker is the storyteller (92). Fran Tonkiss describes this action as the intersection between the subject and the city (6). Tonkis draws on work done previously by Walter Benjamin and Georg Simmel to discuss the individual and the sensory environment of the city. "The city

appears here not simply as the background to events in a life, but as an agent of memory, a store of meanings that belong as much to the place itself as they do to the individual who retraces their steps through it (114). The Edmonton Pipelines sub-project Vertical Suburbia from Edmonton Pipelines continues the discussion that the map is no longer being an object that's being read or written by one person, but one that is being engaged and performed. This particular map is created by curating photos and stories that challenges the "horizontal perceptions of suburbia and provoke new ways to view the space in which we live" (edmontonpipelines.org).

Edmonton Pipelines are interested in mapping the people and their lived experiences in the city. The data that digital technology creates in the city show that urban experience is no longer linear. Maps can now visualize and convey the experience of the street as it is lived and felt.

Motorola Mobility Study and Eric Fischer

In the summer of 2011, a group of researchers from Motorola Mobility and the Mobile Life Centre in Sweden conducted a study based on Stanley Milgram's 1970s Mental maps study in order to understand how individuals' views of the city change based on technology use. They conduced their study in downtown Chicago where they asked 87 participants who were a mix of tourists and residents to draw maps of "their city" and highlight what's important to them in terms of arts & entertainment, travel, shops, food, and other miscellaneous daily activities. The study's motivation was to find out how people understand and live in their cities to build better mobile services and applications.

Based on both Milgram and Lynch's work on mental maps, we understand that people's perception of the city differ from one another. Not only that, but they differ from the physical layout of the city. While Lynch and Milgram's work in the 60s and 70s are classic studies based on mental maps, their results are still valid based on the GPS data we are able to collect using locative devices. Cities are now hybrid spaces that combine layers of digital data with the physical environment (Bentley et al 1). The results for the Motorola study showed that most of the maps focused on different aspects of the city. Some showed detailed individual neighbourhoods, some were an overview of the city. Some maps were focused on the transit system or roads while others were a set of points floating on the page. Most maps only covered a small area of the city. The results also showed that participants who were mobile users who checked-in to locations were more likely to travel around the city and knew more of it in greater detail. The mobile users, however, was not correlated with age, educational background or difference based on gender, which shows that mobile check-in has become more mainstream (Bentley et al 3).

Most notably, this study claims that existing mobile services (Yelp, OpenTable types of services) are not used in the places that are considered most important to their participants. While this may be their results of their study, based on my own results and other work done since the Motorolla study in 2010. Based on the previous case studies and my own data from Mapmyrun that I will discuss in Chapter 3, the opposite is happening. Instead of mobile apps leading to favourite and important places, users are logging their favourite places into a mobile app, whether purposefully (an intended check-in on Foursquare) or consequentially (by posting a photo on Instagram with a geolocative feature). While a digital platform and mobile apps have certainly expanded how mobile users engage with the city in terms of accessibility (be it looking up an address, finding

online reviews, getting lost and looking up directions), creating a meaningful experience in a certain location isn't a function of a location-based service. Rather, specific location-based service allows the individual the ability to make their mark on that particular location.

It is interesting to read the Motorola study in parallel with Eric Fischer's interactive city maps that visualize preferred locations by locals and tourists. This map was released in early 2015 and plots the social media trails of locals and tourists in cities and visualizes their movements. Fischer designated local geo-tagged tweets with blue dots on the map while tourist geo-tagged tweets were represented with red dots. The result in Fischer's work showed the tweet points manifesting into its own urban geography, rather than tweet points that are overlaid onto an existing map. The tweet points are tactics throughout the city and the map of every city is an aggregate of the tweets belonging to locals and tourists. When looking at the dots as a whole map, you cannot distinguish between neighbourhoods or street boundaries. His tweetbased map is "more representative of a broader slice of life and of local neighbourhood concentrations" (citylab.com).

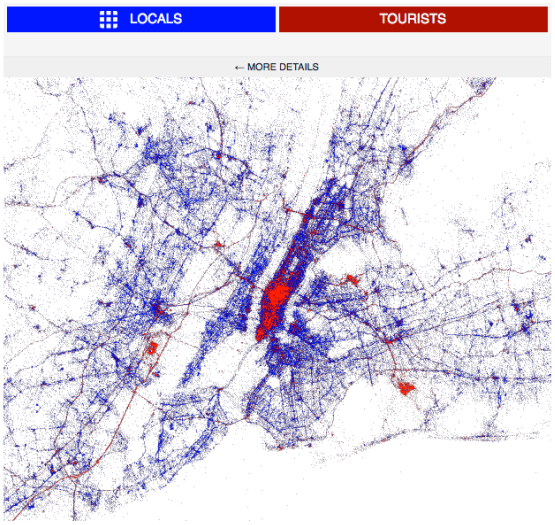

Figure 2.4

I am comparing the Motorola study with Eric Fischer's interactive world map because Fischer's discovery with his tweet based maps serve as a missing factor to the Motorola study. The concluding argument in the Motorola study is that "designing new systems to fit with users' models of urban environments is important to create services that work in daily life" (4). Their user study showed that mobile technology still adds to the overall experience of the city, even though the most used/popular location-based services did not reflect the mental maps that the same participants drew of places in the city that are important to them. Most studies around mental mapping conclude that every individual has their own story in their city. However with digital data, there's a reversal of emphasis where the individual isn't following GPS coordinates, or marking a particular location. What happens now: GPS data happens and then they get mapped. This happens with active GPS data in the form of a check-in, and passive GPS data, in the form of social media data. We make a digital map meaningful by feeding data back onto a once static map. Rebecca Solnit observes in *Infinite City,* "a static map cannot describe change and every place is in constant change" (4). We can identify these subjective places by the aggregated data from GPS location devices. Apps that generate maps are interrupting the idea of the digital map (Google map, GPS) as simply a digital tool.

The Twitter map, along with the Livehoods project and UrbanDiary speak to the tactics that are produced organically by individuals who move through the city and reappropriate the space (de Certeau 2002). These types of maps recount lived experiences. These mental images are a product of both memory of past experience and also immediate sensation that helps individuals interpret information and guide their actions (Lynch 1960). Ian McKay states "only in transgressing the rules of the planned space can we really find our own meaning and space" (qtd. in theguardian.com). He suggests that the problem with city

planning is that designers don't think about how people would want to live their lives and that people will want to break the rules that planners try to set for them. Contemporary cartography emphasizes the different ways that people want to live in their city. Everyone will see their routes a little differently based on what they want to experience and what interests them. Some may only know the route between transit stations and bus stops. Others might have a preferred route that they take and go about the city based on how they feel and not the physical layout. Debord suggested that people's interaction with their environment are becoming increasingly limited, and his solution for that was that we should have unplanned journeys through the city or the urban landscape (1). Both Debord and de Certeau believed walking as a form of resistance. By abandoning any type of motive or plan, we can reconnect to local surroundings, specifically by walking. "Thus the street geometrically defined by urban planning is transformed into a space by walkers" (de Certeau 117).

Conclusion

Ira Glass asked, "What if map-making were an expressive art, a way of coming to terms with place, with the experience of place, with the love of place?" (14) The ability for millions to map their "ground truth" by adding personal, crowdsourced data has marked a shift in cartography (Harrison 65). As mentioned previously, the focus is now on the individual acting as the mapmaker rather than one cartographer speaking for an entire society. The case studies that I have outlined bring greater awareness of the value inherent in individual spaces, and the communities that can benefit from looking at spatial representations from the ground up instead of the top down.

Mental mapping is not just a situated, self-contained individual process. It's true that we all have our own individual images of a location, but it is not completely arbitrary or individualized. If it were, we wouldn't be able to set up a meeting spot with another person. A perfectly personalized mental map would be incomprehensible to another person. We wouldn't be able to drive to any location or be able to describe to someone else where you are. We rely on shared understanding of space to communicate our location to other people. Mental maps are neither perfectly personal nor universal; instead, it's a constant negotiation between the two. However, this type of mapping is highly individuated and specific in a time and place, it isn't as effective to only look at them one at a time to understand how groups of people make meaning in spaces and to see how a city works. We still need a collective understanding for people to recognize their own map. This type of mental mapping is about a community of people coming to an understanding of space and place. New forms of maps are emerging through mobile devices and the subjective mapping process holds more meaning for individuals than just a record that shows your coordinates. What is more important than coordinates is where you went for a run, or which area you frequent. The personal artefact is more interesting than the coordinates of where you are. But, when you have a group of people who are simultaneously doing the same thing, then this digital form of mapping forms collective mental maps of the city, a community or a neighbourhood by showcasing trends that are emerging when that data become aggregated.

The act of mapping participates in meaning making. Mapping is a subjective action of creating a record of a meaningful place. These hand drawn mental maps are a collection of derives, but they are also tactics. If the derive is an unplanned journey, then the tactic is breaking the conformed path that was set out for them. Using a map was predominantly

about following GPS coordinates. Maps used to impose a relative shape on the world, but GPS traces reveal a new one from the ground.

Maps are neither perfectly personal nor universal; instead, it's a constant negotiation between the two. However, this is type of mapping is highly individuated and specific in a time and place, it isn't as effective to only look at them one at a time to understand how groups of people make meaning in spaces and to see how a city works. Instead, if we start collecting these maps based on GPS data, it becomes a more collective understanding made up of individual paths.

Each case study shows that city inhabitants create paths and places for themselves that transform the strategies into tactics. A tactic is determined by an absence of power and in this circumstance, the collective map has shown various different ways of reorganizing the city based on personal interests (from Livehoods) and routines and patterns (UrbanDiary) that form different pathways in the city that are not previously planned out on a city map. Inhabitants cannot physically reorganize the city, but they can choose different methods to move through it. A tactic is a specific type of knowledge, sustained and determined by the power to provide oneself with one's own place. All of these processes, from Livehoods to UrbanDiary, are leveraging the wisdom of crowds (Surowiecki 2004) in a mobile and social context that transforms strategies into tactics. City boundaries are planned spaces where city planners have organized set neighbourhoods. The Twitter map showed tweet points that mapped into its own urban geography. The tweet points are tactics that are more representative of a local neighbourhood than a static map. Finally, the Edmonton Pipelines project is a prime example of how individuals create their own place on a map. The sub-projects in Edmonton Pipelines examine how the individuals and communities impacts the mapmaking process. They posit that the digital screen is

transforming our sense of place and the ties we have to the places we live in. (64) All of the maps created by these cause studies contain information about how people perceive, create and move through a space. It is a personal experience based on temporal perceptions that are based on the affordances of that time and space.

Chapter 3

Mapmyrun

Introduction to Mapmyrun

My intent for this case study is to show how individuals generate place, how runners inscribe their tactics onto a city map, and how that city map changes shape based on its inhabitants. MapMyRun was conceived in 2005 as a training tool for runners that would help them to calculate the distance that they ran, the routes that they ran, search for different locations to run, along with other metrics (time, distance, pace, elevation and calorie count) that would help them improve their next run. This was an app originally conceived to track and record bike paths, but has since transition into a fitness tool where you can share your progress with friends in the same social network. The mobile interface gives you the option to record the length and location of your run, save the logistics of the run and upload it to your online profile. The interface has an activity feed that shows the routes logged by your friends on Mapmyrun. Finally, the app lets you explore routes that have been logged by other Mapmyrun users. You can filter by city and distance. What MapMyRun doesn't offer on their mobile or online interface is a representation of the data. What does it look like when the city goes running? While the marketing for this app was meant to be a social networking tool that allowed runners to share their routes and keep track of their runs, the data it generates is much richer than its original purpose.

The app uses built in GPS technology that allows users the ability to map, record and share exercise routes and workouts on their smart phones or on the main website. My analysis is inspired by Cooper Smith's New York City visualization using over 10,000 run maps provided by Nike+ Run. Smith sought to analyze the metadata and audit what running looks like in New York City. His renderings created a visualization of the Manhattan streets based only on run paths focused on popular locations for runs based on time of day.

Data collection

I downloaded running routes generated over the time span of January 2012 – December 2013 that Mapmyrun users uploaded to mapmyrun.com (via the mobile app). Users would turn on Mapmyrun at the beginning of their run and the app tracks their path until they ended their run and turned the tracking off. Users could then share that path with their social network, their friends who are also on Mapmyrun and add their route to the "Edmonton routes" on the web interface. The Mapmyrun mobile app both plots the path on an online interface, while also packaging the run along with its metadata into a .KML file. This data is available for download and is transferable to other apps. In order to gather a large enough data set for both a collective map and number of individual users, I collected routes recorded over the course of January 2012 to December 2013. In the two years worth of running maps, I collected 451 individual runs by 174 individual users. These routes are available to anyone looking through Mapmyrun.com. While personal information on the Mapmyrun interface is already limited (and open to the general public at the time of collection), I have assigned user names a number (Eg. User 1) and removed all other

personal information. In total, there were: 105 users with a single run, 25 users with 2 runs, 36 users with under 10 runs and 7 users with 10 runs and over.

Name	Number of runs
User 1	32
User 2	24
User 3	17
User 4	14
User 5	13
User 6	12
User 7	11
User 8-10	9
Users 11-12	8
User 13-17	7
Users 17-19	6
Users 20-22	5
Users 23-28	4
Users 30-43	3
Users 44-68	2
Users 69 - 173	1

Table 3.1

Month	Number of runs
January	25
Feb	36
March	41
April	58
May	68
June	24
July	26
August	34
Sept	32
Oct	60
Nov	38
Dec	9

Table 3.2

I used Google Earth to compile the .KML files and the routes formed a type of heat map that illustrated the popular areas of the city and the parts of the city that seem undiscovered. Google Earth uses Simple Cylindrical projection for its imagery base. According to ESRI, the projection forms a grid of equal triangles and the scale and area of regions are less distorted than in the Mercator projection. This projection, like the Mercator projection has its limitations; there is noticeable distortion of all properties away from

standard parallels. The distortions increase as the distance from the standard parallels increase. However, for the purposes of mapping the Mapmyrun data, the projection distortions do not affect the map because of its small scale. In fact, this projection is recommended for best use for city maps or other small areas with map scales large enough to reduce distortion. (55)

Mapmyrun Data analysis

MapMyRun isn't the same type of social media where you connect to people by checking in to your location. This type of data gathering is more akin to traffic maps or visualizations of how people are moving through space. If you were new to a city and looked at a standard city map (akin to something a hotel might give you), you would be able to distinguish the boundaries of the city. However, when you are creating your own path, those boundaries begin to shift. Creating a city map using individually based paths builds a different community altogether. I discussed this type of map-making in Chapter 2 (case studies), however, the case studies are only a handful of projects that exemplify map-making based on the individual. Many of these projects are created using mental mapping (Lynch) and psychogeography (Debord) as their foundation.

The following image represents all 451 runs collated in Google Earth.

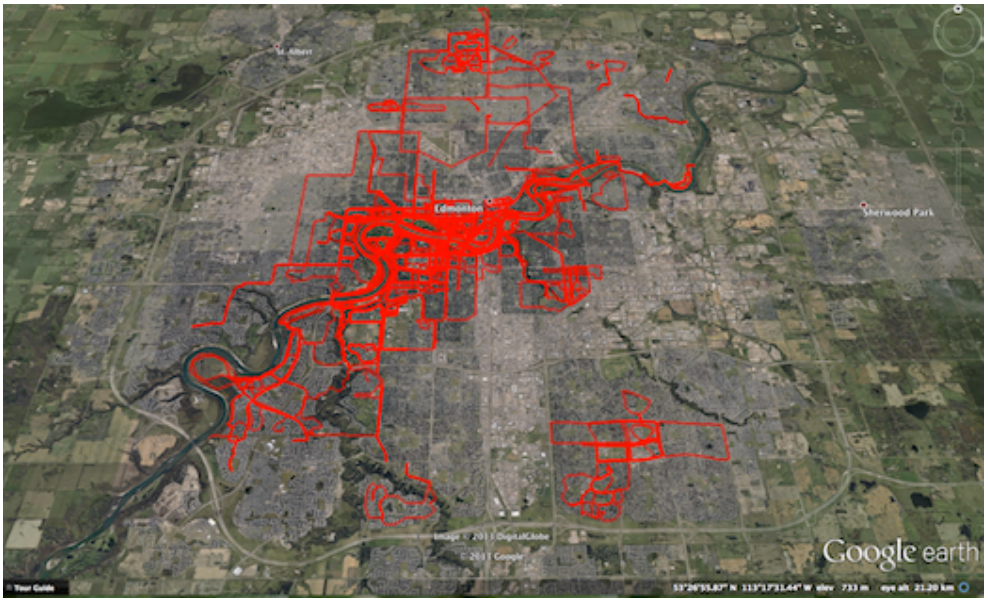

Figure 3.1

Each red line on the map represents a user's running path. The data is recorded from the beginning of the run until the user stops their device (presumably at the end of their run). While layering the paths together, the map built patterns that represented popular run paths in Edmonton. It would be no surprise to Edmonton locals that paths along the North Saskatchewan River are more popular and are well represented on the map — these popular paths are illustrated by brighter and bolder red lines. The two images below provide a closer look at the thicker arteries along the North Saskatchewan River while thinner, less pronounced lines represent routes that are less popular.

Figure 3.2

Figure 3.3

The pattern that is most predominant on the map runs along the river. This is created by the collective activity of all the runners and evidence that the paths along the river are a favourite among Edmonton runners. The brighter red lines represent personal arteries that are also collective arteries that represent “transport corridors” (Neuhaus 18). In the next

couple of images, I focus on two users who logged the highest number of runs. User 1 logged 32 runs while User 2 logged 24 runs. The following images show both users' first 3 runs, then half of their logged runs and then finally the full map of their logged runs. I'm choosing to discuss these particular runs because the users have logged enough runs to analyze a pattern for an individual runner.

In User 1's running map, s/he starts their run on 109 street and 83 avenue, runs east and then south towards 63 avenue. In their second run, they start at the same point of the first run (109 street and 83 avenue) but instead heads west towards Groat Road along Saskatchewan Drive, which is a popular destination for runners in Edmonton. In the third run, User 1 starts at the same point again, runs west towards Groat Road and creates a new path once again. By the time we aggregate all 34 run paths, the lines tracing the original starting point at 109 street and 83 avenue and the surrounding area are the brightest. Neuhaus noted similar findings in his own user study. His map of central London was layered to show patterns in participant behaviours (14).

User 1 Run Map

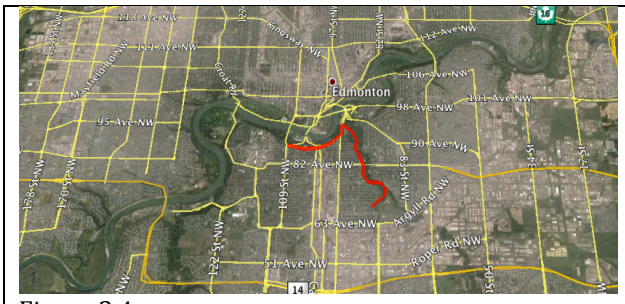

Figure 3.4
First run

Figure 3.5
Second run

Figure 3.6
Third Run

Figure 3.7
12 Runs

Figure 3.8 (All 32 runs)

In this instance, the path starts small. As the runner continues to log their runs, the path starts to build on the original run and continues to extend further out into the neighbourhood. When all the runs have been mapped, there are clear sections that are brighter in colour which shows the frequency that particular path has been run and newer lines that extend further out from the original paths. Debord's work on psychogeography helps us read how these paths are formed. He and other Situationists use the term "ambiance" to refer to a feeling or mood associated with a place, to its character, tone or appeal it might have. The Mapmyrun data visualizes Debord's study "of the precise laws and specific effects of the geographical environment, consciously organized or not, on the

motions and behaviour of individuals" (3). Both Users 1 and 2 begin with a familiar path, but over time, deviate from their familiar route and extends their run to a new area.

User 2 Run Map

Figure 3.9
First run

Figure 3.10
Second run

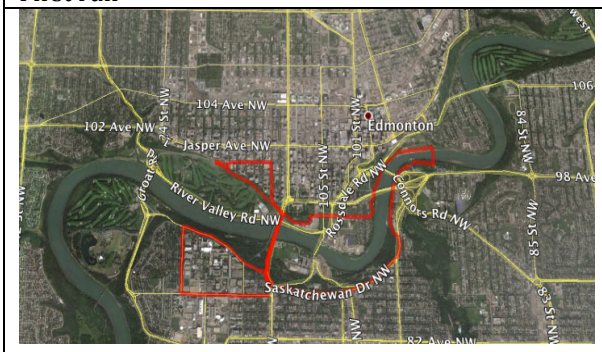

Figure 3.11
Third Run

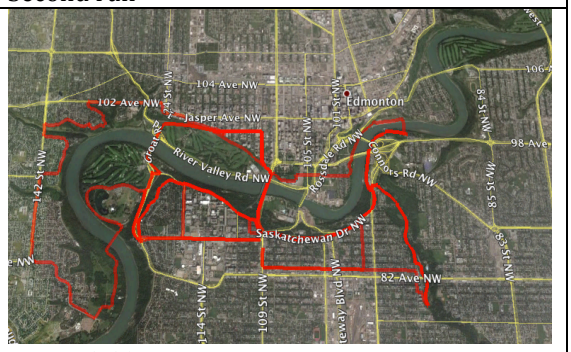

Figure 3.12
9 Runs

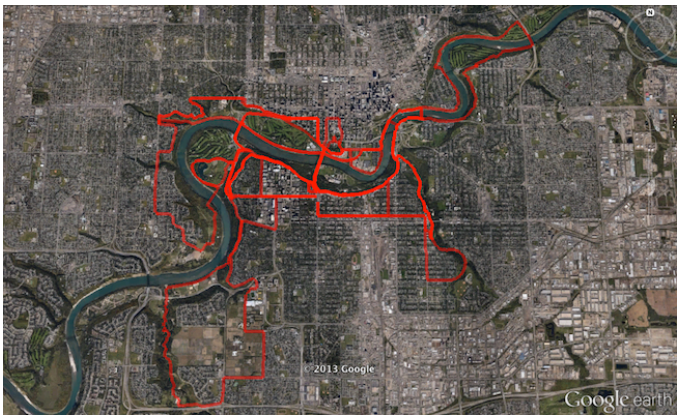

Figure 3.13 (All 24 runs)

Over time, the routes that are bolder in colour (as in more deeply run through) start deviating into different spots. They go longer, or they take an extra loop before moving back onto the same path. Individuals create their own space by creating "small modifications" to make it suitable for their own needs (de Certeau 2002).

In figure 3.1 there are also sections of the city where run paths are disconnected from the majority of where the paths are situated. Guy Debord examined these detached areas of the city in *The Naked City* by creating a map that challenged the traditional grid. Debord's fragmented map of Paris shows how a pedestrian would create order mentally instead of following the city structure. What we would recognize as Paris' city grid no longer follows any form of logical pattern and arrows connect different areas of the city inspired by different ambiances and dérives of the inhabitants. This type of activity follows the traditions of a subjective map based on personal narratives of the city versus a planned one. The Mapmyrun map, like Debord's is transient because the ambiance and the decisions of the inhabitants will change. The relationship between a city and its inhabitants is defined by the activity of travelling (Debord) and individual behaviours impact the urban space. To showcase the difference, the following two images are a side-by-side comparison of the Mapmyrun map and a running map of Edmonton created by Strava.

While layering the paths together, I noted that each line has a unique pattern, even when the same runner repeats portions of a path. It should be noted that the shape is also potentially based on a lot of physical factors. eg. Weather disturbances, roadblocks, traffic. However, while the individual lines each contain a unique shape, a distinct and congruent pattern emerges as the lines are layered on top of one another. Returning to Lynch, once I started building the maps on top of each other, new elements of the city

started to emerge. It is also of interest that, with the exception of several paths in the Ellerslie community that are disconnected from the rest of the city, runs do not extend beyond 23rd avenue and 111th street. According to the 174 users between January 2012 and December 2013, that area of the city does not exist. "It's a simple concept, but revealing about where the edges are where people turn back and stop exploring," says Eric Fisher of Mapbox (citylab.com). This establishes that each city has certain neighbourhoods and streets that are core to the running community. For many runners in Edmonton, they have established their place along the river and other areas of the city that are well represented on the Mapmyrun map. Alternatively, there are large pockets of the city that are unexplored. One hypothesis based on these maps is that there are certain groups of runners who commute to a location to run. This would explain a high volume of runners along the Saskatchewan River and in the river valley, but not all of those individuals would live in those areas. Edmonton is defined as a commuter's city and that could very well extend to how people are running into the city, as well. While space is defined by logistics and locations points, place is defined by people, by their perception and has movement that extends further than a physical location point or an objective space. Some of these pockets are industrial areas that are not conducive to running or to pedestrians. However, there are multiple neighourhoods in South East Edmonton that are not populated by any runs, nor are there many runs in West Edmonton. The aggregate of the running data succeeds in visualizing how a specific subset of runners view the city. While space is defined by coordinates, place is defined by people. Their perception and movement extends further on a map than a physical location point or an objective space.

Pavlus writes that

> " traditional city maps visualize just one aspect of urban design — the city's intended structure, full stop. But add in a layer that visualizes how people actually use the city and the map becomes much more interesting" (fastcodesign.com).

Based on the map, most runners have created their sense of place within the core of the city, while large areas of the city are unexplored. The following image is a visualization of the Edmonton based solely on the movements of Mapmyrun members. This map shows us the city from the perspective of Edmonton runners. It is based solely on the 174 runners and their paths they took over a two-year period.

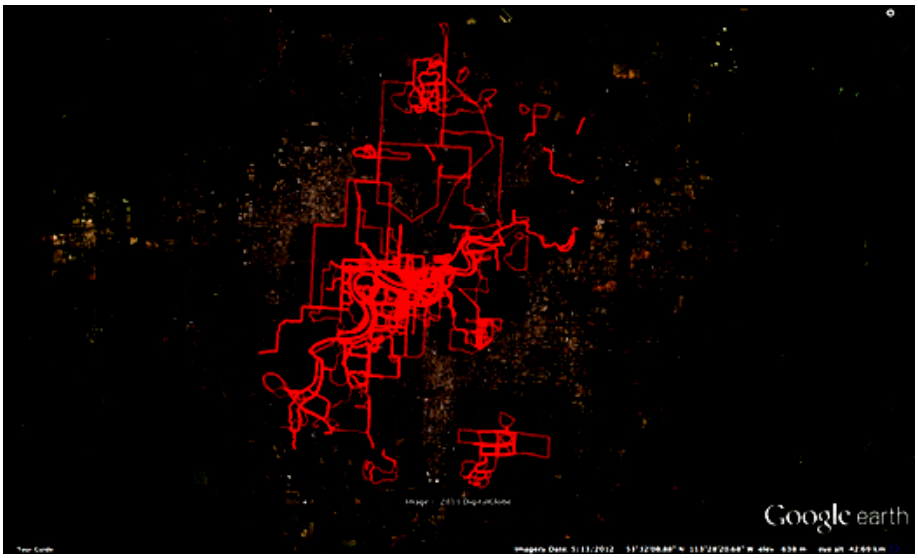

Figure 3.14

This is similar to work done by Fischer who geolocated tweets to find the most frequently travelled traffic routes in American cities (theguardian.com). Real inhabitants motivated and created these movements and patterns. It did not come from an urban designer. When you first look at a map of all the different routes, it does not look like these individuals are

working together. They are merely following their own route and heading to their destination. But, all these individual strands work together because they are creating a separate network and rebuilding a version of the city based on their own movements.

For comparison, I downloaded official walking maps from the city. The city of Edmonton website provides community walking maps for the North East, North West, South East, and South West. From each region, I chose a popular neighbourhood to examine based on the KML files that I've downloaded. These neighbourhoods include: Highlands, Riverdale, Glenora, Laurie Heights, and Strathcona. Bonnie Doon, Mill Creek, Riverbend, and The Ridge. While running and walking are different activities, the Mapmyrun captures the way people think about navigating a space while the walking map represents a strategic plan.

The MapMyRun routes do not deviate drastically from the city maps. However, the routes on the community maps present clear, orderly paths with a beginning and end point. On contrast, the Mapmyrun routes extend beyond what the city recommends. The paths and routes that veer off the track and also routes that explore other areas not plotted on the city maps. This is illustrated in the images below. As de Certeau explains, the runners are subconsciously reacting to what was planned out for them. Instead, they follow their own natural rhythm, desire and interest in where they want to go. Tactics generate "circumstances which the precise instant of an intervention transforms into a favourable situation, to the rapidity of the movements that change the organization of a space, to the relations among successive moments in an action, to the possible intersections of durations and heterogeneous rhythms, etc" (38). As de Certeau argues, the urban viewpoint is from the governing body (government, city planners, even Google Maps). The City of Edmonton maps for walkers are evidence of strategies while the maps people create using their mobiles are

the tactics. The aggregate data from MapMyRun show how users generate place and the tactics they use.

City of Edmonton - Strathcona

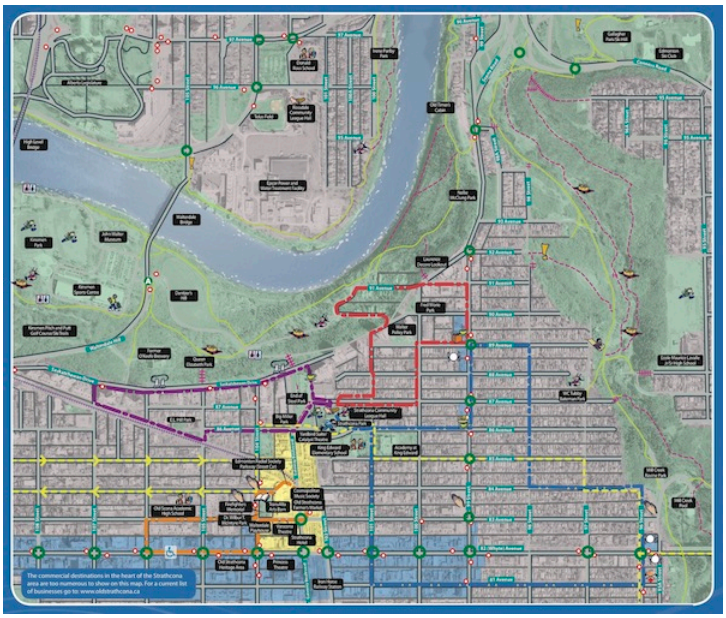

Figure 3.15

Mapmyrun - Strathcona

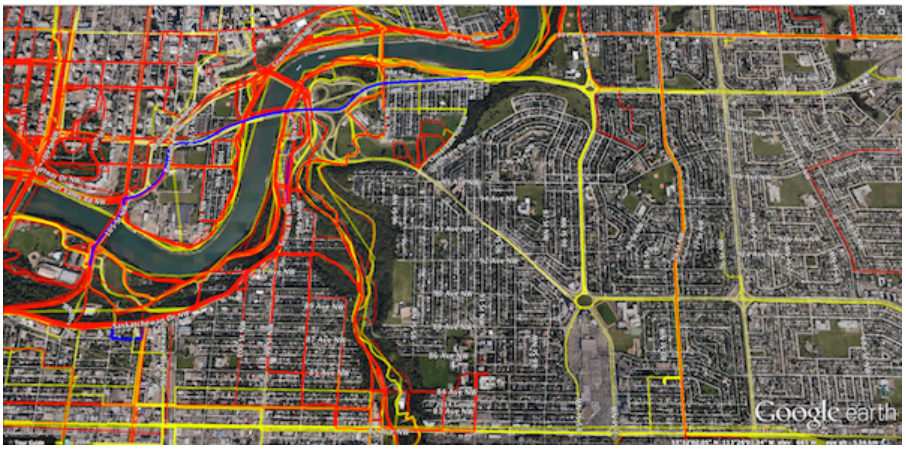

Figure 3.16

City of Edmonton - Glenora

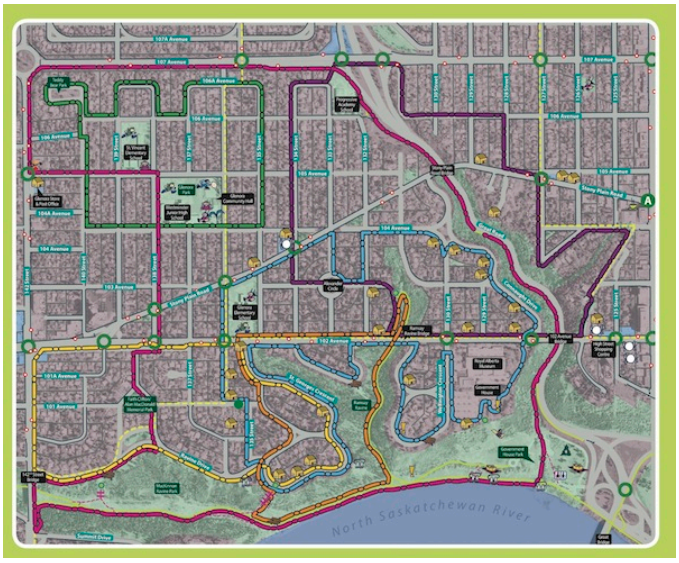

FIGURE 3.17

Mapmyrun – Glenora

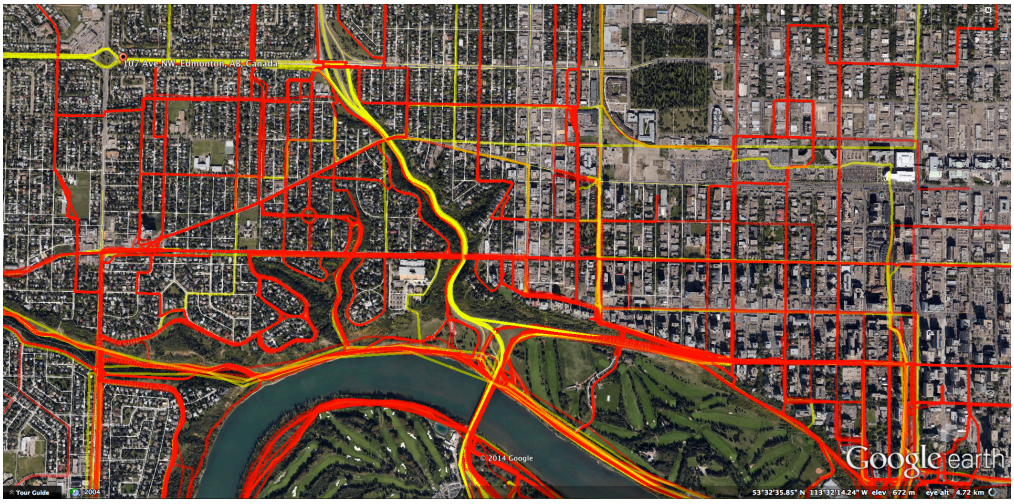

FIGURE 3.18

As mobile technology and GPS-enabled mobile devices continue to advance, the types of GPS maps that I discussed in Chapter 2 and the type of run maps that we are able to analyze thanks to applications like Mapmyrun, become more available. The standard map (the hotel

map) shows us boundaries and street names while these GPS crowdsourced maps shows us patterns of movement, density, transitions, moods and other elements that speak to a place. These types of datasets are able to change the way we visualize and experience the city. Andre Lemos notes that digital maps can "represent people, community and a more legitimate space and place that show how people see and feel their environment" (416).

Discussion

When we look at a standard map whether online or digital, the map is a flat representation of the city. It is best used to find where a location is situated and how to get from point A to B. However, that is not the only way a map can function. A map is also capable of showing personal and meaningful layers by drawing or tracking how much a particular path has been used. We can also map the desire lines of a city. These lines are the worn down paths that start forming an alternative to city planned footpaths or streets. The desire line cuts through a park or a field and was never intended to be a throughway. The path usually represents a shorter route or a route that is more easily navigated than the one that was planned. This would look like a shortcut through the grass or snow where paths were not intended. It is the wisdom of the crowd that informs these desire lines and tactics.

When Google Maps launched in 2005, the map was a read-only interface. Today, digital cartography has the capability to transform standardized maps with external data (Harrison 3). Users can now attach geographical coordinates to photos, posts on Twitter, Instagram, Facebook or share their location using a multitude of apps and websites (Runkeeper, Nike+ Strava, Flickr). Using spatial analysis, we now have more insight into our world than ever before. Harrison explains, however, that while an aerial perspective gives us

new insight into our world, it also becomes what Manovich observes as a gap between spectator and spectacle.

> "Spinning a virtual globe and gazing at satellite images, we become disembodied consumers of the landscape. The planet is reduced to digitized bits of information, branded and packaged into a ready-made spectacle" (qtd. in Harrison 65).

However, the aggregated data that I have collected, and the data from the case studies in Chapter 2, are looking at the city from the ground up instead of from the top down.

The crowdsourced data informs us of how real users carve out their own pathways. This is proven by how each individual creates their routes on a digital map. The data represents more than one line on a map that logs the distance that was traveled or a unique location for a singular person. Location data, in the past, focused on physical coordinates of where people traveled and their current location. For example, I can check into a coffee shop on Foursquare, then check in at the University and then perhaps a store in Downtown. If we plotted those 3 check-ins on a map, they would be scattered points of where I've been, but no traces of the route I took to get to these spots or the layers of that route that become meaningful. This was the type of location data that the Motorola study collected and, based on their research question, the data did not speak to how individuals live or navigate the city. The results from the Motorola study stated that the check-ins on location-based services ultimately were not reflected in individual mental maps.

Eric Jaffe from citylab.com notes that the way researchers and designers are approaching location-based data is evolving. I am contributing to this narrative by focusing on how the aggregate data reveals the tactics individuals' use to create a sense of place. The Edmonton Pipelines' group describes this sharing of information as a "network of dissemination leading to alternative crowd-sourced representations of communities" (2). What creates

place for us is our surroundings and how we engage with them. As noted in my literature review, “place” is defined by the experience and the relationship that develops with that place. It is not defined by the geographical and physical layout. Our perception and experience personalizes a space for us. I used the Mapmyrun data to ask my own research questions — How do individuals create their own place on a map? And, how does user-generated data inform us of how people move through the city? The Mapmyrun maps differs from the maps discussed in the case studies because Mapmyrun users actively mapped their own paths while the case studies created maps by creating an algorithm based on user patterns.

I am interested in the act of creating individual maps and how the traditional cartographer is being replaced by a highly personalized experience. What could this aggregate data tell us? James Fallows’ from theatlantic.com notes how the map has transformed from “a static stylized portrait of the Earth” to a “dynamic, interactive conversation.” This type of individualized, mobile GPS mapping isn’t location-based in the sense that a user has checked-in to a spot; it is considered location-based because it is a trace of their movement. This type of mapping is tracking users’ movements through a route that they have chosen for themselves and that is being recorded. Some of these paths are known as a dérive (Debord), but can also be described as a tactic (DeCerteau). Using the Mapmyrun data, I aggregated the tactics that runners use in the city. And, as a consequence of these tactics, a different idea of a place started to form. If once the urban planners and cartographers are the writers of the city, then those who are navigating the city are the readers. As de Certeau says, “the act of walking is to the urban system what the speech act is to language,” (3). However, with geo-locative tools, mobile users are now capable of being writers also. Joanne Mikulski from nextcity.org states how “modern cartographers are using

data to spark a mapping renaissance that's changing the way we interact with our cities." Using new mapping ventures to demystify the way cities work and uncovering new urban challenges along the way.

We traditionally think of maps as being about strategies, however these particular running maps show a different kind of location technology that showcases the tactics that are created by a shared community (de Certeau 35). The maps that I am discussing show the result of how individuals are forming their own place. Place, as stated previously, address the relationship between location and experience. Matthew Dance describes maps as one tangible way of conceptualizing space, while a less tangible way includes the everyday space in which people live and move (27). Desire lines or a dérive from a path that was set out for us (the strategy) is a tactic that individuals make in the city. By mapping these tactics and defining places, we are able to see these subtle changes that would not be presented to us on a static map.

Seeing the map from above becomes what Lev Manovich observes as, "responsible for creating the gap between spectator and spectacle" (7). While we were once either spectator or spectacle, the act of mapping ourselves is bridging that gap. We're used to seeing maps as physical layouts of an area that were predetermined for us by a city planner or with political boundaries. Lippard's definition of a place does not define what I have been calling a standard, flat map. The paper map that you once kept in the glove compartment is an overview of physical locations. Even the Google Map, which I would argue is the current conventional map, despite being able to explore locations in street view, would not be able to showcase the places that are meaningful and how we relate to them without participants feeding data into the map.

The standard map that we recognize is being replaced by the subjective mapping experience of things like MapMyRun. The subjective mapping process holds more meaning for individuals than formerly objective maps. This is changing the way maps are functioning in our culture. Maps are no longer just a public record that shows a set of coordinates. The Edmonton Pipelines project notes that there are numerous digital maps that visualize a specific issue. In Edmonton, alone, there are crime maps, sexual assault maps and photojournalistic maps (amongst others). As the Pipelines project states, "there is a burgeoning interest in using locative technologies more creatively" (37). We are now mapping places laden with emotional meaning. In this sense, the personal artifact (the individualized map) we've created is more useful in how we understand the city. This type of mapping borrows from the term "neogeography". Rather than

> making claims scientific standards, methodologies of neogeography tend toward the intuitive, expressive, personal, and/or artistic, but may just be idiosyncratic applications of 'real' geographic techniques. (qtd in Harrison 75)

Maps are subjective, experiential. The crowdsourced GPS maps do not act as an objective atlas. Instead, these maps act as subjective experiential processes rooted in the aggregate of individuals.

If urban planning is transformed by walkers, (de Certeau) then the objective space is given meaning by the different networks that are mapping themselves traversing through this space. Along with my discussion on MapMyRun and other similar case studies, we see how meaning-making happens on a map with a collection of that aggregated data. Harrison argues that the map is being transformed into a social space when walkers recognize themselves in the "massive grid of the anonymous city"(2). The data that Mapmyrun provides generates new perspectives on how to define and interpret the city as a collective

product based on everyone's personal and individualized track. The route an individual decides to run might be different from a route that Google Maps would create for you. Harrison questioned whether aerial photographs and digital reproductions of the landmass on Earth are able to trace the bonds of community that hold people together (67). With this study, I offer a reverse analogy: instead of looking from the top down (an aerial perspective), we focus on the layers created on the ground. The data I gathered from MapMyRun show how a group of individuals are linked together, particularly in specific communities.

Up until recently, GPS data instructed us where to go and how to get there. However, it is now flipped where GPS data is informing where we've been and what we did. Each line created by the Mapmyrun data represents an individuals' urban story and as these lines intersect, the map builds a place based on these narratives.

Matthew Dance argues in his work on Neogeography that the evolution of technology has created a shift in how public participation can be understood within the context of location (18). The Mapmyrun data set represents areas where individuals are creating memories, building experiences and narratives. The perspective that individuals have of their place in a city is changing with geolocative tools, particularly with GPS tools that track their movement. While strategies define the city as a unified whole, the Mapmyrun maps, along with other case studies from the previous chapter, depict the city as having moving patterns, specific pockets of community and activity that reduces the city down to a smaller scale. By plotting user-generated data, these maps are also an example of the tactics that manipulate the already-constructed city strategy. Instead of mapping the boundaries and grids, the map of the city represents the flow and pattern created by its inhabitants. The GPS data draws its own map of Edmonton, particularly giving shape to the river valley, which is remarkable in how we recognize the map of Edmonton.

I discussed in the previous chapter that both symbolic and indexical maps have their biases and Mapmyrun is no different. The runners represented in the aggregate of maps are random, but they also share similarities. There are a handful of assumptions I could make about the users age, fitness level and finances based solely on the fact that they're logging runs in Mapmyrun. First, the fact that they're recording runs in a fitness app suggests running is important enough to them that they want to keep track of it. A selection bias also exists between the data and the users base since users can cherry pick what they share and what they don't share. This would happen on all forms of crowdsourcing social networks. So, that part of the city disappears off a digital map. In regards to the Mapmyrun maps, very few of the runs were less than 1 km. It shouldn't be assumed that 1 km is an easy distance for everybody. However, it's likely that if you're a committed runner who's logging your run routes, then 1 km might not be a worthwhile distance to record. Moreover, if you're sharing your routes with your friends, it might not be something users would choose to share. Just like any other social networking tool, users may not want their connections to see the worst runs, but would be willing to share the best ones.

As I had mentioned earlier the Washington Post's Know More Blog suggested that the types of maps that these running apps produce are biased to wealthy neighbourhoods, wealthy mobile users while disregarding those who are less likely to be able to afford smart phones and fitness apps. However, as stated in my literature review, all maps carry their own spatial understanding of the world. One understanding could be an image of the world with a focus on theology over geography and the place is understood through faith rather than location. The mappamundi, for example, reorients the world with East at the top as a representation for the Garden of Eden. Another focus could be one of empire where the

physical shape of continents is distorted to favour accurate navigation for shipping purposes. The Mapmyrun data created a map specific to a community of people who have a smartphone and who are motivated to track their runs. As Silva and Frith argue:

> Urban spaces can be represented and narrated in many different ways, producing multiple maps, each of which contains different elements and perspectives of the urban environment … [mobile media enable] us to connect fragmented locations in the urban landscape, and by doing that, they create new forms of mobility and mapping within the city (175).

These maps represent the places of a specific group of people, while a map based on cyclists movements or a map based on individuals who take public transportation or who drive through the city would produce different results. These different types of datasets are all unique. They each tell a separate, yet equally important, narrative of how a city functions.

Conclusion

All cities have municipal organized boundaries, neighbourhoods, which do not always accurately reflect the movement in these areas. City elements are,

> blocks that form the space within, [the] given space is generally taken as universal and objective similar to a box populated with objects. Within this box-like construction of space-time, movement and change are treated as placed attributes. (Neuhaus 315)

By compiling user-generated datasets, we can study the structure and composition of a city. Mapmyrun reveals a different shape of the city based on runners' perceptions. The Livehoods project reveals neighbourhoods outside of the city boundaries based on Foursquare check-ins.

Movement and change are not employed in the construction of the box because they, unlike the physical elements of the city, do not only have one state of being; they haves many. While mental maps are a process to curate individuals' perceptions of their space, curating GPS maps is a process that aims to find new perspectives on how to understand the city as a collective product that's based on individual paths. For Neuhaus, repetitive patterns are the main source of identity in any urban setting that helps provide orientation and the main creator of memories. Memory, is "one of the key ingredients in the creation of place...rarely without contradictions and it must be compromised in order to function" (Curtis qtd in Neuhaus).

This is an explorative project to address how paths on the street level add depth to the city. These GPS maps, however, do not suggest a re-design of a city. Instead, by mapping the data, the GPS data reveals different narratives and layers in the city. The Mapmyrun map is one form of expression of people's memories, patterns and decisions. Place is created by linking memories with information in both a physical environment and conceptual environment, as evidenced by Lynch's study on the images of the city and Wood's studies that are more about a perceived environment on places that people prefer, or a happiness/stress map of the city. In future studies, it would beneficial to compare the run map with a mental map to get a comparison of how they perceive that run.

The creation of space is an abstract concept. Neuhaus' compares space to the "technical creation of space in the virtual world as an orbit around the subject in time and space." The creation of place, however, is something more personal. Through something like GPS tracking the creation of place can be recorded as a very fluctuating and moving perception based either on a current whim or a rehearsed path. Brighter and thicker arteries on the Mapmyrun map start to represent routes that show repetition. Personal arteries start

to become collective arteries. The city also has separate sections that are isolated and spatially disconnected. There are a lot of different criteria that go into these patterns - connecting people's personal preferences, their sense of direction, their own personal challenge for that particular run.

Digital maps allow us to leave traces of our individual experiences and create a multi-layered narrative in the city. This is how we create place. Lynch attempted to accomplish this by drawing out the social experience of a city and not just how an urban centre is laid out. Lynch's claim was that individuals receive information from the city in different ways. Space is a practiced place (de Certeau 8) and urban planning is transformed, influenced and defined by walkers. Harrison's statement that a space is transformed into a social space the moment we recognize ourselves in the landscape (67) supports my own data of runners. "The places we mark, the layers we add, these are the memories and experiences that transform an empty landscape into a social space, encoded with personal meaning" (67). The Mapmyrun data visualizes how individuals adapt and transform the logic of the streets by altering them to suit their own needs (de Certeau 2002).

My analysis of Mapmyrun contribute to the discussion of creating place in a digital space. The data is based on both individual lines and collective lines. Combining these two perspectives gives us some insight into the chosen routes, the patterns that ensue, the personal lines that start being built up over a longer period of time. These singular lines reveal a lot about the individual and what can be based on assumption, over time, form a pattern of the culture inhabiting it. The user-generated data is evidence of traces that individual experiences create a multi-layered narrative in the city.

Conclusion

In Jorge Luis Borge's *On Exactitude in Science,* he recounts a fable where cartographers were asked to create a map of the Empire. In the end, they create a map that is so exact that the map is able to cover the Empire at every point. However, the Empire begins to fall into ruins and so does the map. The moral of the fable is — which one is real, the Empire or the map? Is Google Earth and Google Street View our version of the map of the Empire? Does the map precede the territory? From what I have discovered within the Mapmyrun data and the case studies, it does not.

The objective for this thesis was to explore how GPS data could inform us how individuals create their own place. Moreover, how did the aggregate reveal individual tactics? I explored how geolocative apps contributes to digital mapping and to the narrative of the city. This thesis illustrated how data provided by digital mapping technology revealed different layers of the city. Digital apps are changing how we're making meaning of our space by providing different datasets for us to interpret. However, this is nothing new. By continuing to collect this type of data, we can anticipate richer and more complex data sets created by collectively gathered subjective experiences.

In Chapter 1, my discussion of symbolic and indexical maps provided evidence that the bases of mapmaking remains the similar to current day. The first argument being: maps are inherently biased, whether the map supports a mythology, religious belief over geographical accuracy, or declarations of political intent and/or power. The second: they represented the

mapmaker's motivations and portrayed the cultural beliefs/agenda at the time. This could be a conscious decision by the mapmaker or a consequence of how the map was created. In my section on the history of maps, a single mapmaker created a map that represented what was true for an entire society. My framework for the historical maps discussion is that maps are cultural objects. By reading the map, you can read the culture. Maps organize information and illustrate relationships and it is our readings of the maps that unlock the story of the time. My close readings of historical maps showed how each period had their own preoccupations that were showcased on those particular maps. The research questions I answered were: to what extent has our understanding and reading of maps changed with GPS data? How do individuals create their own place on a map? And, how does user-generated data inform us of the city?

In Chapter 1 the discourse on mapping progressed from Jerry Brotton's historical maps to the digital maps that we recognize today, the emphasis changed from a cartographer who spoke for a society to individuals who become their own cartographers. The case studies in Chapter 2 proved an emphasis on the individual cartographer over the omnipotent cartographer. I used de Certeau's theory and read a collection of maps that speaks to the current motivations of mapping: a personal map that represents their own place. The mapping projects I discussed had a focus on the individual user who fed data onto a map. The Livehoods project and Eric Fischer's interactive map collected social media data and plotted a visualization of the city based solely on location data. The check-ins from this project created a new tactic of looking at city neighbourhoods. The neighbourhoods are not bound by city limits, they are created by the relationships and activity patterns individuals have within the city. Similarly, Fabian Neuhaus' UrbanDiary was interested in the rhythms

and patterns of the city. He conducted a user study by tracking individuals' daily patterns using a GPS tracking device. His study created a map of central London that represented individual and collective routes of how people travelled through the city. The maps that came out of these projects were evidence of the place and tactics that individuals create for themselves in a city. The dataset that produced these maps were all based on the individuals' movements, decisions, and routines.

As I've discussed throughout the thesis, the case studies detail the value inherent in creating meaningful place, the tactics that individuals create throughout the city and the communities that benefit from looking at mapping the city from the ground up. In Chapter 3, I conducted an in-depth analysis of Mapmyrun data by mapping routes on Google Earth. The point of convergence between mapmaking and meaning making in a digital space happens when individuals are checking in to places on their phones and tracking their run paths. I was motivated by an interest in visualizing how individuals understood their own place. Guinevere Harrison aptly stated that a space is transformed into a place the moment we recognize ourselves in the landscape. The data that I collected from Mapmyrun is evidence of how we navigate a place in the city. While looking at two users who were the most active on Mapmyrun, I discovered that none of the paths were the same. Many were built on top of each other, but they all had their own unique deviations. The routes that were mapped created a multi-layered understanding of de Certeau's tactics and visualized how the city is transformed and defined by individuals, and in this particular instance, runners.

The creation of place is personal. My analysis of Mapmyrun contributes to a discussion of creating place in a digital space. The user-generated data that I mapped was evidence of the traces of our individual experiences and how they created a multi-layered

narrative in the city. The Mapmyrun map was a visualization of a specific group of people moving through the city. Using the Mapmyrun data, I was able to not only determine how inhabitants perceived their city individually, but also collectively. The space between the digital and the urban is shrinking while our relationship with the city is being transformed by this new technology. This project proves that individuals adapt and transform the logic of the streets by creating their own patterns.

Moving beyond this thesis, there are potential avenues for expansion and exploration. This thesis focused on space and place based on a data set collected from Mapmyrun. Along with case studies that did similar research, this area of study would benefit from a larger discussion with a more expansive data set. For future purposes, I would propose a study that expanded to user studies that asked individuals for the affordances that may have influenced their run. The limitation of the Mapmyrun data is the anonymity of the users. Different hypothesises could be drawn based on the motivations of their routes, but not definitive conclusions. I would also expand the study into different communities of people and not focus on primarily on runners. This type of study could be narrowed down to different types of communities, whether it's a particular neighbourhood, or if we're tracking individuals who take public transport, walk, bike or drive. This type of project aids us in reconceptualising the dynamics of the city based on the routes that individuals generate. The Mapmyrun data presented city routes and boundaries that were not created by urban planners (desire lines) and proved that local patterns and dynamics reshape the city. Each map tells a different story based on the behaviours' of the individual and the preoccupations of the city.

Returning to Borge, he cautions the mapmaker on the dangers of the 1:1 map. With

our current technology, the mapmaker's dream does not seem so impossible. However, what we have learned in rethinking city spaces is: where there is a strategy, there is a tactic. Based on all the user-generated maps, boundaries created by the inhabitants will shift over time. This is the nature of living and moving within the city. The map is a metaphor for not only the territory it represents, but also the culture within it. And, while the space is fixed, the place is not. We can never achieve the 1:1 map because the tactics of the city are always transient.

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