The Spatial Turn in History: Implications for Curriculum in Higher Education

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Abstract

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The emergence of visualization and spatialization technologies, such as digital maps, Geographic Information Systems (GIS), and data visualization is generating new ways of knowing within academic disciplines. This epistemological shift, or "spatial turn," like the Quantitative or Cultural Turns before it, impacts the ways in which knowledge is created, consumed, and communicated. New jobs that require spatial skills are coming into being. It is reasonable to expect, therefore, that education in general, and curricula in particular, would respond to this shift. This thesis explores the curricular responses to spatial ways of knowing in higher education, using the case of one academic discipline–History. The dissertation investigates through a case study, five inter-related aspects of the spatial turn in History: The creation and communication of History knowledge through spatial means, work and employment of History graduates with spatial skills, teaching and learning in higher education with respect to spatial ways of knowing, tools and technologies that drive the spatial turn, and the perspectives of History professors and students with respect to spatial ways of knowing. I explore each aspect separately and use them to triangulate my findings, before synthesizing them into conclusions.

The findings indicate spatial ways of knowing are still a niche area in History as far as creating History knowledge is concerned. In addition, spatial History is decidedly interdisciplinary, and scholars and the professional community take a variety of approaches to navigate this interdisciplinarity. Several career opportunities exist both within and outside academia for the spatially oriented Historian, but this is not a factor that traditional History departments consider when determining curricula. However, a wide range of online learning resources are available with respect to spatial ways of knowing, should students wish to pursue this line of learning in addition to their regular History education. Geo-spatial and visual-spatial tools present their own set of challenges to Historians, and I analyze how they contribute to the complexity of teaching spatial ways of knowing. I conclude that although spatial ways of

knowing offer History some unique possibilities for generating knowledge, the curricular response to them is mixed. I offer some recommendations for possible ways in which History higher education curricula may respond to the spatial turn.

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Researcher Reflexivity

I wish to acknowledge several personal and professional circumstances that have in all probability influenced my approach to this study. They are likely to have predisposed my choice of research questions, the methods I choose, and my position on issues. I document these here in the spirit of researcher reflexivity.

I have had a robust obsession with maps for most of my life. I pored over atlases with great enthusiasm as a child, and first encountered the power dynamics inherent in maps at age eight, while immersed in the Readers Digest Great World Atlas. Every page that showed the map of India, where the book was purchased, was manually stamped with the words “The external boundaries of India depicted in the map are neither correct nor authentic”. Even at that age, it gave me much to think about the meaning of “correct and authentic” maps. It took me on a lifelong exploration of what maps depict, and how they shape us as individuals and societies.

I have also had a decade-long intimate relationship with a meta cognitive subject best labeled “theory of knowledge”. The International Baccalaureate Organization (IBO) has included, for the last 50 years, Theory of Knowledge as part of its high school curriculum with the aim of getting students to reflect on the epistemological bases of their knowledge. I have studied the subject for 12 years and taught it for three in secondary schools. I have also been an external curriculum advisor to the IBO for the subject. I find the question “How do we know what we know?” a deeply engaging one, and a source of constant insights.

Finally, my 20-year professional life has revolved around teaching, learning, curriculum and technology. About half that time was spent pursuing questions of learning in schools and universities, with the other half dealing with skills for employability and workplace learning. This combination influences my perceptions of the relationship between formal education, self-driven learning, workplace requirements and people’s aspirations.

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1: Introduction

Academic disciplines undergo periodic epistemological shifts. These are phases of evolution in the discipline, where the methods of creating, using, and communicating disciplinary knowledge undergo substantial changes. Established and accepted knowledge production methods adapt to changes in the disciplinary environment, which may be, among other things, historical, cultural, or technological. The invention of the telescope, for example, was a technological development that changed the basis for empirical evidence in astrophysics: It changed the way the discipline generated new knowledge about heavenly bodies. Similarly, the emphasis on de-colonization has created a space for non-western knowledge systems and ways of knowing in many social sciences, the humanities and to an extent, in medicine as well (Castelden et. al., 2017, Mazocchi, 2006). These may be called epistemic shifts—a shift in the knowledge production methods adopted by disciplines. Epistemic shifts need to be distinguished from its more well-known counterpart—the paradigm shift. While epistemic shifts are comparable to paradigm shifts as outlined by Kuhn (Bird, 2018), they are not entirely the same. Paradigm shifts, as argued by Kuhn, are a shift in the entire knowledge framework of a discipline. Though Kuhn himself saw the idea of paradigms as applicable to the natural sciences, social scientists have been drawn to the concept for a variety of reasons and have often adopted it (Bird, 2018). Paradigm shifts are ontological or conceptual in nature and may or may not have been driven by changes in epistemology: A paradigm shift could occur by a new way of thinking about existing knowledge, or about thinking new thoughts altogether. For example, Einstein generated the theory of relativity based on *a priori* thinking, and it took decades for scientific methods to provide conclusive empirical evidence for his theories. Therefore, an epistemic shift may be a precursor to a paradigm shift but is not necessarily so.

My research concerns itself with epistemic shifts in the humanities and social sciences specifically, and not conceptual and ontological shifts. Though ontological and epistemic shifts invariably influence each other (Couclelis, 2009), I will constrain myself to the latter—the ways in which knowledge production methods have affected disciplines in research, and more specifically, in education.

In the last century, we may observe four definitive epistemological shifts in the social sciences and humanities, often referred to as "Turns" (Guldi, 2018). These are the Quantitative Turn (an evolution in the use of quantitative and statistical methods), the Cultural Turn (an evolution in the interpretive methods based on postmodern thinking), the Linguistic Turn (an adoption of the textual analyses based on the work of post-structuralists) and currently, the Spatial Turn (an evolution involving the adoption of map technologies, multi-dimensional visualization, and spatial orientations in general, to creating new knowledge). In recent years, there have been references to other "turns", such as the Digital Turn, the Computational Turn (Berry, 2011) and even an Algorithmic Turn (Uricchio, 2011). These last few are still not as yet entrenched in the literature as the earlier four. My research concerns itself with the spatial turn, its impact on disciplinary knowledge, and therefore its impacts on curriculum in Higher Education.

The spatial turn applies to many disciplines, through its nature varies widely between them (Hegarty et al., 2013). It is not possible to have a unified conceptualization of the spatial turn that is equally applicable to say, Physics, Biology, Sociology or History. In order to uncover the discipline-specific nature of the spatial turn and its educational implications, it is necessary to explore it within the context of a discipline. I have chosen History as the area of focus for this study and I justify my choice later in this chapter. I first present the concept of the spatial turn in more detail.

Understanding the "Spatial Turn"

The term "turn" is used to refer to an intellectual orientation in disciplines, especially in the social sciences and humanities, though fields such as health research have also periodically used the term (see Richardson et al., 2013). This intellectual orientation affects the research questions that are asked, the research methods that are employed, how resulting knowledge is disseminated, and how it is taught. The intellectual orientation is driven by a specific "way of knowing", or an epistemological stance that a practitioner of the discipline takes. Guldi (2018) argues that the tools and methods of any new "turn" mostly allows researchers to answer older, already-existing questions. While this is no doubt true, I believe newer tools and technologies themselves also make it possible to ask different kinds of questions, simply on account of their nature. For example, it would have been impossible to ask a question about large-scale, global

crowdsourced maps fifteen years ago, because the technology platforms that make such crowdsourced maps possible did not exist.

One needs to explore if the spatial turn is unique or if it shares characteristics of other epistemic shifts. How does the spatial turn and spatial ways of knowing, for example, compare with other turns that have come before? As mentioned previously, the social sciences and humanities have journeyed through what is called the Quantitative Turn in the 1960s, the Cultural Turn in the 1970s, and the Linguistic Turn in the 1980s (Guldi, 2018). The quantitative turn emphasized a positivist mindset and required an epistemology that valued hypotheses, models, experiments, quantitative data, statistical analysis, predictions and generalizability. Some disciplines in the social sciences such as psychology and economics adopted the quantitative turn and flourish in the same mode currently. The cultural turn, on the other hand, had its roots in critical theory and cultural studies, and emphasized reflection on, and the assessment of society and culture. It valued perspectives, narratives, explorations of relationships, exposing the assumptions and limitations of concepts, groups, and power structures. Sociology, Literary Theory, History and many of the humanities adapted to the cultural turn and continue to be rooted in them even today. The linguistic turn emphasized the philosophy of language and the role of language in generating and establishing meaning as well as its cultural origins and biases. Philosophy, History and other humanities disciplines found newer ways of approaching their scholarship through the linguistic lens. The current spatial turn appears to have elements of the quantitative turn and the cultural turn but is clearly an approach that offers something beyond the other two as will be demonstrated in this thesis.

The ways of knowing associated with each of these earlier turns made demands on the knowledge and skills required to work in that discipline. A budding psychologist in the 70s was, and is still likely to be, learning about experimental study design, inferential statistics or learning to use tools such as SPSS. They would learn quantitative thinking. A sociologist's education in university was likely to be with the works of Foucault for example, with skills of critical analysis, and they would hope to develop critical thinking. It must be noted that the term *critical thinking* is now commonly used to mean the general skill to thoughtfully or analytically reason about anything. Harvey (2018) argues that this ambiguous use of the term *critical thinking* causes issues both among the general public and among academicians, because scholars use the

term with different intended meanings, and it is interpreted in other senses. I clarify therefore that in this case, I am using critical thinking in the sense of being capable of using critical theory.

Just as earlier turns have implications for the education offered in a discipline, I argue that the spatial turn will make its own demands on the knowledge, skills, values, and dispositions, needed by people to engage with the spatial turn. The link between a turn and its knowledge-skill demands has obvious implications for education in general and curriculum in specific, which is particularly obvious in higher education. This educational and curricular impact is, in essence, the focus of my research. I propose that the combination of competencies and methods results in the epistemological stand one takes, and may be called a "spatial way of knowing". I unpack this term in the next section.

Unpacking "Spatial Ways of Knowing"

Philosophy uses the term *ways of knowing* to refer to the processes through which knowledge is created. There is substantial discussion in philosophy and beyond and multiple views abound on what knowledge itself means (Steup, 2018), and what the justifiable means of generating knowledge are. The discussion of how knowledge is created is closely tied to how one defines knowledge itself. This, in turn, leads to complex and nuanced considerations of what it means to "know", what it means to be "certain", what counts as "truth", what it means to "believe" and so on (Hetherington, 2019). I will not be engaging with these complexities in the scope of this study. I use the term "ways of knowing" to simply refer to the means of generating data, evidence, and information based on which people can make inferences, interpretations, and judgments. A spatial way of knowing is a specialized process in which spatial ideas, spatial concepts, spatial tools, and spatial formulations are used to create knowledge. Seen in this way, spatial ways of knowing may be thought of as the engine for the spatial turn.

However, the term *spatial thinking* is used more often than the term *spatial ways of knowing* to describe the process of thinking and creating knowledge through spatial means. Though they appear similar, there is an important but nuanced difference between the two terms. Spatial thinking is often interpreted as a specific cognitive process. It concerns itself with how mental processes occur, how they may be quantified, and what sub-categories of spatial thinking exist (See Knauff 2013, Jones 2001, Huk 2006, Hoffler 2010). Any arguments built around the term spatial thinking, tend to accommodate the cognitive and person-specific ways of processing

spatial information. A spatial way of knowing, on the other hand, refers to an epistemological stance. It asks what can be known about a discipline through spatial means, and how disciplinary knowledge can be generated through spatial methods. A spatial way of knowing addresses not individual mental processes but a discipline's approach to knowledge.

The two terms are however, close enough to be often conflated. Within the literature, there were often references to spatial thinking that could be interpreted as spatial ways of knowing in the way I describe it here, though the reverse was not that common. Different areas of knowledge, such as the natural sciences, the applied sciences, and the social sciences and humanities, each see spatial ways of knowing / spatial thinking in distinct, sometimes non-overlapping ways. Some of these variations are explored below:

Spatial Ways of Knowing and Spatial Thinking

The American National Research Council defines Spatial Thinking as a "habit of mind" that is a constructive amalgam of "concepts of space, tools of representation and processes of reasoning" (National Research Council, 2005). The definition has a broad appeal since it elegantly captures the knowledge, skills, technology and dispositional aspects of spatial thinking. However, the definition has some limitations from the perspective of my research. Firstly, it was created by a committee of geography minded people[1], within the context of geography, though the report very clearly indicated that spatial thinking was applicable in a wider variety of disciplines. Secondly, the definition was created in the context of K-12 education—the report was intended to propose ways to address spatial thinking in school education. In fact, much of the committee's report focuses on how spatial thinking may be developed for K-12 students specifically. Thirdly, and perhaps its largest limitation, is that the definition is scale-agnostic and context-free, which makes a big difference across disciplines. The next sections specifically explore this last limitation.

[1] The report was prepared by the Geographical Sciences Committee Board on Earth Sciences and Resources Division on Earth and Life Studies.

Spatial Ways of Knowing and Scale

Different disciplines engage with the concept of space at wildly different scales. Astronomers' sense of spatial is at a galactic scale or beyond, while molecular biologists and chemists may consider the spatial at cellular levels and below. Radiologists' challenge with the spatial is in interpreting two-dimensional images to detect three-dimensional anomalies. An epidemiologist may work with maps of communities at human scale to trace epidemics. Engineers conceptualize space in terms of rotational or cross-sectional views of their designs. In this light of this wide variation, Baker et al. (2015) propose that a distinction is necessary between spatial thinking and geo-spatial thinking. According to Baker et al., spatial thinking concerns itself with "locational, positional, and measurement data" (p. 120) and refers to the ability to interpret these data and relationships between them. These spatial data manipulations and interpretations involve objects or spaces at a human scale. Geo-spatial thinking and reasoning, on the other hand, are "higher-order cognitive processes" (p. 120) that involve manipulating data, analyzing it, and solving problems at a geographic, planetary scale. While this distinction does not fully address all the variations of scale for spatial thinking, it acknowledges that the issue of scale makes it difficult for all disciplines to conceptualize spatial ways of knowing in the same way. Since this fundamental difference exists between disciplines, their understanding of spatial ways of knowing also varies substantially.

Spatial Ways of Knowing and Context

The other limitation of the National Research Council's definition of "concepts of space, tools of representation and process of reasoning" is apparent when applied to the social sciences and the humanities. For social science and specifically humanities scholars, the "concepts of space" is quite different from the concepts employed by the geographers, or indeed any of the natural and applied science examples mentioned above. Social scientists and humanities scholars tend to emphasize "place" instead of "space".

Costa (2016) analyzes this difference between place and space from an ontological frame by comparing the definitions of Cosgrove and Harvey. The conception of *space* is based on a Newtonian and Cartesian perspective. In this view, space is an objective entity or form, independent of, and unaffected by the events that transpire on or in it. The social scientists and

humanists often align with Harvey's argument that "processes do not occur *in* space … The concept of space is embedded in, or internal to process" (Costa, 2016. p. 29). This argument views space from a critical theory lens, and calls it *place*. Faisst (2014) similarly argues "To think that space is simply existent and ready to be explored would neglect the complexities in thinking about spatiality" (p.63). Faisst comments about how both time and space have shrunk in human experience on account of current technologies, making a case to consider space and the human experience in tandem. In other words, she emphasizes context.

Context is, like scale, a foundational conceptual difference between disciplines, and influences what each discipline means by a "spatial way of knowing". Though some scholars such as Bodenhamer (2010) make a case for humanities scholars to use both interpretations of space and place, a strong sense exists among humanities scholars that place – both literal and metaphorical – are more important than physical space for their disciplines.

I next review a term that is not discipline-specific in the sense of context and scale but has strong implications for how the term spatial ways of knowing is interpreted and used.

Spatial ways of knowing and "visualization"

A third variation in the meaning of *spatial* relates to the concepts of *visualization* and *data visualization*. Both these terms refer to the graphical display of data, presented through charts, graphs, and other spatial-visual means. In this case, "space" is neither geo-spatial, nor spatial at the human scale. It is a spatial representation of data, usually on a two-dimensional, and sometimes three-dimensional space. For continuity in my terminology I extend Baker's (2015) continuum of *spatial* and *geo-spatial*, to include *visual-spatial*, as a means of referring to visualizations or data visualizations.

Visual-spatial representations are of all kinds, ranging from a summary infographic to complex interactive data displays. Despite their high or low fidelity to the underlying data, they are nevertheless useful to generate understanding or new insights. Visual-spatial thinking is sometimes seen as a subset of spatial thinking (see Jones 2001), and at other times equated to spatial thinking, as evidenced by the chapters in *Visualization in Science Education* (see Gilbert, 2008). The STEM disciplines typically use the term *visualization* in the same sense that geographers use when they refer to *spatial* thinking. Earlier reviews of the term visualization equate visualization to *imagery* as well (see Reiber, 1995), which adds a further layer of

complexity to the term. This overlapping sense of *picture*, *image*, *map*, *model*, *representation,* etc. are comparable in meaning to spatial thinking and spatial ways of knowing.

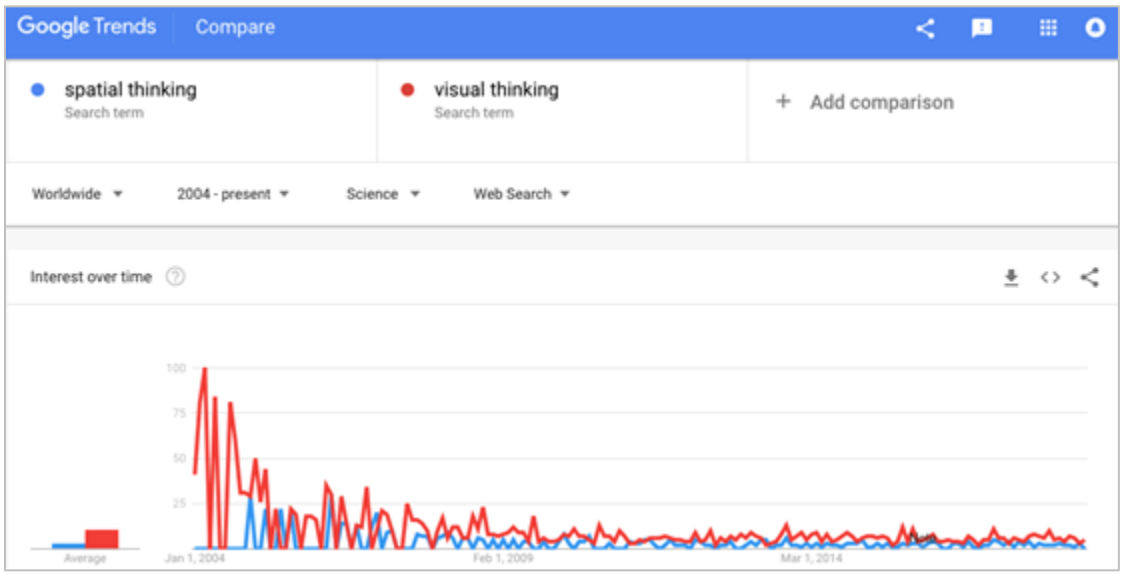

Figure 1: The worldwide use of the terms 'spatial thinking' and 'visual thinking' as measured on Google Trends in 2018.

It is also noteworthy that the word spatial thinking has become more popular after the 2000s and literature from before that time would be equally likely to have used the word visualization. Google Trends search data for the terms *spatial thinking* and *visual thinking* in the area of science, for example, shows visual thinking steadily converging with Spatial thinking between 2004 and 2018. (Figure 1)

The visual display of quantitative information has become increasingly popular in the current atmosphere of large and dynamic datasets. As Agrawala (2005) points out, these visual displays are necessary to "answer questions, make decisions, see data in context, analyze and discover, present an argument, tell a story, inspire" (p.2). It is easy to intuitively believe this to be true since it resonates with general experience on many levels. It is even built into everyday language ("A picture is worth a thousand words" for example). While the visual display of quantitative information is certainly not a new phenomenon, technology now puts it within easy access of researchers, businesses, institutions, technocrats, policymakers and the public. Fairly complex data visualization capabilities are built into everyday software such as spreadsheets, not to mention dedicated data visualization software such as Tableau. Yet, the key to effective use of these tools, lies more in the skill to think spatially about data than to use the tools specifically.

Next, I consider a final variation of terms and concepts relating to spatial ways of knowing: augmented reality, virtual reality and mixed reality which are often grouped under the umbrella term xReality.

Spatial Ways of Knowing and xReality

A variation of visual-spatial representations occurs when the data and information are presented three-dimensionally and in virtual environments. Terms to indicate such virtual environments include Mixed Reality (MR), Shared Reality and xReality (xR), where x stands for any form of technology-mediation. (Mann et al., 2018). The most commonly implemented virtual environments are Augmented Reality (AR) and Virtual Reality (VR).

Augmented Reality refers to a layer of additional information that is made available over existing "reality", which could be the room one is in, the neighborhood, or a map, and is viewed through a device, typically a smartphone. With augmented reality, the user is seeing the world through a filter of additional information, usually via a smartphone screen, as of 2019. Users may be conscious of the physical world, such as when navigating a walking path using AR guidance on Google Maps. Or they may be drawn deeper into the AR experience to the extent of losing focus on the physical world, as was seen in the instances of people playing the popular AR game Pokémon Go (Joseph & Armstrong, 2016). Virtual Reality, on the other hand, requires the user to shut out physical reality using head-mounted hardware, or to enter a closed space that entirely shuts out the physical world. VR immerses the user into an alternative reality, which could look like "regular reality", or pure fantasy, or something in between. The immersiveness of the experience affects the cognitive and emotional experience differently than augmented reality (Chicchi Giglioli et al., 2015). However, as seen in the example of Pokémon Go, this distinction is not absolute. These have, in my opinion, much potential to add to the discussion around spatial ways of knowing. However, the affordances of these technologies to generate and communicate knowledge are still evolving as of 2019. The most advanced uses are seen in domain of medicine, where it is used both for professional and educational purposes. Other better-evolved domains include gaming and the entertainment industries. In the context of spatial ways of knowing for History, I do not consider them evolved enough for any in-depth analysis of their role in disciplinary epistemologies. Future iterations of this research may undertake such an exploration depending on how these technologies evolve and are adopted.

Scholars have acknowledged that issues of scale, context, terminologies, and evolving technologies present considerable problems when considering spatial ways of knowing. To grapple with these issues of disciplinary variations and differing terminology, the Center for Spatial Thinking at the University of California Santa Barbara (UCSB) convened an expert group meeting in 2013. Forty-two experts from various fields including geography, chemistry, psychology, astronomy, computer science, sociology, and political science discussed the teaching and learning of spatial thinking in higher education, hoping to pick up where the NRC report had left off nearly a decade ago (Janelle, Hagerty & Newcombe, 2014). The group suggested that it might be worthwhile to approach disciplines independently to determine the nature of spatial ways of knowing, given the specifics of the Spatial Turn for that discipline. They proposed what they called a collaborative deep dive into the issue of spatial thinking for a discipline.

I believe that by undertaking a series of such deep dives into different disciplines, an interesting, and perhaps informative picture may be drawn about spatial ways of knowing. The aim would not be to generalize across disciplines but to find intersections, overlaps and other patterns that would provide a thick description of spatial ways of knowing. Through such a research agenda, it may even be possible to propose a curriculum theory about emerging technology-mediated ways of knowing.

Why Choose History?

While a deep dive into each discipline is desirable in the long run, for purposes of this study, I selected a single discipline following a systematic process. Based on my review of the literature, I first identified four broad areas of knowledge where spatial ways of knowing are relevant: The first was the Science, Technology, Engineering and Mathematics (STEM) areas which include pure or applied science, pure or applied math and medicine; The earth sciences and geography; social sciences and humanities; and visual and performing arts. I then applied the following criteria to each area of knowledge:

- How clearly are the terms spatial thinking or spatial ways of knowing understood in the discipline?
- To what extent have spatial technologies impacted the discipline? What has been the impact so far? Is it different from how it might be, going forward?

- To what extent does a tension exist within the disciplines regarding spatial thinking and technologies – both among people and between underlying philosophies?
- To what extent is a shift towards spatial thinking "inevitable" in the discipline? For example, at this time, spatial technologies appear more a foregone conclusion in engineering and geography than in sociology and literature.
- To what extent, and in what ways are spatial ways of knowing currently accounted for the higher education curriculum?

Based on the literature review and these criteria, I determined that the STEM and earth sciences already had a rich literature regarding spatial thinking from their perspectives. There were practically no philosophical tensions in these areas, spatial ways of knowing were widely accepted, and most of the academic discourse was related to specific empirical findings and ideas. The discussions in the literature are largely about how to optimize spatial ways of knowing, not whether to use them at all (see Huynh 2009, Perry 2013, Lee and Bednarz, 2012). The social sciences and humanities, on the other hand, demonstrated a lot more fundamental tension, and there are pronounced disagreements with some academics wondering if spatial technologies are relevant at all for their disciplines, while others have advanced research agendas involving spatial tools and technologies. The visual and performing arts seemed to have features of both the STEM and the Social Science-Humanities.

Given these, I saw the social sciences and humanities as having the most potential for interesting insights with respect to spatial ways of knowing. Literature regarding spatial thinking or spatial methods in the social sciences and humanities exists but is smaller in volume and is far more heterogeneous than the literature in STEM fields. I believed there was scope to draw out richer understanding. I also have personal disciplinary exposure to the social sciences and humanities in my own education and I, therefore, assessed myself as being better equipped to study them. Under these considerations, I first narrowed down to the social sciences and humanities as candidates for the study.

From among the social science and humanities disciplines, History was of particular interest to me, for a variety of reasons. It is interestingly considered a social science by some academics and as a humanities subject by others (Landes and Tilly, 1971), with each camp making different foundational assumptions about the subject. It appears, as will be seen in Chapter 2, that spatial technologies offer History some unique possibilities that were here before

impossible. For example, Geographical Information Systems (GIS)[2] offers newer spatial-temporal perspectives to study History (Bodenhammer, 2013), or augmented reality can be a way of documenting and experiencing history through a range of applications that are now available (for example, BBC's Civilizations AR application that allows users to explore historical artefacts via their smartphones). However, there is both enthusiasm and resistance to these spatial possibilities from within the discipline. Some universities and departmental groups have extensive research agendas in Spatial History and Digital Humanities, such as for example Stanford's Spatial History Project, which is a part of the University's Center for Spatial and Textual Analysis. Other universities barely acknowledge the existence of anything Spatial with respect to History. It seems a worthwhile endeavour, therefore, to understand these tensions, and to assess their implications for History curriculum in higher education.

Summary

In this chapter, I introduced the research topic and unpacked the terms the spatial turn and spatial ways of knowing. I explored the variations in meanings and the use of different terms related to the idea of the spatial. Context and scale create disciplinary differences, while the ideas of visualization and xReality open new doors with respect to what is considered spatial. I explained my rationale for choosing History specifically as the focus of this study. Chapter 2 offers a more detailed review of the literature and proposes a theoretical-conceptual framing of the study.

[2] "GIS is framework for gathering, managing, and analyzing data, (rooted) in the science of geography.. It analyzes spatial location and organizes layers of information into visualizations using maps and 3D scenes. With this unique capability, GIS reveals deeper insights into data, such as patterns, relationships, and situations—helping users make smarter decisions". (ESRI, 2019)

2: Framing the Inquiry

In this chapter, I review the literature that lies at the intersection of History as a discipline, the ideas of spatial ways of knowing and spatial turn, and technologies that enable the spatial turn. This chapter presents the literature relevant to the overall conceptualization of my inquiry. Other chapters include literature reviews relevant to the ideas and information specific to those chapters.

Spatial ways of knowing, spatial technologies and disciplinary knowledge interact in complex ways within a broader ecosystem of influences. The ecosystem here refers to the philosophical, social, technological and curricular elements that influence this interaction. I explore each of these elements in its own section in this chapter. I first begin with a review of History as a discipline, as it relates to my inquiry around the spatial turn.

History as a Discipline

History is commonly understood as the study of the past, based on evidence. It involves the discovery and documentation of past events, as well as their interpretation and presentation (Stearns, 1998). Written documentation has been the most trusted form of evidence in History, with the periods before which written records existed being designated as prehistory. Some historians see the study of the past as an end in itself, while others hope to throw light on current issues through an understanding of the past. (Carr, 1962). History for a long time emphasized chronological sequence and a political orientation. More recent approaches tend to emphasize the social and take thematic approaches, studying the history of peoples, places, ideas, and materials. Many of these themes tend to use space and place as an organizational principle, rather than time alone (Bodenhamer, 2013).

Historiography is a meta-level study of History. It refers equally to the history of history (Vann, 2018), as well as to context in which previous historical analysis has been conducted. It questions the motivations and orientation of the historian, the disciplinary context within which a previous historical analysis took place, perspectives which were privileged, and the methods used to collect evidence. I am particularly interested in historical methods as they are directly relevant to the question of using spatial ways of knowing about the past. The methods available

to historians to collect and analyze evidence has expanded considerably in the recent past — from carbon dating to DNA testing. Consequently, the kind of questions posed by the historian have expanded as well. The shifts in methods and questions are of primary concern to the historiographer. Historiographers would seek to understand whether or not spatial technologies offer anything of value to the discipline, and if they do, what that value might be. These ideas of evidence, the source of this evidence, its organization and interpretation, as well as underlying principles has fundamental implications to the question of creation of knowledge through spatial ways of knowing: Does data from spatialization technologies such as Google Earth and ArcGIS simulations count as admissible evidence for History? Does it help or hinder interpretation? What new interpretations could spatial organization of temporal events offer?

Related to the question of historiography is the classification of History as a discipline. If one were to classify History as a social science, as some historians do, the emphasis would be on evidence that supports generalizable insights, or at least concrete ideas of causality. If History were classified as a humanities subject, the emphasis would shift to the construction of narratives, the plurality of perspectives and questions of power. It would seem, therefore, that geospatial ways of knowing would be more popular with the History-as-social-science orientation while visual-spatial ways of knowing may offer greater appeal to the history-as-humanities camp. The literature does seem to indicate that such an association between technology and the orientation of the discipline exists, and is even explicitly stated as such by Bodenhamer (2013).

Bodenhamer succinctly summarizes one tension that exists with history in terms of geographical vs metaphorical space. In the early 20th century, some historians vigorously pursued the interpretation of the past through geographical space, most prominently in the Annales School, through the work of Braudel, for example (Fink, 2018). The rise of postmodernist thought and critical theory in the 70s and 80s began to de-emphasize geographical space as it was seen as being positivist and quantitative in nature. For the humanists, space was still seen as central to the interpretation of the past, but it took on the more metaphorical sense of gendered space or racialized space. This metaphorical space is also referred to as “place” to distinguish it from the sense of geographic space. Costa (2016) also speaks of this distinction in terms of Cartesian / Newtonian space as an independent entity that exists in its own right and within which events occur. He contrasts it with the sociological view of space-time being a

socially forged institution, and where space is internal to the event instead of the other way around. In my view, this ontological difference is so deep-seated that any subsequent epistemologies are bound to be incommensurable, and conversation between scholars of the two traditions bound to be problematic.

Bodenhamer (2013) however argues that historians as such have not grappled enough with the sense of the physical world, and geographical space. He makes a case both in his essay (2013) and his book (2010), that there exists scope for richer interpretations of history through spatialization technologies. He posits that some of the antagonism of historians towards the spatial turn is because of an overly narrow interpretation of spatialization technologies to mean just GIS software. GIS software, the bedrock of spatial technologies from a geographer's perspective, makes far too many quantitative and positivist demands of the humanist historian – such as the need to view evidence in terms of models, attributes, fields, objects and so on. Not only does this make GIS software difficult to master for the Historian but is also perceived as not worth the effort because it cannot seem to answer the questions the humanist historian poses. Bodenhamer proposes a broader interpretation of spatialization technologies and calls it GIScience including mixed reality, cyber geography (broadly referring to location-aware data), animated digital maps, and visualization of spatial data for historian's inquiries. Schuurman (2015) proposes the term alt.gis to refer to the critical use of GIS in its multiple mash-up forms for History and the other humanities disciplines.

In addition to this, the spatial turn in History may have to acknowledge the impact of spatial technologies on related disciplines such as archeology, genealogy, genetics, and linguistics. GIS specifically, has begun to impact these disciplines in a variety of ways, and examples abound. The hotly contested Indus civilization(s) in Northwest India is being explored by archeologists through large scale GIS projects (Greene and Petrie, 2018). This will no doubt have a direct impact on the historical understanding of the time and space referred to as the Indus Valley / Harappan civilizations. GIS is being used to create historical gazetteers in conjunction with corpus linguistics to study the nature of language use across space and time (Brando and Frontini, 2017). It is easy to see the impact this might have on the historical evidence and thereby the historical understanding of events and phenomena. The rapidly exploding popular interest in ancestry is made possible by easily accessible genetic mapping. When this is combined with geographic information through GIS, it provides a richer picture of populations both spatially

and temporally (Dempsey 2012). This again, cannot fail to impact a historian's understanding. These developments imply that even if History as an academic discipline is divided on the relative use of GIS or other spatialization technologies, it is bound to feel an indirect effect on account of the spatial orientations in sister disciplines.

In this section, I reviewed the nature of history and historiography, and their relation to the spatial turn. I next review concepts that illuminate how History relates to technology.

Philosophical and Social Discourse Around Technology

The Stanford Encyclopedia of philosophy succinctly summarizes the source of a key tension between the humanities and social sciences, and technology. The philosophy of technology comprises what the authors call two cores – "instrumentality" and "productivity" (Franssen et al., 2018). The former refers to how things (technologies) are used, while the latter refers to how things are created. The issue is complex and nuanced and is not possible to fully discuss in the scope of this dissertation. Despite this, I believe the ideas of instrumentality and productivity can inform this inquiry, with respect to History and Spatialization technologies.

Franssen et al. (2018) argue that the humanities philosophy of technology of the 20th century has occupied itself with the instrumentality dimension. It treats technology as a black box and raises questions regarding the relationship of technology with the structure of society, politics, morals, culture, the human condition, and even metaphysics. This approach derives primarily from the developments in the humanities and the social sciences, such as critical theory and Science and Technology Studies (STS), as opposed to developments in philosophy, such as the philosophy of science, or the philosophy of mind. The authors claim that it also ignores the productivity dimension of technology. The Analytic approach to the philosophy of technology, on the other hand, focuses on technology as a phenomenon grounded in practice. It examines not the relationships of technology with society but with itself. The Analytic philosophy of technology concerns itself with questions such as the relationships between technology and science, the centrality of design to technology, and the ethical implications of specific designs and technologies.

I believe that at least some of the tensions between History scholars and technologies such as GIS may have its roots in this underlying philosophical schism. Engineering practices are quite clearly rooted in design practices, and people who create technologies are driven by

productivity priorities (Madrigal, 2012). Technologies such as Google Earth, Google Maps or ArcGIS have invariably developed as a result of engineers seeking to solve specific technical or business problems, or meet commercial goals. Their interest in the social impacts of their technology is primarily through the lens of user experience, profitability, market considerations, legal issues, and public perception of their technology, and less about issues that concern humanities scholars.

As has been established before, humanities historians seek to establish the instrumentality of the technology and are less concerned, if at all, by the technology itself. I conjecture if this disregard for the working of the technology may also explain why it is so much more difficult for humanities historians to learn to use these technologies, or see them as anything other than a black box. The social science historians are also concerned about the instrumentality, but some of them seem to consider the productivity aspect of technologies when framing their inquiries. Numerous publications and conferences have dedicated themselves to "looking under the hood" of spatialization technologies, specifically GIS, in an attempt to find insights to inform their inquiry, such as for example *Exploring Big Historical Data: A Historian's Macroscope* (Graham, Milligan and Weingart, 2015)

The instrumentality-productivity axis is one way of framing the philosophical underpinnings in this inquiry. Alternatively, one could use the continuum of technological-social determinism to frame the question of the philosophical and social aspects of spatialization technology and its use by Historians. However, I find the instrumentality-productivity axis to be more useful since it relates more closely to the issues raised by humanities scholars. The question of how spatialization technologies are used by historians could perhaps also be explored through the lens of Diffusion of Innovation, Social Construction of Technology (SCOT), or Actor Network Theory (ANT). These lenses are important in any discussion of technology where the focus is on how individuals and social structures interact with society. However, in this inquiry, my interest is more towards the epistemology afforded by these technologies, and the theories of knowledge that may be associated with technology. I, therefore, adopt instead a theory of specialized knowledge, which I discuss later in this chapter.

In this section, I reviewed the philosophical underpinnings of technology and how the historian's association with the philosophy of technology may illuminate any fundamental tensions between History and spatialization technologies. Next, I review the cognitive-

psychological discourse around spatial thinking, and how it might affect Historians' view of the spatial turn and spatial technologies.

Cognitive-Psychological Discourse

Psychology and the cognitive sciences have concerned themselves with the processual and perceptual nature of spatial thinking, often analyzing it as a combination of different skills. These fields draw on physiology, brain functioning, and psychological constructs to offer a view of spatial thinking that is person-centered and positivist. The knowledge generated by the cognitive sciences and psychology are considered to be verifiable, generalizable, credible and in general, more scientific. This section will explore how the dominant concepts from cognitive science and psychology frame the discourse around spatial thinking, and how it, in turn, affects the discipline of History.

In line with the epistemic practices of cognitive science and psychology, the preferred approach to studying a phenomenon (in this case spatial thinking), is to define, dissect, categorize, manipulate the variables, measure, calculate all aspects of spatial thinking and thereby infer causes and effects. There are at several taxonomies and classifications of the subskills of spatial thinking, which have received considerable attention (Lee and Bednarz, 2012) As mentioned in chapter 1, the literature also shows that the terms spatial skills, spatial ability, spatial literacy, spatial intelligence, and spatial competency have been variously used, each with its own nuance and reasoning. Lowry (2016) establishes the relationship between these concepts through a literature review. The paper makes a case to say spatial thinking is inherently intermodal: spatial thinking has clear ties to visual, verbal and logical-math abilities and they work in tandem. The paper also cites neuroscience to establish that spatial thinking is mapped to different parts of the brain, contributes to neuroplasticity, and therefore plays a role in developing the multimodal cognitive processing that one associated with new literacies. These views have a direct implication on educational questions raised about spatial thinking. Researchers in this tradition tend to ask how best to measure spatial thinking, and which instructional interventions can improve achievement on standardized tests of spatial thinking.

This approach has parallels with how "critical thinking" has come to be understood in educational priorities and curricula. In this instance, I refer to critical thinking in the sense of a general ability to reason, and not as the ability for applying critical theory. Critical thinking also

has had its share of disputes, with scholars arguing whether critical thinking is domain-general or domain-specific (Davies, 2013), or if critical thinking dispositions support the transfer of critical thinking skills between contexts and disciplines. The California Critical Thinking Dispositions Test (Facione et al., 1995), for example, evaluates people on seven dispositional attributes: truth-seeking, open-mindedness, analytical tendencies, systematic tendencies, critical thinking self-confidence, inquisitiveness, and cognitive maturity. These attributes are expected to help in the quest for transfer between contexts. The spatial thinking field has tended to follow a similar cognitive approach to understanding what underlies a spatial way of knowing.

The second recurring issue in the literature is the framing of spatial thinking as either a domain-general ability, or as a domain-specific one. In the 2013 interdisciplinary meeting at the Center for Spatial Thinking mentioned before, the experts agreed that there seem to be domain-general spatial thinking concepts such as distance, dispersion, scale, spatial dependence and heterogeneity and domain-specific skills such as designing and critiquing alternative spatial representations, and the use of specific spatialization technologies. While acknowledging that this view needed further exploration, they proposed that there may be a case to be made to teach domain-general spatial thinking skills to students.

However, Janelle et al. (2014) use earlier research to establish that it is very difficult to transfer skills between the learned context and other contexts. That is one of the reasons the expert group proposed a deep dive into individual disciplines—to assess the nature of spatial thinking in each case and then formulate appropriate curricular responses to it.

These questions of "spatial thinking as a measurable skill" and "transferability of spatial thinking" have framed and dominated the discourse around spatial thinking and spatial ways of knowing. How does this impact History as a discipline? It is immediately obvious that these conceptions of spatial thinking are better suited to the view of "space" used by the natural and applied sciences, most of geography and some social sciences, and not so much to the disciplines that emphasize "place" in a metaphorical or constructivist sense. Yet, there seems to be scope within History, as argued by Bodenhamer (2013), to interpret history through geographic space, as well as to use broader definitions of spatialization technologies in terms of mashups, mixed reality and so on. So, at least in some traditions of History scholarship, it is probable that the concept of spatial thinking as a measurable, teachable skill may be valid.

Other questions to consider would be: What implications does the intermodal nature of spatial thinking have for History? Given that spatial thinking is closely related to verbal ability, is it possible, for example, to establish spatial thinking through means that are primarily text-based? Can texts themselves support spatial thinking in the absence of spatialization technologies such as GIS? To what extent are the domain-general spatial thinking concepts and skills proposed by the expert group applicable to History? What would the domain-specific skills look like for History in Higher Education? These questions are open to further inquiry.

This section reviewed the dominant concepts of spatial thinking from the cognitive-psychological angle and evaluated its implications for the History discipline. The next section reviews another aspect of the ecosystem which directly impacts spatialization technologies, (and by association, the discipline of history) – the economic and political environment.

Economic-Political Environment

When the camera was first invented, taking a photograph was a static process in a studio. However, in 1888 Kodak created the first "snapshot" camera, a portable device affordable by the middle class, changing the nature of photography forever. Thompson (2014) describes how easy availability and low cost changed the content of the photos – photos went from serious, formal affairs to playful ones, since film was no longer a valuable, to-be-hoarded item. It also changed the nature of people – they began to modify themselves and events for better on-camera presence. As cameras and photo-taking evolved, they went on to change not just memory-making and preservation, but everything from security to scientific discoveries. Another example of the reduced cost of technology that has had far-reaching consequences in recent times has been genome sequencing. The first human genome to be sequenced cost nearly 3 billion dollars and took 15 years to complete (National Human Genome Research Institute, 2018). Today it costs about $ 130 to use parts of the technology for quasi-entertainment or hobby purposes such as looking up one's ancestry (for example, at www.ancestrydna.ca). More importantly, the reduced cost makes its implications for healthcare drastically different than 15 years ago. These two examples, among many, show how the accessibility to a low-cost technology impacts the process of knowledge creation and commoditizes the knowledge generated using that technology. In this section, I explore the cost and accessibility of spatialization technologies and their implications for History as a discipline.

What Kodak and Polaroid were to the camera, Google and ESRI are to map and Geographical Information Systems (GIS) technologies. They were begun as business ventures and have grown exponentially within a business framework. Google Maps is ubiquitously available, while Google Earth only needs an adequate browser and stable broadband internet connection to provide a range of spatial data and experiences that did not exist a decade ago. ESRI has over 129 different spatially oriented products to meet the needs of individuals, enterprises, communities, and developers (ESRI, 2019). Open Street Maps (OSM) is a platform for crowdsourced map data, with non-experts adding data to a common database. In the spirit of open software, both Google and ESRI have opened up their software to an extent for communities to adapt and extend – to create variations suited for specific project needs. With the right skills, one could, in theory, build a precise feature set needed for a specific project, by piggybacking on Google Earth or ESRI's ArcGIS. Or the project could, with the help of the community, devise ways of using these commercially created software to do things its designers may not have specifically intended. It is not surprising therefore that many conferences, books, and articles exist to support those seeking to use GIS for History scholarship. These technologies are explored in detail in Chapter 8, Tools and Technologies.

To work with this software however, history scholars need data that is suited for use in this software. At the expert group meeting at the Center for Spatial Thinking, Bol, a History professor from Harvard, summarized this issue succinctly (Hagerty et al., 2013). He gives the example of the China Historical GIS project, which has historical data temporally and spatially coded in the China Biographical Database. He calls for a similar world Historical gazetteer—a "listing of place names with their locations in space" (p 10). Such a gazetteer could then be enhanced by recording the time at which names and boundaries of places changed. This, in his opinion, would be the fundamental step in being able to use vast amounts of historical data for spatial analysis. Extracting vector data from historical maps would be necessary to create such a gazetteer and this would require smarter optical recognition software for maps, or would need to use crowdsourcing to manually extract this data. While such efforts are underway (such as with oldmapsonline.org), they appear to be progressing at a slower pace than possible. On a related note, Goodchild, in the same meeting, pointed out another barrier to humanities scholars using GIS software. He underlined the need to reorganize the tools in software such as ArcGIS to enable humanities scholars to work more intuitively with certain features of the software.

The crux of the issue then becomes the interface between the data and the software used to analyze it. In the case of historical maps, since the data is produced by a History community or a government, and since the software is controlled by a commercial entity, it is perhaps not easy to make quick progress on handshakes. Institutions of higher education seem to be working on separate Historical GIS projects (such as the Canadian Historical GIS project or the Harvard HGIS group) bringing together the resources and data as possible within their capabilities. Google Maps made rapid progress not only because they generate their own map data, but also because they actively source data from governmental and other partners across the world (Madrigal, 2012). Clearly, Google would have the wherewithal to create historical map data but doing so is not a commercial or business priority for the company.

So, we see a paradox. While the technology itself becomes very accessible to the public, and historians may well be using these technologies on a personal basis, there still exist barriers to making large scale, high-quality historical data available for History scholarship. There are also issues of copyright of these data which need to be resolved (Bonnell and Fortin, 2014). Some of these issues are discussed towards the end of this thesis. However, a deeper analysis of these issues would be part of future research.

The other spatialization technology to consider is Mixed Reality. Google is a leader in this business as well with its Daydream VR platform, but it shares the space with equal-sized competitors in this case-Apple (ARKit SDK for iOS), Facebook (Oculus suite of products), Microsoft (Hololens), Sony (Playstation), HTC (Vive products), Samsung (Gear). A Goldman Sachs report expects the Virtual Reality industry to grow to USD 80 billion by 2025 (Bellini et al., 2016) while others estimate that up to 480,000 jobs will be created in the AR-VR sector by 2020 (Global Virtual Reality Association, 2017).

Most of this development in mixed reality is expected to be aimed at entertainment uses such as video and gaming, but there is also a range of educational uses it is expected to be put to. Both the creative and educational aspects of mixed reality technologies are of interest to History as an interpretive discipline. However, it is difficult to comment on its implications for knowledge production or knowledge communication in History. It remains to be seen what, if any, possibilities emerge for History as a discipline, given the decidedly entertainment direction of that industry.

An examination of the economic environment is not complete without a note about the political environment in which History and the Spatial Turn exist. The current neo-liberalization of Higher Education has emphasized measurability and generalizability and by extension has privileged positivist traditions more than others. Empirical, measurement intensive work is seen more favorably during funding processes and is viewed as more reliable in matters of policy (Lather, 2004; Kerrigan and Johnson, 2019). There is thus a tendency, as Kerrigan and Johnson argue, for researchers to align themselves to quantitative methodologies. Kerrigan and Johnson were making the case for methodological plurality and the need to prioritize and valorize qualitative and interpretive methods. However, under the circumstances, it is reasonable to entertain the possibility that a move towards spatially and quantitatively oriented methods may a by-product of these funding pressures. Just as a case can be made for the intellectual value of using spatial tools and ways of knowing, the neo-liberal environment may offer a less flattering case for putting the spatial tools cart before the disciplinary horse. Evidently, it needs to be examined to what extent this may actually be the case.

This section reviewed the commercial and political environment, concluding the review of the ecosystem within which the spatial turn, spatial ways of knowing, spatialization technologies and the History discipline exist. In the next section, I review the state of curriculum in higher education and its relationship with my inquiry.

Curriculum and Higher Education

In this section, I consider issues of curriculum in higher education and its implications for my inquiry. I first review curricular theories that are relevant to my research. I then consider the unique challenges of teaching younger students who have a well-developed sense of digital maps and wayfinding[3]. These frames are developed more in the Discussion Chapter 9, in the context of interpreting my findings.

When considering epistemic shifts and their relationship with research and teaching, it becomes necessary to consider the nature of knowledge itself and its relationship to the curriculum. After all, disciplinary epistemology is a particular kind of knowledge, and its

[3] Lidwell, Holden & Butler (2010) define wayfinding as the "process of using spatial and environmental information to navigate to a destination" (p.260). Way finding has a long history—travelers of all ages have used different kinds of spatial information to orient themselves and get to a destination. Current way finding is technologically mediated through digital map and GPS technologies.

relationship with the discipline firmly involves the curriculum of that discipline in Higher Education. A curriculum is, broadly, a description of the knowledge that is considered relevant and desirable to a given context, and which needs to be accounted for in the teaching-learning process. A key task for curriculum creators, therefore, is to determine what knowledge(s) is relevant and desirable. How can we then analyze the relationship between certain kinds of knowledge and curricula in that discipline? Young and Muller's conceptualization of specialized or "powerful" knowledge (2015) seems to offer the best fit to consider the question of knowledge and higher education curriculum. At the risk of oversimplifying Young and Muller's nuanced arguments, I offer here a brief summary of their ideas. (Young, 2010; Young and Muller, 2015; Muller and Young, 2019)

Young argues that powerful knowledge, which he also calls specialized knowledge has a central place in the curriculum. Young takes great pains to distinguish between "knowledge of the powerful", and "powerful knowledge". The former deals with power dynamics of "who knows" and "what is known". "Powerful knowledge" on the other hand, is specialized knowledge in a discipline, which is, by the standards of the discipline, "better" than other, non-specialized knowledge in the discipline. Powerful or specialized knowledge may be exemplified by the combination of knowledge and skills applied by a surgeon during a surgery, or by a sociologist in interpreting a social phenomenon. However, the social sciences and humanities have, in Young and Muller's argument, diluted the possibility that some knowledges could be more powerful or specialized than others, because of their focus on the social construction of knowledge. He goes on to offer arguments for how this concept of specialized knowledge can be adopted to determine curriculum.

This framework of powerful or specialized knowledge, and the distinction Young and Muller make between powerful knowledge in the sciences vs. in the social sciences and humanities, appears particularly relevant for my choice of History and the spatial turn. One of the tensions identified earlier was the extent to which historians were willing to see their work as being positivist and science-like, or not. Their adoption of spatial and quantitative technologies, and therefore a different epistemology, hinged quite largely on this distinction. I am therefore convinced that this conceptualization of powerful knowledge offers me a sound framework to analyze the nature of knowledge and its relationship to epistemologies and curriculum.

The second consideration for higher education curriculum comes from the perspective of the students. Students are as central to the question of how disciplines respond to epistemic shifts, as researchers or teachers. This is because students today, more than any time in the past, have their own expectations with what they would like to learn, and for what purposes. While they definitely look for instruction and guidance from teachers, they come with rich life experiences and are more knowledgeable than teachers in many areas, especially where technology is concerned. While students are quite a heterogeneous group, if one considers a typical undergraduate student in university in the present times, they would belong to Generation Z, exhibiting particular generational characteristics of interest to this research. Though universities are increasingly seeing a rise in mature students, younger students still form the bulk of the student body, at least the undergraduate level. (Johnes, 2014)

"Generation Z" refers to people who were born between 1995 and 2015 (Kingston, 2014), into a world that is hyper-networked and mobile. The oldest of this generation are just leaving university and entering the workforce, while the youngest are starting elementary school. Clearly, it is not possible to paint all people in the group, everywhere in the world, with the same brush or attribute a single set of characteristics to them. Yet, certain generational characteristics seem to be valid, provided a certain level of technology access is present.

Members of Generation Z share certain life experiences primarily on account of their exposure to a post 9/11, hyper-networked world, with access to information, communication technologies from early childhood. This results in some new dynamics in the student-university relationship. For example, some studies have found that nearly all members of generation Z perceived themselves as having more knowledge of technology than their professors (Cilliers, 2017). Scholars have begun to pay special attention to their location awareness, and spatial abilities (Downs 2014). They have different expectations about education - they expect to be in charge of their own learning and learn in a flexible, networked manner, with low barriers to access (Kozinsky 2017). Similarly, they have different challenges and opportunities in entering the workforce because many traditionally entry-level jobs are being automated, and their own expectations from work are more self-directed (Deloitte, 2017)

It is therefore instructive to interpret students' responses to disciplinary epistemic shifts, and their expectations from universities and teachers, through a generational lens. This is especially true in the context of the spatial turn, which has a significant emphasis on spatial and

visual technologies. The next section concludes this chapter with a review of questions raised in the literature with respect to my inquiry, and for which there do not seem to be any documented answers.

Opportunities for Research

As mentioned previously, an expert group met at the University of California, Santa Barbara Center for Spatial Thinking (Janelle, Hegarty and Newcombe, 2014) to discuss how spatial thinking may be developed as part of Higher Education. Having examined the perspectives of several disciplines on spatial thinking, the group proposed four tracks to move forward on the questions of researching and teaching spatial thinking and spatial ways of knowing. The first track concerned basic research into the nature of spatial thinking across and between disciplines. The second track was regarding the teaching of spatial thinking in Higher Education. The consensus was that teaching of spatial thinking should not wait till progress had been made in basic research. The group felt that several current approaches to teaching spatial thinking such as spatial thinking minors, electives, and course insertions may well inform basic research. The third track was on the research into the teaching of spatial thinking. Of special interest here was the question of domain specificity and transfer, and the group agreed that basic research may inform the question of how best to enable spatial ways of knowing through the curriculum. The final track was the evaluation and assessment of spatial thinking. Here, the group opined that challenging as it was, ways must be devised to assess the habit of mind, and not just specific sub-skills. Moreover, this habit of mind would need to align the requirements of the job market.

Though the expert group proposed a disciplinary focus only for basic research, I believe that all four tracks need to be reviewed from a disciplinary lens. Here I briefly review the possibilities for research in each of these four tracks, with specific reference to the spatial turn in History.

For basic research, the questions that would need to be answered are: What does spatial thinking mean in the context of History? What do spatial ways of knowing encompass? What are the underlying assumptions and arguments? What environmental factors affect the nature of spatial thinking in History? It is evident from the literature, as discussed in this chapter, that the conception of spatial thinking in History is significantly different from the STEM disciplines,

and perhaps from the other social sciences as well. The fact that History itself is seen as both a social science and a humanities discipline highlights these differences even more.

For the 'teaching and research on reaching' track, the relevant questions would be what drives the need to teach and learn spatial thinking in History? What might be the consequences of teaching or not teaching spatial ways of knowing? What efforts are already underway in different higher education institutions? How, if at all, are they related to the spatial turn in History?

On the evaluation track, relevant questions would be: What knowledge and skills with respect to spatial thinking do History students need, from an employability perspective? If this is a significant issue, how will employers determine if students possess such skills? How is this aligned to what is taught in universities? How are the demands of employability different between industry and academia?

In my study I will consider these and similar questions, as may be seen in Chapter 3, Scope and Purpose of this Inquiry.

Summary

In this chapter, I reviewed a variety of literature in order to frame my research. While this chapter serves as a literature review, it is not intended as all-encompassing. I review relevant literature in individual chapters in the interest of better contextualization. Here, I first provided an overview of History as a discipline. I then considered the philosophical discourse around technology and its relevance in the context of History. I also reviewed the cognitive-psychological discourse around spatial thinking and how it relates to spatial ways of knowing. There was then an overview of the economic-political context within with spatial ways of knowing, and the History discipline operate. I finally reviewed issues of curriculum in terms of disciplinary knowledge and student expectations from higher education. I concluded the chapter by highlighting the opportunities for research in this frame.

3: Scope and Purpose of this Inquiry

Research programs and the kind of knowledge generated in a discipline change as the epistemologies shift. It is reasonable to expect that curricula in universities will adapt to the shifts in epistemology and prepare students to work with the changed ways of knowing. It may be argued that higher education History curricula have a responsibility to respond to the spatial turn and prepare students to be better historians and to take up academic and non-academic careers after their education. However, curricula may or may not reflect the changing realities in the discipline, due to a variety of reasons. There may be resistance to the spatial turn within the discipline based on the perception that it is not as valid a way of knowing as traditional methods used in History. Or, the pace of the curricular change may be far slower than the pace of change in research fueled at least in part, by a lack of adequately equipped teachers. There may also be other complex systems issues at play, involving university structure, funding priorities, the role of technology players and so on.

My research aim is to, therefore, analyze how History curricula in higher education has responded to the spatial turn. I anticipated that there would be a gap between research, practice, and curriculum with respect to the spatial turn, and the inquiry was to build evidence for or against this perspective. In identifying and analyzing this gap, I hoped to throw some light on the higher education History curriculum and analyze its implications for students, teachers and the potential development of the discipline in the short term. The aims and specific research questions are detailed in the following section.

Research Aims and Questions

This inquiry has a broader aim of exploring how Higher Education curricula of a discipline change to reflect epistemological shifts in that discipline. It will attempt to do so by studying one specific instance of curricular change, or the lack of it. The aim is to identify if curricula have changed to reflect epistemological shifts, and if so, in what ways they shift. The analysis would also assess why curricula changed in the ways they did.

The route to this larger aim is through the specific, empirical analysis of how History curricula in Higher Education has changed in response to the spatial turn. There would be first a

need to establish **how research and practice have changed as part of the spatial turn**. This is explored through questions such as: To what extent are the nature publications changing to reflect the epistemic shift? Are different kinds of books and textbooks being published or used in curricula? What sorts of labs or projects are being established? How have history based professional practices changed with the advent of spatialization technologies and with the spatial turn in general? What careers are available to History majors, and to what extent to jobs demand spatial orientations?

Subsequently, there is an exploration of **how the nature of teaching has responded to the spatial turn**: Is there a relation between the kind of research being done and the curricula adopted? Do departments in the discipline offer learning opportunities that prepare students for spatial ways of knowing? Are there other interventions such as workshops or course insertions? Are these courses for undergraduate students or graduate or for a general audience? These courses, where they exist, are they specific to the department or made available in an open format such as a MOOC? What informal learning avenues exist to learn spatial ways of knowing and doing History? Are there professional development opportunities for those that would like to enhance their ability to deal with the Spatial Turn?

There is also an exploration of **the perspective of undergraduate and graduate History students with respect to the spatial turn**: What preparation would students need to continue in the discipline—academic or otherwise? What, if anything, are students entitled to learn, in the context of the spatial turn? How does that relate to employability? Given that current and future generations of students are most likely to have grown up in a world where spatial technologies such as digital maps are commonplace, how do their life experiences with technology, their approach to learning, and their overall expectations from education relate to spatial turn?

Finally, it would be necessary to **consider the technological factors that enable spatial ways of knowing:** What kinds of technologies support spatial ways of knowing—both for research and teaching? What features of these technologies are relevant for History? What is involved in learning to use them? How amenable are they for typical History students?

These lines of inquiry may be crystallized into three specific research questions:

1. What are the gaps between research, practice and higher education curriculum in the History discipline, with reference to the spatial turn?
2. How can those gaps, or the lack of them, be interpreted?

3. Should the History curriculum in higher education change in response to the spatial turn? If yes, how? If not, why not?

From the review of literature, there is a strong rationale to say that while History research has adopted spatial ways of knowing to varying degrees, the curriculum has not been as much in alignment. My data and subsequent analysis throws light on this situation.

Relevance of this Inquiry

The spatial turn promises to be a significant shift in epistemology and has been acknowledged as such in many disciplines. While it may not replace other, traditional ways of researching and teaching History, it offers certain possibilities to generate and communicate History knowledge.

Spatial analysis of historical events is not new—Lefebvre and Braudel of the Annales School explored geographic historical data in the early and mid 20th century respectively. However, this approach while admired at the time, did not find much long-term traction with historians and seems to have been given up by the middle of the century. Other attempts at spatial analysis appear during the 80s. However, the term was then used mostly in the critical sense of "place" and not necessarily geographic space. Starting in the early 2000s however, early versions of certain spatial technologies such as ArcGIS and Google Maps became available and were accessible to the non-technical researcher by the mid-2000s. The data visualization software Tableau, which also has strong map components, was first released in 2005 and has steadily grown in popularity and user base (Wu, 2016). I argue that this made the spatial turn take on a character that was previously not possible. It was the start of, to use an informal phrase, the spatial turn on steroids.

These developments have meant that the options open for research, practice, and communication of Historical knowledge are moving forward very rapidly. In many technology-driven fields, practice moves faster than changes in education (Markus, 2017). It is quite likely the situation is much the same with technologies in the History discipline. Much literature exists about the spatial turn in History and what it means for the discipline's production of knowledge as may be seen in the works of Bodenhammer (2013) and Lunen and Travis (2012). However, there seems to be far less discussion on what the educational implications of the spatial turn are. Neither is there any significant research about how History education should adapt to the spatial

turn, or if it should adapt at all, in the first place. Since spatialization technologies are a contemporary, specific development related to methods of studying history, the expectation is that it would have greater implications for the higher education curriculum than for K-12. It is relevant, therefore, to analyze the extent of the spatial turn, and how prepared students are to operate with a spatial way of knowing as part of their education and professional life as Historians.

There is limited literature related to curriculum theory or theory of curriculum change specifically related to higher education, History, or responses to disciplinary changes. What exists is often squarely focused on K-12 education. Consequently, the theories rarely consider disciplinary differences in curricula. Therefore, there is clearly a gap with respect how we understand curriculum change in higher education. The closest literature is the work of Michael Young and his colleagues, who draw on ideas from sociology adapted to education. Young argues that specialized knowledge has a place in curricula and he also builds a case for considering disciplinary differences in curricula. I review the developments in the higher education History curriculum through the lens of specialized knowledge and explore if it offers any insights more broadly into curriculum change in higher education, or more narrowly into curriculum change in response to epistemological developments in a discipline.

In order to explore this, I gather a substantial body of data related to History research, practice, curriculum, and spatialization technologies. This data itself does not exist in any readily available format. Collecting and describing this data would offer a substantive state of the art perspective on History education. This data may be useful to future researchers of curriculum or History education, to base their work on.

I see, therefore, two unique and original contributions of my research. At the first level, a description of the state of the art with respect to History curriculum and the spatial turn and an analysis of why that situation exists. At the second level, it would offer insights what could this state of the art could tell us about curricular change in higher education.

A third contribution is also possible. The research design itself can be re-used to analyze the curricular responses of other disciplines to the spatial turn. Framed as a research program, a series of such inquiries could generate comprehensive knowledge related to curriculum change in Higher Education. When more data is available from different disciplines, newer themes and fresher perspectives become possible. The research design could also potentially be adapted to

study the relationship between curricula and any other epistemological shift. For example, it may be used to analyze how History itself responded to the Cultural or Linguistic Turns. It could also perhaps be used to study how another discipline such as Psychology responded to the Quantitative Turn, and how the Psychology curriculum evolved as a result.

In the light of these proposed contributions to knowledge, I believe the inquiry is a relevant and timely one.

4: Methodology

This chapter discusses the methodology I adopt for my inquiry, describing and justifying the research design, the samples, the data collection procedure, approach to data analysis and an overview of the participants of the surveys and interviews which are part of the research design.

Research Design

In this inquiry, I study a specific instance of an epistemic shift, in one particular discipline. In other words, it is an in-depth study of a specific case. My research questions themselves are exploratory and dependent on context. A case study method, therefore, lends itself to this inquiry. It provides opportunity and the flexibility to use a mix of tools and analytical techniques while providing the structure required for a coherent thick description and analysis.

In the social science methodology literature, there is no consensus on what exactly a case constitutes. While its nature, scope, and purpose are debated, there seems to be an overarching agreement that it is an "instance, incident, or unit of something" (Schwandt and Gates, 2017 p. 331). It could be an empirical unit or theoretical construct at a personal, institutional or community level, or an even larger frame. Different definitions reviewed by Schwandt and Gates outline the following common characteristics: Cases are in-depth and multi-faceted studies, with a focus on complexity and particularity, without normally attempting to generalize beyond the case. Cases also tend to have defined boundaries within which the data collection and analysis can occur, as relevant. Cases could use several data sources, which could be qualitative or quantitative in nature.

Schwandt and Gates (2017) propose four possible case study designs, each meeting a particular purpose: descriptive case studies, exploratory case studies aimed at hypothesis development or theory generation, explanatory cases aimed at hypothesis or theory testing, and cases that develop a normative theory. It is possible of course, for case studies to have the characteristics of more than one type listed by Schwandt and Gates. My study is a combination of a descriptive and exploratory case study. The case describes "what exists" in the domains of research, practice, and teaching with respect to the spatial turn in History and will interpret the

descriptive data. Based on the description and interpretation, I offer insights into how and why curricula in higher education change in the ways they do, in response to developments in the discipline.

Components of the Case

The proposed case study has a descriptive as well as an exploratory level, which are detailed in this section. I divide the case into five units of analysis to create a comprehensive picture of the spatial turn in History and how it relates to History education. I consider how History knowledge is created and communicated in the context of the spatial turn, as well as how History is taught and learned. I also consider the spatial competencies that History students may need if they are to take up spatially oriented careers, perspectives of students and professors on the teaching and learning of spatial History, and the affordances of spatial technologies that enable spatial ways of knowing in History. I refer to these units of analysis as 'components' of the case study. The units of analysis are viewed through a conceptual-theoretical lens to illuminates the curricular implications of the spatial turn in History. I also make some proposals regarding a curricular response to the spatial turn. These components may be visually represented as in Figure 2.

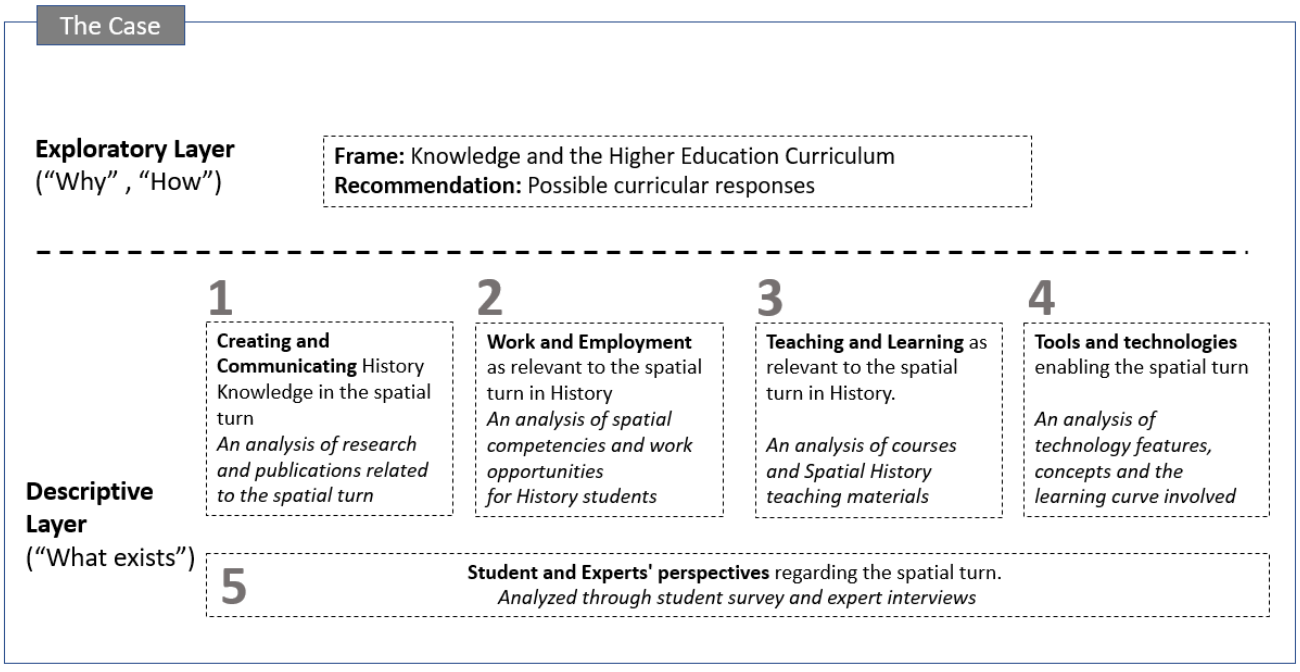

Figure 2: The proposed descriptive and exploratory elements of the case; A visual depiction

Descriptive Layer

The five units of analysis lend themselves to describing the state of art with respect to the spatial turn in History. It outlines "what exists" at the present time. The five units of analysis or components of the case are: (1) spatially-oriented research and communication in the discipline, (2) spatially oriented careers and the spatial competencies required for them, (3) spatially oriented curricula, such as it exists (4) tools and technology relevant to the spatial turn and (5) student perspectives and expectations with respect to spatial ways of knowing. Each of the first four components is treated as a separate analysis, with the fifth lending itself to all the four, all of them illuminating the status of spatial ways of knowing within History at the present time. I describe the purpose and scope of each of these elements below.

Creating and communicating History knowledge. First, I trace the development of spatially enabled production of History knowledge (research), as well as the spatially oriented communication of History knowledge, and making it available for use in professional and societal contexts (knowledge mobilization). The former outlines the kinds of spatial History research being done through geo-spatial and visual-spatial technologies. The latter, communicating History knowledge, describes the ways in which Historians represent and communicate historical information spatially—for example through maps, charts, data visualizations, and infographics.

Work and employment. Second, in my description of the practice of History, I analyze typical careers for historians and the need for a spatial orientation in those careers. It appears that a majority of History students in the United States who graduated with a PhD degree between 2004 and 2013 aspire to, or end up working in, academic research and teaching. However about 25 percent of them took up jobs outside academia (Swafford & Ruediger, 2018). Even though Swafford and Ruediger's data is out of date by about five years and covers only the United States, it makes some important points about the kinds of careers available to the History student. Students with History majors in an undergraduate degree, or a History graduate degree are likely to have options to take up careers with a specific history focus. Examples of such careers are researchers, teachers, anthropologists, librarians, curators, museum conservators, and journalists and writers. Newer professional areas would be multimedia creation, data analysis, digital cartography and map design, textual corpus analysis and so on. I describe a selection of such careers in the present time, and the spatial orientation demands such professions may make. I

also consider jobs that primarily require spatial competencies and to which History graduates may reasonably apply, and in which they may succeed.

Teaching and learning in the spatial turn. Third, I describe how curricula in undergraduate and graduate programs have evolved (or not) in tandem with the spatially oriented developments in research and practice. The curricula are analyzed to determine the extent to which they incorporate spatially oriented topics, how History methods courses have evolved, and to what extent issues around the spatial turn are considered in the curriculum. The analysis covers spatially oriented courses, seminars, workshops, etc. offered in universities, as well as a review of the kinds of textbooks being prescribed. I also explore informal and non-academic paths to learning about spatial ways of doing History.

Tools and technologies enabling the spatial turn. Fourth, I describe key spatialization technologies—mainly the popular GIS, digital maps, data visualization technologies, and their current role in the spatial turn. The description covers what features they offer, how they are used, how departments decide to use certain tools, and the learning complexity of each tool. Since the spatial turn derives significant momentum from these technologies, it is important to consider their role in how the History curriculum aligns to this epistemological shift.

Student and expert perspectives. Finally, I describe undergraduate and graduate History students' perspectives and expectations with respect to learning about the Spatial Turn and spatialization technologies. Students' perspective on what they would like to learn is important to consider in the context of curricula. Students today are very likely to have their own expectations with what they would like to learn, and the purposes for which they would like to learn it (Kozinsky 2017). While they definitely seek instruction and guidance from teachers, they come with rich life experiences and are more knowledgeable than teachers in many areas, especially where technology is concerned (Cilliers, 2017). The experts I consider in this context are Professors of History, people who have a doctorate in History, but are currently involved in non-teaching jobs, and professionals who may not have a doctoral degree but are experts in a tool, technology or other aspect related to the spatial turn.

Each of the first four elements is treated in a distinct chapter in this thesis. I provide additional descriptions and details about the purpose and scope of each within those chapters. The last element – that of student and teacher perspectives informs all the other elements and

will be dealt within each chapter as relevant. I provide details about the student and expert participants later in this chapter. I next outline the exploratory elements of the case study.

Exploratory Layer

The exploratory component of the case study is overlaid on the descriptive ones. The Exploratory layer interprets what has been described and analyzed previously through the lens of curriculum theory as well as pragmatic issues related to the History discipline's adoption of spatial ways of knowing. I use Young and Muller's conceptualization of specialized or "powerful" knowledge (2015) as an interpretive framework as discussed in Chapter 2, Framing the Inquiry. On the pragmatic side, I explore scholarship issues, pedagogical issues, availability of data, and others as a means of understanding the curricular responses. Against this background, I attempt to understand and clarify what counts as specialized knowledge for the History, with reference to the spatial turn and what approach History curriculum in Higher Education should take towards such specialized knowledge. Through this combination of description, analysis, and interpretation, I offer insights into how History curriculum has evolved or changed in response to epistemological changes in the discipline.

As part of the exploration, I also propose some ways in which History curricula may, in fact, respond to the spatial turn. I offer specific curricular ideas which may reasonably be adopted by History departments if they were so inclined. I also reflect on the merit and practicality of this proposal. I offer these proposals not as a conclusive prescription, but as an examination of possibilities.

This section described the scope of the case study research design. The next section will outline the operational details of the research design.

Case Boundaries and Sampling

A key consideration for the case study method is determining the units of the description and analysis, and the boundaries of the case. The scope of my inquiry is the history discipline in general and higher education in particular. Keeping this in mind, I first use a **temporal boundary**, by restricting myself to a 15-year time period between 2004 and 2019. As mentioned before, spatial analysis of historical events is not new—Lefebvre and Braudel of the Annales School explored geographic historical data in the early and mid 20th century respectively (Fink,

2018). However, this approach while admired at the time, did not find much long-term traction with historians and seems to have been abandoned by the middle of the last century. Other attempts at spatial analysis appear during the 80s. However, during this revival, the term was used mostly in the critical sense of "place" and not necessarily geographic space. It is therefore not easy to pinpoint an exact start date for the spatial turn, where one could note a clear upswing in the use spatial ways of knowing in History.

I propose a 2004 as a start date to my inquiry on the basis that spatialization technologies became mainstream and accessible to non-technical people around that time. I argue that this made the spatial turn take on a new-found intensity, which I have previously described as the "spatial turn on steroids". I use the current time, 2019, as the end date, making it a sizable, but manageable, 15-year frame.

The second boundary parameter I use is **geographic**. From the literature review, it appears that the spatial turn has been most talked about in North America and Europe. While there are many instances of spatial history projects in other countries, including China and India, I restrict myself to the United States of America, the United Kingdom and Canada, since the bulk of spatial history literature is from these geographical areas. The literature from these regions is also predominantly in English, my language of preference for this study. Finally, I have some familiarity with the Higher Education structures in North America and the UK, which allow me to interpret my data more authentically.

Within the constraints of the temporal and geographic boundaries, I plan to sample the units of analysis, or components as outlined below. The sampling will be purposive and a combination of expert sampling and maximum variation sampling.

The research and knowledge mobilization component is studied through a sample of academic publications related to the spatial turn in the leading History publications in the US, UK, and Canada. While some of this already covered in the literature review, the range of articles will be systematically described for quantity and the exact nature of the research being undertaken. For this element, the sampling will be purposive, and expert-led.

For the work and employment component, instances of possible careers are studied by reviewing the career sections of websites such as the American Historical Association (AHA) and the Canadian Historical Association (CHA). In addition, history-related job postings on leading academic and professional job search platforms, such as Glassdoor and LinkedIn, are

reviewed to assess the demand for such skills. Job postings relevant to students with History degrees are identified and the available job descriptions analyzed to identify to what extent these jobs are spatially oriented or make demands for spatial competencies. This too can be classified as expert sampling.

The teaching and learning component is studied in two ways. First, the curricular and competency recommendations by professional organizations such as the AHA and CHA are reviewed for a global understanding of curricular thinking in the discipline. In this case, too, I use expert sampling. Secondly, I analyze available curricular and curriculum-related documents from history departments in universities across the United States, Canada, and the United Kingdom. I use publicly available course listings as well course descriptions obtained from individual professors who were willing and able to share their course and syllabus details. I also use the Open Syllabus Project's repository of six million course outlines (Open Syllabus Project, 2019) to identify course readings that are relevant to my inquiry. For this element, I attempt a maximum variation sampling within the course outlines that are available, or that I could individually obtain. Therefore, there is an element of convenience present in this approach to sampling. More accurately put, this may be seen as maximum variation within a convenience sample.

The Technology elements follow an expert-led sampling approach. The technologies most used for spatial history projects in History departments are identified. ESRI's ArcGIS, the open source QGIS and Google's Maps / Earth are the leading technologies for spatial research while Tableau is a leading technology for data visualization. These technologies are described in detail in terms of their features, costs, adoption and usability, since these affordances have a direct bearing on how they are used, how they are adopted within History departments.

I have attempted to follow a maximum variation sampling for student and expert perspectives. The student survey instrument was circulated to a wide variety of students from a range of universities in the three countries, both from undergraduate and graduate programs. However, the students self-selected to respond to the survey, and a complete maximum variation could not be ensured. With the experts, however, I selected experts based on specific perspectives I sought for my inquiry. This was, therefore, a completely expert-led sample.

This section outlined the case boundaries and sampling approach for my case study. I next discuss my approach to collecting data, analyzing and interpreting it.

Approach to Data Collection, Data Analysis and Interpretation

All the descriptive elements of the case study rely substantively on document analysis methods. Documents analyzed in this context are publications at the intersection of history, curriculum and higher education, websites of AHA and CHA, job descriptions from job search websites, curriculum documents, technology feature descriptions from ESRI and Google, and so on. Most of the data samples are publicly available, with the exception of curricular documents obtained by request, and the perspectives of students and experts. Student perspectives were gathered through electronic surveys and expert perspectives through semi-structured interviews.

I use O'Leary's (2014) document analysis recommendations for all document-based data in which she suggests two approaches to document analysis. The first is what she refers to as the *Interview approach*, where the document is reviewed with the express intention of looking for answers to specific questions that are part of the inquiry. The second is closer to *content analysis*, where the content of the document is analyzed for instances of specific words or ideas which are then grouped into themes or otherwise analyzed. I anticipate taking both approaches in different documents. For example, with the research and knowledge mobilization related publications, as well as in the job and career documents, I use the keyword approach to find the instances in which spatially oriented research or careers appear. For the curriculum-related documents and the technology-related documents, the approach is closer to the interview approach, where I seek answers to specific questions such as 'what spatially-oriented courses are being offered', or 'which technology feature is particularly useful for spatial history'. A comprehensive list of questions used to interrogate the data may be found in Appendix A (Questions used for Document Analysis). In addition, I also use counts and categories to analyze data that emerges from the documents. For example, the career and job-related data is analyzed through such counting and categorization, as is the data about the number and kinds of research and knowledge mobilization undertakings.

For the student and expert perspectives, I use both a survey and an interview to collect data. 47 undergraduate and graduate students from 10 universities responded to an electronic survey which consisted of both open and close-ended questions. The survey instrument may be seen in Appendix B (Survey Instrument). The close-ended questions resulted in categorical data and supported the themes emerging from the open-ended questions. I do not undertake any sort

of statistical analysis with the survey data. For the expert perspectives, I interviewed nine experts using a semi-structured interview format. The Interview instruments can be seen in Appendix C (Interview Instrument). Details about the data collection and analysis process for the first four components are described in their individual chapters. However, the data specifications for the students and expert perspective is not described in any individual chapter and I describe it below as part of this Methodology chapter.

Student and Expert Perspectives: Survey and Interview Sample and Instruments

The Sample for Student Perspectives

I sought maximum variation within my geographic distribution for the student perspectives. Consequently, I identified the following ten universities to which I sent my electronic survey: Harvard (US), Stanford (US), Bucknell University (US), University of Virginia (US), University of Toronto (Canada), McGill University (Canada), Concordia University (Canada), University of Saskatchewan (Canada), Oxford University (UK) and the London School of Economics (UK). This offered a spread of four universities each in the US and Canada and two in the UK. I gathered History graduate student email addresses from universities' websites and sent the survey link directly to 447 graduate students. In addition, I requested professors that I interviewed to forward the survey link within their universities and departments. For undergraduate students, I relied on individual professors to send the link to their undergraduate students who took their courses in the previous terms. These students may have been History majors or not, depending on the course the professor had offered. I also reached within my personal network to directly send the link to undergraduate students in various universities in the UK, US, and Canada, with a request to forward to other students. Under the circumstance, I was unable to track exactly how may students received the survey link, in addition to the 447 students I directly contacted.

From this pool, 47 students responded to the survey. Of these, 28 were from Canadian Universities, three from UK universities and 16 from US universities. The survey did not ask students to identify their exact university, but only the country in which their university was located. From the same pool, eight were undergraduate students, ten were graduate students at the Master's level and 29 were graduate students at the doctoral level. 37 of the respondents listed History as the discipline in which they would get their degree. Three listed arts and

humanities in general, two listed geography, while Archeology, Architecture, Urban Studies, Law and Engineering each had one. This is consistent with the fact that undergraduate, and to some extent Masters' students might take History classes as part of their education but may not graduate with a History degree. No other demographic data was collected from the students.

The Sample for Expert Perspectives

I identified 24 experts to potentially interview, based on my review of the literature, and with the aim of speaking to experts who had breadth and depth of experience with spatial History. I also identified a smaller set of four history scholars who had no special affinity for spatial ways of knowing. The purpose was once again, to maximize the variation. I emailed the 28 experts individually outlining the scope of my research and with a request for an interview. Four experts responded to indicate their inability to participate, while I did not receive a response from 15 of the experts. I conducted interviews with the other nine. Two of the interviews were conducted face to face, while two were email-based. The other five were conducted online via teleconferencing applications or through phone. The interviews were audio-recorded with the consent of the experts and later transcribed. All the interviews were semi-structured. I had a base set of questions that can be seen in Appendix C. I modified the questions depending on the particular expertise of the interviewee. I also explored other ideas that emerged in the course of the interview, with the overall purpose of illuminating my research questions. To adapt the instrument for each interviewee, I used the same guiding questions as used for the document analysis and which may be seen in Appendix A.

Six of the nine interviewees were professors with both research and teaching responsibilities. The other three were experts in closely related fields. I describe their profiles briefly below to provide a context for their responses. In accordance with my research design and the Research Ethics Certificate issued by Concordia's Research Ethics Unit, I am not disclosing the identities of the interviewees. I will instead refer to them by initials assigned by me, and which are not their actual initials. To mask gender, I use the pronoun "they", even when referring to the experts individually. I also use the honorific "Prof." to indicate that they are academic teachers and researchers, and this does not necessarily refer to their actual designations within their institutions. If they are not teachers, I use the descriptor "Expert".

1. **Prof. NF.** Professor of History at a large US university. Prof NF has an active interest in spatial History and explores ways in which to bring spatial methods to the History classroom.
2. **Prof. CC.** Professor of History at a small Liberal Arts focused US university, with an active interest in Spatial History. Prof CC has successfully integrated spatial analysis into undergraduate history classes
3. **Prof. KD.** Professor of History at mid-sized and well-regarded Canadian university. Prof KD specializes in the use of GIS to study History.
4. **Prof. TD.** Professor of Geography at a large Canadian university. Prof TD collaborates with the History department at their university to explore spatial narratives. They also plan to co-teach a class with the History department shortly.
5. **Prof BL.** A recent PhD graduate, Prof BL is an early career academician and teacher at a large Canadian university. Though they have a doctorate in History, they teach Gender Studies at the current time and have no specific orientation to spatial ways of knowing.
6. **Prof DN.** Professor of History at a small university in the UK. Prof DN also has no specific orientation to spatial methods and provides an "insider-outsider" view of spatial History.
7. **Expert KH.** A GIS expert employed by the Libraries and Center for Teaching and Learning unit of a small US university. Their mandate is to support any faculty who wishes to explore or adopt spatial ways of knowing into their teaching or research. KH is discipline agnostic.
8. **Expert EE.** A senior employee of ESRI with insight into their product line, working at the ESRI headquarters. Expert EE has a PhD in History and has worked extensively with ESRI's products in the educational context.
9. **Expert NC.** A manager of academic and spatial technologies aligned within the geography department of a large Canadian university. Expert NC maintains hardware and software related to spatial technologies and also co-teaches certain courses. They have an interest in, and expertise with, geo-referencing historical maps.

This section outlined the sample for the students' and experts' perspectives. As mentioned before, the perspectives data is analyzed and interpreted in the context of the other four elements of the case—creating and communicating History knowledge, work and employment for history students, teaching and learning history in the context of the spatial turn, and the spatial technologies that enable the spatial turn.

Limitations in the Methodology

The inquiry methodology as outlined here has some limitations. Firstly, given the variety of data that I consider, it is not possible to use a uniform sampling method for all the units of inquiry. It is also not possible to ensure maximum variation sampling in choosing student perspectives, in spite of the intent to do so. I do not, however, see this as a major drawback given the exploratory nature of the inquiry and the multiplicity of data sources and units of analysis. I use student perspectives to triangulate findings and illuminate the context, not to make definitive conclusions.

Secondly, the perspectives of all the actors in the context not studied in-depth and phenomenologically. Taking a phenomenological approach to uncovering the experiences and perspectives of researchers, teachers, students, administrators and perhaps employers may have offered different insight into the research questions, as compared to analyzing documents. My aim in the inquiry, however, has been to take a systems view of the research questions. I focus on multiple elements and their interrelationships, rather than explore human experience in isolation. A phenomenological interview approach would have provided a different insight, but at the cost of exploring inter-relationships between artifacts, people and processes. I do not, therefore, consider a lack of phenomenological focus as a limitation that undermines the quality of the study.

Thirdly, the study only uses data available in a snapshot form, even if the scope of the study spans the past 15 years. There is no longitudinal analysis of the evolution of any of this data over time. For example, the study describes the state of art at the current time but does not chart the changes over time in the 15-year time period. Such a time series view of the spatial turn would offer other insights but is better undertaken as part of a different study.

Finally, the theoretical lens of disciplinary knowledge, through which I propose to interpret the case data is sound, but only one of many possible ones. The domain of the sociology

of education offers other ways of interpreting curriculum and curriculum change such as for example, the critical view or the functional view of curriculum (Young, 2013). Though well established, these approaches are formulated around K-12 curriculum, primarily. Like with other qualitative research of this nature, the theoretical lens allows the emergence of one particular narrative. A different lens could lead to a variation in the narrative.

I believe this kind of qualitative work, focused on describing elements and interpreting interactions, is essential in the study of emerging and evolving fields, where categories and relationships are fluid and uncertain. I compare this work to that of a naturalist cataloging species, or an astronomer charting celestial objects. Such an undertaking neither provides infallible explanations for phenomena, nor studies them for conclusive evidence of cause and effect. Yet, it is important and essential groundwork that allows future research in the domain to pose better questions.

5: The Spatial Turn in History: Creating and Communicating History Knowledge

In this chapter, I analyze the ways in which spatially motivated History knowledge is created and communicated. Broadly, the creation of History knowledge would be labeled "Research". The communication and use of History knowledge would refer to "Knowledge mobilization" in academic parlance. I prefer to use the terms "creating knowledge" and "communicating knowledge" because the range of spatial history knowledge activities goes beyond academia, as will be seen in this chapter. What is the difference between spatially enabled research and spatially enabled knowledge mobilization? The former involves asking spatially motivated questions using spatial methods and requires a range of competencies and the use of different tools. For example, it could involve manipulating geo-spatial data to arrive at new perspectives and insights. It might equally involve arranging historical data visually and spatially, in order to develop a historical argument. It is a means of "doing history". Communicating History knowledge, on the other hand, is the telling of history through spatial means by situating a History narrative within maps, or visualizing History data and representing it spatially in order to explain historical findings. The analysis itself may have happened through traditional ways of doing History research.

The creation and communication of History knowledge is viewed through two perspectives in this chapter: The visual-spatial and the geo-spatial. As discussed in Chapter 1, the visual-spatial refers to the graphical representation of quantitative and qualitative data, while geospatial refers to map-based spatial analysis on a geographic scale.

Scope and Purpose of this Analysis

My first research question is: *What are the gaps between research, practice and Higher Education curriculum in the History discipline, with reference to the Spatial Turn?* Through the analyses in this chapter, I paint a detailed picture of the current status of research and knowledge mobilization, as the first step in answering that question.

To this end, the analysis addresses the volume and nature of spatial history knowledge created, and the modes through which it is created, without delving into the quality of the knowledge being generated or communicated. I expect such an analysis to reveal:

- The volume of spatial history research. The analysis would validate if Spatial History is "booming" as believed by some experts, or whether one might take a more conservative view of how extensive the academic work in this field is.
- The institutional and academic acceptance of spatially motivated History research and knowledge mobilization. This is accomplished by analyzing what kinds of work are being published—books, journals conference proceedings, etc.—and on what platforms they are being published.
- The presence of specialized centers or dedicated projects for Spatial History research and communication, as well as the presence of special interest groups or communities of practice.
- The volume and nature of spatially enabled History knowledge mobilization in terms of data visualization, storytelling, or other means.

Description of the Data

The analyses in this chapter draw upon several kinds of data. The following section describes the kinds of data I collected, the rationale for choosing them as well as the findings from the data. In the subsequent section of the chapter, I discuss these findings.

Academic Journal Articles and Books

The first analysis was to assess the formal academic work being published in the area of spatial history. To this end, I investigated academic databases, narrowing down my choices to Academic Search Complete, Historical Abstracts, and ERIC. Academic Search Complete is a multi-disciplinary database run by the privately held EBSCO Industries (EBSCO Information Services, 2019) covering over 6300 full-text journals and 5300 peer-reviewed journals (EBSCO 2019, b). Historical Abstracts, also owned by EBSCO, is a comprehensive database of World History from the 15th century to the present. It indexes over 2300 journals (EBSCO Information Services, 2019, c). ERIC is an education-specific database administered by the US National Library of Education (NLE). ERIC includes a range of records including policy briefs, conference reports, technical reports, and books. (Education Resources Information Center,

2019). Between these three databases, I expected to observe patterns, if any, of publications at the intersection of spatial ways of knowing, History, and spatial technologies. In addition, I used Google Scholar as a point of comparison to the databases. This allowed me to observe grey literature as well. The process of reviewing publications and the results are described below.

I narrowed the search based on two delimiters: the time span of 2004 to 2019; and the English language, as per the overall boundaries of my case study. I first surveyed the results through the title and the abstract to determine if the publication was at some intersection of History and spatial ways of knowing. After removing publications that were completely unrelated, the final list was tabulated and may be seen in Table 1. These searches were conducted in April 2019.

Source	**Search Term 1**	**Search Term 2**	**Number of results**
ASC+HA+ERIC	"spatial turn"	history	92
ASC+HA+ERIC	"quantitative history"	visualization	1
ASC+HA+ERIC	quantitative history	--	41
ASC+HA+ERIC	"spatial history"	--	154
ASC+HA+ERIC	historical GIS	--	196
ASC+HA+ERIC	spatial thinking	history	11
ASC+HA+ERIC	spatial ways of knowing	history	0
ASC+HA+ERIC	spatial epistemology	history	401
ASC+HA+ERIC	spatial methods	history	2
Google Books	“Spatial History”	--	8
Google Books	“historical GIS”	--	4
Google Books	“spatial turn”	history	4

Table 1: Scholarly publications found in academic databases and Google Books

An exploratory search on Google Books showed additional references to books that did not appear in the academic databases. I, therefore, conducted a separate search within Google Books which in which additional books appeared. Google Books search also returns results for articles within Journals which it considers books. However, these are not included in Table 1. I discontinued the Google Books search once no new results appeared even with variations of the search terms, indicating saturation.

For comparison with the academic databases, I conducted a Google Scholar search for the same terms. Google Scholar, however, showed a much larger number of results for each of the search terms. For example, Google Scholar returned “about 5590 results” for the search term ["spatial turn" and History -book] on Jul 4, 2019. When limited to the time frame for this study (2004-2019), the number was 5320, indicating that most of the work returned in the overall search was of a more recent date. I was not able to limit the search to English publications using Google’s advanced search features. However, a scan of the first 100 results showed only 6 non-English publications. It may reasonably be inferred by extension, that the bulk of the publications were predominantly in English. The number of results was closer to 16,000 when the descriptor [book] was not excluded. (The ‘-’ sign in the query specifies that a particular term is to be excluded). In short, the number of Google Scholar results were higher by a 100 order of magnitude.

Next, I reviewed what kinds of journals existed at the intersection of [spatial] and [history]. While articles regarding spatial history or the spatial turn may appear in a wide variety of journals, I was curious to see if there were journals dedicated to the topic. The rationale was that the presence of dedicated journals would point to an institutionalized acceptance of spatial ways of knowing. To this end, I looked through two journal ranking platforms—Journal Citation Reports (JCR) and SCImago Journal Rank (SJR). JCR, owned by the private entity Clarivate Analytics, describes itself as an entity that “aggregates the meaningful connections of citations created by the research community through the delivery of a rich array of publisher-independent data, metrics and analysis of the world’s most impactful journals”. It indexes 11,877 journals and 2.3 million articles as of 2019. (Clarivate Analytics, 2019). SCImago Journal Rank draws on Elsevier's indexing database Scopus and includes 34100 titles as of 2019 (SCImago, 2019). Given the ubiquitous nature of the JCR and SJR rankings, I used both of them to determine the presence of journals in the domain of spatially enabled History.

I used the latest available (2017) reports for both. I limited the results to journals in the Humanities and Social Sciences that had at least 50 total cites in three years. This search yielded 227 journals in JCR and 151 in SJR. I reviewed each journal’s title to determine if the journal was oriented to either History and / or spatial methods, and shortlisted 15 journals. I then surveyed the *Descriptions* and *Aims and Scope* section for each journal to determine to what extent the journal positioned itself at the intersection of spatial ways of knowing and History.

This review turned up only one journal that met all these criteria: the Taylor and Francis journal *Historical Methods: A Journal of Quantitative and Interdisciplinary History*. A dipstick analysis of this journal shows that it indeed covers issues related to different methods of doing History, though its scope is understandably larger than just spatial history.

Another notable journal, which I found through other references, but not on the journal databases was the *MIT Social Science History* journal. MIT describes *Social Science History* as being "dedicated to the study of social theory within an empirical historical context. Our interdisciplinary readership includes anthropologists, demographers, economists, geographers, historians, political scientists, and sociologists, all in pursuit of a deep understanding of societies, past and present. The journal invites articles that blend empirical research with theoretical work, undertake comparisons across time and space, or contribute to the development of quantitative and qualitative methods of analysis." (Massachusetts Institute of Technology, 2019). In summary, there were no journals dedicated to spatial history, and two that were potential publication avenues for spatial Historians.

I then also surveyed the field for the presence of journals specific to History teaching. My aim was to identify if there was any journal that dedicated itself to teaching methods within History or had any focus toward teaching quantitative / spatial History. I found only three journals dedicated to teaching history. The first, with a useful and straightforward title, is *Teaching History,* published by the Historical Association of the UK. It has a specific K-12 focus and was published between 1969-2015. The journal had, in its life, 151 issues. A review of the Table of Contents of the issues from 2005-2015 revealed no specific resources or articles to teaching spatial or quantitative History. A single issue in 2000 was dedicated to the use of "ICTs" in the History classroom. Given that the publication was not intended for Higher Education, and since there was no specific mention of teaching spatial methods for History, I did not undertake a further analysis.

History Teacher is published by the Society for History Education, UK. It began publication in 1967 and goes on to the present day. It covers History teaching from a content, as well as theme perspective, both for K-12 and higher education. A dip stick review of Tables of Contents shows no emphasis on teaching methods of History as such, though there is the occasional article which discusses the method of dealing with a particular topic such as for

example, "Assessing Ways of Seeing the Past: Analysis of the Use of Historical Images and Student Performance in the NAEP U.S. History Assessment" (Suh and Grant, 2014).

Teaching History: A Journal of Methods is published by Ball State University and has been in circulation from 1976 to the present. The journal describes its purpose as providing "historians and history teachers with approaches to teaching that focus on the use of primary and secondary sources and that increasingly emphasize the Scholarship of Teaching and Learning" (Ball State University, 2019). Evidently, the journal focuses on the methods of teaching History, and not necessarily on the methods of "doing" history. Since my study also concerns itself with how History teachers may adopt spatial means to teach, I undertook a more detailed review of the Table of Contents of all the available archive issues (2011-present). There is an occasional reference to the use of technology in teaching History, but nothing specific with respect to spatial means, or even Digital Humanities in a broader sense.

There are more journals dedicated to the distinct field of Digital Humanities, which has a broader scope than History, which is just one of the humanities disciplines. The scope of "digital" is also larger, with spatial approaches to knowledge creation being one many digital methods. Oxford publications' *Digital Scholarship in the Humanities* and *The Digital Humanities Quarterly* are examples of such journals. These journals are neither explicitly about Spatial ways of knowing, nor about History. Yet, spatial History falls within the scope of both, and there is an occasional article within those dealing with topics of spatial History. The scope of these journals is very diverse, and the number of digital humanities journals is also substantial. Identifying specific spatial History related articles within these and analyzing those numbers would have been expanded the scope of this inquiry beyond practical limits.

On the other hand, there are Geography journals that emphasize History, such as for example, the *Journal of Historical Geography*. This peer-reviewed Elsevier journal describes its themes as: "The geographies of places and environments in the past; The dynamics of place, space and landscape; Historiography and philosophy of historical geography; Methodological challenges and problems in historical geography; Landscape, memory and environment." *Historical Geography*, a non-peer-reviewed newsletter from the University of Nebraska has a similar goal but emphasizes its interdisciplinary nature.

In essence, there were no journals dedicated to spatial history, and two that explicitly positioned themselves at the intersection of History and spatial methods. Of these, one was

rooted in the History discipline. Others were interdisciplinary in nature, rooted either in Geography or Digital Humanities.

Labs and Projects

To continue the review of knowledge creation in the domain of spatially enabled History, I then undertook a review of Labs specializing in Spatial History, as well as projects that are exploring spatial History themes. These were traced through references in publications as well as through open Google searches. This is in no way an exhaustive list of every lab or project in the US, UK, and Canada. However, it certainly includes the documented ones with a web presence and is also representative of the kinds of projects being undertaken in general. A sample representation of these labs and projects is seen in Table 2. A more detailed description of these labs and projects may be seen in Appendix E (Spatial History Labs)

Affiliation	**Name of Lab or Project**
Stanford University	Spatial History Project
Harvard	The Imperiia Project
Michigan Technological University	Historical Environments Spatial Analysis Lab (HESAL)
Northeastern University	NU Lab for Texts, Maps, and Networks
UC Santa Barbara	Center for the Spatially Integrated Social Sciences (CSISS)
University of North Carolina	Carolina Digital Humanities / Digital Innovation Lab
University of Portsmouth	Great Britain HGIS Project
American Association of Geographers	Historical GIS Clearinghouse and Forum
Lancaster Univ	The Historical GIS Research Network
Indianapolis University	The Polis Center / Spatial Humanities
Brown University	Spatial Structures in the Social Sciences (S4)
Rice University	Imagine Rio
Harvard	Open World Map
University of Victoria, BC	Map of early and modern London
Citizen GIS Project	Irish Speakers and the Empire city. Citizen data from NY
University of North Carolina	Ancient World Mapping Center
University of Richmond	Digital Scholarship Lab (previous 2 under this?)

George Mason University	Roy Rosenzweig Center for History and New Media
Columbia University	Center for Spatial Research / Mapping Historical NY
Univ Saskatchewan	HGIS Lab
Canadian Research Group	Canadian HGIS Partnership
USC Dornsife	Spatial Science Institute
Univ Oregon et al.	Mapping Rome
Univ PEI	GeoReach Lab / Back 50

Table 2: Labs and Projects specializing in Spatial History Part 1

Other projects were individually identified from references and searches in non-academic sources and are represented in Table 3. A longer repository of about 200 projects is available on the Projects and Resources page of the Geo Humanities Special Interest Group website (as of July 2019). However, the Geo Humanities repository covers the entire world and multiple languages. Most of the list below also makes an appearance in the Geo Humanities SIG Resource Repository.

Project	**Affiliation / Context**
Geography of the post	An interactive spatial visualization by Cameron Blevins and Jason Happler of Stanford
Digital Harlem	Design Damian Evans 2007, redeveloped Ian Johnson & Artem Osmakov 2015
Historical Exploration of DC	Interactive map of DC's history
Locating London's past	British center for 18th-century studies, 2014
New Orleans Historical	Storymap Interface for New Orleans History
ORBIS	The Stanford GeoSpatial network model of the roman world
Philaplace	Interactive spatial exploration of Philadelphia
Railroads and the Making of Modern America	A University of Nebraska Lincoln Digital History Project
Exploring Richmond, Virginia	University of Richmond
Exploring voting in America	University of Richmond

Table 3: Labs and Projects specializing in Spatial History Part 2

To summarize, there is a variety of projects in spatial History, but they occur in a small proportion of the number of History departments.

Professional Communities and Special Interest Groups

The next part of the analysis involved a review of online communities and groups that are partly or wholly dedicated to spatial History. The search was initially conducted through an open Google search. Subsequently, I searched for groups on Reddit and Facebook, which are two of the more common platforms where communities can form open or closed groups to discuss special interests in a sustained format. On both these platforms, I first identified groups with titles that were relevant to my inquiry. I next shortlisted groups that had at least 1000 members. Small groups with tens of members, especially on Facebook, tended to be ad-hoc groups created for specific classes or projects, and were generally inactive. For the groups with 1000+ members, I read through the group description and some sample conversations to evaluate if they were relevant to be included in this sample. The groups identified on Reddit and Facebook are represented in Table 4. The first column indicates the group name and the second indicates its size and nature. The last column contains a group description, in most cases taken verbatim from the "About" statements of the group. Where such a self-declared statement was not available, I have provided my own summary. All membership numbers in the table are as of July 2019.

Group and Affiliation	**Size and nature of group**	**Description provided by the group mentioned in quotes**
SIG Geo-Humanities, Alliance of Digital Humanities	Established in 2013. Five working groups.	"focuses on spatial, spatial-temporal and "placial" perspectives in the digital humanities"
Stanford Spatial / GIS SIG, Stanford Spatial History Group	Established in 2007, active group.	".. formed around a common interest in working with spatial data and/or GIS, particularly in the Humanities and Social Sciences."
r/gis	37,100 members.	"A community dedicated to everything GIS (Geographic Information Systems)." Extremely rich associated WIKI for GIS
r/History	14.1 million users.	A general-purpose History Subreddit. Rich, extensive resources available
r/digital History	1,100 members	"dedicated to all the cool stuff that archives, libraries, museums, and others

		are putting online for free! Special focus on historic documents, artifacts, newspapers, printed ephemera, historic artwork, and audio."
r/askHistorians	98,5000 members,	"The portal for public history". Rich resources available
r/OldMaps	19,000 members	"Beautiful, interesting and/or illuminating maps, from the oldest examples known to about 1950."
r/dataisbeautiful	13.6 million members	"A place for visual representations of data: Graphs, charts, maps, etc. DataIsBeautiful is for visualizations that effectively convey information. **Aesthetics are an important part of information visualization, but pretty pictures are not the aim of this subreddit."
r/visualization	49,600 members	"For topics related to information visualization and the design of graphs, charts, maps, etc."
r/tableau	17,200 members	"Tableau makes software for data analysis and visualization that is easy to use and produces beautiful results. /r/Tableau is a place to share news and tips, show off visualizations, and get feedback and help."
r/GoogleMaps	14,400 members	"A subreddit for anything and everything to do with Google Maps, Google Earth, and Google Street View."
r/mapPorn	707000 members	"High-quality images of maps."
Facebook/ESRI ArcGIS	4663 members, Active since 2013	A general-purpose support group for all things related to ESRI ArcGIS

Facebook/ ESRI GIS Higher Education Community	17,930 members. Administered by ESRI staff	Driven by the Education unit within ESRI, the group maintains the community element around the Higher Education use of ESRI products

Table 4: Special Interest Groups and online communities

The Reddit and Facebook groups are all global and include members not necessarily from UK, US or Canada. Neither are they necessarily completely in English. In spite of this, I have presented this table here to give an overview of the kinds of professional networks that may be available to anyone interested in spatially enabled History.

Data Visualizations

I undertook a final survey to review the extent of publicly available data visualizations in History. Data visualizations need not necessarily be geo-spatial in nature, in the sense of using maps. They essentially present data in a visual form, most notably in the form of various kinds of graphs, and in the form of infographics. These visualizations may be static or interactive. The work of Harvard historian Kelley O Neill includes both spatial and data visualization and is an excellent example of how both spatial representations and geo-spatial representations serve similar functions but are nevertheless different. Each has a different strength and can be employed by Historians to view their data through new lenses. Some kinds of data lend them to geospatial representation and analysis (map-based) and other kinds of data lend themselves to spatial representation in the form of graphs and infographics. Examples of spatial representations of Historical data are presented below. Neither of these is geo-spatial. Example 1 shows fires across Russia (O'Neill, 2018) while example 2 visualizes the size of ships in different Navies in the 18th and 19th centuries (O'Neill, 2013). The maps are interactive online and present a much richer perspective to the viewer. They are presented here in a static form for reference and an overview.

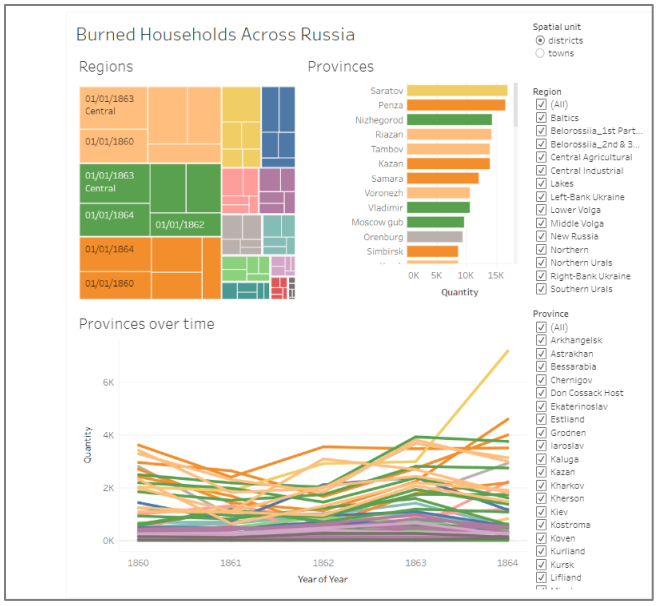

Figure 3: Spatial representation of historical data. Example 1

Figure 4: A spatial representation of historical data. Example 2

One of the best places to access searchable, publicly available data visualizations on the Internet, is on the website Tableau Public. Tableau is a data visualization software that positions itself as intuitive and easy to use by the non-technical person. (A detailed discussion of such

tools is presented in Chapter 8). Tableau Public is a free version of the software used by professionals, learners and other enthusiasts to create and share data visualizations with the community. Interestingly Tableau has a curated list of the 10 "best" data visualizations of all time on its blog and five of them are directly or indirectly related to history.

Tableau Public's repository is searchable. A search for "History" visualizations on Tableau Public returned 7158 results from 504 authors in early July 2019. "Historical" returned 4509, and there were clearly many that belonged uniquely to the second search. Not all these are created by Historians and nor for academic purposes. However, a dip stick survey showed that many to most of the results concerned themselves with historical data for one domain or the other, ranging from sports to insurance. These visualizations were created by a variety of people—professionals, semi-professionals, as well as people experimenting with the tool.

Power BI, which is also discussed in detail in Chapter 9, is a comparable data visualization tool from Microsoft, which positions itself specifically to the business market. However, it has the same features as Tableau to enable people to visualize Historical data, if they chose to. A similar search for historical data visualizations on Microsoft Power BI showed 30 results in the public data stories gallery on July 6, 2019. As with Tableau, these were not necessarily for the academic study of history, but 24 of the 30 results visualized historical data.

Apart from these two sources, I also searched through other sources from centers that specialize in Spatial History (Table 5). This list is by no means exhaustive, but it gives an overview of the kinds of visualizations that are created with Historical data.

Affiliation	**Data Visualization Title**
Harvard	Kelley O Neill's visualizations on Tableau
University of Richmond	Visualizing emancipation
University of Wooster	Bahaian History visualization
Bernard College	A spatial History of the College
Data Visualization Society	Historical Visualization Digests (Issues 1-4 current)
University of Virginia Scholar's Lab	Neatline Demos. (Neatline is "a geotemporal exhibit-builder that allows (one) to create beautiful, complex maps, image annotations, and narrative sequences".)
Private website of Designer Siverino Ribecca	Data Visualization Catalogue (a collection of visualization types with examples)

Table 5: A sample of Data visualization Sources relevant to spatially enabled History

So far in this chapter, I described the process of data gathering and the data results from four areas: Scholarly work around spatial history including books and dedicated journals, Spatial History Labs and projects, Special Interest groups and communities of interest, and data visualizations with Historical Data. I discuss these results in the next section.

Discussion

Research and Knowledge Mobilization in the Spatial Turn

From the data on the publications, it may be reasonably concluded that scholarly work on spatially enabled History is still a very small fraction of the total publications in the discipline. The number of English articles found in academic databases in the last 15 years, with keywords exploring spatial ways of knowing and History, is not overwhelming – ranging as it does between 401 and 0 results per each search. From this I conclude that Spatial History is still not institutionally accepted as common among History scholars. This is also reflected in the opinions expressed by graduate students in History.

> *"Personally, I don't see much value in these technologies in terms of changing the methods of doing History. In my view, History is in many ways the story of writing, which separates it from archeology/paleontology/anthropology. I think that these technologies could be very useful for other or even new disciplines, such as communications studies, or for very specific branches of History, such as the History of Cartography; however, in terms of the most pressing/mainstream questions that are relevant to a Historian, I don't see much use in them. I feel as if the traditional tools of History are adequate and still leave much to be explored."* (Graduate Student in Survey)

It appears that the traditional epistemologies of History still hold center stage in the History scholar's mind.

The Google Scholar search includes a wider range of publications, since its algorithm tracks references of the search term within the full-text, as opposed to the human-curated, keyword-based approach of the databases. Google Scholar also includes non-peer reviewed literature. According to Google, Google Scholar ranks documents by "weighing the full text of each document, where it was published, who it was written by, as well as how often and how recently it has been cited in other scholarly literature" (Google Scholar, 2019). If Google's

ranking algorithms work as described here, the quality of its results are reasonably, if not completely, as accurate as the academic databases, while including a wider variety of texts.

This implies that the spatial turn in History may have a distinct interdisciplinary character, and that at the present time, a lot of the work is exploratory. For each of the search queries, Google Scholar results show a wider disciplinary range—from political economy to management and organization History. There was also a range of books and publications from within universities or organizations which may or may not be peer-reviewed. There is exploratory, multi-disciplinary work happening in the field than work that falls into previously determined disciplinary/academic structures. In my estimation, the presence of extensive grey literature points to an evolving field.

The data around the journals seems to paint a similar picture: Spatial History is interdisciplinary. While scholarly spatial history work is being published, it happens more in conjunction with other disciplines than within History alone, as may be seen in the Labs and Projects. As described earlier, there are potentially publications within the digital humanities that can throw more light on the matter, and this could be taken up in future research.

Labs and Projects in the Spatial Turn

There are fewer projects and labs dedicated only to spatial history as compared to spatial History projects within Digital Humanities Labs. The ones that are specific to Historical GIS appear to be of three types. The first would be the specialized Labs dedicated to spatial inquiries in History and led by History scholars. Examples would be Harvard's Imperiia project and University of Saskatchewan's Historical GIS Lab. The second, labs that are driven by History departments and which focus on gazetteers and historical map-making projects, such as the Great Britain HGIS Project and Harvard's Open World Map projects. Third, projects that focus on networking and knowledge mobilization around spatial history, rather than specific projects. Examples of this type would be the Historical GIS Research Network in the UK and the Canadian HGIS Partnership. Spatial History work being done as part of larger Digital Humanities initiatives have similar goals on smaller scales.

Also interesting is the work of not-for-profit organizations such as History Pin which focus on involving citizens in community-based storytelling of History. This work is not academic in the traditional sense, but it aligns with participatory paradigms in research and knowledge mobilization. This can be seen in conjunction with the development of crowd-

sourced maps, and the exploration of space and place in indigenous knowledge systems. Together, it paints a picture of a community and grass-roots flavored spatial history that is aligned to, but distinct from, formal research work in labs.

Special mention must be made of projects involving Historical gazetteers and map-making. Gazetteers have always been an important part of the archive but are of vital importance to spatial history, as emphasized by Harvard historian Bol at the experts meeting on spatial thinking (Hagerty et al, 2013). History data sets are not readily available for spatial analysis and the work of these projects is important not only in creating new knowledge, but also in creating usable data for future generations of spatial historians to work with. Getting data into an analyzable form is an important prerequisite for either spatial analysis or data visualization. Prof NF put is as follows:

> *Most of my students who work on it, America, 17th–18th century America, they don't have that kind of data, they have to generate the data themselves. And it's very irregular data. So, it's not as I mean… ESRI is really built for modern data sets. And many early historians don't have such data sets. So I think it's, it's, it's just part of the landscape, and we have to teach it and get people familiar with it. But it's [ArcGIS] not necessarily that useful for most early modern and earlier historians, because we just simply don't have the data to make the best use of.* (NF, personal communication, June 2019)

'Data wrangling', the art and science of identifying, cleaning, and merging data from multiple sources in preparation for analysis is a completely different skill than actually doing the analysis. Expert EE describes it in terms of effort:

> *"...data wrangling is trying to get datasets to work together, accounts for 70 to 80 percent of the time and effort data scientists and GIS specialists spend."* (EE, personal communication, June 2019)

I conclude, therefore, that labs and projects involved in the creation of gazetteers and maps have a central role to play in the future evolution of Spatial history and are as important as projects undertaking spatial inquiries.

Communities and Special Interest Groups in the Spatial Turn

The data in this inquiry show that there are hardly any formally constituted and institutionally supported Special Interest Groups when compared to informal ones. They are far fewer not only in number but smaller in membership as well. The formal groups are well

structured and governed, with articulated mandates and specific aspirations. The groups on social media platforms, on the other hand, are broad-based, evolving, active, and reflect the culture and affordances of those platforms. For example, Reddit lends itself to longer conversations within specific interest groups (subreddits). An original post (OP) may elicit responses and conversation spanning hundreds of comments over weeks or even months. Reddit allows users to post long messages. While longer messages are technically possible on Facebook, the affordances of the Facebook user interface nudge most users towards shorter responses and non-verbal communication in the form of emoji-based responses. Reddit's "upvote" feature, unlike the "like" or "responses" feature of Facebook, prioritizes items that the community deems to be more worthwhile in some way. Reddit users on special interest groups provide extremely thoughtful comments and responses, sometimes including worked through examples and detailed descriptions and links. Based on these affordances, features, and personal observation, I believe that Reddit is particularly well suited for knowledge creation and communication in special interest groups. Needless to say, neither Reddit nor Facebook is specifically academic. Yet, there is no reason why valid knowledge or even profound analyses and insights may not be generated and shared on those platforms.

For more traditional scholars, formal SIGs such as geo-Humanities may hold a particular appeal. There is a case, however, for knowledge creation and knowledge mobilization to be interpreted more flexibly, focusing on the quality of the knowledge, rather than the credentials of the knowledge creator. Of all people, humanities scholars from critical traditions would see value in knowledges generated through alternative channels. Viewed in this way, I would claim, based on membership evidence, that there are millions of people with an active interest in spatial History, though they may or may not describe themselves as Historians. Given the dynamic nature of knowledge around tool usage, the geographic dispersal of interested people, the variety of interests, and the speed of changing information in some areas, a Reddit or Facebook forum may be a more valid way of establishing a Special Interest Group. As Prof NF would say, "people are hungry for this kind of thing".

Data Visualizations

There are clearly fewer visualizations and spatial representations of Historical data, than there are geospatial analyses, even among spatial Historians. The Imperiia project is one of the few that emphasizes both geospatial as well as visual spatial analysis of historical questions.

Time, chronologies, sequences, movements, narratives could lend themselves to spatial organization and analyses, independent of maps and geospatial analyses. Yet, this appears to be an under-explored area. As Rosenberg and Grafton write in their book *Cartographies of Time* (2010) "while historical texts have long been subject to critical analysis, the formal and historical problems posed by the graphic representations of time have been largely ignored" (p10). This perhaps points to why most of the data visualizations available tend to be geographically mediated and are geo-spatial in nature. Historians seem to not have engaged enough with the visual-spatial representation of time or other forms of spatially organizing history knowledge. They thus find themselves beholden to maps alone for spatial inquiry. This, in turn, brings up the critical concerns of differences between space and place and leads traditional Historians to the conclusion that spatial ways of knowing are not well suited to History.

In addition, it appears that the term 'data' has a positivist and therefore pejorative connotation to traditional Historians. What geographers consider data, Historians see as evidence (Suri, 2013). I hazard a guess, therefore, that data visualization may appear to traditional historians as yet another positivist endeavor with questionable value to the study of History. In addition, data visualization tools that are available for such purposes, even easy-to-use ones such as Tableau, for example, require the scholar to engage with terms and concepts such as variables, dimensions, measures, which may seem alien to the Historian. It is interesting to note that in the survey results, nearly three-quarters of the responders have never heard of Tableau, while a little more than half the respondents had heard of programming platforms such as Python or R for visualization purposes. This finding is discussed at greater length in other chapters. I believe that a combination of the lack of engagement with the spatial and a general aversion to the idea of 'data', may have led Historians to undervalue the spatial way of knowing.

In conclusion, it appears that in History, geospatial inquiry is understood better and practiced more widely than spatial inquiry, at the present time.

Summary

In this chapter, I sought to establish the ways and extent to which spatial ways of knowing were becoming evident in the History discipline. I did this by examining scholarly work in the area, the specialized projects and labs doing work with spatial history, the nature and extent of special interest groups and communities of practice, as well as examples of historical

data visualization. These analyses indicate that spatial ways of knowing in History are well-established but not mainstream in academic arenas. Traditional Historians still resist the idea of quantitative and spatial History. However, there is fluid, rich and evolving knowledge around spatial ways of knowing for History as well as tool use for the same, especially in conjunction with other disciplines, and with the participation of people who may not identify as academic historians. The spatial turn in History, as it exists at this time, appears to be fluid with a strong interdisciplinary flavor.

6: The Spatial Turn in History: Work and Employment

In this chapter, I analyze the work and employment scenario for the History graduate in the context of the Spatial Turn. I explore the ways in which the Spatial Turn extends beyond ways of knowing and ways of doing History, into the employment domain. As it may be recalled, my first research question is *What are the gaps between research, practice and higher education curriculum in the History discipline, with reference to the Spatial Turn?* In the previous chapter, I explored the research and knowledge creation aspects of the Spatial Turn. In this chapter, I turn to the world beyond History education, or in other words, the *practice* of History. For researchers and career historians, there is, of course, no distinction between research and practice. Scholarship and employment are seamlessly integrated. However, for those history graduates who choose to (or are compelled to) go outside of the research arena, the practice of History may have a significantly different scope and flavor than what they encounter in their history education. If the Spatial Turn in History is influencing ways of doing history, I surmise that it may be influencing the career and employment options for History graduates as well. This chapter offers evidence around this hypothesis and analyzes the same.

Who exactly qualifies as a History student? History graduates and students are not a homogenous group. People study History at various levels of intensity and depart from the study of History at varying points. I consider five categories of students, listed here in increasing order of intimacy with History: Undergraduate students with a History minor, undergraduate students with a History major or an honors track, Masters students in an interdisciplinary program with a History component, Masters students in History, and Ph.D. students in History. The work and employment options for each of these groups of students is diverse.

History itself is not a homogenous discipline either. There are specializations by time period (a given century or time frame), by geographical area (continent, country or area) and by type (for example, History of Science or Intellectual History). Occasionally, there is specialization by method as in the case of Spatial History or Cliometrics[4]. The boundaries between History and other social sciences or humanities subjects are also porous, with many

[4] The study of History by applying Economic theory and statistical analyses to large datasets

hybrid variations available such as Economic History and Environmental History. In addition, there are close cousins such as Archeology and Public History.

Given these variations of students and disciplinary boundaries, it is difficult to create a generic description of who a History student is and what careers are available to them. I overcome this limitation by embracing the variety and undertaking my analysis through the lens of the underlying competencies (knowledges, skills, and dispositions) in play, as opposed to what labels are applied to the student's brand of history.

Scope and Purpose of this Analysis

In order to explore the gap between research, practice, and curriculum as conceptualized in my research question, I establish in this chapter, the current status of History practice in relation to the Spatial Turn. I do so by analyzing three separate components.

- **Disciplinary competencies as understood by History professionals.** Professional bodies in the History discipline have outlined desirable competencies and provide career advice for History students in higher education. I analyze what these competencies and advice are, in the light of spatial ways of knowing in History.
- **Work and employment options available to the History graduate**. I explore job postings—both academic and non-academic—to which a History graduate may reasonably apply for. I categorize the jobs by type and nature to throw light on the variety and volume of jobs available to history graduates. I then consider the spatial knowledge and skills that the jobs demand. I assess how the demands of these listed jobs align with the competencies articulated by the professional organizations. In the next chapter, this forms the basis to study the gap between what jobs demand and how History curriculum is structured.
- **Expectations and career aspirations of History students**. I finally draw on data from my survey to analyze the expectations and aspirations that History students have, in terms of work and employment. I discuss how students' interests, aspirations, and beliefs about History are related to the jobs available, and what role, if any, spatial skills play in the picture.

In the following sections, the data for each of these components is described along with a discussion of the same.

Disciplinary Competencies as Understood by History Professionals

In this section, I draw upon the information published by the three professional organizations for historians: the American History Association (AHA), the Canadian Historical Association (CHA) and the Royal Historical Society (RHS) of the UK. All three are well-established, discipline-oriented professional bodies. They position themselves broadly as supporting the integration of academic, professional and public aspects of History. I analyze each organization's position on work and employability through the lens of the support it provides for History students and teachers in general, and for Spatial History in specific.

The American Historical Association has a very well-articulated set of "skills, knowledge, and habits of mind that students develop in History courses and degree programs" (Hyde, n.d.) This amalgam of skills, knowledge, and dispositions is what I refer to as a competency. The competencies listed by the AHA have been outlined through a comprehensive consultative process. In 2011, the Lumina Foundation awarded the AHA a three-year grant for the History "Tuning" project. Tuning is a collaborative process which convenes experts in a discipline to spell out the "distinctive skills, methods, and substantive range" of that field. Participants then work to harmonize or "tune" not only the goals of their discipline, but also the curricula that support those goals, on each participating campus. The first version of the *History Core* was published in 2013, and then revised in 2016. At the top level, the *History Core* calls for the following competencies among History students:

- "*Build historical knowledge*
- *Develop historical methods*
- *Recognize the provisional nature of knowledge, the disciplinary preference for complexity, and the comfort with ambiguity that history requires.*
- *Apply the range of skills it takes to decode the historical record because of its incomplete, complex, and contradictory nature.*
- *Create historical arguments and narratives*
- *Use historical perspective as central to active citizenship*" (Hyde, 2016).

In addition to the competency descriptions, it is apparent that the AHA concerns itself quite extensively with the work and employment aspects of professional historians. The AHA lists extensive career related resources including possible career paths, career advice for History majors, advice on how to take charge of one's History education, an outline of skills that

employers look for, and so on. Of specific interest is a program the AHA calls *Career Diversity for Historians*. Started with a grant from Mellon Foundation in 2014, the pilot program explored the "culture and practice of doctoral education in History" (American Historical Association, 2016) in four universities – Columbia University, the University of California Los Angeles, the University of Chicago and the University of New Mexico. The aim was to "implement programming and activities aimed at career preparation for graduate students" (American Historical Association, 2016). After the pilot was completed, the program received an additional USD 1.5 million in funding to expand and build on the findings of the pilot.

The AHA lists the following as the most important insights from the pilot program:

1. *"Preparation for careers outside the academy fundamentally overlaps with preparation for 21st century careers inside the academy, both professorial and otherwise.*
2. *Learning to be a professional historian cannot be separated from learning to teach history, including engaging with scholarly literature on history education.*
3. *Only 1 in 6 history PhDs pursue careers as faculty at R1 institutions, despite the fact that most graduate programs are designed with this career outcome in mind.*
4. *The experiences and learning opportunities that best prepare students for careers inside and outside the academy should be integrated into the curriculum rather than be defined as external or supplemental.*
5. *The first step towards reconsidering a PhD program should be articulating its purpose. A department can choose to align purpose with actual outcomes, aspirations, both, or neither. But the choice should be intentional."* (American Historical Association)

It is evident that professional Historians recognize that focusing only on academic work in History in curricula is doing a disservice to students, given the variety of work options that are potentially possible. The articulation of the AHA manages to expand the scope of History education without being "market-driven". It also recognizes that many history graduates go into the teaching of History without being adequately prepared for it, and which is a situation to be remedied. Employment requirements and teaching preparation are also themes that recur in the interviews and surveys. However, it must be noted that

all the work in the Career Diversity program focuses only on doctoral students. There is no

recognition of the needs of undergraduate history students, who far outnumber the graduate students. I can imagine this being justifiable to the AHA in the sense that undergraduate History students are not yet committed to being History professionals and may well not even continue studying History. Yet, by not focusing on undergraduate students, the AHA is leaving the reality of a large group of stakeholders unaccounted for, and thereby missing an opportunity to demonstrate the richness of the discipline to an impressionable mind.

The Career Diversity program included focus groups, where History PhDs in non-academic jobs reflected on the skills they had not learned as part of their education, but which they discovered to be necessary to succeed at their chosen professions. The program identifies five such skills (American Historical Association, n.d.). This list, while very relevant, is very similar to many other aggregations of competencies that are broadly termed 21st-century skills:

1. "**Communication**, in a variety of media and to a variety of audiences
2. **Collaboration**, especially with people who might not share your worldview
3. **Quantitative Literacy**: a basic ability to understand and communicate information presented in quantitative form, i.e., understanding that numbers tell a story the same way words, images, and artifacts do
4. **Intellectual self-confidence**: the ability to work beyond subject matter expertise, to be nimble and imaginative in projects and plans
5. **Digital Literacy**: a basic familiarity with digital tools and platforms"

The Career Diversity pilot acknowledged that preparation required for careers outside the academy and inside are identical. So, it stands to reason that these five skills are as relevant to academic careers as they are to non-academic ones.

Of specific interest in this list, is the mention of Quantitative Literacy as a required skill. The AHA webpage for this skill states "Quantitatively literate historians do not shy away from numbers, charts, or graphs—they use their critical minds and historiographical training to contextualize the numeric information in front of them and interpret it" (Mulder and Woker, 2016). There is no mention of spatial skills, but this is an acknowledgment that non-textual sources can be a valid basis for historical analysis and representation. From my reading of the AHA description of this skill, I argue that professional Historians still have a conservative view of quantitative literacy. They hedge their advice about adopting quantitative methods. The recommendation is positioned as a way of making a narrative more compelling, and as a way of

making grant applications better or as necessary for managing budgets. It does not emphasize any specific value of a non-textual epistemology for the discipline. However, this discussion of quantitative literacy on the AHA website needs to be seen in context. The description of quantitative literacy is not a consulted articulation in the way the competency descriptions or the five skills are. It is a write up adopted from an AHA guest blog post by two individual PhD students. To that extent, I do not consider it the official stand of the professional body, though it is quite possible the AHA agrees with this articulation.

In addition to the competency descriptions and the career diversity resources, the AHA also offers teaching resources for undergraduate History teachers and publishes perspectives offered by History teachers who share their experiences and experiments in the teaching of History. The section *Approaches to teaching History*, explores in detail other concerns of History teachers and History departments – curriculum design, dealing with dual enrollment, and ways to engage History students in civic life. There is also a section on Digital History teaching, though there is no emphasis on the spatial within the Digital.

I conclude therefore that the AHA as a professional body sets an aspirational mandate for the History education and for the profession and supports it with a variety of resources. While there is no specific mention of spatial ways of doing history, there is a mention of both quantitative literacy and the recommendation to be familiar with a variety of methodologies as previously mentioned. Next, I compare AHA with the professional History bodies in Canada and the UK.

The comprehensive structure and resources available on the American History Association website is in stark contrast to the position of the Canadian Historical Association (CHA). The CHA does not have an equivalent competency definition on its website, nor any publicly available discussion about the discipline itself. In fact, CHA's *raison d'etre* seems to have a different focus, which I describe as publication, networking, and activism. Its publication focus is borne out by its extensive collections of knowledge artefacts: There is a repository of syllabi from across universities, journals, short book series, a separate booklet series, as well as an article series and a blog series. Its networking and action-orientation focus is apparent in the fact that the association is a central hub for a variety of committees and advocacy groups. The *About Us* section of the CHA states that the purpose of the association is to represent the

interests of academic and professional historians at various venues and to lobby for their interests (American Historical Association, 2018).

The CHA website (cha-shc.ca), does, however, contain a blog on what students can accomplish with their history degree, and a not-very-obvious link to a list of general higher education job boards. The site had a career match program in 2018, which was no longer visible on the site as of July 2019. The teaching resources section is limited but has a teaching-learning blog, with entries beginning May 2019, suggesting it is newly created as of this writing. Overall, the CHA has few insights to offer for my analysis. It is disciplinarily inward-looking and does not provide enough information to comment on how professional historians in Canada position themselves with respect to work and employability academically or beyond. Needless to say, there is insufficient information to comment about spatial history specifically.

The Royal Historical Society (RHS) is the leading and comparable professional body for Historians in the UK. It is a much older organization than the other two, having been founded in 1868. Like the CHA, the RHS positions itself as an advocate for History scholarship and sees itself "increasingly at the forefront of policy debates about the study of History" (Royal Historical Society, 2019). Whatever policy work is done by the RHS, is not evident from its website. The Society's focus is on continuing its role as an authority on History, through the publication tradition. The RHS states that supporting early-career historians is part of its mandate. It appears to fulfill this mandate in two ways – by providing publication avenues for early-career historians, and providing guidance and access to fellowships, grants and other forms of funding. The RHS lists a few pages of advice for early-career historians ranging from an overview of academic and non-academic History work to application letter dos and don'ts. Under the circumstances, the RHS website offered me even less insight into UK historians' view of their profession with respect to work and employability, than the CHA.

In this section, I reviewed prominent professional bodies in the US, UK, and Canada, to assess their positions on the practice of History. I interpreted those positions, where they existed, in the light of spatial history. I will use these interpretations to assess the gaps between practice and curriculum in the discussion in Chapter 9.

Work and Employment Options for the History Graduate

I now turn my attention to the existing work and employment opportunities for history students in the current time period. The previous section provided a picture of how historians see their profession, while in this analysis, I will establish the other side of the practice of history – the perspectives and needs of employers. To do this, I analyze what jobs are available, what the requirements of available jobs are, and what knowledge, skills and dispositions of mind these jobs demand. I look at three categories of jobs:

1. **Traditional**. This category refers to academic and non-academic jobs that are traditionally seen as the natural work option for history graduates.
2. **History + Spatial.** The jobs in this category call for history graduates with spatial skills. (These skills may be either mandatory or desirable for a given job).
3. **Spatial + History.** The jobs in this category require spatial skills, and list history or a related discipline as a preferable underlying degree. These are jobs for which a History graduate may reasonably apply for, if they have spatial skills.

Collecting the data

The data for this section comprises jobs advertised on several locations. The first was the AHA job postings site. I determined that the AHA job site was representative of the kinds of jobs available to History students specifically. When I compared the job postings on the AHA site to the job postings on specialized higher education job sites (for example, www.higheredjobs.com) I found them to be repeats. Therefore, instead of duplicating searches, I focused on one representative source and analyzed it in greater detail.

The second source of advertised jobs were three commercial job posting sites: LinkedIn, Glassdoor and Indeed. LinkedIn is a California based job search engine established in 2003 and acquired by Microsoft in 2016. It currently claims to have 200 million users and 20 million jobs posted (Linked In, 2019). Glassdoor is also California based, and has been operational since 2008, currently with 67 million users and listing 11 million jobs (Glass Door, 2019). Indeed is a Texas-based, Japanese owned job listing aggregator in operation since 2004 (Indeed, 2019). The site does not indicate how many job postings it has currently. Between these platforms, it is reasonable to expect to find all internet-listed jobs for certain criteria.

It is likely, however, that the online search platforms do not fully represent all the jobs that are actually available. Many positions are filled internally. Many others are not necessarily

advertised online. In spite of this, I maintain that the picture of jobs painted by the online platforms are indicative of the kinds of jobs available, even if they do not necessarily indicate the volume of jobs available.

I collected data on two separate occasions with a gap of 10 weeks in between, to ensure a wider representation in the searches. The findings of the second search were very similar to the first, so I determined that I had reached data saturation with respect to job types and did not conduct a third search after another interval. With the AHA, I analyzed all the listed jobs. On the commercial job sites, I used the search terms "History", "research" and "GIS" along with the geographical limiter of US, UK and Canada. I found these to offer the greatest number of relevant results, ranging from 45-91 results for different searches. All other combinations of search terms (such as spatial history, university, maps, and data visualization) did not yield relevant results. In all, I identified and analyzed the requirements and descriptions of 74 different jobs from all four platforms, over the two iterations. Though this data is not exhaustive, it represents the kinds of jobs that are currently available to History graduates, especially if they have spatial skills.

The jobs were identified by the title first and then by the job description, the preferred educational requirement, skills requirement – both mandatory and preferred. I made no distinction on the source of the job post or the experience level in the filtering. All sources of jobs, academic or otherwise, were included, as well as entry-level jobs and jobs calling for prior experience. Full time, part-time, hourly work, contract work, and fellowships were all included. The detailed table of jobs analyzed can be found in Appendix D. An overview of the job types may be seen in Figure 5. I describe below my findings along with an analysis.

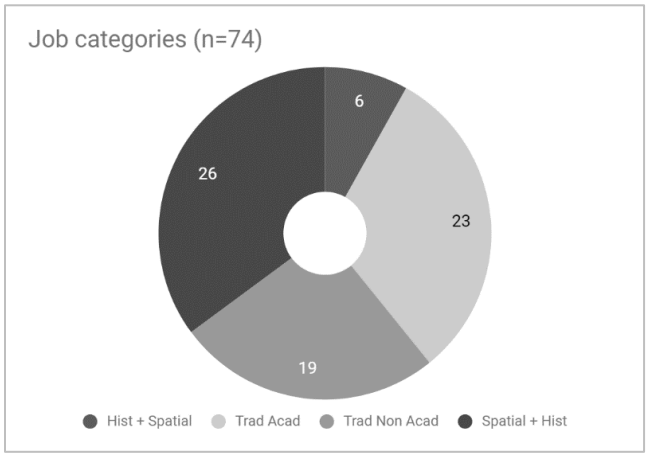

Figure 5: The distribution of different job types in the analyzed sample

Traditional Jobs for History Students (n=42)

In the analyzed sample of 74 jobs, 42 were jobs traditionally considered by history graduates. Of the 42 traditional jobs, 23 jobs were academic, meaning they involved research, teaching, or a combination of the two. 19 jobs specifically called for Historians but in a non-academic job, involving supervising or managing teams or departments, or as curators, editors for history publications, archival specialists, and curriculum developers. Of the 42 traditional jobs, 6 were entry-level jobs, while all the others called for some degree of experience. The research jobs that were open to PhD candidates, assumed experience with research and sometimes classified the job as for experienced people, even though they did not specify exactly what kind of experience was required. Among the 42 traditional jobs, 2 were listed as part-time, and 2 jobs did not specify the nature of employment. The 38 remaining jobs were full time.

Traditional Academic jobs (n=23). 19 of the 23 Traditional academic jobs were full time, the other four being part-time. 11 of the 23 traditional academic jobs described the position as tenure track. The remaining were either non-tenure track, fixed-term, visiting faculty status or fellowships. Five jobs were explicitly about research, two involved both research and teaching and the rest were specifically teaching jobs. All the traditional academic jobs had a minimum requirement of a PhD.

Traditional Non-Academic jobs(n=19). Among the 19 traditional, non-academic jobs, 17 jobs were full time, while this was not specified for the other two jobs. Nine jobs involved management, supervision, and leadership and were senior, to very senior positions. There were three editorial jobs, four curatorial and archival jobs, and one job related to curriculum development and program management. Six of these jobs needed a minimum PhD qualification, whereas in five of them a PhD was not required but preferable. Six jobs required a bachelor's degree, a four-year degree or "some college". The other two did not mention the educational requirement.

Jobs for History Students with some Spatial skills (n=6)

This was the category with fewest jobs. Of these 6 jobs, only one was full time. Two had the option of being either full time or part-time. The other 3 were part-time. Four out of six jobs were entry-level. Two were not looking for spatial skills explicitly but stated that expertise in Digital Humanities would be preferable. While this does not automatically indicate that spatial competencies were being asked for, it does not exclude them either. Of the six jobs, three were

specifically research-oriented, two were specifically about teaching and the last was a teaching support and consultative role as an academic technology consultant. Three of the jobs needed a PhD, two required a bachelor's degree and the last called for “experience in History”.

Jobs Available for Spatial Technology specialists with History Background (n=26)

This last category was the most varied in the kinds of jobs available. 16 of the 26 jobs were full time. Two could be structured either as full time or part-time. Two were a fixed-term contract, two were hourly, one was an internship, one was a fellowship, and two did not mention the nature of employment. 11 of the 26 jobs were entry-level. Five of the jobs were open to both entry-level and experienced applicants. The other 10 jobs required some extent of experience. Interestingly, 22 of these jobs were research-oriented, meaning these jobs were with industry players looking for research services. This was part of the reason they sought History graduates, who presumably bring an aptitude for sifting through information and making sense of it. All the research jobs had some element of communication, report creation or research presentation in addition to undertaking the research. The other four jobs were more supervisory in nature.

This picture of available jobs suggests that there are several academic jobs available for History graduates, but fewer at the entry-level. There are some tenure track opportunities, but a significant number of them are not. For those who venture outside of academia, there are other options, but these demand a different orientation and perhaps a wider set of competencies. For undergraduate History majors, or those with an active History interest, the opportunities are wider outside of academia, especially if they choose to consider non-traditional areas. Employers seem to be interested in the “Collect, sift, organize, question, synthesize, and interpret complex material” competency that the AHA so accurately describes (Hyde, 2016).

These results can be seen in the context of the AHA’s observations on, and advice for, History professionals. The education provided to Ph.D. students, and the traditional job options available to them are for the most part aligned. However, when it comes to non-traditional jobs involving spatial and digital skills, education is not aligned with the jobs available. History students interested in the Spatial + History category of jobs, will likely need to have acquired the spatial skills on their own initiative and outside of their History education context. It emphasizes my earlier observation that there are opportunities for undergraduate history students outside the academia, which require History competencies, in conjunction with other competencies. Taking an integrated approach to both aspects in History education may be beneficial.

A 2013 study (Wood and Townsend, 2013) shows that of the 2500 people who earned a PhD between 1998 and 2009 in the US, only about 24% of the History majors worked outside of academia, while nearly 70% went on to become academics, teaching in tenured or non-tenured positions. There does not seem to be any more recent data and similar long-term analysis of what jobs history PhDs actually take up. Even so, the 2013 findings seem to mirror observations in this study regarding the connection between a PhD and an academic job, even as of 2019. However, my interest is broader than just doctoral students, and once again, this study does not throw any specific light on undergraduate students.

The AHA website has a video series called *What I Do: Historians Talk about their Work*. This 15-video series features a wide variety of possible History-based professions ranging from professors to archivists, to entrepreneurs, to the "Director of cloud services, Internet2". There are no historians in this series speaking about spatially oriented careers. If there were, it would serve to provide insight to any interested History student. At this juncture, however, it is interesting to note the observation of Expert EE, a senior employee at ESRI. EE feels that many entry-level GIS-oriented jobs are not likely to be all that interesting and maybe a disappointment for new graduates as they involve low-level data crunching work for most part (EE, personal communication, June 2019). This has implications for the orientation that students receive about such careers, and the expectation they create in their minds.

When considering this apparent mismatch between the undergraduate History student's education and career possibilities, I find myself contemplating the thousands of participants on online forums discussing History, maps and spatial tools and who probably have an accurate grasp of what the work actually involves. My conjecture is that if industry employers wanted to find the right fit for specific spatially oriented jobs, they may be better served by following participants on those forums and recruiting them based on their demonstrated competencies, irrespective of what education they have. In any case, while most of the industry job descriptions mention desired and preferred education, they hardly emphasize them in the same way academic job descriptions do. In any case, the recruitment practices of industry players would be the subject of another inquiry.

Student and Teacher Perspectives on Employment

In the previous section, I presented data and analysis about jobs available for History students. As a counter perspective, I now explore the perspectives of students before they take up careers, with respect to their interests and expectations from work and employment. The data for this section is drawn from the survey responses of 46 students. As may be recalled, these were students from graduate and undergraduate programs, though a majority were graduate students, especially in doctoral programs. I use five different questions from the survey to develop this analysis.

The survey posed the open-ended question "*What career do you hope to pursue after your degree?"*. 33 of 46 responses said they expected to be in academic careers. 20 of the 33 explicitly said they would like to be teaching, while the rest saw themselves doing a mix of research and teaching or be generally associated with "academia". 11 of the respondents preferred non-traditional jobs. The non-traditional jobs mentioned were: Labor organizing, parks and recreation, archeology, digital historical production, GIS expert, landscape artist, urban planning, environmental policy, lawyer, and project manager for environmental projects. One person mentioned Army officer. (This person was on a sabbatical from the army and expected to return). Most of the graduate students were gravitating towards academic jobs, while the master's and undergraduate students were understandably more open about their career interests and prospects. From the responses, it was also clear that some of the doctoral students were older individuals who already had a career of some sort and were not necessarily seeing their program as preparation for a career.

The follow-up question in the survey was *"What skills do you think are necessary for such a career?"* and *"To what extent does your current program prepare you for such a career?"*. Most of the respondents thought that their education prepared them for the research, thinking and writing skills needed for their desired jobs – which in their case was academic work. Among these, the respondents felt better equipped for research than for teaching. As one respondent put it "it (my program) does well, EXCEPT for teaching". Another respondent said, "I believe that having some education in teaching as a profession is highly important". Yet another respondent felt that though no explicit instruction was given on how to be a good teacher, the professors themselves modeled ways of teaching history, so one could potentially learn from it. The research and writing competencies themselves were well catered to, with many

of the respondents expressing great satisfaction with their program on that count. The lack of focus on teaching reiterates the observations in the AHA Career Diversity pilot – if History graduates are going to be teachers, they need better preparation for it.

On the other hand, respondents listed several competencies they thought would be necessary for successful careers, and for which their current programs did not quite prepare them. These were skills related to emerging technologies and social and networking skills. Many respondents said their programs did not prepare them for oral and written communication skills. By this, they referred to something beyond teaching or communicating research. One respondent called it "communication with other stakeholders, and begging". Though the respondent does not specify, I interpret the "begging" to mean grant and funding applications. Another competency desired by the respondents was other methods and tools including GIS. One respondent made a case for learning newer technologies "Emerging technologies. (if you're under 40, you'll be expected to know technologies in your dept, regardless of training"); and another opined "understanding maps is waaaay up there on the list of must haves." A third wished for "Spatial analysis, multifaceted learning, and graphic representation"

In this context, some students mentioned that though these other competencies were not taught explicitly in their program, their university had other departments and channels through which they could access learning for these competencies. It did, however, depend on the initiative and drive of the student to find, access and benefit from these opportunities in other places. To quote "My current program offers minimal training beyond critical reading and writing. Opportunities I have sought out independently from the program and past experience have given the necessary competencies for digital historical work." There were three people who were ambivalent and did not have an opinion on whether their programs were preparing for work and employment.

From these responses, I conclude that support for traditional academic jobs within the education program was good for research and writing, but somewhat lacking for teaching. It was largely missing for competencies outside the traditional scope of History.

The next question of interest in the survey was *"Would you be interested in researching or studying History through (spatial) tools and methods?"* A full three-quarters of the respondents replied yes, with 8 remaining non-committal. Three respondents explicitly said they had no interest in studying History through spatial means.

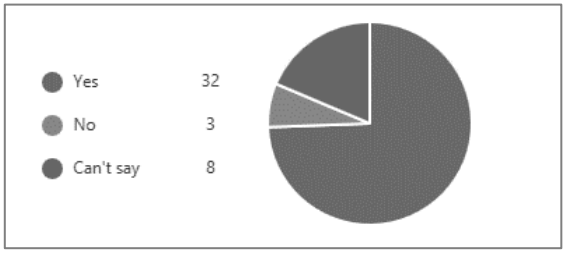

Figure 6: Students' interest in using spatial tools and methods to study history

The follow-up question was an open-ended invitation to explain their responses. Of the three people who replied they had no interest, two stated that it was because they did not know enough about technology in general, or that they did not like it. One person had categorical views that the traditional methods of history held plenty of untapped potential, and that spatial methods were superfluous and unnecessary. The persons who were undecided either did not explain their choice or took the stand that the tools and methods would depend on the nature of inquiry, and that they couldn't comment on it outside the context of a specific research inquiry. The ones who replied in the affirmative were largely interested because they believed spatial inquiries would expand their understanding of history. They thought that interesting connections could be made, or new insights could occur. To quote one respondent "I like to think about history in terms of the spaces that stories occupy/have occupied in the past. I have experience engaging with history using mapping technologies and it has been super useful! I've made interesting connections that I would otherwise have not made." Yet another stated, "It opens up new dimensions and certainly brings a deeper and richer comprehension of history". Some of the people who replied 'yes' to this question already had some exposure to spatial tools and methods at some level, while others said they could appreciate the possibilities even though they had not actually worked with these tools and methods before.

Following the exploration of studying history through spatial means, was the open-ended question: *"Would you consider a career that specifically demands spatial skills? (For example, working with maps, creating visualizations, analyzing spatial historical data, etc.) Please explain why or why not"*. The enthusiasm to explore spatial ways of knowing continued into the job realm, with 22 of the 42 respondents saying they would consider such a career. 17 people responded that they would not be interested in such careers. Of these 17, 8 said 'no' because they had not tried it or did not know enough about it to take up a career. Some of these expressed a hesitation of taking up something technical that required "math and formulas". 4 did not give any explanation why they would not consider such a career. The other 5 'no' responses gave

rationales such as “these technologies simply do not interest me” and “What sort of career would "demand" spatial skills? Maps are important and being able to read and understand them is a good thing, but ultimately this seems to be about analyzing and communicating history knowledge, not about research” and “No. Such tools are a bonus and cannot be the core”.

Of the 22 people who said they would consider such careers, there was a variety of rationales: Some were plain curious (“I am fascinated with mapping of human geographies in historical contexts” and “it allows me to combine my interests in history and technology”). Others wanted to build on skills they already had (“I currently work in the GIS department part-time. I would consider professions that allow me to merge my history skills with spatial technology” and “Absolutely! I think spatially and having a job where I could do that is super important to me”). Yet others saw it as an inevitable outcome (“I believe these technologies are necessary in modern teaching spaces and future education professions.” and “I wouldn’t mind working with maps. In fact, I think I may have to”).

All of these responses need to be seen in conjunction with the students’ self-reported familiarity with spatial tools and technologies. This helps frame and interpret their responses. For example, if a person who has never heard of any spatial technology says they do not believe spatial ways of knowing are important, it must be interpreted differently from people who know the technology, but still think it is not useful. Alternatively, when a person professes enthusiasm for spatial ways of knowing, it is necessary to interpret that response in the context of their level of exposure to those ways of doing spatial History. The aggregated data about their self-reported exposure to different spatial technologies is represented in Figure 7. This question was followed by an open-ended question that asked respondents to explain what they did with each of these technologies.

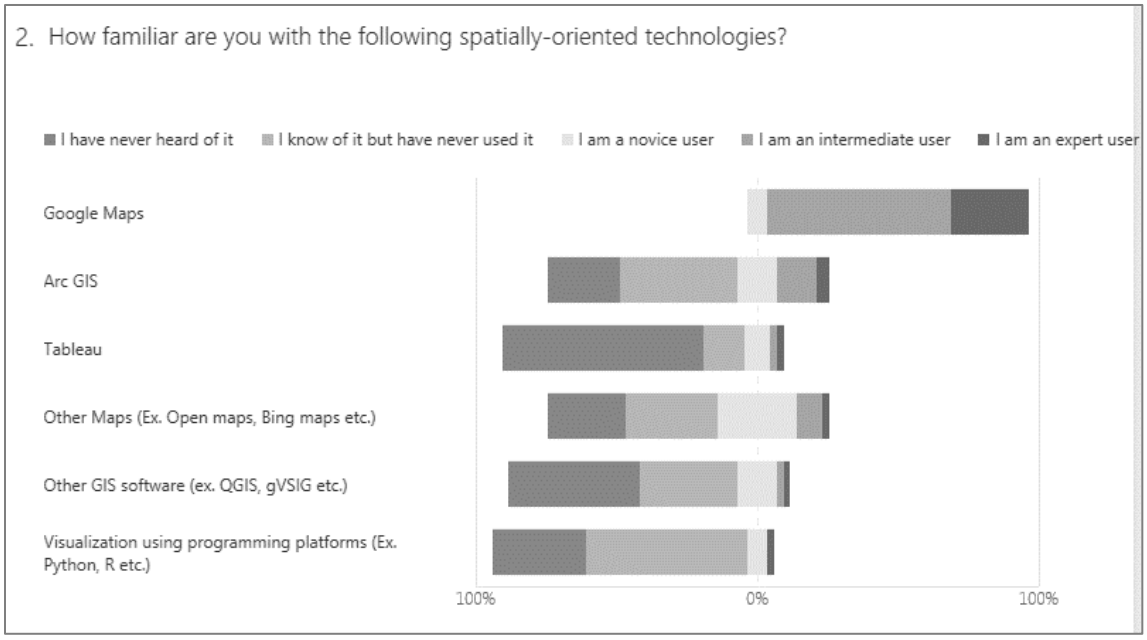

Figure 7: Students' self-reported familiarity with spatial technologies

It is clear from the responses to these two questions that most people are very comfortable with Google Maps but use them on an everyday basis for navigation and not for any analysis (though Google Maps does offer the possibility for some kinds of basic analysis). Most people have heard of geospatial technologies such as ArcGIS, but not about visual-spatial technologies such as Tableau. Interestingly, more people appear familiar with programming platforms such as Python and R, than with less technical data visualization platforms. There are very few people who have in-depth expertise on these platforms. A detailed exploration of the technologies is undertaken in chapter 8. I introduce them here to argue that the beliefs and interests of people cannot be seen in isolation of their familiarity with the tools themselves. I explore this in the next section, *A typology of History Students*.

In this section, I explored five different aspects of students' perspectives on their careers: their career interests, the skills required for that career, the extent to which their program prepared them for such careers, their interest in studying history through spatial means and their interest in working in jobs that needed spatial competencies. From this exploration, I conclude that many of the graduate students surveyed saw themselves in academic careers and felt supported by their programs to that end. However, they perceived no support in learning how to teach History. Students who were more open about their career choices had wider expectations from their programs and did not necessarily perceive their programs to be supporting them.

Three-quarters of the students were open to the idea of studying History through spatial means while about half were open to the idea of a career that demanded spatial skills.

A Typology of History Students

Based on the exploration of student perspectives as expressed in the survey, I propose a typology of History students, with respect to spatial ways of knowing. Though this typology accurately describes only the current sample, I am optimistic it may be applicable more broadly to describe the interaction of student beliefs and interests with their level of exposure to spatial ways of knowing. The proposed typology is constructed on two axes

- Axis 1. The students' belief that spatial ways of knowing can be useful in History, and their interest in spatial ways of doing history and / or spatially oriented careers
- Axis 2. The awareness and exposure that students have to spatial methods, tools and technologies

Each of the axes has a "low" to "high" scale, resulting in four quadrants: Low belief and interest + low awareness and exposure; Low belief and interest + high awareness and exposure; High belief and interest + low awareness and exposure; High belief and interest + High awareness and exposure. These are visually represented in Image 8.

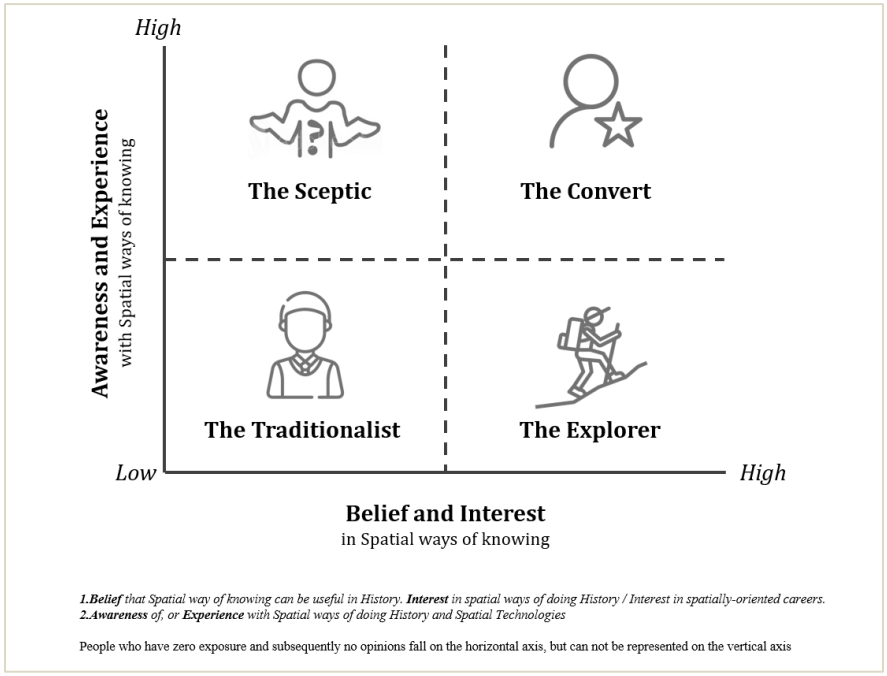

Figure 8: A typology of History students based on survey data

Each of the quadrants represents a particular type of student. The **Traditionalist** has low belief in spatial ways of knowing, has little or no exposure and isn't interested in acquiring any. They are rooted in the established methods of History and are satisfied with them.

The **Skeptic** has some exposure to spatial ways of knowing but remains unimpressed by this epistemology for History. Their exposure may be limited or flawed, or they may have had high-quality exposure. In either case, they have a rationale for why spatial ways of knowing are unsuitable for History. Depending on the quality of their exposure, their rationales may be valid or not. For example, a person may only ever have seen superficial spatial analyses or poor visualizations leading them to a belief that spatial ways are in general of no use. Or they may have tried spatial ways of doing history and have valid concerns about its applicability. In either case, they would be classified as Skeptics.

The **Explorer** has little to no real exposure to spatial ways of knowing. Yet they have an enthusiasm for it, because they can imagine the value of it, or on account of other life experiences. Explorers are willing to try spatial ways of knowing and doing History as well as spatial careers. They are open to possibilities but may or may not actively seek them out. If life events were to lead them to spatial ways of knowing, they may be likely to take them up.

The **Convert** knows quite a bit about spatial methods and has probably applied them on a real project already. They are convinced about its value for creating new knowledge and will seek out opportunities to work with spatial tools and technologies. They may also actively advocate for the use of spatial methods.

A fifth category would be people who have no awareness or exposure to the concept of spatial ways of knowing and subsequently do not hold any opinion about them. The whole idea is too new to them to have any beliefs one way or the other. They cannot be represented on the proposed quadrants. I label them "**Undecided**"

In the sample of 46 respondents, I would classify 8 as Traditionalists, 5 as skeptics, 18 as Explorers, 8 as converts and other 7 as Undecided. I anticipate that each of these types of students would have different expectations and response to how spatial ways of doing History is addressed in the curriculum. I explore this further in Chapter 10.

Reflections on Work and Employability in the Current Time

The question of work and employment must be seen in the larger context of the current times. There is a vast body of literature that explores the issue of work and employment in the current time, and key ideas revolve around the fluid nature of employment and how it impacts people's perceptions and readiness for work. A popular formulation of the environment is that there is widespread volatility, uncertainty, complexity and uncertainty, which transforms to the handy acronym VUCA. (Lemoine, Hackett and Richardson, 2017). The VUCA world stems from many geopolitical, economic and social realities. This situation is seen as driving people to multiple careers in a lifetime, leading to a need for lifelong learning and a constant need to accumulate credentials. Simultaneously, there are other complexities such as a need for interdisciplinary work and generational differences in how older and younger people approach work, technologies and social interactions. Almost all the analyses in this chapter can be interpreted from these broader contexts, and I explore some of these complexities in the final discussion chapter.

Summary

In this chapter, I explored the work and employment context for the History graduate in the context of the Spatial Turn. The analysis of the professional bodies in History, showed that some of them recognize the work and employment realities for History students, but offer no specific acknowledgment of spatial ways of knowing. The analysis of the jobs available showed that though there are academic jobs for the History graduate, there are a fair number of non-academic spatially oriented jobs, should the graduate be interested. The analysis of student perceptions and expectations of work showed that while many graduates hope to work in traditional academic positions, there are a sizeable number who would enthusiastically consider other possibilities rooted in spatial epistemologies. I also offered a typology of students based on two dimensions: their belief and interest in spatial ways of knowing, as well as their exposure to such technologies.

7: The Spatial Turn in History: Teaching and Learning

My primary research question, it may be recalled, is *What are the gaps between research, practice and higher education curriculum in the History discipline, with reference to the Spatial Turn?* In the last two chapters, I presented evidence and arguments to draw a picture of the knowledge that is being created as part of the spatial turn in History, and the practice opportunities present themselves to a historian skilled in spatial ways of knowing. In this chapter I turn to the curriculum element of the question, analyzing higher education curricula related to spatial ways of knowing. I review curricula and structured learning materials available to students in higher education and discuss how they relate to the spatial turn in History.

A curriculum is, in its most essential terms, an articulation of that which is going to be taught and learned in a given context. It is variously interpreted as content, reading materials, learning objectives, the activities involved in the teaching and learning, and the alignment to standards, among other things (Egan, 1978; Great Schools Partnership, 2014, Glatthorn et al, 2018). Curricula sometimes refer to what an individual teacher does within the scope of her or his class, and at other times refer to a broader, department or institution-level structure for a discipline. Curricula have also been characterized as explicit and hidden. The former refers to formally articulated and documented objectives, content, teaching methods and assessments. The latter refers to tacit experiences and messages a student is subject to in the learning process, which may influence the dispositions and motivations the student develops (Glatthorn et. al., 2018).

Traditionally, students were limited by the curriculum of the institutions they attended. In the current context, given the proliferation of online resources, online courses, and communities of learning, students have the option to choose what to learn and from which sources, in addition to what is offered by their institutions. Some of these available materials are formally structured, while others are not. Moreover, much of the available online material is not limited to those enrolled in formal programs but to anyone with an inclination to learn. The nature of learning itself has evolved to become an on-going process, driven by the needs of the learner, and extending beyond a grade or certificate awarded at the end of a course. Given all these factors, I interpret curricula both as structured learning within universities and institutions of higher education, as well as structured learning materials available elsewhere on the internet, which

may reasonably be used by students of History. By 'structured' I refer to the presence of a learning goal however broadly defined, a fixed duration, or a fixed scope of content, offered by either educators or professionals. By this definition, I exclude resources such as YouTube video tutorials and technical manuals. The former are useful for learning, but are usually not structured in the way I define it, while the latter are structured but aimed at usage, not broader learning.

Scope and Purpose of this Analysis

To analyze the current state of curricula in higher education with respect to the spatial turn in History, I use four sources of data. I describe below each dataset used for analysis.

- **Traditional courses within universities** This dataset draws on courses within History departments at universities in the US, UK and in Canada. The courses in the sample relates to spatial ways of knowing, and / or spatial tools. They are mainly undergraduate level courses, though some of the analyzed course outlines are at the graduate level. The course outlines, also called syllabus or course requirements documents, describe the goals of the course and outline the week-by-week progression of learning. By analyzing this dataset, I paint a picture of the curricular response within universities to the spatial turn in History.
- **Online courses, including Massive, Open, Online Courses (MOOCs).** This dataset includes online courses relevant to the spatial turn in History. These courses are not meant specifically for History students and are not even specifically intended for students in universities and institutions of higher education. They are open to anyone with an interest in the subject and are typically positioned as a steppingstone towards a professional, academic or personal learning goal. Despite this, they qualify as resources for tertiary education since the learners would have otherwise had to access universities, or resources meant for the on-going education of professionals. Through this analysis, I comment on the learning opportunities available outside the university and compare it with what exists within universities.
- **Other learning resources.** In addition to courses, structured self-study learning resources such as tutorials are also available to the history student. I look at a selection of such resources to assess what they offer historians with respect to spatial ways of knowing.

- **Prescribed course readings as evidenced in the Open Syllabus Project (OSP).** The fourth dataset I explore relates to prescribed course readings relevant to my inquiry. Information about course readings is typically contained within course outlines or syllabus documents. While it was not possible to access vast numbers of course outline documents for the first analysis, an opportunity presented itself to access prescribed readings from within course documents, thanks to the Open Syllabus Project (OSP). The OSP is a database of six million English language course syllabus documents from across the world. This project algorithmically picks, and reports prescribed readings from within these course documents. I analyze specific keywords in the OSP to identify the books and readings used in the last 10 years in the context of the spatial turn in History.

Each of these datasets is described in detail and analyzed in its own section below. Findings from across all four datasets are presented in the subsequent discussion section.

Traditional Courses within Universities

In this section, I draw upon courses related to spatial history that I accessed from university websites. To identify these courses, I followed a three-pronged approach. First, I conducted an open Google search for keywords such as “spatial history courses”, “Digital History courses”, “Digital Humanities courses” and “Historical GIS courses”. I identified courses that were listed in these results offered in universities in the US, UK, and Canada. Secondly, I revisited the universities that had spatial history labs or projects, as seen in Appendix E. I searched through the publicly available course listings on these university websites and documented all courses relevant to my inquiry, based on their titles and brief descriptions. Finally, I requested the experts that I had interviewed to direct me to course outlines that they or their colleagues may have with respect to spatial ways of knowing. Through a combination of these tactics, I was able to identify 55 courses of interest in the US, UK, and Canada. By further reviewing the available course descriptions I narrowed the list to 42 courses based on their relevance. The criteria used for the selection was that the courses had to address at least one of the following ideas: place, space, maps, spatial analysis, geo-spatial or visual-spatial tools. The identified courses were from the following universities: University of Toronto, McGill University, University of Saskatchewan and the University of Western Ontario in Canada; Harvard University, Stanford University, MIT, University of Columbia, University of Pittsburgh,

George Mason University, Bucknell University, University of Chicago, University of Virginia, and the University of Central Florida in the US; St. Andrews University in the UK.

I then attempted to access the full course outlines for each of the courses in the list. This was not a uniformly successful activity. While some course outlines were available publicly in their full form, others had only brief descriptions available publicly. Several of the courses had accompanying course websites, offering a rich insight into what the course was about and how it was conducted. However, only some of these companion websites were accessible, while others were either not available publicly, or were archived at the current time. Among the courses that had brief descriptions, some still offered insight into what the aims and objectives of the course were, while others offered little to no information relevant to my inquiry. Writing to individual universities and professors requesting course outlines had mixed results, with some responding enthusiastically and sharing their course outlines while a majority did not respond to the request. In effect, I was finally able to access detailed curricular information for ten courses.

In the interests of confidentiality, I will not be revealing the exact names of the courses, the universities or the instructors in my analysis. This decision was taken with the following rationale: Though the course outlines are publicly available, the course instructors did not intend them to be available for a scrutiny such as this research (unless they were listed as part of a teaching portfolio). Therefore, I retain the anonymity as a matter of professional courtesy. The Open Syllabus Project, which also analyzes course materials publicly available on the Internet, similarly anonymizes the authors of the particular syllabi. A summary of the analyzed courses is presented in Table 6 below. The full list may be seen in Appendix F. The course names are approximations of their original names. The program column indicates the intended audience for the course – whether they are undergraduate or graduate-level courses. The third column specifies the department offering the course, while the fourth specifies the subject orientation of the course classifying it as specifically spatial or more broadly digital. The next two columns summarize the course formats and assessments. The seventh column describes whether the course primarily addresses ideas and concepts related to spatial ways of knowing or if the course is more oriented towards specific tools and technologies. The last column classifies the courses as being either for beginners or for those who already have some grounding in the subject.

Course	Level	Dept	Subject Focus	Teaching format	Assessments	Concept / Tool Focus	Level
Spatial History M Litt.	G	Hist.	Spatial History	Seminars, fortnightly tutorials and practical classes	M Litt. Dissertation	concept	Inter-mediate
Intro to HGIS	UG	Hist.	Spatial History	Seminar, Lab	projects, participation	concept, tool	Beginner
Intermediate HGIS	UG	Hist.	Spatial History	Seminar, Lab	Projects, participation	tool	Inter-mediate
Mapping History	G	Hist.	Spatial History	Seminar, skills workshops, practical work	participation, Deep maps, paper	concept	Inter-mediate for History, Beginner for tool
Digital History (1)	G / adv. UG	Hist.	Spatial History	Seminar, Projects	participation, blog posts, toolkit exercises, project portfolio	concept	Inter-mediate
Spatial analysis of the past	UG	Hist.	World History	Seminar, exposure to tools	Participation, weekly writing, project	concept	Beginner
Digital History (2)	UG	Hist.	Digital History	Seminar, lab	tool based assignments	concept, tool	Beginner
Digital Humanities (1)	UG	Hist.	Digital History	Lecture and discussion with exploration of tools	assignments, essay, class presentation, final exam	concept	Beginner
The Spatial History of Cities	UG	Lang uages	Spatial History	Spatial Concepts, Exploring ArcGIS	Project	concept, tool	Beginner
Digital Humanities (2)	UG	Hist.	Digital History	Using technology for History	Reflection Essays, Project	concepts about tools	Beginner

Table 6:A sample of courses relevant to Spatial History

In this pool, the first listed 'course' is, actually an entire program comprising multiple courses. However, details of individual courses are not available on the university website. I have therefore considered it as a single unit in this analysis, assessing the program's goals and approaches. As may be seen from the table, seven of the ten courses are undergraduate level beginner courses. All of them focus on the technology to some degree, with the objective of exposing students to the tools that drive the spatial turn. All of them are also firmly rooted in the context of a historical problem or inquiry, intertwining the study of history with the use of a new method to study it. The emphases, however, vary. The Introduction to HGIS course, for example, teaches the use of ArcGIS within a History context. In this course, the main learning goal is certainly not the mastery of tool. Yet, the structure of the course provides equal weight to learning technology-specific material, as well as spatial history material. For example, in each of the thirteen weeks, one part of the class is dedicated to exploring History related questions and readings while the other half is dedicated to hands-on work with the technology, in this case ArcGIS. The *Spatial History of Cities* course, places the tool center stage. The History component allows students to get the context for a historical problem, and they are then taught to analyze it using ArcGIS. The *Spatial Analysis of the Past* course is technology agnostic. The course emphasizes spatial analysis but leaves it to the student to choose a preferred tool, depending on the nature of the analysis they undertake in the class. The course offers them the option, for example, to submit a Neatline or Storymap[5] digital publication, a printed static map or even a term paper reporting data and analysis derived through spatial tools. The course instructor clearly states, "I will accept a wide variety of approaches so long as your work reflects spatial thinking, it is about an era in the past, or change over time, and it touches a global or transnational theme". The graduate course *Mapping History* also falls in the technology-agnostic category. It emphasizes the study of both historical maps and maps made by historians. It does not mention any tool or mapping technology to be used or studied but expects a final project in the form of a "deep map". Deep maps in this context refer to annotated maps that enhance the richness, and therefore depth of the map by providing more context in the form of words, pictures, other data or artifacts. The students are not expected to have any prerequisite skills with any technology, and a "skills workshop" is included as part of the course.

[5] A simplified spatial tool from ESRI that allows users to create a story based on a combination of spatial data, maps, images and text

Other courses with a broader digital history orientation explore spatial ways of knowing as a subset of other digital approaches to doing history. These courses typically use some of the 13-week schedule to specifically study geospatial or visual-spatial approaches to doing history. The other weeks are dedicated to basic skills such as reading and editing HTML and JavaScript and learning to use version control software, or more discipline-specific skills such as corpus analyses, representing oral history and so on.

The undergraduate courses that teach the use of technology skills start at the very basic computer-related skills—sometimes as basic as how to save files and ensure work is not lost. The experts I interviewed clarified why this might be the case, based on their teaching experiences. Students, especially younger ones, are adept at using interfaces, but they have no knowledge of how data and information are stored and managed beneath the interface. This makes it difficult for them to understand how to organize and manipulate data (NF, personal communication, June 2019). One of the courses in this data set even includes a professor-authored rhyme in the tune of Hokey Pokey, to remind students how to save their ArcGIS work. The tools themselves—especially ArcGIS and QGIS—aggravate the problem on account of their architecture. Expert NC explained that the file and folder structures in these tools can seem particularly impenetrable to students who have no mental model of file storage architectures in software. It seems completely valid therefore to dedicate course learning time to such technology basics. However, it seems to come at the cost of lesser time being available to address issues of analysis specific to History.

The teaching and assessment approach follow a predictable model in most of the courses, using a combination of class discussions based on readings, lectures and hands-on project work. Some courses dedicate time each week to hands-on work, while others introduce them periodically. The graduate-level courses and two of the undergraduate courses appear to leave the hands-on work to the students' time and self-study, offering at best one workshop during the course. A term paper is a popular assessment strategy. Given that writing is central to History scholarship, a written paper is not only in keeping with a disciplinary tradition but is actively positioned as a key skill to be developed for a historian. The writing element is further supported through assessment tasks that require students to create blog posts, weekly reflections, summaries of readings, and other forms of written expression.

Projects, either individual or groupwork-based, is the other recurring assessment option. The projects vary in scope and depth, but typically involve creating an artifact to demonstrate the learning objectives of the course. One course uses a unique grading mechanism. The professor lists a series of increasingly complex assessment tasks in the course outline. Completing more complex tasks results in higher grades, though each task itself is marked simply as pass or fail. The students can choose which grade they will aim for, and complete only those tasks that suit their grade objectives. Interestingly, this assessment and grading model has been inspired by courses that teach technology-related subjects, and the professor acknowledges its origins in the course outline. I argue that this is an example of cross-disciplinary influences in curricula. Not only does the subject matter cross disciplinary boundaries, but pedagogical approaches cross them as well. The teaching and assessment approach in these courses borrow ideas occasionally from other disciplines when it comes to project work but are firmly rooted in the traditional pedagogical practices of History when it comes to writing. All other assessments in these courses follow traditional university models of teacher-assigned grades, with or without rubrics.

As part of my inquiry, I attended a workshop on GIS intended for a general audience. This was conducted by a geography department at a Canadian University and was intended for a general audience. My aim with the workshop was to better understand geospatial technologies and to evaluate the nature of learning that a historian may potentially need to undertake. I discuss my findings related to the technology learning in Chapter 8. Here, I add my reflections on the teaching format of the workshop. The workshop was conceptualized completely as a "lab-based course". It was physically conducted in a GIS lab, a room full of computers capable of running GIS software. This was a justifiable choice since the focus was GIS technology, as applicable in multiple contexts. The one-week workshop could be taken as a two-day, three-day or five-day module, with each passing day adding a layer of complexity in the tool use and customization in the data used for analysis. The last hour of each day was dedicated to a lecture-demonstration by experts in different fields who use spatial ways of knowing in their work. The experts, while largely from the geography department, had done a variety of work in environmental studies, urban development and even History. This helped the participants appreciate the various contexts in which GIS could be used. As such, the structure of the workshop offered a lot of flexibility to a heterogeneous audience. My reflections concern the pedagogical opportunities and challenges of a lab session.

The goal of each session was to create a hands-on artifact, or analyze some data using QGIS, an open-source geospatial tool. Despite having extremely detailed documentation, well-organized data, and ready teaching assistants for individual support, the student group found it quite difficult to follow along with the sequence of actions required to make the tool accomplish what was intended. My own assessment of this situation is that since the audience lacked a mental model of what they were trying to accomplish in spatial analysis terms, it became difficult to complete tasks without blindly following instructions in the manual or the demonstration of the professor. For example, getting data ready for analysis involves a specific set of steps. Each of these steps requires the understanding of a different concept to appreciate why that step is necessary, or why it needs to be done in that particular way. For example, without truly grasping the idea of projections, it is difficult to understand why one needs to select "Projection XYZ" from a drop-down menu in order for the data to work. It is impossible likewise to understand what a particular error message means or how one may recover from the mistake of not having selected the correct projection. Therefore, I argue that conceptual understanding of spatial analysis is a prerequisite to both learning how to use a spatial tool and to understand any analysis done using such methods. I discuss this further in Chapter 8 Tools and Technologies.

I next review the structured opportunities available online to historians to learn competencies related to the spatial turn.

Online Courses, Including MOOCs

To evaluate self-directed learning opportunities available to historians, I identified two categories of resources: online courses and Massive Open Online Courses (MOOCs). In this context, by online courses, I refer to those courses that are offered by professional bodies, aimed at specific learning outcomes and which most often result in certifications of some kind. They often need to be paid for, though free courses also exist. Assessments in these online courses are sometimes completely online, and at other times offered as a non-virtual proctored exam. MOOCs on the other hand, as the name suggests, are open to a very large number of students to take up simultaneously. MOOCs sometimes follow either a timed approach, with specific start and end dates to the course. In this case, each offering of the course has its own student cohort. Increasingly MOOCs take a self-paced approach where students can start a course at any time

and finish it at their own pace (Shah, 2015) The distinction between regular online courses and MOOCs increasingly hinges only on the massiveness and reach of the courses. MOOCs tend be 'massive', on account of hundreds or thousands of students enrolled in the course, but many MOOCs are no longer 'open', in the sense of being completely free. While most MOOCs are free to audit, they have a paid component to complete assignments and receive a certificate. In 2018, Coursera, a MOOC platform with 37 million registered users earned $ 140 million in fees-based revenue (Shah, 2018). On account of this diminishing distinction, I analyze both types of courses together. For ease of reading, I will use the terms online courses and MOOCs interchangeably in this dataset.

To identify the online courses relevant to spatial ways of knowing, I used an open Google search as well as platform-specific searches. I did not restrict the courses based on my geographical boundary of the US, UK, and Canada since courses are globally available and students from these countries could well learn from courses that originate from countries anywhere in the world. However, I did restrict my search to English language courses. Since such courses are a phenomenon of only the last ten years, it included all courses without consideration for my temporal boundary of 2005-2019. A substantial part of my search was conducted on Class Central, a MOOC aggregator and analysis platform that has been in operation since 2011, from almost the same time that MOOCs first became available. Class Central labels itself the "#1 MOOC Search Engine" (Class Central, 2019). By using Class Central, I was able to simultaneously search across course multiple platforms as well as independently offered courses, since the Class Central search engine indexes all such courses. I used the following keywords to find, sort and select the online courses to include in the dataset: Spatial, ArcGIS, Data visualization, ESRI, Google Earth, Tableau, and R. I also searched the ESRI and Tableau platforms individually for any other structured courses they offered.

From these results, I reviewed the titles and course summaries to determine if the course was relevant to my inquiry and might reasonably be a learning resource for a history student seeking to learn about spatial ways of knowing. In order to do this, I selected courses that were oriented towards the social sciences and humanities, and more specifically those that were specifically about history or related disciplines such as archeology. With courses that were relevant but more technology oriented, I chose those courses that were at a beginner level, designed for non-specialists, and did not call for specific prerequisite competencies. The

rationale was that a non-technical person such as a typical History student would be able to take the course and benefit from it.

Based on these criteria, I identified 82 MOOCs from multiple platforms. ESRI has a suite of 575 courses at all levels, of which 175 were online. Of these, I selected the 29 courses that were free and of a general nature, more suitable for a wide audience. Tableau also offers online courses, but these are far fewer than those offered by ESRI. Moreover, the Tableau courses are offered via a subscription model and do not have courses in the same format as the others in the dataset. After filtering for these criteria on these platforms, the dataset comprises 82 MOOCs from multiple platforms and 29 courses from ESRI. The five MOOCs offered by ESRI are considered a part of the MOOC dataset and not as part of the 29 ESRI courses.

The complete listing of the MOOCs and courses may be seen in Appendix F. I present below some highlights from this dataset. The MOOCs were offered both by Universities and commercial entities. Of the 82 MOOCs, 69 were offered by Universities. Five were offered by ESRI, three by Udacity, two by Microsoft, while iversity, IBM and PricewaterhouseCoopers (PwC) offered one each. Of the 69 courses offered by academic institutions, the University of California Davis had the highest share of 10 courses. The Indian Institute of Technology had eight courses in the dataset, though the courses came from three of its campuses in Rourkee, Kharagpur, and Guwahati. The Knight Center for Journalism in the Americas at the University of Texas offered four of the courses, as did New York University (NYU). Arizona State University, Delft University of Technology, Ecole Polytechnique Lausanne, and University of Toronto had three courses each. Harvard, University of Michigan, Duke University and University of Illinois had two courses each in the data set. The other 23 courses in the dataset came from 23 different universities. The geographical spread of the courses by country of origin may be seen in Figure 9 The US heads the list, being the country of origin for 56 of the 82 courses. Canada has four courses while the UK has 2. However, as mentioned before, in the case of online courses, the country of origin does not limit its access to students and while important, is less relevant than other indicators.

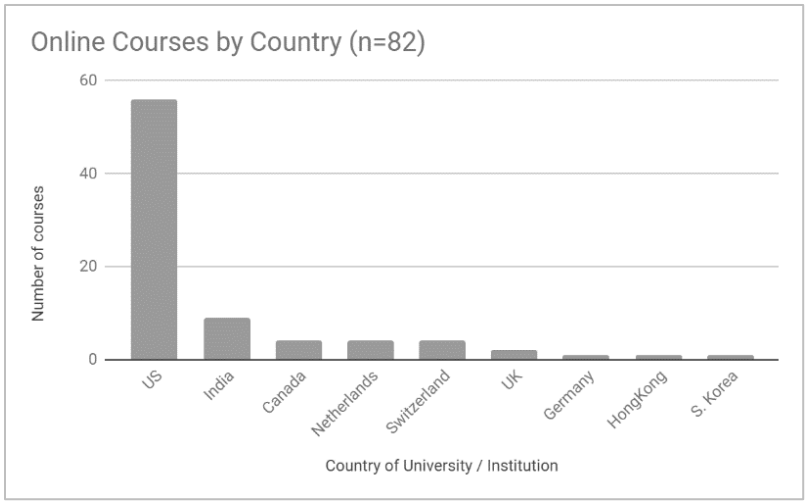

Figure 9: MOOCs by country of origin

The most common course duration for MOOCs is four weeks, followed by the six-week format. A sizeable number of courses also adopt the five-week and the eight-week format. This is in contrast to University courses that typically follow a semester-long schedule of 12 to 13 weeks. It follows therefore that online learning is designed for shorter cycles of learning. This is a conscious design decision, given that the courses are taken by people who are likely to be significantly occupied by non-course related life activities. Multiple short cycles are also better suited to attract students who want immediate access to learning and may not be able to wait several months for the next class cycle to begin. (Shah, 2013)

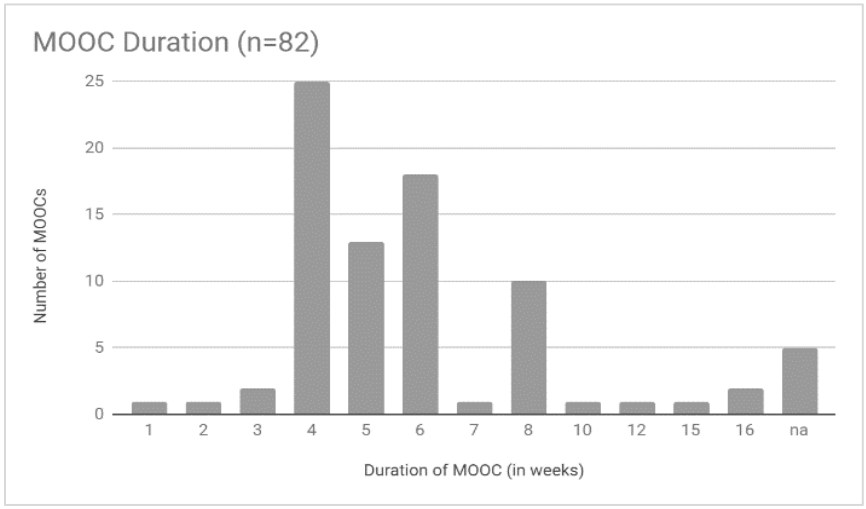

Figure 10: MOOCs by duration in weeks.

Coursera was the platform that hosted the maximum number of courses (37) with EdX hosting 12 and independent platforms accounting for 10 courses. The Indian government's

SWAYAM portal for higher education in India accounted for 9 courses. Coursera is commercially owned and operated, while EdX is a non-profit, while SWAYAM is government-owned. Coursera and EdX both began as campus initiatives, the former originating out of Stanford and the latter out of Harvard and MIT. Both began in 2012 with the aim of providing a broader population access to college courses online. Both have evolved slightly differently, however. Coursera is currently a for-profit platform while EdX and its offshoot Open EdX remain non-profit. This difference has not affected the kinds of courses hosted on both platforms, which currently include courses by universities, commercial entities, and other policy, advocacy or professional bodies. For the purposes of this inquiry, there is no substantial difference between the two in terms of courses they offer. SWAYAM, on the other hand, is run by the Indian Ministry for Human Resources Development, with the aim of making learning accessible to everyone in India. All courses are free, but obtaining certificates requires students to attend proctored in-person exams conducted in India. In this respect, the SWAYAM courses are distinctly different from the other platforms in this dataset. Effectively, a student in the US, UK or Canada may take a SWAYAM course but is unlikely to be able to get a certificate.

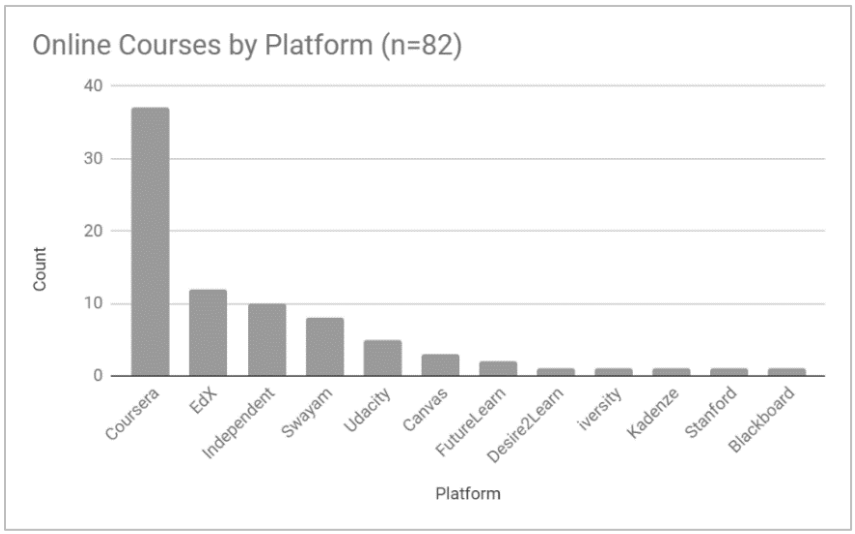

Figure 11: MOOCs by platform

I next reviewed the popularity of the courses as evidenced by ratings, reviews, and enrollment. The MOOCs provide data about their popularity and perceived quality in terms of a five-point (star) rating. Information about the enrollments and ratings of MOOCS may be seen in table 7. The average rating must be seen in conjunction with the number of reviewers. Normally, higher the number of reviewers, the more valid is the average rating is likely to be. However,

rating and recommender systems are growing more complex on account of more sophisticated algorithms. Ratings may be weighted by recency, the rating history of the rater, whether the rater was a verified user of the product and so on (Mastakis, 2019). It would be simplistic to treat the ratings as raw averages, but the platforms themselves do not expose the exact ways in which the ratings are derived. Mastakis argues that in general, platforms have the interests of their users in mind when determining the rating. Though Mastakis speaks in the context of Amazon's rating and recommender systems, similar systems have been proposed and user-centric arguments made for MOOCs (Zhang et.al., 2018). I, therefore, reason that the ratings, while not indicative of an average, and though not disclosing the nature of its weighted calculations, is still a valid and useful measure of the course's popularity.

Reviews relate to written comments in addition to the star-based rating. They provide a richer context for the rating. In this analysis, I have not undertaken a content analysis of the review comments, but determined popularity based only on the number of reviewers and ratings. The last column in Table 7 indicates the number enrolled in the course. Table 7 shows only those courses in the dataset that have an enrollment of over 10,000 students. It must be emphasized, however, that the enrollment and rating information was not uniformly available for all the courses. Only 31 of the 82 courses included this information. Courses for which this information is not available have been classified as "Data not available" (indicated as NA) for this measure. In spite of this missing data, I am confident about the popularity due to the following rationale: Courses with high enrollments and popularity tend to advertise the fact, considering they contribute to marketing the course and optimizing it for search engines.(Pickard, 2019) Therefore it is reasonable to conclude that the other 51 courses in the list that do not advertise their enrollments do not have enrollments exceeding 10,000.

Course	Provider	Platform	Average Rating	No. of Ratings	No. of reviews	No. enrolled
Analyzing and Visualizing Data with Excel	Microsoft *	EdX	NA	NA	NA	771636
Data Visualization and Communication with Tableau	Duke Univ	Coursera	4.7	2000	423	117281
Applied Plotting, Charting & Data Representation in Python	Univ. of Michigan	Coursera	4.5	3130	513	74513
Fundamentals of GIS	UC Davis	Coursera	4.8	2723	753	68904

Data Visualization	Univ. of Illinois UC	Coursera	4.5	812	188	63543
Fundamentals of Visualization with Tableau	UC Davis	Coursera	4.4	2443	501	57316
Data Visualization with Advanced Excel	PwC *	Coursera	4.8	1804	263	48667
Data Management and Visualization	Wesleyan	Coursera	4.4	699	195	48116
The Brain and Space	Duke	Coursera	4.7	259	71	28521
Data Visualization: A Practical Approach for Absolute Beginners	Microsoft *	EdX	NA	NA	NA	22014
Essential Design Principles for Tableau	UC Davis	Coursera	4.5	1003	151	20008
GIS Data Formats, Design and Quality	UC Davis	Coursera	4.9**	1182	222	19659
Visual Analytics with Tableau	UC Davis	Coursera	4.5	899	199	18390
Geospatial and Environmental Analysis	UC Davis	Coursera	4.8	705	137	16756
Creating Dashboards and Storytelling with Tableau	UC Davis	Coursera	4.6	469	82	15904
Visualizing Data with Python	IBM *	EdX	NA	NA	NA	14023
Maps and the Geospatial Revolution	Penn State	Coursera	4.7	140	48	12745
Understanding and Visualizing Data with Python	U Michigan	Coursera	4.6	239	53	10952
Imagery, Automation, and Applications	UC Davies	Coursera	4.9 **	406	78	10948
Prediction X: John Snow and the Cholera Epidemic of 1854	Harvard	EdX	NA	NA	NA	10172

Table 7: MOOCs in the dataset with over 10,000 enrollments

** Commercial providers ** Highest rated course*

The MOOCs in the dataset are dominantly technology-centric in that they focused on learning a particular tool, or analysis process in addition to underlying concepts for the technology. However, 18 of the 52 courses demonstrated a focus that put technology in a secondary role, similar to the courses analyzed in the University courses section. Examples of such non-technology centric courses are: *The Brain and Space; Maps and the Geospatial*

Revolution; Vernacular Architecture; GeoHealth: Improving Public Health through Geographic Information; The Location Advantage; Sagas and Space - Thinking Space in Viking Age and Medieval Scandinavia; Architecture 101 - Part I: From Nothingness to Place; Rethink the City: New Approaches to Global and Local Urban Challenges; Exploring Humans' Space: An Introduction to Geographicity; Urban Design for the Public Good: Dutch Urbanism; Intro to Mapping and GIS for Journalists; How to Find Great Stories in Data; Prediction X: John Snow and the Cholera Epidemic of 1854; Introduction to the Natural Capital Project Approach; Data Visualization for Storytelling and Discovery; Crafting Data Stories; Information Visualization: Applied Perception.

I next review the online courses available on the ESRI website. These 29 courses do not describe the course duration in weeks but in the number of learning hours/minutes. These are much smaller, self-paced modules. The longest course in the ESRI pool is 5.5 hours of learning with the shortest being 50 minutes. The most popular course is *Getting Started with GIS*, a 3.5-hour course with 25900 raters and an average rating of 4 stars. The next most popular course is *Getting Started with ArcGIS Pro* with 6375 raters giving it an average score of 4 stars. Evidently, the ESRI courses are specifically about ESRI products and geo-spatial analysis as practiced with ESRI technologies. However, there are some courses that address the broader scope GIS and its uses. Examples of such courses are: *Using GIS to Solve Problems, Getting Information from a GIS Map, Exploring GIS Maps, Telling Stories with GIS Maps, Teaching with GIS: Introduction to GIS in the classroom*. Interestingly, ESRI also offers a one-hour course titled *Putting your GIS Skills to Work* which outlines the career options for someone with geo-spatial skills. The course provides an overview of the GIS job market, lists the basic technical jobs, and includes interviews with GIS practitioners. It also demonstrates what a GIS job posting looks like and where one might search for jobs related to GIS. None of this is specific to any particular discipline. However, the course does list sample courses that one might take in college that could form the basis for a career in GIS. Among such possible college courses are examples such as *Introduction to geospatial technology* and *Cartographic design and visualization*. Nine of the 29 courses in the ESRI course set are specifically aimed at preparation for certification exams. They offer "sample questions" for ESRI Technical Certification Exams. In all, it may be said the ESRI courses are focused, short term undertakings with very specific outcomes, as compared to the MOOCs analyzed earlier.

In this section, I described and analyzed online courses and MOOCs relevant to the spatial turn. In the next section, I consider other online resources available to history students to learn spatial ways of knowing.

Other Online Learning Resources

Other online learning resources, as conceptualized here, refer to structured learning materials, typically in the form of tutorials. I draw this data set from two sources: The *programminghistorian.org* website and the *geospatialhistorian.org* website. These are repositories of digital and spatial analysis learning materials specifically aimed at historians.

The Programming Historian is a website founded in 2008 by William J. Turkel and Alan MacEachern, both professors at the University of Western Ontario. (Programming Historian, 2019). As the name suggests, the website was initially focused on supporting Historians with programming by publishing peer-reviewed resources. Over time, the tutorials on the website have included a wide range of materials including geospatial analysis, visualization, and data management. The website's aim, as described on the site is to "publish novice-friendly, peer-reviewed tutorials that help humanists learn a wide range of digital tools, techniques, and workflows to facilitate research and teaching" (Programming Historian, 2019). The website lists 80 lessons available in English, under five heads—Acquire, Transform, Analyze, Present and Sustain – which encapsulate the typical workflow for any digitally oriented work. Of these 80 lessons, 11 are specific to geo-spatial and visual-spatial work. These lessons and tutorials are programming focused within the context of History. Examples of these lessons include: Using geo-spatial data to inform historical research in R; Using JavaScript to create maps of correspondence; Creating mobile augmented reality experiences in Unity; Visualizing data with Bokeh and Pandas, and so on. In all these lessons, the focus is firmly on learning to accomplish technical, programming tasks with historical datasets. All material on the Programming Historian website only addresses open-source tools and technologies. The lesson materials themselves are also provided under a Creative Commons Attribution license, which allows others to freely share and adapt these resources (Creative Commons, 2019). Another website, with a similar but narrower focus is the geospatialhistorian.org. The lessons on this site are very specifically oriented towards geospatial technologies, specifically Google Map, QGIS and ArcGIS. Some of these lessons are also available on the Programming Historian site, as they are authored by the

creators of geospatialhistorian.org. The website also links to a list of geospatial projects and offers advice on how to find geospatial data to work with. To that extent, the geospatial historian takes into account other needs of a spatial history student or scholar – needs that are prerequisites to actual programming or manipulating of data.

The small pool of recurring authors at the intersection of programming, spatial technologies, history, and the teaching of it all, indicates that this is a niche area that may still be evolving.

Prescribed Course Readings as seen in the Open Syllabus Project

The last set of data I consider is the course readings results from the Open Syllabus Project (OSP). The OSP is a database of six million course outlines or syllabus documents dated till 2017. The assigned readings in these course outlines have been algorithmically extracted and may be explored through the OSP web interface. The course documents themselves are not accessible through this interface and are not available in any format at the current time.

The OSP is affiliated with The American Assembly, a non-profit organization within Columbia University, with an aim of supporting "educational research and novel teaching and learning applications" (Open Syllabus Project, 2019). The project collects course English language syllabi both through web scraping as well as through contributions from individuals and institutions. The applications algorithm 'counts' the number of times specific readings appear in the syllabi and assign them a ranking score. As of the current time, the algorithms cannot distinguish between primary and secondary readings and nor can they provide any other details about the syllabi themselves. This project became opportunistically available towards the end of my data collection and was not part of the original design. However, since it had the capability to offer some insights into the nature of syllabi, I decided to include this data as well.

The OSP offers a search and filter interface. I was able to search for keywords in the reading titles and then filter by Subject (History), country (US, UK, and Canada) and time period in which the class was taught (2005-2017, since data exists only till 2017). For each title in the OSP, it is also possible to see other texts that are most often assigned with the initial title. I, therefore, conducted a second level of search and filter with the co-assigned readings. The keywords I used were 'spatial', 'spatial history' and 'maps'. I present the complete findings in Appendix G: Assigned Readings.

The data from the OSP must be interpreted with caution on account of its data collection mechanisms. Currently, course outlines that are publicly available for scraping on the web are privileged, as are documents submitted by individuals and institutions. There is no guarantee of equal representation from different regions, and neither is it possible to say if all varieties of universities are represented. It is therefore imprudent to generalize from this data set for my inquiry, in spite of the overall dataset being so large. For very general readings, this lack of representation may not be such a limitation. For example, the most popular book in the OSP database is William Strunk's *Elements of Style*, closely followed by Diana Hacker's *A Writers Reference*. Their broad applicability, in addition to their high count in a large dataset, lends itself to a valid generalization that they are the most widely prescribed texts. However, when researching niche subjects such as the one in this inquiry, the lack of representativeness in the sample may paint an incomplete picture at best and an inaccurate one at worst. Despite this limitation, it is still worthwhile to consider what texts are being taught with respect to the spatial turn in History. It is only not possible to form any generalized conclusions from them.

Through a combination of searches on OSP, I identified 23 readings in all that related to the spatial ways of knowing, and which were popular in History courses in the US, UK, and Canada. The top ten of these readings are presented below in Table 8, in order of popularity. The table indicates the title of the prescribed reading and the authors. It also indicates the overall number of times it appears in the OSP database, and the number of times it appears in History syllabi. Finally, it shows the countries in which these books are prescribed.

Title	Authors	Appear-ances	Appearances in History courses	Geographical presence
Digital History: A Guide to Gathering, Preserving, and Presenting the Past on the Web	Daniel J. Cohen, Roy Rosenzweig	217	101	US, UK, Canada
Maps of Time: An Introduction to Big History	David Christian	106	71	US, UK, Canada
Time Maps: Collective Memory and the Social Shape of the Past	Eviatar Zerubavel	68	44	US, UK
The New Nature of Maps: Essays in the History of Cartography	J. B. Harley, Paul Laxton	55	23	US, UK
The Spatial Turn: Interdisciplinary Perspectives	Santa Arias, Barney Warf	68	21	US, UK

Title	Authors	Appear-ances	Appearances in History courses	Geographical presence
How to Lie With Maps	Mark Monmonier, Mark S. Monmonier	333	19	US, UK, Canada
Maps and History: Constructing Images of the Past	Jeremy Black	25	17	US, UK
Rereading the Maps of the Columbian Encounter	J. Brian Harley	20	14	US, UK
Computers, Visualization, and History	David J. Staley	23	12	US
Past Time, Past Place: GIS for History	Anne Kelly Knowles	35	11	US, UK

Table 8: Top ten readings for keywords related to the spatial turn in History, on the Open Syllabus Project

A large difference may be seen between a title's total number of appearances vis-à-vis its appearances in History syllabi. The other appearances are typically in disciplines such as geography, or in other humanities subjects. In fact, it is interesting that a book completely rooted in spatial History, such as Knowles' *Past Time, Past Place: GIS for History* has been prescribed most often outside of History. Another book by Knowles, along with co-author Amy Hillier *Placing History: How Maps, Spatial Data, and GIS Are Changing Historical Scholarship*, has even fewer counts in History (4) while it has 27 counts in all subjects combined. This book does not make it to the top ten listed in the Table 8, but may be seen in Appendix G, Assigned Readings. Other spatial history books such as Geddes and Gregory's *Toward Spatial Humanities: Historical GIS and Spatial History* appear just two times in History and four times in all. Ell and Gregory's *Historical GIS: Technologies, Methodologies, and Scholarship* appears five times in History syllabi but 11 times overall.

The data regarding prescribed readings, despite the cautious interpretation it demands, shows that spatial history tends to be an interdisciplinary undertaking. Readings related to spatial history appear more in non-History disciplines, and spatial history as an independent field itself is very niche. More insight may be generated through this line of inquiry when more courses become available in the database, or when more data from each syllabus, beyond the prescribed readings, can be accessed. This may become possible in future iterations of the OSP.

In this section of the paper, I described and analyzed four sources of data: courses offered in university contexts, courses offered online, including MOOCs, other online learning

resources, and prescribed readings in courses as described by the Open Syllabus Project. I now discuss some themes that run across the datasets.

Discussion

In this section, I discuss the curricular analyses along three axes: The teaching of history vs the teaching of History methods; the teaching of ideas and concepts vs. teaching tools; and learning in preparation for work and employment

The Teaching of History Vs. the Teaching of History Methods

Reflecting on "ways of knowing" or the "ways of doing" a subject, is a meta endeavor. Boon and Van Baalen (2019) call this metacognitive scaffolding and argue that knowledge is indelibly shaped by how it is constructed. Though Boon and Van Baalen speak in the context of science-based disciplines, it holds true, in my opinion, to all disciplines, including History. Reflecting on one's disciplinary epistemologies ought to be part of the curriculum for any discipline. The most common route disciplines take towards metacognitive reflection, is through "methods" classes as part of the curriculum. Well-designed methods courses would ideally address not only how to study the discipline, or the method, but also reflect on the ways in which that method constructs knowledge. Methods in History, however, are not addressed in the same way as they may be in the social sciences. In History, teachers and researchers tend to discuss historiography, not methods. Historiography is a meta concept referring variously to the history of history, philosophy of history, theories of history, ways of knowing about the past, as well as the body of knowledge created about the past through a specific inquiry (Vann, 2018). It may involve reflection on a theory of knowledge for History, but its scope is usually far larger than that.

There is limited emphasis within History programs on teaching methods or ways of doing history independent of the specific historical subject being studied. It is possible that history courses about a particular geography (for example Latin America) or theme (Feminist History) embed a method of doing history (for example, spatial history) within those courses. The method of spatial history or the use of spatial tools happens in conjunction with the study of history itself. My search strategy was aimed at identifying those courses that explicitly taught a method or a spatial tool, and that pool was not very large, as seen in the analysis. However, I assert that though there is a possibility that a regular history class teaches spatial methods, that volume is

unlikely to be large. I base this assertion on the patterns of spatial history research, on the structure of history departments, as well as the job advertisements that call for teaching faculty at universities—all of which were analyzed in previous chapters. None of this data makes a case to demonstrate that spatial history is being taught within regular history courses. Where spatial ways of knowing are being taught in universities, it is part of courses such as those that I have analyzed. The data from my interviews also strongly suggests that spatial history or digital history tend to be concentrated in a few pockets. The professors doing spatial history no doubt specialize in a region or theme, but they spend a significant part of their energy considering the ways in which they adopt spatial ways of knowing.

Teaching Ideas and Concepts vs. Teaching Tools

University courses in my dataset tended to focus on teaching ideas and concepts related to spatial history, the spatial turn or spatial ways of knowing. The teaching of the tool was secondary in all instances but one. However, in the case of the online courses, MOOCs and other learning resources, the thrust was more strongly on learning the use of a tool; Only 18 of the 82 courses placed primary importance on ideas and concepts. None of the other online learning resources addressed ideas and concepts at all. I conclude therefore that curricula within history departments are structured with a different focus, than online courses, even those offered by universities themselves. I argue that the affordances of online courses, and the heterogeneous audience they cater to, tends to make them technology-centric in nature. It stands to reason that an online course meant for a large unknown audience is better off being as context-free and tool focused as possible.

Teaching spatial history in a university context poses pedagogical challenges. Lincoln Mullen of the George Mason University offers a summary of such challenges on his blog. Mullen is a History professor and digital methods teacher and offers an experience-based analysis of the practical problems of teaching digital history. I find Mullen's observations valid in the spatial history context, both with geo-spatial and visual-spatial analysis. Mullen recommends that digital history assignments are best tied in with course material in such a way as to generate historical insight. He recommends that the assignments allow for both individual and group work and the opportunity to intertwine traditional history work with digital history work. He further recommends that it is best to start an assignment with a "major wow factor" but that the assignment should then ensure that it teaches "mechanics of digital work and critical

thinking" (Mullen, 2015). His observations on how to approach the technology itself is valid and is reflected in some of the courses analyzed here. One of his key recommendations is to keep the assignment tool agnostic. As he humorously puts it, "students should learn the principles of digital work instead of which levers and knobs to operate on the Google dingus that is about to be canceled". Even more relevant is the distinction Mullen makes between "necessary complexity (which requires scholarly insight) and incidental complexity (putting up with the cruft around technology)" (Mullen, 2015). Given that incidental complexity cannot be completely avoided, it becomes more important to find means and techniques to reduce it substantially for learning to happen.

My own experiences with learning the tools as described earlier in the chapter also exposed the tension between learning ideas and concepts on the one hand and learning to use a tool on the other. In addition, the incidental complexity is so high that one can only accomplish the most basic tasks. This combination of factors precludes the necessary complexity of in-depth analysis, scholarly insight or critical thinking.

The courses analyzed demonstrate that history professors tend to follow the overall approach advocated by Mullen to combine ideas, concepts, and tools. There is not enough information in the dataset to comment about the extent to which the courses provide a "wow factor" but they do emphasize the mechanics of working with a tool and the ability to think critically about the subject. These insights are as applicable to online courses as they are to regular courses. However, there is not a uniform amount of data regarding the content and flow of the courses to comment about how they compare with Mullen's recommendations for teaching digital ways of knowing for History.

Learning in preparation for work

Curricula are sometimes aligned to explicitly stated learning outcomes, and at other times choose to leave the goals more loosely defined. Within university courses, those goals are rarely explicitly related to work and employment opportunities, especially in History. Three of the interviewees mentioned this point in different ways. Prof NF was categorical in that they would never position a spatial history class in terms of preparing for employment. However, they acknowledged that students were sensitive to the employment potential of their learning choices.

> *"They're also more savvy about the difficult job market we're in in the humanities and social sciences. So, they know that having some kind of edge with technology is going to*

be effective when they go out on the job market. And also they're bracing for the fact they might have to pursue careers outside the Academy, right? (NF, personal communication, June 2019)

Prof TD took a more flexible view with respect to how spatial history related to employability and whether the professor should bring up the issue in a class.

".. the question of employability arrives before the class, Oh, am I going to be more employable if I take that class? And my answer is probably yes. And I give example in the class, so yes, because if you have those skills, they're valuable, right? You know how to use those technology, you know, how to use maps, different kinds of maps, in different contexts. ... and you also know how to get data. And you know what that means... So those skills are definitely there" (TD, personal communication, June 2019)

The most candid comment came from Expert KH.

"It's a touchy subject, ...I've got a colleague at (another university) ... and he's very much about helping students get employed in geospatial jobs. And I know that that's not something that (our university) wants to see itself doing. But they also like to trot me out for parents weekend and for, you know, Board of Trustees things and talk about how many students we've had that have gone on to grad school and jobs doing GIS. So, it's a weird mix" (KH, personal communication, June 2019)

This tension is far less evident in the online courses, including those offered by universities. The courses either make a clear case for employable skills as a result of the class, or they do not specifically valorize it. There is no attempt to hedge the question of whether the skills acquired lead to employability. Some courses, such as the ones aimed at journalists (University of Texas) provide learning spatial skills specific to journalists. Though the course does not mention employability specifically, it nevertheless positions itself for use in a professional context. In the list of courses with enrolments over 10,000 students, most are tool-specific skills that support learners with professional skills valued in the workplace. It is not surprising therefore that the Microsoft course *Analyzing and Visualizing Data with Excel* has more than 77,000 students enrolled. In fact, of the 20 courses in that list, only three may be classified as courses that are not directly about employability, but more oriented to general learning: *The Brain and Space*, and *Prediction X: John Snow and the Cholera Epidemic of 1854*, both of which explore other aspects of spatial ways of knowing; and *Maps and the Geospatial*

Revolution, which is a general-purpose introduction to the field. The ESRI technical certification courses are firmly in the realm of employability, with active preparation for professional certification exams, a key component for certain categories of jobs.

It must be acknowledged that most of the online courses are not intended for the History students in particular. Yet there is no reason a history student with the inclination would not be able to benefit from them. As described in Chapter 6 Work and Employment, students in the sample were enthusiastic to learn "emerging technologies" including spatial ones. This observation is also supported by Prof NF who says, speaking of his History students, "I'm offering a course called geospatial historical visualization…because I know that they're kind of hungry for this kind of training." (NF, personal communication, June 2019). Under the circumstances, I argue that curriculum in higher education with respect to the spatial turn cannot insulate itself from the question of work and employment. I also argue that 'higher education curriculum' for all practical purposes includes all online courses and MOOCs available to the History student. It remains to be investigated to what extent History students make use of these other learning resources as part of their education.

Summary

In this chapter, I analyzed samples of learning resources available to students in higher education to learn spatial ways of knowing. I reviewed course syllabi from university courses, online courses including MOOCs, other online learning resources and prescribed readings from a selection of universities as seen through the OSP application. Firstly, I concluded that History as a discipline does not make a distinction between the methods of history and historiography. This makes it complex for history departments to offer courses in spatial ways of knowing independent of a specific field of history. Secondly, I argued that an alignment is necessary between ideas, concepts, and tools related to spatial ways of knowing. Courses approach this alignment in different ways, with the university courses mostly taking an idea-first approach with the online courses taking a tool-first approach. Finally, I established that there is a tension within universities about positioning spatial methods in terms of their employment potential, in their regular classes. Yet universities take a more direct view when they offer online courses. Like their commercial counterparts, they offer courses that teach skills aimed at making the students work-ready, even if they do not explicitly position them as such.

8: The Spatial Turn in History: Technology and Tools

The previous chapters explored the research, practice and curricular context for spatially enabled History. In this chapter, I explore the broader technological context within which History research, practice, and the curriculum operate. The term "technology" sometimes elicits a strong negative response from traditional humanities scholars, including historians. This is evident in the literature, as seen in Chapter 2, Framing the Inquiry. A recurring theme among some of the survey respondents was also, for example, that technology is a non-issue, and an over-rated element, given inflated and unjustified importance. To quote one survey respondent: "'Technology' is kitschy and overrated. There is no replacement for expert knowledge and dynamic lecturing". Given a degree of resistance among humanities professionals to technology use in general, I first justify my choice to analyze the role of technology as explicitly and as intentionally as I do.

I infer from the literature and my data, that resistance to the terms 'technology' and 'tools' stems from the constructivist tradition in History that emphasizes human agency and denies technology the power to determine human thought and action. At the other end of the spectrum is 'hard' technological determinism, a stand that reifies technology and emphasizes its choice-constraining, enslaving nature. While radical technological determinists have nearly fallen out of favor, the 'hard' constructivists still seem to influence thinking in the social sciences and humanities.

My own position is that neither ends of the continuum offer a useful lens to understand the influence of technology on human relationships or on people's thoughts and actions. I agree with Dafoe's (2015) framing of the issue. The question is not a binary one of whether technological determinism or social constructivism correctly explains anything, but "to what extent, in what ways, and under what scope conditions ...technology (is) powerful" (p.1050). Dafoe proposes that the level of analysis impacts how one views the evidence for the power of technology. At the micro-level of analysis—at the individual or small group scale—it seems self-evident that people exercise agency with respect to their use of technology. A historian chooses what methods she or he will adopt, and how they will use a particular tool, if at all. At a macro level, however, it is much more likely that large socio-technical systems subsume individual agency to a great extent. The historian may need to work within infrastructure decisions made by

institutions, student expectations of technology use, and the larger economic-technical imperatives at play. An extensive discussion on the levels of analysis, supported thoroughly by literature, may be seen in Dafoe (2015).

Science and Technology Studies (STS) literature discusses the impact of technology on social relationships and human agency. I am specifically interested in a subset of the STS focus—technology and its impact on a way of thinking and a way of creating knowledge (in History). I believe that under certain conditions, a technology and the thinking process associated with it are so closely intertwined that it would be futile to see them in isolation. In this context, I offer an analogy to describe a similar relationship between spatial technologies and spatial ways of knowing: 'Driving' is a competency—it involves an interplay of individual knowledges, skills and dispositions. One could, for example, know the rules of the road and the working of a vehicle; one may skillfully manipulate mechanical objects to make them move; one may have the considerate disposition of a good road user. Yet, these can result in 'driving' only in the context of automobile technology—the vehicle. 'Driving' without the automobile is a meaningless construct, even though the underlying elements are completely valid on their own terms. The affordances of the automobile directly influence the nature of the driving. To understand driving, one needs to understand the automobile as well. I argue that spatial competencies and spatial ways of knowing have a comparable relationship with the enabling technology. Given these two arguments, I believe a detailed analysis of spatial tools themselves is justified.

Scope and Purpose of this Analysis

In this chapter, I analyze the relationship between spatial technology and spatial history along two lines:

- The concepts, affordances and constraints inherent to spatial technologies
- History students' relationships with spatial technology

Technology sometimes denotes the functioning of a complex socio-technical system – such as the Internet and is sometimes conflated with material tools or artifacts (Dafoe, 2015) such as calculator or washing machine. The STS literature discusses these differences at length. However, in the realm of software as technology, I find it difficult to distinguish between the functional and material aspects of technology since the two are deeply intertwined in the context

of software. Given this, I use the terms tools and technologies interchangeably, without delving into the nuances discussed in the STS literature.

For the purposes of this analysis, spatial tools and technologies, as discussed in the earlier chapters, refer to technology that enables spatial questions to be answered, spatial representations to be made, and spatially enabled knowledge to be created and communicated. These fall into two categories: Technologies that support geospatial inquiry and those that enable visual-spatial inquiry both of which I address in the following sections. I specifically consider ESRI's ArcGIS, Google MyMaps and Google Earth, and open-source GIS platforms such as QGIS for the geo-spatial technologies' category. Tableau and Power BI are the two graphical user interface-driven data visualization platforms that I consider for the visual-spatial technologies category. I also consider coding languages such as Python, and platforms such as R, which may serve the purpose of geo-spatial or visual-spatial analysis depending on how they are used.

The data for this analysis is drawn from publicly available information about these tools, as well as from my own forays into learning and working with QGIS, Google MyMaps, Tableau, and Power BI. In addition to my self-directed learning, I attended a certificate course on using GIS for analysis, the *Introduction to Geographical Information Summer Certificate* program conducted by the Geography department at Concordia University, Montreal. This workshop was built around the open-source tool QGIS. In addition, I downloaded and worked with Tableau Public and Microsoft Power BI, both of which I attempted to learn on my own by reviewing materials and tutorials online. To estimate the kinds of work possible with these tools, I also analyzed and reflected on over 50 samples labeled as 'good examples' from curated galleries at ESRI[6] ,Tableau Public[7], the Spatial Awareness newsletter[8], data visualization sites Information is Beautiful[9], Flowing Data[10], the Data Visualization Society[11], and Hans Rosling's work (Gapminder[12]). In these samples, I analyzed the effectiveness of the final output, the platform on which it was created, and the complexity involved in its creation. Based on my learning in the course, my self-directed learning, and analysis of samples, I describe the affordances of these

[6] https://www.esri.com/en-us/maps-we-love/overview
[7] https://public.tableau.com/en-gb/gallery/?tab=viz-of-the-day&type=viz-of-the-day
[8] https://www.getrevue.co/profile/maps/issues/spatial-awareness-1-new-maps-spatial-newsletter-by-robin-hawkes-183451
[9] https://informationisbeautiful.net/
[10] https://flowingdata.com/
[11] https://www.datavisualizationsociety.com/
[12] https://www.gapminder.org/

tools and the underlying knowledge required to effectively use them. I also draw on data from the interviews and the surveys where respondents spoke about these tools from a variety of perspectives.

Concepts, Affordances and Constraints of Spatial Technologies

Spatial analysis and representation are built on some specific technical concepts. These concepts are embedded in the tools to such an extent that is it impossible to use the tools without a good grasp of the concepts. An assessment of these concepts is also of interest to the curriculum: How generic are these concepts? To what extent might a typical historian have encountered them outside the context of spatial history? To what extent, if at all, do they need to be part of the teaching and learning around spatial history?

Geo-spatial concepts

Points, Lines, and Polygons. These refer to geometry concepts learned in elementary school, by the same names. All geospatial representation, in the highest form of abstraction, is either a point on a coordinate system, or a line that connects two or more points, or an area bounded by lines (in other words, a polygon). Geospatial technologies are reliant on the user specifying points, lines, and polygons, at some scale. Current technologies are capable of producing increasingly accurate measurements and calculations of points on the earth's surface. This, however, is not the case with historical records and it poses specific challenges to the spatial historian. For example, consider an archival record that refers to a location, say town A. First, the historical place name A may not match current place name, even if it still exists. Two, it may not always be clear what boundaries A refers to in the archive. If the spatial historian is to incorporate town A into an inquiry, they are compelled to make decisions about the position and boundaries of A, for the tool to function. This may prove troublesome in some inquiries.

Vector, Raster. Geo-spatial tools create images by manipulating pixels – the smallest unit for representation on a display device such as a screen. In vector images, the points, lines, and shapes are mathematically calculated and drawn by software. They are also better suited to representing information on coordinates. Raster images, on the other hand, are fixed configurations of individual pixels that create a picture, such as in a satellite photo. Raster images do not scale well and result in heavy files but have the advantage of being easier to manipulate and analyze. Geo-spatial tools can typically use both vector and raster images, and

can convert between them. For geography and other disciplines dealing with modern data sets, the choice between raster and vector is a technical one. For spatial historians, using an existing archival map is essentially a process of digitizing the map into a raster form, and then re-drawing details (such as buildings, roads or other features) as vector points, lines, and polygons over the underlying map. (See geo-referencing, below). Alternatively, the spatial historian may input data from other sources (such as trade log) onto an old or current map depending on the nature of the inquiry. (See basemaps below)

Basemaps, layers. A basemap is a geographically accurate reference map upon which other details may be added by the spatial researcher or map creator. One can add multiple 'layers' or sets of information onto a base map. For example, information about rivers, roads, buildings, political boundaries, are layers over a basemap. Observing patterns across layers is an important way in which spatial insights are generated in these tools (CC, (2019), Tufte (2006)). Thousands of proprietary and open-source maps are currently available to spatial analysts. The spatial historian must reckon closely with the basemap they select, evaluating its accuracy and relevance to the historical context under study. Or, as seen earlier, they need to digitize archival maps to create their own basemaps. As discussed in the Chapter 5, Historical GIS projects that focus on digitizing maps and generating historical gazetteers play a fundamental role in the spatial historian's ability to use spatial tools. Without this starting point, the road to spatial inquiry can be long.

Coordinate systems, map projections. Geo-spatial tools and maps represent three-dimensional data of the earth in two dimensions through calculated adjustments called "projections". The popular Mercator projection, for example, shows latitudes and longitudes at equal distances on the flat representation, even though longitudes are closer to each other at the poles. This system, while visually inaccurate, was helpful for 16th-century sailors to navigate the seas but causes other complications in the current time. With geospatial tools, results could vary significantly depending on the projection in use, making analysis more complicated or potentially inaccurate. In working with old maps, matching up coordinate systems is an important step. Many different map projections are currently used[13]. While the historian need not be familiar with all projections, understanding the concept of projection is vital.

[13] For an overview of different map projections see https://map-projections.net/singleview.php

Geocoding, georeferencing. Geocoding is the plotting of spatial data onto a map either by importing a list or table of spatial data such as addresses, or latitude and longitude; or by manually added points over a base map. Georeferencing is the process of overlaying a digitized version of a physical map with locations on a coordinate system. Seeing a georeferenced map can be a powerful experience. In my own learning, I georeferenced an old map of the Montreal island, to a current map of Montreal. The changes to neighborhoods caused by erosion along the riverbank were eye-opening. It was also interesting to compare the names and locations of specific places over a hundred years. In my case, I was merely exploring the technique of georeferencing, with no larger historical inquiry in mind. I expect, however, that if I were a historian with an interest in Montreal, this spatial experience may have suggested new angles and questions for inquiry.

Choropleth (thematic) maps. A choropleth map plots statistical data spatially. For example, crime rates (a statistic) in an area (a spatial boundary) can be represented by creating area polygons and assigning a different value to each. Choropleth maps are well suited to depict data stories, and current-day journalism is increasingly adept at using them. Creating choropleth maps requires the user to be familiar with statistical terms (for example, categorical and continuous variables, normalization, rates, ratios, percentages, etc.), and thinking in terms of how to visually represent them.

I so far described concepts specific to geo-spatial tools. I next describe a sample of visual-spatial concepts that underlie spatial tools. The categories are not mutually exclusive—there are conditions under which the visual-spatial concepts can be used in geospatial tools and vice versa.

Visual-spatial concepts

Tables. A table, in its simplest form, is a classification of information by rows and columns and is a concept most people learn in elementary school. Spreadsheets and databases are essentially tables of varying degrees of complexity. Both geospatial and visual-spatial tools are enabled by tables. Being able to conceptualize one's data through tables is a pre-requisite to working with these tools. While it is one thing to conceptualize an idea spatially, these tools require an underlying conceptual clarity about how tables are organized. This is a different kind of cognitive task for a historian who may naturally be used to linear and text-based organization of their evidence.

Graphs, charts. Graphs are visual-spatial representations of information usually describing variables and showing relationships between them. Again, most people learn about basic graphs in elementary school. However, data visualization tools offer the user a wide variety of graph and chart possibilities, and it quite likely that the average person has not encountered many of them before, let alone having used them. Tableau lists a sample of such possible representations: "area chart, bar chart box-and-whisker plots, bubble cloud, bullet graph, cartogram, circle view, dot distribution map, Gantt chart, heat map, highlight table, histogram, matrix, network, polar area, radial tree, scatter plot (2D or 3D), streamgraph, text tables, timeline, treemap, wedge stack graph, word cloud and any mix and match combination" (Tableau. n.d.). Each of these visual types is better suited to some kinds of data than others – a fact that is not readily evident to the non-specialist. A historian seeking to present historical evidence or findings in a visual-spatial form needs to learn the specialized grammar of charts and graphs.

Infographics. Infographics are a combination of information and data presented in a quick and easily consumed format. Infographics can be any combination of charts, graphs, text, and other visual depictions. Edward Tufte's (2001) list of the essential elements of infographics (or "graphical displays" as he labeled them), is still considered a good guideline. He emphasized the importance of staying true to the data, while layering it for complex and engaging data stories. Infographics are easy to get wrong, as is often demonstrated in the collections of poorly designed infographics that abound on the Internet[14]. Good infographics are design-wise more complex to create than charts generated by spatial tools such as ArcGIS or Tableau. Infographics are often created through yet other design tools such as Canva or Venngage, popular in 2019. Creating infographics is technically less demanding than using geo-spatial tools or programming, but requires a visual design sensibility in addition to data sensitivity and a visual storytelling flair—a combination of skills that is not very common. For the spatial historian hoping to use charts and infographics to communicate historical evidence or tell a historical story, it is yet another complex competency to master.

Perhaps the most important visual-spatial element for historians is the timeline, a device which allows the temporality of history to take center stage. Given the importance of representing time in the context of history, I describe it in its greater detail than the others.

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[14] For example, this can be seen The Guardian's list of *16 Useless Infographics* (Chalabi, 2013)

Nuanced Challenges of Representing Time

Spatial historian Ian Gregory (2010), identifies six ways in which time may be conceptualized: linear, calendar, cyclical, container, branching and multiple perspectives. Linear time is the most easily visualized or represented as a continuum in one direction flowing from the past to the future, typically represented as moving left to right. Calendar time relies on subdivision into periods and eras to make sense of linear time. Cyclical time, of which seasons are an example, lends itself to circular and spiral representations. Container time breaks time into discrete units such as days, weeks, months and years. While convenient, container times lead to paradoxical situations where two consecutive days can be in the same week-container, but different month or even year-containers. Branching time refers to multiple event lines leading to, or away from a single event. Examples are evolutionary trees and family trees. With multiple perspectives, Gregory refers to the difference in time where an event actually occurs and the moment at which the event is recorded, which can often be of significance in History.

Conceptualized in these nuanced ways, the timeline as a representational technique is a complex affair, beyond the scope of GIS tools except in the most rudimentary ways, in Gregory's opinion. Rosenberg and Grafton (2010) present a comprehensive review of the timeline as a visualization device—delving into its history and evolution. From Rosenberg and Grafton's work, it is apparent that the timeline, as it is most commonly presented today, has a mere history of 250 years, though scholars and artists have explored the representation of time in many ways for much longer. Their book, *Cartographies of Time* (2010), is a rich collection of these time representations, hand-drawn and printed on paper over the centuries and providing much to consider about the ways in which people have visualized time.

Gregory (2010) and Bodenhamer (2010) both mention the possibility of data visualization, especially animated data visualization, as a potential way to bridge the gap between the depictions of space and time. However, neither builds on the idea substantively, since they restrict themselves to only geospatial technology. It is interesting that in the mid-2000s, Hans Rosling was making his popular and insightful data visualizations using a software called Trendalyzer, developed by his company Gapminder. He melded data various variables, time, and space into a compelling narrative that not only communicated and engaged the viewer but allowed for more fundamental mind-shifts to occur. Rosling perfected the art of data storytelling with time series visualizations and maps. Rosling was a doctor, interested in issues

regarding health and public policy and probably never saw himself as a historian. Yet, he successfully used historical data, going back to the 19th century to create his very effective visualizations. His ability to break up data by time periods, countries, and variables—at multiple levels of granularity—is proof that synthesized representations of time and space are possible[15]. I agree with Rosenberg and Grafton's view that it is perhaps the case that historians have not yet applied themselves adequately to the issue of representing time (Rosenberg and Grafton, 2010).

Rosling's Trendalyzer software was acquired by Google in 2007 (Rosmarin, 2007). Over the years, the Trendalyzer bubble chart visualization capabilities have evolved within Google to become part of its Google Charts visualization service, though Trendalyzer itself has been retired. Gapminder continues to offer the tool as a downloadable software, which people can then use to explore readily available datasets or datasets of their own creation. In recent years, time-series animations have become more common, though people use a variety of tools and programming platforms to create them.[16]

The analysis process. In addition to the concepts discussed above, using geo-spatial and visual-spatial tools requires an understanding of the overall spatial analysis process. The Programming Historian website (Programming Historian, 2019) summarizes the process aptly: Acquire, Transform, Analyze, Present, Sustain. The *Acquire* stage refers to the process of obtaining spatial data from the real world. Current geospatial data is physically acquired through simple or sophisticated GPS systems. Historical data has to be typically acquired from the archives and may be found in the form of printed maps, documents or other records. Maps need to be scanned and other data digitized into compatible formats. The next step would be to clean and transform the data into a structure that is amenable to analysis within a chosen tool. Cleaning refers to reviewing the data to identify and remove errors and inconsistencies in the data. Transforming is the process of creating variables that need to be analyzed. Data acquisition and transforming are the most effort-intensive and potentially frustrating stages for both geo-spatial and visual-spatial tools. General understanding among data analysis professionals is that data transforming accounts for 80% of the effort involved in analysis (Press, 2016; Gabernet and Limburn, 2017). In fact, Expert EE identifies this as perhaps the most complex part of the spatial

[15] The best of Hans Rosling's visualizations may be see online on TED.com and on his company website, gapminder.org

[16] For example, see NASA's timeseries-based interactive animations on climate change at https://climate.nasa.gov/climate_resources/25/interactive-climate-time-machine/

analysis journey (EE, personal communication, June 2019). I argue that this creates a conundrum for the spatial historian. In order to even estimate if a spatial analysis has something to offer by way of insight, tremendous preparatory effort is needed. However, as more data becomes ready for use through the work of gazetteer projects, the first two steps for spatial analysis are bound to become easier. In fact, this is precisely what has happened over the last ten years with non-historical geospatial data. An explosion in the availability of geo-spatial datasets has made the process increasingly easier for analysts. Clean, transformed, ready-to-use data sets help researchers focus on their question rather than the demands of the process (EE, personal communication, June 2019).

Once the data is ready, the analysis is straightforward, since the tool completes the required calculations and typically provides answers in formats ready for interpretation and discussion. Even with complex analyses, this step is nowhere as effort intensive as the previous stages. Analysis using these tools can be as simple as importing clean data and clicking a few buttons. Google's spreadsheet program Sheets, for example, even allows users to provide commands in natural language to execute an analysis: On Sheets, it is possible to create a table, say of countries with their population, education level and income, and then literally type the question "compare income by education level in <Malaysia> and <Japan>" and have the software provide an answer, complete with graphs. This allows the user to focus on the question they are exploring more naturally than if they had to execute a series of actions by navigating technical terms. The professional geo-spatial tools such as ArcGIS and QGIS do not offer this level of ease, while Tableau and Power BI are marginally better.

Once the analysis is complete, is the fourth step is to effectively communicate the findings. At this stage, the tools provide maps or other artifacts to illustrate the analysis. Historians have typically used text-based essays to discuss their work and they may choose to support their writing with spatial representations. Identifying and using appropriate representations for a context can be a complex skill, as discussed before. The last stage labeled 'Sustain' refers to the steps users need to take in order to extend or continue their analyses over multiple projects. There are questions of storing data, establishing copyrights or usage rights, and otherwise maintaining the long-term integrity of the project. Since each tool has different ways of structuring, exporting and archiving data, this is an additional aspect for the spatial Historian to consider.

In this section, I outlined the concepts underlying spatial tools and technologies. Based on this I argue that successfully using geospatial and visual-spatial technologies requires certain clear competencies: the knowledge of underlying concepts, the skills to iteratively use spatial analysis and traditional interpretative methods, and an openness to the multi-dimensional demands made by the tools. Since the underlying concepts are so deeply embedded into the structure and working of these tools, it is difficult to distinguish between what it means to use the tool versus what it means to use the spatial method. I revisit this idea again in Chapter 9 (Discussion) to explore the implications for curriculum. I next provide an overview of the effort and cost implications of using these tools.

Spatial technologies: Effort and Cost Implications

Geospatial technologies

The main geospatial technologies available to Historians to undertake spatial analyses are from the GIS tools from Environmental Systems Research Institute (ESRI) and Google, along with other open-source and smaller applications. ESRI is a private entity whose proprietary ArcGIS software is used by over 45% of all professional GIS users across the world, according to the ARC Advisory Board report of 2019 (ARC Advisory Group, 2019). It is several times more popular than its closest competitor according to the report. As Prof. NF puts it, ESRI is "the hundred-thousand-pound gorilla in the room" (NF, personal communication, June 2019). Most ArcGIS users are from industries such as Power, Water, Oil and Gas and so on, while governmental and non-governmental entities are also leading users. ESRI has in recent years, moved significantly to cloud-based versions of their software, allowing people to use the tool without having to download, install and maintain the software. It also provides flexibility in software ownership, allowing multiple levels access to features, including pay-per-use options.

According to EE, a senior ESRI employee, ArcGIS is used in education and research to a significant degree, but the education sector contributes far less to the ESRI's revenues than other industries, since ArcGIS is heavily subsidized for educational use. Notwithstanding the subsidies, the costs of licensing the software or per-use costs can run into tens of thousands of dollars per year for universities. In short, ArcGIS is an established technology with a huge array of powerful analytic features and is proportionally expensive. Ironically, the range of features

available in ArcGIS is overwhelming for the typical education and research needs of universities. In fact, Expert EE calls it a "tragic mismatch" between educational needs and the ArcGIS product (EE, personal communication, June 2019). Prof NF describes learning to use these tools as "trying to drink out of a fire hose" (NF, personal communication, June 2019).

Given the fact that educational use is subsidized and contributes to a very small percentage of ESRI's revenue, the company's product development does not necessarily prioritize the needs of users in this segment (EE, personal communication, June 2019). Instead, ESRI took an alternative approach and created Storymaps, a lighter, technically less overwhelming spatial tool. Storymaps, as the name suggests, allows users to tell spatially-organized stories, integrating text, images, and maps. It requires no technical knowledge of GIS. Understandably, no form of spatial analysis is possible through Storymaps. It is only optimized to communicate a story in spatial ways. For History students, this is beneficial in the sense that it allows for a quick and easy taste of thinking in geospatial terms. Geography professor TD, in collaboration with his university's department of History, offers a course in spatial storytelling that uses Storymaps. He observes that students engage with it since they can easily create something substantial while learning about spatial ways of knowing and storytelling (TD, personal communication, June 2019). However, for History students who are interested in deeper questions and explorations, this is a completely inadequate tool. In fact, I would argue that if historians and history students were only exposed to such superficial applications of spatial tools, it would be natural for them to conclude that a spatial approach is in no way comparable to the traditional ways of doing history.

Universities typically overcome the pay-too-much-and-use-too-little problem by adopting open source tools for their GIS needs. QGIS is a popular choice, as is gVSIG. These come with the known attendant issues of needing to install and maintain software, troubleshoot issues independently and so on. Depending on the resources available to a department or a university, it may be easier to use and maintain open-source software, than make a purchase decision regarding ArcGIS. Some scholars also take a principled stand to only use open-source software in the larger interests of intellectual freedom. Yet other historians such as ND decide to simply build their own software to meet the needs of their specific interest. This observation also appears in the surveys, where students described how their professors collaborate or employ other professionals to build tools that suit their needs. This raises a different question with

respect to the curriculum – to what extent is it necessary to understand software development paradigms in addition to spatial paradigms? EE is unequivocal. They firmly believe that the future direction is for people to build their own apps and extensions to meet their needs, since it is impossible for monolithic tools to be ideal for all the possible contexts of use. However, EE is not referring to individual scholars building tools from scratch like ND did. They are referring to people's ability to extend the code base that already exists in the public domain and use it as a starting point to customize their tools. ESRI itself contributes a significant amount of code for public use and is the seventh-largest contributor on GitHub, according to Expert EE (EE, 2019). Other historians have also explored the tool customization and coding approach. The Programming Historian platform brings together reviewed resources and curated materials to help those historians who want to explore this option, as seen in Chapter 7, Teaching and Learning (Programming Historian, 2019). Coding in the current time is predicated on mixing, matching and building from existing libraries to create specific apps. In fact, there exist platforms to create apps with minimal coding required, as long as the creator has conceptual and logical clarity about what they want their app to achieve. Given this, it would not be extreme to consider that historians could potentially make their own apps to accomplish the spatial analyses they have in mind. It would, of course, require a significantly different mindset.

The other technologies to consider are Google Map and Google Earth applications. Google Maps is most commonly used for navigation and wayfinding. Almost half the people in the survey quoted that as their primary relationship with Google Maps. However, Maps also allows a degree of spatial analysis using publicly available data, or one's own data through its MyMaps application (previously called Maps Engine). While nowhere as extensive as ArcGIS, it allows for light, non-technical spatial exploration in a more sophisticated way than Storymaps. Creating a Google MyMap is as intuitive as creating a Google Doc or Google Sheet and uses the same interface elements and conventions. On a MyMap, one can use different basemaps, draw shapes and save them as layers, import data for new layers from tables or shape files, and explore multiple layers of spatial data. One can also add markers and directions and measure distances. One of the survey respondents describes a project they undertook using MyMaps to measure the walking distance between places to comment on the social interactions between people. MyMaps is not conceptualized as an analysis tool, but as a way for people to customize their Google Maps

experiences. Yet, its affordance makes it suitable for analysis of certain kinds and is likely to be perceived as more accessible than other geospatial tools.

Google Earth as a geospatial tool supports spatial explorations of a different kind than the layer-based analysis of Maps. It combines maps, street views, and 360-degree photographs to create immersive experiences that one can undertake in the "Voyager" mode to explore contemporary places or visit historical sites. An example of a historical exploration, authored by PBS, traces the travels of Marco Polo and Ibn Batata across continents[17]. There are historical map collections available in the Google Earth Voyager mode. While these are not geo-referenced and overlaid on the current map, they are positioned side-by-side, allowing for an easy comparison. The David Rumsey Map collection is an example, with over 100 historic maps from across the world, as of July 2019. One could also explore in 360 degrees, well-known sites such as the Taj Mahal, or less known ones such as the north face of Mt Fuji. To the casual view, Google Earth appears to be a platform for no-cost, exotic field trips but that view alone is short-sighted. If a researcher wished to explore specific spatial elements and views to answer a question, Google Earth could possibly be a powerful tool. For example, I would imagine that an aerial view of a historic battleground (a view that may have been impossible to have before) might provide new insights into the historical events or allow for a new interpretation of other evidence around the event[18].

All of Google products are free and offer a very low barrier for Historians to explore spatial ways of doing History before they make larger commitments of time, effort and money towards it. To that end, Google's spatial tools have much to offer the spatial historian.

Visual-spatial tools

Visual-spatial tools are those that enable data visualizations. Tableau and Microsoft Power BI are both user interface, rather than coding driven. The Gartner 2019 report rates them very high for both ease of execution as well as thoroughness of vision (Gartner, 2019). Both require specialized learning of the concepts described before to undertake sophisticated analyses. However, for simpler visualization, a historian may, with little effort, reasonably use these tools

17 PBS World Explorers can be seen on: https://www.pbslearningmedia.org/resource/ff32837d-b085-40d4-8d60-ac9a676cb857/marco-polo-pbs-world-explorers/

18 This example is inspired from a similar example where a first world war battle was analyzed using ArcGIS to reveal new insights about the battle which may be seen here: https://www.arcgis.com/home/item.html?id=ad59f48b10774c23b748ec4d0fae5831

based on a high school level understanding of the concepts. Power BI Desktop is free and can be used by individuals, with access to most of Power BI's features. Professional licenses start at about ten dollars per month per user. Tableau has a 12-dollar per month view-only license and a 35-70 dollar per month versions to create visualizations. However, students have a free one year access to Tableau (Pardo-Bunte, 2019). Tableau came into existence around the same time Google Maps and ArcGIS went mainstream and has a more extensive user and support community than Power BI. I discuss Tableau and Power BI as potential visual-spatial tools for Historians, though more sophisticated visualizations are being created in programming languages such as R and Python, as evident by the works of Yau at Flowing Data[19]. Considering that code-based visualization requires more complex software and mathematics competencies, I argue that they may not be the best options for the typical historian.

In this section, I explored the time, effort and cost implications of spatial tools. I end this chapter with a description of students' relationship with technology.

Students' Relationship with Spatial technologies and Tools

In this section, I review the data from my surveys and interviews to assess how students view and interact with these technologies and tools. I offer this as a counter perspective to the technology-centric discussion in the previous section.

Survey question 3 asked students to rate their familiarity with several geospatial and visual-spatial tools. It was followed up by an open-ended question about what they used the tools for. I discussed students' technology skills briefly in Chapter 6 (Work and Employment), interpreting their readiness for the skills required by different jobs. Here I approach the same data to consider how their self-reported competencies align with the issues discussed in this chapter. All the respondents stated they were intermediate to expert users of Google Maps but most also stated they only ever used it for navigation and wayfinding. Only one respondent described any analytical work they undertook with Google Maps. It seems, therefore, that though Google Maps is ubiquitous, its MyMaps features is largely unknown among the sample. As for ArcGIS, nine people reported never having heard of it, 20 had heard of it but never used it, while the rest had some degree of familiarity with the tool. More people had never heard of open

[19] Nathan Yau is a statistician and visualization expert whose work may be found on flowingdata.com

source and other GIS tools, mirroring the industry trend of ESRI products dominating the GIS space. There were only two people who reported being expert users of ArcGIS and one who specialized in QGIS.

On the visual-spatial front, 70 percent of the group reported never having heard of Tableau. Interestingly, more people were aware of programming platforms such as R and Python for visualization than the UI based programs such as Tableau and Power BI. There was only one person who identified as an expert in each of these categories, with five novice and intermediate users for Tableau and four for the programming platforms.

On the open-ended question about what they used the tools for, there was a variety of responses. 16 respondents reported having used the programs for some sort of significant academic or research endeavor. Some projects were sophisticated ("I've made simple maps of coal production county-by-county using GIS and Tableau", "I have used ArcGIS, Google Maps, and QGIS to process cartographic data and build a 3D model of sixteenth-century Florence onto which historic census data is projected", "I used Arc GIS and Tableau specifically to track outbreaks of tuberculosis and consumption in the eighteenth and nineteenth centuries for a digital humanities project."). Other projects were simpler ("I have used Google maps to create maps of my research for personal use"; "ArcGIS and Google Maps for historical analysis of a town – Liverpool"). One expressed surprise that Google maps, something that they used so frequently and expertly, could actually be used for research, and they did not know about it.

Question 13 was close-ended: *"How would you describe your affinity for technology in general, or with digital ways of working?"* 22 of the 46 respondents said they preferred using digital methods over analog methods. 22 said they preferred analog methods but could work with digital methods as needed. Two categorically stated they did not like working with technology. This paints a picture of the people in the sample largely being open to using technology provided there was a justification for it. I would argue that if these people were offered a comprehensive view of the possibilities offered by spatial ways of doing history, they would find it more justifiable to invest in learning how to do it.

Question 14 was a close-ended question: *"In your experience, how does your knowledge of technology compare with those of the teachers/professors in your program?"* 25 people felt that they were likely to know some technologies better, while their professors knew others better. Overall, for this subgroup, the sense was that professors tend to know technical and discipline-

specific technologies better, while students knew general technologies and social media better. 11 respondents felt their knowledge of technology was superior to that of their professors. Some of these people also reported that their professors used next to no technology, so I surmise that even a little expertise on their part would have counted as being more knowledgeable. Others, however, were very specific in the ways their knowledge was more sophisticated, listing out specific tools or skills they had.

Student respondents also demonstrated insight into what it means to be familiar with technology as evidenced by these two responses (emphases are mine): " How to create datasets that clearly display specific objects, or in making tables and graphs, **is not really a matter of technological skills** -- you can google any spreadsheet formula and learn a process in 15 minutes -- **but logical reasoning (is needed)**"; "I was the only member of the research team with any graphic design skills, coding skills, ArcGIS competency .... Perhaps most pronouncedly I was the only member of the research team **with any willingness to engage with technology that operated beyond a textual basis**."

Finally, there was an acknowledgment among three respondents that estimations of knowledge are transient, and people learned what was required as the need arose. As one respondent put it "all knowledge is transferrable, and subject to collaborative efforts"

Several of the professors interviewed offered a comparable perspective in the context of students' familiarity with technology. Both NF and TD stated that younger students are very comfortable with interfaces in general, but do not typically understand how software works or how to accomplish complex tasks with specialized tools (NF, TD, personal communication, June 2019). Interest varies among undergraduate students, as well as the amount of work they are willing to put into a course (TD, personal communication, June 2019). However, when students do have an interest, they are willing to extend themselves beyond the scope of the class to invest in their own learning. Expert KD offered a view that was also echoed by survey respondents: At least at the undergraduate level, some students drift towards the humanities and history in order to avoid math, or because they have no technical inclination. It is understandable that they would resist learning something that is, or appears to be, numbers-oriented (KD personal communication, June 2019).

Overall, student and professor views point to the fact that while not everyone is naturally inclined to the competencies these tools demand, the tools can be learned by those who have an interest and motivation to do so.

Summary

This chapter offered two views on the issue of spatial tools and technologies. The technology-centric view outlines the concepts embedded into the tools, and which were essential for spatial historians to be aware of, or develop mastery in, to be able to use these tools. These are concepts people are likely to have learned in high school, and which can be then developed upon. There are thousands of high-quality resources available to enable such learning. Among the tools reviewed, it is likely that a novice spatial historian is likely to find some technologies such as MyMap much easier to navigate than creating visualizations in R. Ultimately, the technologies do not offer perfect answers to nuanced disciplinary questions such as what it means to represent time, and the conceptual differences between space and place. In finding answers to those questions, the spatial historian may well need to develop custom tools that meet their specific needs.

9: Discussion

In this chapter, I summarize the findings and discussions from the previous chapters and synthesize them to address my research questions. These were, as may be recalled:

1. What are the gaps between research, practice and Higher Education curriculum in the History discipline, with reference to the Spatial Turn?
2. How can those gaps, or the lack of them, be interpreted?
3. Should the History curriculum in Higher Education change in response to the spatial turn? If yes, how? If not, why not?

In the last four chapters, I explored different elements, each addressing a different aspect of my first research question: Chapter 5 concerned itself with how History knowledge is generated and communicated in the spatial turn. Chapter 6 dealt with the practice of History by exploring work and employment in the context of the spatial turn. Curricular responses to the spatial turn were analyzed in Chapter 7. Finally, the tools and technologies central to the spatial turn, and which impact research, practice, and curriculum were analyzed in Chapter 8. Each of the chapters presented data and included analyses to illuminate the research question.

In this discussion chapter, I integrate those analyses and interpret them to answer the second question as to what the gaps between research practice and curriculum may indicate. I also make some normative suggestions with respect to curricular responses. I propose some options for History curricula in higher education to incorporate spatial ways of knowing, where appropriate. These address my third research question.

Given my methodology, the interpretations are most accurate in the context of this case, and even more specifically to the particular datasets that I have used. While I make no claim to the generalizability of these findings and interpretations, I argue that the picture and patterns that emerge provide useful insights into higher education curricula.

The Gaps between Research, Practice and Curriculum

As mentioned earlier, the gaps between research, practice, and curriculum have been explored in previous chapters. Here, I review them along two axes: the curriculum vis a vis

history knowledge, and the curriculum in relation to the traditional and non-traditional work of historians.

History Knowledge and the Curriculum

My analyses have indicated that spatial history, spatial ways of knowing in History, and spatial ways of doing History are well established, but not mainstream in the academic arena, as evidenced by research publications and spatial History projects and labs. The survey data as well as interviews show that traditional historians resist the idea of quantitative and spatial history. This is borne out by the analysis of the curricula. History knowledge is still largely text-based, and it is taught as such. Engaging with textual sources and writing as a form of producing History knowledge is the preferred approach to doing History. This is supported by the findings that history courses emphasize writing, and assignments typically take on the form of term papers or other written artifacts. History students also expect that the skills they need to succeed as historians is the ability to think critically and write well, and which they largely felt their courses prepared them for. I also demonstrated at various points that the epistemology of traditional history with its emphasis on place, rather than space, and on interpretation than on analysis sometimes makes it difficult for Historians to use geospatial and visual-spatial methods to approach their discipline. Naturally, this mismatch implies that spatial ways of doing history are not likely to be privileged in the curriculum.

Given these, I argue that the traditional curriculum in History is aligned to the traditional and predominant perceptions of the nature and scope of History as a discipline. There is, however, a gap or lack of alignment between the traditional history curricula in universities and the possibilities offered by spatial ways of knowing.

These possibilities, which are not acknowledged extensively within History, are becoming apparent in an interdisciplinary context. First, there exist large numbers of special interest groups especially on online forums such as Reddit, that discuss and create knowledge around spatial ways of knowing, including in History. These groups, however, are not restricted to historians. Secondly, jobs are being created which require some combination of spatial skills and History knowledge. Both historians and non-historians might qualify for these jobs, depending on their competencies. Thirdly, readings rooted in spatial history are being prescribed in a range of other subjects including geography, urban planning, archeology, literature, and

theology. This points to the fact that the approach to combining spatial ways of knowing and History is an interdisciplinary endeavor.

The traditional History curriculum within History departments does not necessarily align with these interdisciplinary developments. However, a non-traditional curriculum of online courses and structured learning materials is becoming available to the History student. This, in a sense, by-passes the History department to bring History students to non-History learning resources, and non-History students to History learning resources. So, if the definition of curriculum is expanded to include these opportunities for learning, it may be said that there is alignment between spatial history and the curricula available to higher education students. This argument presupposes, however, that the history student is interested in, and capable of, accessing learning opportunities beyond the department. Given the pressures of finding employment and the overall familiarity that people have with finding resources online, and using them to accomplish their goals, it is not far-fetched to imagine that history students are likely to be interested and capable of self-directed learning. To what extent they actually do so, requires further investigation.

The Work of Historians and the Curriculum

Findings from across the four chapters may also be summarized along a second axis – that of the work historians do, and how the curriculum prepares them for it. Data from multiple sources have underlined the fact that most graduate students in History aspire to work within the academic environment, and significant numbers of them do find employment within universities. Most of the advertised jobs specifically calling for history graduates are also within institutions of higher education, in teaching and research positions. Surveyed graduate students tended to think that as far as preparing them for work is concerned, their programs were meeting expectations, focusing as they do on skills of research, thinking and writing. Not all graduate students shared the same degree of confidence that their programs prepared them adequately to communicate with their peers and the public. Notwithstanding the last comment, it is a valid observation that history curricula for graduates are largely aligned with the perceived work of historians. In other words, traditional courses are well aligned to prepare history graduates for the traditional work of historians.

When it comes to non-traditional work possibilities involving spatial ways of knowing, or work possibilities outside the university, the alignment with traditional university curriculum is

absent. University courses do not position themselves as being responsible for preparing students for any specific work area, though individual professors or the university itself may acknowledge that skills students learn are useful in a wide variety of contexts beyond academia. In the context of spatial ways of knowing, this relates to the ability to undertake geospatial analysis or communicate history knowledge through visual-spatial means. The small size of spatially-oriented university courses that were available for this inquiry indicates that traditional curricula for spatial history are still a niche area.

Undergraduate history courses are taken up by a range of students, many of whom may not go on to be professional historians. These courses are often a means of fulfilling a writing skills credit requirement in a liberal arts college structure. In Prof CC's university, the spatial history course using GIS was offered as a means to meeting the quantitative reasoning credit requirement. Though my data refers to one US university, I contend that the situation is similar in most other liberal arts university structures. Under such circumstances, the curriculum is aligned to meeting the general competencies expected of liberal arts undergraduate students, though it is implemented in the context of History. In practice, an undergraduate student in that situation could well meet the writing or quantitative reasoning credit requirements by taking any other course that met the criteria, for example in literature or statistics. An undergraduate student who takes up a history course or a spatial history course is then either interested in the subject of history, or they are drawn to the skills being taught. (For purposes of this argument, I ignore a third category of students who may take a course merely for logistic reasons, such as fitting in a course in their schedule). In addition, undergraduate students in my survey showed a marked enthusiasm or at least an openness towards learning spatial ways of knowing. Based on these data points, I argue that at the undergraduate level, the interest in spatial history is likely to be larger and learning spatial ways of knowing may well spur students into newer academic or professional directions. The courses analyzed in this inquiry show that this is an area with potential – seven of the courses analyzed were for undergraduates. However, the small number of courses in the area indicates that this potential is underutilized.

It follows then, that neither graduate nor undergraduate curricula specifically prepare students for work outside the university. This prompts me to place the question of curriculum alignment in a larger frame of the purpose of history education. If the purpose of history education is to create more people capable of studying or teaching history, then the curriculum in

in alignment. If the purpose is to bring a special kind of thinking and research skill to other disciplinary or professional areas, then the curriculum is somewhat aligned to that purpose. If the purpose is to expand the scope of history education by actively interacting with other areas of knowledge and non-traditional ways of knowing, then the curriculum is not aligned.

These arguments are specific to university courses, however. When online courses and resources are considered, the picture looks very different. The 'curriculum' in this case has much to offer with respect to spatial ways of knowing, but it is left to the inclinations and motivations of the student to find, access and learn from them. The online curriculum is aligned to non-traditional work opportunities for history students. History students may just be unaware that they exist.

Having summarized the gaps between research, practice, and curriculum, I next undertake to explain these gaps.

Interpreting the Gaps

In this section, I interpret the gaps and alignment discussed in the previous section. I have described what the gaps are, and here I attempt to throw additional light on how those gaps may be understood, where they may arise from, and the significance of those gaps for history education.

Gaps arising from epistemological roots

Can 'place', a construct more amenable to History, be studied through the same means used to study 'space', a construct more in line with geography, or the sciences? This recurring and unresolved question is perhaps one of the primary reasons there is considerably less enthusiasm among traditional historians with respect to spatial ways of knowing. In addition to the space-place distinctions, spatial history poses the problems of scale and terminology, starting with differences of view for concepts as basic as what constitutes data. As Suri (2013) states, what the historian sees as evidence, the geographer sees as data. Various authors such as Bodenhammer (2010) and Lock (2010) provide suggestions and options for how these differences can be negotiated. Researchers such as O'Neill of Harvard's Imperiia Lab (cf. O'Neill 2019), and public communicators such as Hans Rosling (2006) show how this negotiation of contested concepts may be implemented in practice. Despite this, the overall

enthusiasm for spatial ways of knowing remains limited within history departments. This lack of conviction in spatial ways of knowing is subsequently reflected in the curriculum.

A second epistemological issue is related to how the "methods" of history are taught. As demonstrated in previous chapters, the teaching of historiography is rarely done in isolation of the history content itself. Teaching history methods, unlike in the social sciences, is intimately intertwined with the subject matter, along with investigations of authority of the source under study, the philosophical viewpoint of the historian, and so on, all of which are aspects of historiography. Consequently, there is relatively less space within the history curriculum to reflect on the meta aspects of the epistemology or range of methods available to historians in general, and to evaluate them as approaches to doing History. In the absence of this space in the curriculum to consider methods, there is no opportunity to introduce spatial ways of knowing as an epistemological stance for History. If it is to be included, it is done only in the context of a professor who has adopted spatial history as part of their scholarship, and for whom a spatial way of knowing is part of their historiography.

I conclude my analysis of epistemological issues with a review of Nikitina's (2006) typology of approaches to interdisciplinary curricula. Interactions between disciplines have been classified in many ways as interdisciplinary, multidisciplinary, pluri-disciplinary, cross-disciplinary, informed disciplinarity, and so on based on the tightness of connection between the disciplines. Nikitina argues for a definition of interdisciplinarity that draws on the nature of knowledge and disciplinary epistemologies. She proposes that interdisciplinary curricula can take three approaches: Contextualizing, conceptualizing and problem-solving. Contextualizing approaches are preferred by the humanities she argues, focusing as they do on context and interpretations. Conceptualizing approaches are the preferred mode for the sciences where the scientific method is a unifying factor. Applied fields prefer the problem-solving approach, where the driver for the multiple disciplines to function together is the need to find a solution. This typology helps us see how the integrative approaches of history, maybe at odds with the problem-solving approach of areas such as GIS, programming, or data science.

I would argue that the issue of epistemological mismatches is at the heart of the gap between spatial ways of knowing and the traditional history curriculum at the university. The perception that spatial analyses are quantitative and positivist in nature, and therefore contrary to the methods of History, leads to a resistance among those who approach their discipline from a

critical theory or other constructs. It is similarly of questionable value to those whose sources and archives are intimately textual. The epistemological mismatch is further exacerbated by the lack of distinction between methods and historiography in the discipline,

Scholarship Focus

Non-spatial historians interviewed for this inquiry readily acknowledge that spatial ways of knowing may be relevant, but they just don't see it as being relevant to the work that they do. (DN, BL, personal communication, June 2019;). I reason that older scholars who began their careers before 2005 are unlikely to have had exposure to spatial tools that drive the current spatial turn, as part of their education. While it is true that Prof CC was using early versions of ArcGIS in the 90s to study history problems (personal communication, June 2019), it is also true that Prof BL (personal communication, June 2019) a more recent PhD graduate has very little orientation towards or knowledge of spatial ways of knowing. The former is certainly an outlier in History scholarship and the latter is more representative of History professors in general. Consequently, I conjecture that a historian's scholarship and their teaching is less likely to include spatial ways of knowing, unless they developed an interest in the subject after their formal education, later in their careers. If a historian never studied something as part of their education, or their work, it is less likely to be a part of their teaching model. So, in a sense, scholarship and curriculum feed each other, resulting in an on-going cycle.

However, this situation has the potential to change. Expert KH mentions that they are increasingly observing that historians with spatial history and digital history interests and skills are being recruited within departments. (personal communication, June 2019). To what extent this is the case, and why such an increase may be occurring remains to be investigated. The reasons may be varied: increased recruitment of spatially oriented historians may be a genuine response to the perceived relevance of spatial History, or it may be a measure to increase scholarship diversity in the department, or it might even be to cater to 'customer demands' of the students. These plausible causes need further exploration.

It is tempting to consider this situation in the light of what has come to be called Planck's Principle. Physicist Max Planck made a seemingly despondent observation in his 1950 book *Scientific Autobiography and Other Papers*: "..a new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it." (in Kunh, 1962, p 151).

Kuhn himself uses Planck's quote to argue that science often evolves due to factors other than just the truth and validity of facts, or their scholarly merit. In this case, that factor was the passing of a generation. I draw on Kuhn's idea to argue that established ways of studying a discipline may not change simply on account of a newer method's relevance or validity. It needs to be supported by a sizeable number of scholars who actually practice the new epistemology, giving the discipline a certain momentum in its evolution. I contend that as spatial technologies become easier to use, and spatial data sets become more accessible, more spatial questions will present themselves, leading to increased spatial history scholarship. In parallel, the general shift towards spatial-visual communication in society will begin to reflect on approaches to knowledge mobilization in academia, resulting in increased emphasis on visual-spatial artifacts. I argue that these developments, in turn, will result in a greater engagement in the curriculum, with spatial ways of knowing and doing history.

I next explore the availability of datasets as contributor to the gap between research, practice, and curriculum in History, in the context of the spatial turn.

Availability of Datasets

As has been established in previous chapters, a big challenge historians face in adopting spatial ways of knowing is the availability of datasets amenable to geospatial or visual-spatial analyses. One part of the challenge is the effort and complexity involved in converting available data into analysis-ready formats, and this has been discussed in detail in Chapter 8 Tools and technologies. The other challenge is the question of copyrights and ownership of spatial data, which is a problem of a different nature, and arising from more a complex socio-economic context. Bonnel and Fortin (2014) describe this accurately in the context of Canada. Though the government of Canada has made efforts to create spatially referenced census data, there is an absence of what they call a "one-stop-shop" for geo-spatial data making data access a complicated affair. Bonnel and Fortin claim that geospatial data is viewed as a commodity in Canada, bringing it under complex copyright laws which make it difficult for scholars to access data, and place complex restrictions on how maps are reproduced. In addition, the "spatial-data culture" (p. xiii) in Canada is different from in the US, confusing scholars when it comes to understanding what they may legally do with spatial data. They quote Klinkenberg who argues that this restrictive culture in the 90s and 2000s slowed the momentum on what might have been a more vibrant environment for spatial history in Canada.

However, current developments, after Bonnel and Fortin's writing, show that there is an increasing emphasis on governing and managing geospatial data in Canada, as for example under the stewardship of Natural Resources Canada and as part of the Canadian Geospatial Infrastructure (CGDI) project. Increasing amounts of geospatial data including LiDAR[20] data and historic maps are being made available in open formats and consolidated by the geospatial community on websites such as canadiangis.com (Canadian GIS and Geospatial Resources, 2019). The growth of geomatics is driven by the needs of policymakers, communities, and corporations, who use spatial data for decision making and planning purposes. Clearly, the focus of these efforts is on decision-enabling, current data—data that depicts geospatial realities in the current time. While this is not useful for all kinds of historical inquiries, it definitely makes it far easier for some kinds of History scholarship.

The US has its own federally managed approach to geospatial data of the country. The Geospatial Data Act of 2018 defines the institutional infrastructure available to govern geospatial data and outlines the mandates of the National Geospatial Advisory Committee (Geo-Spatial Data Act, 2018). One outcome of the Act has been the development of geoplatform.gov, a website that houses thousands of geospatial datasets developed in collaboration with federal, academic, institutional and community stakeholders (GeoPlatform, 2019). The Act also defines themes under which the datasets are collected and cataloged. These themes include geography and environment-specific ones such as biodiversity, soil, climate, and water, as well as themes more aligned with humanities and social science scholarship such as cultural resources, administrative boundaries, addresses, imagery, transport, properties (Geo-Spatial Data Act, 2018). In the United States, map data has been seen a public good and never copyrighted. Historic and current data are available in the public domain (Bonnel and Fortin, 2014; Sinton, 2019). There are nonetheless grey areas where it is not entirely clear, even to experts in the field, where copyright lines begin and end. This is explored by Sinton in her blog article aptly titled Copyright, Public Domain, and Maps – It's Complicated. (2019). She raises the relevant and interesting question of what happens to emerging forms of spatial data and representations such as LiDAR, the copyright status of which remains murky.

[20] LiDAR stands for Light Detection and Ranging. The National Oceanic and Atmospheric Administration (2019) describes it as "a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth. These light pulses—combined with other data recorded by the airborne system— generate precise, three-dimensional information about the shape of the Earth and its surface characteristics"

The UK too has its own government-run database of open data resources available freely to the public. The Open Geography Portal at geoportal.statistics.gov.uk contains extensive data about boundaries, maps, and postal codes as well as "lookups" (limited pre-calculated analyses, for example, postal code by average internet speed). While extensive, this collection of datasets is nowhere as broad-based as the datasets available on the comparable US and Canadian portals. Financial Times data visualization editor Alan Smith argues that as the UK moves towards Brexit, there is likely to be increased pressure on the government to work with and make available spatial data (Smith, 2018), though he cites fears among some that "most data access arrangements remain prejudiced in favor of data suppliers rather than data users".

The issues of data access, it appears, remain complex in all three countries. In summary, it may be said that data availability has been a significant challenge for spatial History so far, but the situation appears to be easing in the last few years with more open datasets becoming available. A wide range of data is currently available, especially in the US, though most of it is not specific to History scholarship. Nonetheless, the availability of geospatial data is a starting point for those historians whose scholarship focus aligns with these datasets. In addition, as described in earlier chapters, there is a growing body of history-specific gazetteers and map collections that are becoming available to the academic community. Only time can tell if these burgeoning datasets will make a difference to the scholarship and teaching of spatial ways of knowing in History.

I next explore the pedagogical issues that throw light on the gap between research, practice and the history curriculum in higher education.

Pedagogical Challenges and the Curriculum

I established in previous chapters that spatial history is a decidedly interdisciplinarity undertaking. Whether it is the nature of communities of practice, online courses, or the working of scholars themselves, historians must extend beyond their traditional disciplinary boundaries when it comes to geospatial or visual-spatial work. Working in interdisciplinary contexts is never easy given the variations in underlying philosophies, concepts, terminology, tools, and processes. That historians do not necessarily have the skills to engage with ways of knowing non-traditional to History, is an acknowledged fact. Kitchin (2014) calls it a skill deficit, and the issue is discussed in depth in Janelle, Hagerty, and Newcombe (2014).

This then presents some peculiar teaching-learning and curricular problems. It raises questions as to how the interdisciplinary nature of spatial history can be taught while rooting it in the History's disciplinary requirements of interrogation of evidence, historical reasoning, and interpretation. How does one teach a diverse range of elements needed for spatial history: history, reflections on historical methods, geo-spatial and statistics concepts, using tools, interpreting results from programming, data management skills, communication of outputs of such work, and so on. The university courses analyzed in this inquiry show how history departments have approached it. The patterns indicate that there is a backbone of History in the curriculum, over which some of the other skills are overlaid, to varying extents. However, it must be recalled that this was a very small part of the overall history curricula in all three countries. The MOOCs and online courses, on the other hand, restricted themselves largely to skills outside of History, though a few did address issues of both history and the interdisciplinary skills.

As discussed in earlier chapters, the specialist meeting *Thinking Spatially across the College Curriculum*, recommended several approaches to teaching spatial thinking and by extension, spatial ways of knowing (Janelle, Hagerty, and Newcombe, 2014). The challenge the group was hoping to address was to determine how 'spatial thinking' could be taught irrespective of the disciplinary requirements for spatial ways of knowing. The meeting report acknowledged that while each discipline had its own demands for spatial ways of knowing, there still existed commonalities that were applicable across disciplines. These commonalities are comparable to the concepts I describe in Chapter 8, Tools and Technologies. The expert group summarized best practices in college curricula that were being followed at the time and proposed them as possibilities in the higher education curriculum. These included "general education classes, spatial minors, freshman seminars, micro-infusions of spatial thinking modules in different courses, and focused courses on spatial skills for specific disciplines" (Janelle, Hagerty, and Newcombe, 2014).

Considering it has been five years since the publication of this report, I compared these recommendations to my own findings, to assess the extent to which they may have become a reality. General education courses dedicated to spatial thinking were not evident through my data collection strategies. My data does show evidence of freshman-level classes, and classes specific to a discipline (in this case, History). The idea of micro-insertions was not evident in the course

data, but was mentioned by two of my interviewees Expert EE and Prof TD, both of whom thought it was a practical possibility to teach spatial ways of knowing in History. The idea is also proposed by Shook et.al (2019), who propose micro insertions for GIS literacy. They describe a micro insertion as a very small intervention that introduces one single idea or theme into an otherwise packed and structured syllabus. Examples may include a two-slide component of a lecture, a five-minute activity exploring a certain concept, or a homework question requiring reflection on a particular issue (Shook et.al., 2019). They recommend ESRI's Geo-inquiries as good resources for micro insertions.

I argue that the concept of micro-insertion is an interesting one, with potential. It has been used in the teaching of Ethics in Business Management courses (Slocum, Rolfer, Gonzalez-Canton, 2014) and Engineering courses (Riley et al, 2009). In the International Baccalaureate Organization's (IBO) Theory of Knowledge course too, the curriculum positions the consideration of Ethics within different areas of knowledge such as the natural sciences, human sciences, and the arts. (IBO, 2013). The IBO does not specify micro insertions as a curricular tool specifically. Yet, from my own previous experience as a Theory of Knowledge course teacher, I can say that mini reflections and activities on Ethics within other disciplinary discussions, is a beneficial teaching strategy. Despite repeated references to micro insertions as a teaching method for ethics, the idea of micro-insertion as such does not appear to be a well-developed curricular concept nor extensively researched. While I feel optimistic about the possibility of using micro insertions for spatial ways of knowing, further research and development is necessary to comment on its relevance and applicability within the spatial turn in History.

The expert group also proposed the development of a MOOC to address the teaching of spatial thinking across institutions and to harness the perspectives of students across the globe. The Expert group did not specify the scope of such a proposed MOOC, save to state that it would be a beneficial approach. In the five years since the publication of the report, MOOCs related to the topic have appeared, though it cannot be said if they are in the same vein as envisioned by the specialist group. I contend that some of the MOOCs in my data set, such as *Maps and the Geospatial Revolution* or the *Location Advantage* provide some degree of overview of the topic, but do not address the specific concepts and skills mentioned by the expert group, or in the list I propose in the next chapter. It may be a possibility for students to access all the required

discipline-agnostic learning from multiple online sources, if only one had a comprehensive list or map of what needed to be learned. Such a list is available for GIS competencies specifically (DiBiase et.al, 2010). This list outlines GIS competencies from a perspective of what is needed for a GIS-centric career. The idea of a competency list or a competency map may be adapted to curricula for spatial history, with or without a focus on preparation for work. Such a map would outline what needs to be learned, lending itself to further discussion on how it may be taught. I attempt to create such a map in the next chapter.

I conclude the section on pedagogical challenges with some reflections on the curriculum defining process within departments, drawing from my interviews with professors and experts. Any attempts at teaching spatial ways of knowing (or any other subject topic for that matter) typically seems to be left to the discretion of individual professors. There is often no department-wide mandate on what the curriculum should contain, or what directions it should take. The curriculum is determined by the scholarship focus of the professors. The department at best may have an approach to ensuring diversity in the areas and themes of history practiced by its faculty. Prof NF's comments summarize this best:

> *"…our professors have the freedom to teach whatever they wish, essentially, there's no limits or expectations placed on them, we simply submit our course preferences, and occasionally have to negotiate with each other about are you going to teach this course I'd like to teach that course. But we have no overarching curricular idea other than hiring people strategically, so that we have good coverage among world regions, and that we develop areas of strength that we can have kind of good graduate programs built around. So we really don't have a systematic way of addressing curriculum in our department"* (NF, personal communication, June 2019)

Prof TD paints a similar picture of how curricular decisions are made in their department and university. Individual courses are easy to adapt and new courses can also be negotiated with relative ease. However, any over-arching modifications to the program structure or courses that require complex collaborations are much more difficult and time-consuming to implement. (TD, personal communication, June 2019)

I argue that this configuration and approach to curriculum change definitely has an impact on the pace at which newer ideas can be brought into the curriculum. Issues such as methods or epistemologies that potentially cut across world regions and themes have lesser

chance of being addressed since they are not strictly the purview of any one professor. Even if a professor did want to propose such a change, it would create an untenable situation as it does for Prof NF: Being one of the only professors with a digital / spatial history grounding in their department, they feared that if they proposed curricular interventions for spatial methods, they might end up being "burdened with teaching it all the time" (NF, personal communication, June 2019)

In this section, I discussed several pedagogical challenges that play a role in the gap between research, practice and the history curriculum namely the difficulty in defining what is to be included in the curriculum, how it may be done, and the curriculum definition process itself. I next review the perspectives and expectations of young History students, which plays its own unique role in how the curricular offering of universities comes to be.

The Perspective of Young History Students

Students of History are unlikely to be a homogenous group, as discussed in Chapter 7. Their motivations and aspirations vary, as do their expectations from their education. This distinction is more marked between graduate and undergraduate students. Graduate students tend to be older and more committed to the idea of being historians or academics, as seen from my survey data. Undergraduate students are typically younger and as yet in an exploratory stage with respect to their careers. There is some evidence that a greater number of older students are entering undergraduate education in general, but it is difficult to find consolidated data to comment authoritatively on the volume and nature of mature students in universities (Johnes, 2014). In any case, the number of older students is still smaller in comparison with the overall student population, at least in traditional universities. Therefore, for purposes of this discussion, I will adopt the 'young student' profile to discuss student expectations from undergraduate History.

There is substantial literature and interest in the idea of 'generational' differences. A generation is defined as "[G]roups of individuals born during the same time period who experience a similar cultural context and in turn, create the culture" (Campbell, 2015, p. 234), and is seen as a useful way of understanding patterns of human behavior. The idea of describing a whole population in terms of generational characteristics has also had its share of criticism from sociologists (France and Roberts, 2015). Clearly, it is not possible to paint all people in a given group, everywhere in the world, with the same brush; or attribute a single set of

characteristics to them. Yet, certain generational characteristics seem to be valid when I look at the narrower slice of university-going students in the three countries involved in my study. I use the idea of generational characteristics here to illuminate the question of the undergraduate History curriculum.

To frame the discussion of generational differences, I first reproduce below a comparison of generational differences. These have been synthesized from multiple sources by Moore, Jones, and Frazier. (2017)

	Baby Boomers	Generation X	Millennials	Generation Z
Events	MLK, JFK, Woodstock, protests, Vietnam War	Cold War, AIDS, Clinton scandal, Challenger explosion, Fall of Berlin Wall	School shootings, September 11, Iraq War, "Great Recession"	Obama presidency, global terrorism, same-sex marriage, emergence of China
New technology	Television	Computers	Internet	Smart phones
View of self	Confident	Independent	Winner	Adaptive
Learning / teaching	Rote, hands-on	Self-directed, mix traditional with technology	Groups, lots of tests	Groups, lots of tests, on-line, "gamification"
Education	Freedom of expression	Pragmatic	Structure of accountability	Individualized
Trust	Low trust of authority	Low trust of authority	High trust of authority	High trust of authority
Career goals	Build a stellar career	Build a portable career	Build parallel careers	Build a fun, entrepreneurial career
Rewards	Title and corner office	Freedom, flexibility	Meaningful work	Social change
Parent-child involvement	Receding	Distant, divorce, latch-key	Intruding (helicopter)	Connected by technology, co-pilot
Family life	Indulged as children	Alienated as children	Protected as children	Connected as children
Political orientation	Attack oppression	Apathetic, individual	Crave community	Progressive, equality

Source: Adapted from Lancaster and Stillman (2002), Hunter-Jones (2012), DeBard (2004), Northeastern (2014), and Schuck (2012).

Table 9: Comparison of generational characterization: Sourced from Moore, Jones and Frazier, 2017

"Generation Z" refers to people who were born into a networked, mobile world, typically born between 1995 and 2015 (Kingston, 2014). The oldest of this generation are already at university and entering the workforce, while the youngest are yet to start elementary school. For purposes of this discussion, I look at undergraduate History students at the current time as being members of Generation Z.

Members of Generation Z share certain life experiences primarily on account of their exposure to a post 9/11, hyper-networked world, with access to information, communication technologies from early childhood. How does this impact their learning of and through technology? Some studies have found that large numbers of generation Z people perceived themselves as having more knowledge of technology than their professors (Cilliers, 2017). This was borne out to a large extent even with my survey data, at least for some kinds of technologies. Geck (2007) posits that though members of generation Z are technologically savvy, they are

novices when it comes to certain kinds of technologies. This too is borne out from my survey and interview data. This Generation Z-technology relationship has implications for the student-teacher dynamic. Generation Z is seen as having a high trust level with authority (professors) while at the same time seeing education as an individualized affair. I argue therefore that if the generation Z student is given an educational guideline or direction they trust, they are likely to be capable and confident of accessing that learning for themselves. This also lends support to my earlier argument that students are likely to learn from online courses if they know that is what elements they need to be mastering, for a given outcome.

Scholars have also begun to pay special attention to the location awareness, and spatial abilities of Generation Z (Downs 2014). Downs builds a case to demonstrate that a geo-spatially aware generation intuitively understands the interaction between location information and decisions. Widespread usage of navigational software such as Google Maps makes it evident to the Generation Z person that location data drives decisions and those choices, in turn, create more location data. They are primed to use this data and contribute to it. However, like with the technology argument before, there are two aspects to be considered here. The Generation Z person is intensely familiar with the mobile wayfinding aspects of geo-spatial technologies but may yet be fairly uninformed about the possibilities of geospatial analysis or the ability to use this same data for other applications. In this context, I argue that the Generation Z student is more primed than older students to understand and build on geospatial concepts than older students. They may not come into university with well-developed spatial ways of knowing. However, their familiarity with spatial wayfinding and maps, and the tools thereof, give them an advantage with spatial ways of knowing. They may be unaware of the potential, but with orientation and guidance, they are more likely to quickly understand and adapt spatial ways of knowing about a discipline. This then offers a discipline like History an opportunity to reflect on how this body of students respond to the spatial turn within the discipline.

Literature also indicates that Generation Z students have different expectations about education—they expect to be in charge of their own learning and learn in a flexible, networked manner, with low barriers to access (Kozinsky 2017). Similarly, they have different challenges and opportunities in entering the workforce because many traditionally entry-level jobs are being automated, and their own expectations from work are more self-directed (Deloitte, 2017). With all of this, I surmise that creating a flexible learning environment for the undergraduate student is

more likely to tap into the generational ability to find one's way around and create their own educational experiences. It is likely that undergraduate university students may be best served by a collection of learning resources and sound map to navigate those resources. The gaps between research, practice, and curriculum are strongest for undergraduate education when it comes to the spatial turn in History, and for spatial ways of knowing in History. Considering the generational characteristics of the undergraduate student may guide History departments to frame better curricular responses.

In this first section of the chapter, I explored five aspects to throw light on the gaps between research, practice and History curriculum with respect to spatial ways of knowing: Gaps arising from epistemological roots, scholarship focus, availability of datasets, pedagogical issues and the generational characteristics of undergraduate history students. I next make some normative comments on how the History curriculum may, in fact, respond to the spatial turn.

How Should the History Curriculum Respond?

The previous section interpreted the gaps in between research, practice and the history curriculum with respect to the spatial turn. In this section, I address the question about what needs to be done about this gap. Should there be an effort to bridge this gap? What would be the merit of doing so? And if the gap is to be bridged, how could this come about?

Based on my arguments so far, there is a case to claim that the university curriculum will benefit from responding to the spatial turn. There is scope for disciplinary growth with this new epistemology. Spatial ways of knowing offer different ways of approaching the study of history, and the current tools and technologies will only grow to support this. Students themselves are interested in spatial ways of knowing and recognize that it may expand their employment and career opportunities. Online resources are available and may be successfully used by students to guide their own learning, but the students would still need a map to navigate the sea of online materials and to interpret them in the context of History. Universities would, therefore, be doing their History disciplines and their students a disservice if they were to completely ignore these developments. There is a clear case for a curricular response.

The subsequent question would, therefore, be, to what extent the curriculum should concern itself with spatial ways of knowing for History? Should the response take the form of acknowledging this epistemological approach to history, or should it take a comprehensive

approach to revamp curricula to accommodate spatial ways of knowing, or would there be an intermediate level of response? It appears that there are several ways in which history curricula may evolve over the next few years with respect to the spatial turn. Each of these scenarios is briefly envisioned below.

Curriculum Acknowledges Spatial Ways of Knowing

In the first scenario, university History curricula would acknowledge spatial history as a valid epistemological approach to History scholarship. This acknowledgment would come in the way of new recruitments in the field of spatial history, and perhaps some investments in related infrastructure. However, the curricula would be driven by individual professors within the department who have the requisite interest and inclination towards the subject. In many ways, this scenario is similar to the current situations described in my inquiry. They would, as is the case currently, include references to spatial history, or courses in spatial history based on individual professors' priorities. There is no overarching curricular commitment to teaching spatial ways of knowing.

Curriculum is Revamped to Include Spatial History

The second scenario, at the other end of the continuum, would be one where a university or department substantively revamps its curriculum to add spatial history-related courses within or across disciplines. The curriculum may focus on complex topics such as the study of spatially motivated historiographies to simple ones such as using Storymap or Neatline to tell a story. There may be increased emphasis on exploring the developments of spatial history in the history of different locations or themes. Full-fledged courses related to spatial ways of knowing, such as some of the course analyzed in this inquiry, may be offered. Organizations such as the AHA or CHA may call for greater attention to this area, just as they currently call on a Historian's need to be quantitatively literate (American Historical Association, 2016).

However, this scenario is unlikely at the current time. As discussed earlier, the area of spatial history is still contentious, and the field itself is still evolving. Even if such an emphasis was deemed necessary or useful, departments would not know how to address this curricular aspiration. Under the circumstances, a large-scale curriculum commitment may not be possible. In fact, such a large-scale curricular response would even be problematic. It would be as problematic, for example, as claiming that critical theory is the most desirable epistemology for a discipline. The inclusion of any single epistemological approach cannot be at the cost of another

epistemology. The idea of an epistemicide, or the decimation of a knowledge system, is often discussed in terms of colonial knowledge systems and how they delegitimized non-western epistemologies (Paraskeva, 2011). I argue that emphasizing any one epistemology, or claiming its superiority amounts to a similar form of epistemicide. I contend that there needs to be enough curricular engagement with an epistemology for students evaluate its benefits and limitations to the discipline, as well as to explore its potential to grow disciplinary knowledge. Such a curricular engagement would lead then to a scenario that lies between the two scenarios described so far and is described next.

Spatial History Elements are Interposed Within Existing Curriculum

How can a curriculum engage with an epistemology? How can History students be exposed to multiple ways of knowing in History, in conjunction with History content? How can the curriculum support a meta reflection on the ways in which knowledge is produced in History? I propose that this might be accomplished by thoughtfully interposing, or making available, small curricular elements related to the epistemology within an existing curriculum or curricular framework. Examples of these curricular elements would be orientations, taster modules, micro insertions, showcases, reflection assignments within courses, workshops, curated online resources, student-led clubs, or any number of other possibilities. The aim of these small interpositions would be to help students evaluate an epistemology, in this case, a spatial way of knowing, and to explore it in creating and communicating history knowledge. I expand on this proposal in the next section, describing it and evaluating its usefulness. In the next chapter, I exemplify this curricular approach based on the data and arguments made previously.

What are Curricular Interpositions?

I use the term *curricular interpositions* to refer to the approach of interposing curricular elements within an existing curriculum, without the need for any substantive overhaul of what already exists. The word *interposition* indicates that these elements are to be arranged around, within, and between the existing curricular elements. I argue that curricular interpositions have a practical rationale and are also pedagogically appropriate. From a practical perspective, curricular interpositions are flexible, modular, small, and quickly adaptable. The time and effort required to create and implement small curricular elements is much lower than a traditional curriculum overhaul. Interpositions do not need to reflect a significant shift from the existing

ways of departmental functioning, as may be required for a large curricular change. More importantly, given the state of evolution of the spatial history domain, it would even be counter-productive to commit too strongly to a curriculum centered around spatial History. Smaller curricular interpositions can appeal to a wider audience, attracting people from outside the History discipline more easily – something that the interdisciplinary nature of spatial history can only benefit from. Flexible and modular curricular elements can also be administered/taught by wider variety of people, lessening the burden on teacher knowledge and skills within the department. It allows not only for guest appearances by experts but also different forms of collaboration between professors. Having an ensemble of curricular interpositions also enables trial and error in the curricular process, it is adaptable to a more heterogeneous audience and can address different kinds of learning curves for each topic. The complexity of different learning needs is also well supported by interpositions. A graduate student or professor may need a basic orientation, or a first-year undergraduate student may need advanced learning on a spatial technology – and interpositions could potentially make both possible. Interpositions could support awareness level goals but can be easily extended to more complex mastery outcomes, should the need arise.

There is a limitation to this approach, however. The approach may degenerate into ad-hoc and scattered curricular elements with no real impact, in the absence of a dedicated objective and plans around spatial ways of knowing within a department. It is also important for these curricular interpositions to be of a sufficient volume and number to be effective. These limitations may be addressed in several ways. Firstly, the department would need to have a curricular map: something that lists the spatial history objectives the department is interested in, and how the associated curricular elements can be addressed through various means. If micro insertions are planned, it would imply identifying possible courses in which such micro-insertions may take place. If learning events are involved, it would imply a planned calendar. If student-led initiatives are envisaged, it would imply a degree of mentoring and guidance from the department, and so on. All of these would require varying degrees of professorial and administrative oversight—something the department needs to anticipate.

I argue that in spite of these limitations, there is still merit in pursuing the approach of curricular interpositions. Firstly, the approach is well suited to departments and professors of all kinds – those that are skeptical about spatial ways of knowing, those that are open but not ready

to commit time and resources to a curriculum response, and those that would like to actively pursue a curricular response to the spatial turn. For the first kind of department or professor who finds spatial ways of knowing problematic, these interpositions will help students evaluate the method and to discuss the limitations of the approach. A discussion about why something is problematic serves students and the discipline better than if it is ignored in the curriculum. For departments that are open to the idea of exploring spatial ways of knowing, the interpositions approach offers a "try-before-you-buy" possibility. If only some teachers in the department are interested in bringing in this disciplinary knowledge to the curriculum, but may not have the scholarly focus to make a full-fledged offering, small interpositions would offer a useful and non-stressful starting point while being flexible towards future iterations. They would be equally suited to fully committed departments for the same reasons and since to lends itself to interdisciplinary work.

Secondly, I argue that curricular decisions are not always at the complete discretion of individual professors, though it is largely perceived as such in North American and UK universities. There is increasing pressure for humanities disciplines to make themselves relevant in market terms, especially when university success is measured in terms of enrolment numbers and future employability. While some larger universities may resist this pressure in different ways, there are a host of smaller and for-profit universities where the humanities departments may need to reinvent their approach to curriculum in order to be seen as viable. To such departments specifically, the approach of curricular interpositions offers a middle path of demonstrating sensitivity to "market needs" while retaining the traditional knowledge structures of the discipline. In summary, the approach of curricular interpositions has many benefits and challenges, but there are motivations to address and overcome those limitations.

Summary

In this chapter, I discussed themes and issues that emerged from across four units of inquiry to answer my research questions. I interpreted the gaps between History research, practice, and curriculum with respect to the spatial turn in terms of the gaps arising from epistemological roots, the scholarship focus in History, the availability of datasets, pedagogical challenges and the perspectives of young history students. I concluded that History curricula in universities would benefit by responding positively to the spatial turn. I suggested that this can

be done interposing curricular elements related to spatial ways of knowing within already existing curricula. I finally proposed a curriculum of topics for the same around four axes: disciplinary perspectives, working with tools and technologies, professional preparation and enabling systems.

10: The Spatial Turn in History:

A Suggested Curricular Response

If History departments were to respond to the Spatial Turn, how may they do it? What would they need to accomplish, and how would they implement the curricular elements? I attempt to answer these questions in this section from the frame of the scenario where small curricular interpositions are made into the existing curriculum. To do this, I take a goals-driven approach. I first define what the outcome of such a curricular approach would be from a disciplinary perspective; or in other terms, what the discipline and its students would gain as a result of these curricular interventions. I then expand on how these outcomes may be achieved through an associated series of teaching/learning topics. I also suggest possible ways in which each of these topics may be taught/learned, and which type of student each topic is likely to serve best. I describe each of these elements below, and then outline the topics later in the section.

Defining Learning Outcomes

I reason that in a curriculum, there needs to be an overarching curricular goal, to which further curricular elements such as content and teaching approaches can be aligned. The goal would need to be broad enough to accommodate multiple interpretations, yet specific enough to prompt concrete action. Drawing inspiration from the American Historical Association's articulation of goals for the History discipline, I propose two curricular goals relevant to the spatial turn. They are articulated in terms of what the History student will need to be able to do as a result of engaging with a curriculum. I propose that History students at undergraduate and graduate levels should be able to:

- Evaluate the value of spatial ways of knowing as a disciplinary epistemology
- Use spatial means to study and communicate history, as appropriate

I have chosen to define the outcomes from the disciplinary perspective, rather than the viewpoint of teachers and their specialisms, universities and their agendas, or potential employers and their needs. In doing so, I take a knowledge-centric stand on the fundamental curriculum question: What is to be taught? I attempt to answer that question in ways that are useful without being prescriptive. I next outline how these objectives may be met through the proposed curricular interpositions.

Curricular Paths to Spatial Ways of Knowing in History

In the previous chapter, I described how the approach of curricular interpositions, in spite of its benefits, has the potential to degenerate into an incoherent and ineffective pile of topics, in the absence of a cohesive vision and direction. To offer this vision and coherence, I propose below a map of curricular interpositions. The map indicates multiple paths leading the central curricular goal. No one path would be effective by itself, and the paths are interconnected. The overall map may be summarized as in Figure 12.

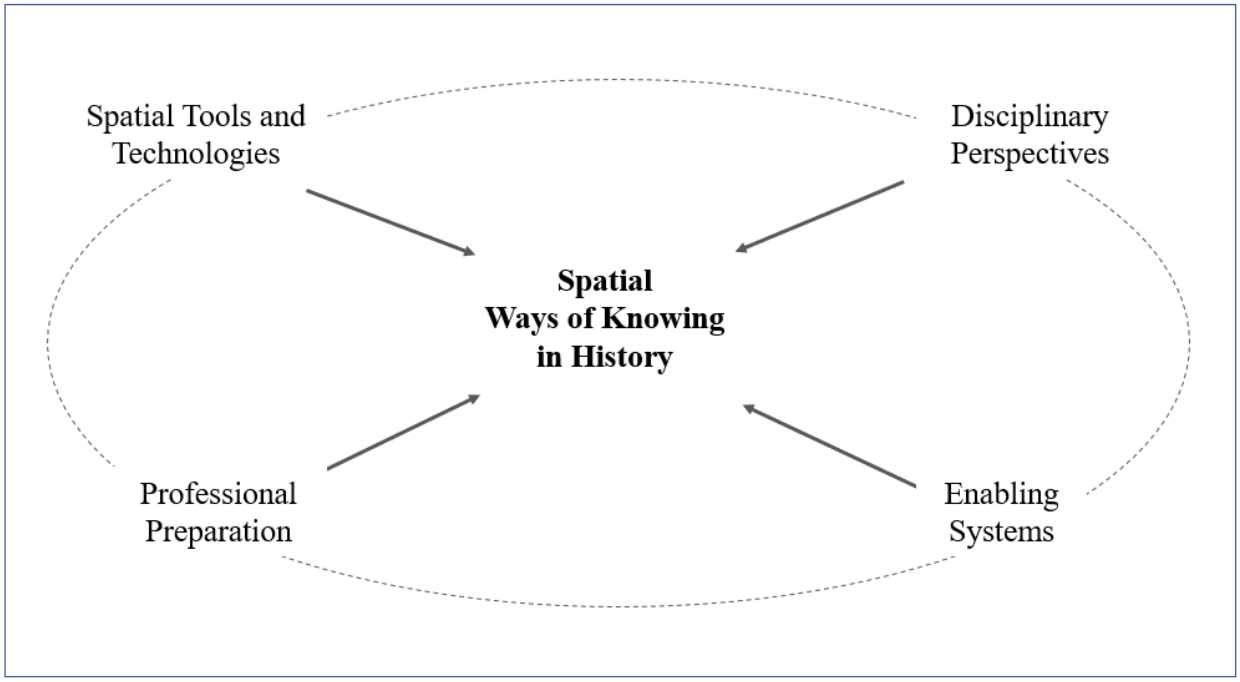

Figure 12: A map of curricular paths to spatial ways of knowing in History

Each of these paths originates in a different knowledge category, which may be described as follows:

- **Disciplinary Perspectives.** Topics specific to ideas and issues raised by historians with respect to spatial ways of knowing; interdisciplinary perspectives.
- **Spatial Tools and Technologies.** Topics related to conceptual understanding of tools, as well as how to use them in the context of spatial history.
- **Professional Preparation.** Topics that give students insights into work, employment and professional possibilities with spatial history

- **Enabling Systems.** Topics that expose students to broader, systemic issues that go beyond the discipline or the department but may nevertheless influence the practice of spatial history.

The knowledge categories do not have impervious boundaries but are nonetheless conceptually well demarcated. Later in this chapter, I exemplify each category, with notes on how the curricular interpositions in each path may be best taught/learned. I also comment which curricular elements are likely to be useful for different types of History students. I do not claim that the curricular elements that are listed in each category are exhaustive. However, I am confident they provide a comprehensive map based on the arguments I derive from my inquiry.

Interpositions and the Typology of History Students

As it may be recalled from Chapter 6, I argued there were four types of students that emerged from my survey data: Traditionalists, who had no exposure to spatial ways of knowing, and also saw no value in it, the Sceptics who had some exposure but were not entirely convinced about its applicability for History, the Explorers, with low exposure to spatial methods but were eager to learn more about them, and the Converts who had high exposure and high confidence in its value. There also exists a group of the Uninitiated, who had no exposure and consequently no beliefs about spatial history. I reproduce the visual depiction again below for convenience.

While I cannot conclusively generalize this typology to a wider population based on my data, I believe the dimensions adopted, and the resulting structure of typology is robust enough to be a useful indicator of History students in higher education. I, therefore, map the proposed curricular interpositions to these four types of students. The aim is to indicate the kinds of learning each type of student is most likely to benefit from. In doing so, I also suggest that the choice of curricular interpositions can be driven by the type of student most predominant in the department.

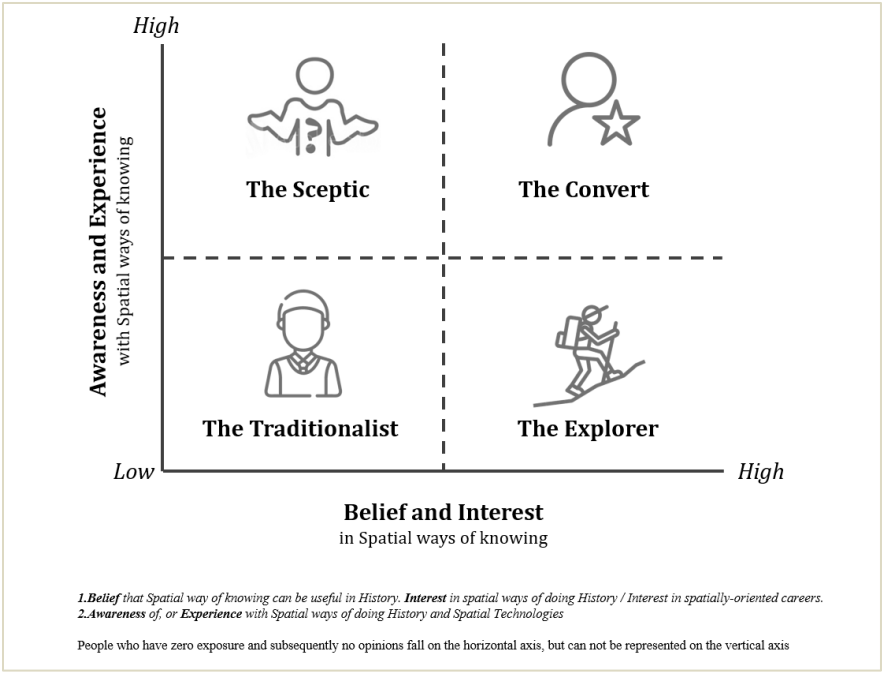

Figure 13: A typology of History students

Proposed Curricular Interpositions

I now provide an example curricular map, with topics and curricular elements under each of the four knowledge categories described before. For each knowledge category, I define overarching goals and then outline possible topics to meet those goals. I also specify what formats of interpositions would be most suitable, and to which types of student each topic is best suited. To reiterate: This list is perhaps not exhaustive, but it provides a comprehensive enough picture as to be useful.

Disciplinary perspectives

The goals of topics aligned to disciplinary perspectives would be twofold:

- Understand, appreciate and critique spatial ways of knowing for History
- Understand and explore the links between spatial history and other subject areas

All the possible topics listed below are intended to be at the introductory level. There is always an opportunity to deepen the scope of these topics should the department's context demand it. The last column indicates student type where T stands for Traditionalist, S for Sceptic, E for Explorer, C for Convert and U for Uninitiated.

Possible Topics	Potential Format	Best Suited For

1	***What is Spatial History? A primer:*** An overview of the field, its motivations and contributions to History scholarship	Microcontent in lectures, workshops, posters	T, E, U
2	***Spatial History Showcase:*** A collection of spatial history project to serve as exemplars of the subject	Curated online collection	T, S, E, C, U
3	***Spatial historians and their scholarship:*** An introduction to key scholars in the field, and their major work	Reading list, annotated bibliography; class assignment as a micro insertion	T, S, E, C, U
4	***Space vs Place: Implications for History:*** A discussion of the complexities in interpreting 'place'. Metaphorical vs. physical space and its role for the scholarship of History; Non-W estern perspectives of place and space.	Expert talk, course insertion in the form of readings, reflection or class discussion	T, S, E, C, U
5	***Disciplinary Turns - Reflections on ways of knowing in History.*** A metacognitive perspective exploring the ways in which History knowledge is/have been created. A theory of knowledge for the History discipline	Class discussion, department-level debate, curated reading lists, expert talks	T, S, E, C, U
6	***The interdisciplinary nature of spatial history:*** A web of inter-relationships between spatial history and other disciplines/subject areas	Poster / Infographic	T, S, E, C, U
7	***Digital history vs spatial history:*** Similarities and differences between the two fields	Infographic, class discussion, expert talk	T, S, E, C, U
8	***Spatial analysis vs spatial storytelling:*** Differentiating between spatial means of	Showcases, infographics.	T, E, U

	doing history research vs spatial means of communicating history knowledge		
9	***Geography concepts for Historians:*** An introduction to geography concepts (Ex: location, region, density, dispersion, and aspects of Human geography)	Curated online resources, interdisciplinary student clubs, infographics	T, E, U
10	***Cartography concepts for Historians:*** An introduction to cartography concepts (Ex. Choropleth maps, Bivariate choropleth, scale, projection, interactive maps, history of maps)	Curated online resources, interdisciplinary student clubs, infographics	T, E, U
11	***Statistics concepts for Historians:*** An introduction to Statistics concepts (Ex.: Data, variables, descriptive vs predictive statistics, chart types)	Curated online resources, interdisciplinary student clubs, infographics	T, E, U
12	***Why might a Historian need to program?*** An overview of the contexts in which programming may be required, an outline of the kinds and level of programming in question	Curated online resources, interdisciplinary student clubs, infographics	T, S, E, C, U
13	***Visual design basics for Historians.*** An introduction to how visual design elements affect communication (Ex. Hierarchy, balance, contrast, dominance, gestalt)	Curated online resources, showcases, class discussions	T, S, E, C, U
14	***Understanding timelines and time-series visualizations.*** An exploration of these topics in History research and knowledge mobilization	Showcases, class discussions, curated reading lists	T, S, E, C, U
15	***Interactive multimedia storytelling.*** Characteristics of effective interactive	Showcases	T, S, E, C, U

	storied. Positive and negative exemplars (Hall of Fame and Hall of Shame examples)		

Table 10: Proposed topics aligned to Disciplinary Perspectives

Spatial Tools and Technologies

The goals aligned with this knowledge category may be defined as:

- Identify commonly used geospatial and visual-spatial tools at the current time. Understand the opportunities and limitations they afford for History.
- Understand underlying categories of concepts required to work with each.
- Understand the workflow involved in working with geospatial or visual-spatial tools

The topics under this category too are intended as introductory level. However, they may be explored to whatever technical depth the students are comfortable with. I do not specify learning the actual use of tools in this list, but it would be evidently necessary for anyone wishing to undertake spatial history. As Prof TD (personal communication, June 2019) and one of the survey respondents mention, learning *how* to do something with a tool is easier to learn, once you know *what* you need to do with it.

	Possible Topics	Potential Format	Best Suited For
1	***An introduction to geo-spatial tools:*** An overview of current, available tools, and their main features as relevant to History	Online courses, spatial history showcases, Demo-lectures as course insertions	T, E, U
2	***An introduction to visual-spatial tools:*** An overview of current, available tools, and their affordances for History	Online courses, spatial history showcases, Demo-lectures as course insertions	T, E, U
3	***Open source vs Proprietary tools: Implications:*** An introduction to the differences between the two, and how they affect the study of history	Reflection, class discussion, Reading materials, expert talk	T, E, U

4	***Underlying concepts for geospatial tools***: Brief explainers of concepts, and their application to spatial history context (Eg Basemap, georeferencing…)	Online materials, equivalents of the "For Dummies" series	E, U
5	***Underlying concepts for visual-spatial tools:*** Brief explainers of concepts, and their application to spatial history context (Eg. Variables, chart types)	Online materials, equivalents of the "For Dummies" series	E, U
6	***Workflow for geo-spatial analysis:*** An overview of data acquisition, transformation, analysis and communication for geospatial work	Poster, infographic	S, E, U
7	***Workflow for creating visual-spatial materials:*** An overview of data acquisition, transformation, analysis and communication for visual-spatial work	Poster, infographic	S, E, U
8	***Programming concepts:*** An overview of programming concepts and terminology that is tool and platform agnostic. (Ex. Variable, data structures, syntax, interfaces)	Online resources,	S, E, U
9	***Evaluating geospatial and visual-spatial tools for History scholarship:*** Exercises in identifying opportunities and limits of the tools from a disciplinary perspective	Debates, expert talks, reading, online resources	T, S, E, C, U
10	***Collaborating with others when using spatial tools:*** The possibilities and challenges of collaborating on cloud-based services and in non-cloud-based tools	Demonstrations, discussions	T, S, E, C, U
11	***Problem-solving and troubleshooting tools and technologies:*** An introduction to	Demonstrations, testimonies by tool users, curated list of	S, E, C

	troubleshooting with online resources and community support	community support resources	
12	***The Spatial technology DIY challenge set:*** A collection of problems/tasks/ challenges of increasing complexity, that the students can undertake on tools of their choice.	A published set of challenges. Scaffolding may be provided in the form of hints and resources, or through peer-support system. Potential to award badges for challenges completed, or other forms of motivation.	T, S, E, C, U

Table 11: Proposed topics aligned to Working with Tools and Technologies

Professional Preparation

The curricular goals aligned with professional preparation may be articulated as:

- Identify work, employment and career opportunities relevant for History students who also have spatial competencies
- Recognize the issues, challenges and opportunities involved in a history student pursuing a career with a spatial focus

These goals may be met by exposing students to actual job descriptions and conversations with professionals or academics who are already practicing spatial ways of knowing. Graduate students and undergraduate students may have different requirements, and this will have to be factored into the choice of topics. As discussed earlier, undergraduate students may not yet be committed to a career in History and may potentially be open to a wider variety of career options.

	Possible Topics	**Potential Format**	**Best Suited For**

1	***History + Spatial: Career Opportunities:*** An introduction to such opportunities, and what such jobs entail	Job talks, subscriptions to automated alerts for jobs matching these criteria, (including within academia) published on common location	T, S, E, C, U
2	***Spatial + History: Career Opportunities:*** An introduction to such opportunities, and what such jobs entail. An overview of the realities of an entry-level job.	Similar to previous.	S, E, C, U
3	***A day in the life of …:*** Stories from the professional field	Testimonies, curated online resources	S, E, C, U
4	***Applying History competencies to non-History work:*** Resume and interview advice	Links to online communities for discussions on this topic	T, S, E, C, U
5	***Career Diversity Skills:*** Exploration of what communication, collaboration, quantitative literacy, intellectual self-confidence and digital literacy[21] mean for History students, and their interaction with spatial ways of knowing	Job talks, curated online resources	T, S, E, C, U
6	***Working outside the academia:*** An introduction to the challenges and opportunities for History graduates	Talks by professionals, curated online resources	T, S, E, C, U
7	***Preparing for work:*** Balancing disciplinary depth and interdisciplinary breadth	Class discussions, readings, talks by practitioners	T, S, E, C, U

[21] Career Diversity Five Skills, American Historical Association, 2016

Table 12: Proposed topics aligned to Professional Preparation

Enabling Systems

The curricular goals related to Enabling Systems may be articulated as follows:

- Identify how to access to historical datasets and maps, and recognize issues that may be associated with them
- Recognize copyright issues related to datasets
- Recognize the elements of a typical lifecycle of a spatial history project.

These goals relate to the big picture issues involved in spatial history. These are typically a concern of more senior members of the department, but students would nevertheless benefit from an exposure to these elements. Except for how to access datasets, the other topics need only be addressed at the broadest level for students. However, detailed versions of these same topics may well be useful for the professional development of department faculty and staff.

	Possible Topics	Potential Format	Best Suited For
1	***Identifying and accessing datasets and maps:*** A primer on historical and current datasets	Curated list of datasets, demonstrations, Librarian access	T, S, E, C, U
2	***What's involved in running a spatial history project?*** An overview of the overall process from data acquisition to sustainability of projects	Infographic	T, S, E, C, U
3	***Copyrights and data created by historians:*** An introduction to typical copyright issues faced by Historians	Expert talk, discussion, access to relevant sections of copyright laws	T, S, E, C, U
4	***Spatial History Infrastructure:*** An overview of the hardware, software and network requirements of spatial history projects	Interview with spatial history/geography Lab managers	T, S, E, U

Table 13: Proposed topics aligned to Enabling Systems

Summary

In this chapter, I extended the idea of curricular interpositions first introduced in the discussion chapter. In providing concrete examples of possible curricular interpositions, I hope to have substantiated the proposal.

11: Reflections in Conclusion

In this final chapter, I offer some reflections on the curriculum in higher education as well as on the value of my inquiry in this context. I first consider curricular theory in higher education and its role in the conceptualization of curriculum in Higher education.

Curriculum Theory and Higher Education

Curriculum theory literature has been rooted for the longest time in school education. A search for the term, for example, shows results skewed towards curriculum in North America and curriculum focused on schools. The discussions range between national curricular frameworks, political control, questions of identity, the environment of standardized testing (Linden, Annala, and Coate, 2017); or in other words, the how education happens, or ought to happen. However, there is little focus on the question of knowledge, or "what is to be taught", which is of interest to my inquiry. I interpret curricular theories, whatever their original context, to the extent they can be, in the setting of higher education. In some instances, I discuss arguments that have been made specifically in the context of higher education.

Linden, Annala, and Coate (2017) identify two features of curricular theory in the literature. First, they argue that there is a consistent conflation of theory and models. They offer examples where authors use the term theory and model interchangeably, which they find to be problematic. In my view, the lack of distinction between the theories and models is understandable in an applied field like education. A theory of anything would need to, in the end, be embodied in practice – which requires models. The second related issue they raise is of disciplinary views of curriculum, with different, non-education disciplines weighing in on the question of curriculum from their unique perspectives. Pinar (2008) for example argues that curricular theories have been "colonized" by educational psychology and the sociology of education, but ought to, in fact, be rooted in the discipline of education. While I find Pinar's argument appealing, I am hard-pressed to imagine a singular theory of curriculum rooted in Education, considering the very applied nature of education as an area of research and practice. A theory of curriculum, irrespective of its origin, can only be relevant through the practice of education. Or to be more accurate, one can view curricular practices through the lens of

particular theories, with the aim of being more reflective or with the intention of change, improvement, and evolution.

I, therefore, view the normative recommendations that I made in previous chapters through the lens of two theoretical arguments. The first set of arguments revolves around critical theory and questions of power within the curriculum – questions such as who decides the scope of education, what voices are represented, and how questions of access are addressed and so on (Paraskeva 2011). The second set of arguments relates to the role of knowledge in the curriculum or the question of "what is taught" based on the curricular arguments made by Young (2013), Shay (2015) Young and Muller (2015) and Muller and Young (2019).

The first lens of critical curricular theory is interesting because the discipline of History itself is so rooted in that tradition. It makes sense then to view the question of history curricula also through the same lens. Paraskeva (2011) quotes a host of scholars to claim "the school sells itself to a system of beliefs and the students are offered very specific pictures. Both serve to legitimize the existent social order, for they systematically neglect change and conflict" (p. 12). The scholars are all referring to school curricula, and the broader role of school education in the socialization processes of human beings. Yet I think this observation is relevant to interpret the slow pace of curriculum change within higher education. If disciplines and professors of those disciplines are better served by legitimizing the existing order, there would be little motivation for them to upend it. Yet there are plenty of people within the discipline engaged in multiple modes of creating and communicating knowledge. While some historians may have strong beliefs about maintaining status quo, there is evidence of intellectual openness when it comes to spatial ways of knowing. In addition, critical curricular theories attempt a theoretical basis that is too broad, in my opinion. It is a given that theories must try to provide broad-based explanations – or they would not be theories. Yet, the field of education is so diverse, and its purposes so varied, that it would be counterproductive to fit everything into a single frame. I conjecture that we may be better served by a curricular theory that is differentiated by disciplines. What would it look like to have a curricular theory for history, or even spatial history?

The second lens I look through is that of powerful knowledge, or PK as authors Young and Muller refer to it. Powerful knowledge refers to disciplinary knowledge that students have a right to know, and which ought to have a place in discussions of curriculum. The authors take great pains to distinguish the idea of powerful knowledge (PK) from knowledge of the powerful

(KOTP), the latter referring to the knowledge mediated by power, voice, and access as discussed in the earlier paragraph. The authors offer many nuanced discussions on what counts as powerful knowledge, and I summarize them here in terms that are most relevant to my inquiry. One argument Young and Muller (2015) make is that powerful knowledge is systematic and holds internal coherence. The curriculum can, therefore, move through a structure of concepts to build disciplinary knowledge. This definition seems particularly applicable to the natural sciences and it leaves other, less internally structured disciplines such as History, without a way to articulate what counts as powerful knowledge. The authors argue that this leads to a situation where curriculum once again get diverted – away from knowledge to what they call "skills-talk" (or "know-how"), as opposed to the structured propositional knowledge described earlier, (or "know that"). Could "know-how" count as powerful, necessary knowledge? And what is its relationship with "know that" in the context of History?

I now apply these ideas to the curricular map and list of topics proposed in the previous chapter. The list of topics themselves have internal coherence in some instances. For example, the concepts underlying spatial technologies, by their nature, are structured and need to be sequential. For example, one needs to understand polygons to understand basemaps, and basemaps to understand georeferencing, in that sequence. The topics within the disciplinary perspectives, however, are not strictly sequential. One can reflect on the nature of place and space and learn about the nuances of timelines in any order, and the concepts would often need to be considered together. This aligns with what Bernstein (Bernstein, 2000 in Young and Muller 2015) calls vertical and horizontal knowledge structures. The technology-based knowledge proposed in the list has a vertical, systematized knowledge structure, whereas the History knowledge has a horizontal, narrative knowledge structure. I argue that the overall map I provide preceding the topic list is a means for students to discern the internal coherence among topics relevant to spatial ways of knowing. I contend that the map provides a unified way of representing vertical and horizontal knowledge structures. It must also be borne in mind that I propose that these curricular interpositions are to exist alongside existing curricular structures and priorities. Therefore, I also contend that this curricular approach offers a way to intertwine know-that and know-how without having to dilute one or the other.

What of "know-how" in spatial History? How is that to be addressed in the curriculum? Spatial ways of knowing, or any epistemology for that matter, would be an example of "know-

how" – something that is content-agnostic, but intimately connected to content, nevertheless. To that extent, I am arguing that the "know-how" of spatial epistemology is, in fact, powerful knowledge. Scholars such as Winch (2010) describe two kinds of know-how: One, to know the relationship between concepts, and two, the ability to evaluate the concepts (where concepts would be the "know-that", in addition to the facts of History). The topic proposals I make quite strongly emphasize these precise ideas. For example, discussion and reflection on the concepts of space and place underline the relationships between key concepts, as do some of the proposed process diagrams. Similarly, studying a showcase of spatial history examples and following it with a discussion lends itself to an evaluation of the concepts with concrete examples. All this is, it is to be remembered, is still in the context of the "regular" history curriculum, which would focus on the traditional "know-that" of history. I am therefore confident, that the proposed curricular approach would adequately balance history "know-how" and "know-that".

In this section, I reflected on curricular theory and the idea of powerful knowledge and viewed my curricular proposals from that perspective. I next view these proposals through a pragmatic lens.

A Pragmatic View of Curricular Change in Higher Education

I refer to the work of Anakin et al (2017) to reflect briefly on the factors that drive curriculum change. Their empirical work is in the context of university-wide curricular change and not specifically disciplinary curricular issues. Their comparative case study reviewed curricular changes in two universities and commented on factors that impacted curricular change in those cases. I believe the factors they identify are applicable to my own inquiry. Firstly, because they are in the context of university curriculum, unlike most of the theoretical work that focuses on school education. Secondly, because they draw on empirical evidence from universities in Canada and UK specifically. I will review their findings regarding factors that drive curricular change and reflect on how these factors may affect the curricular proposals such as I have described in the previous chapter.

Anakin et al (2017) identify six factors that play a role in curricular change. These factors were seen as being either enabling or inhibiting with respect to the curricular change and as either strong or weak in its impact. The curricular change in question was a university-wide adoption of inquiry-based learning. The factors were seen in a social context involving the

institution, the department and the professor. The authors concluded that whether the factors had an enabling, inhibiting, strong or weak impact was tied in intimately with the context of the university. The six factors used to analyze the curricular change were ownership, resources, identity, leadership, students and quality assurance. I reflect on each of these factors in the context of my curricular proposals.

The first factor relates to **ownership** of the curriculum innovation. The factor is operationalized in terms of shared responsibility for the innovation, motivation to implement the innovation and scholarship around the curricular innovation (in other words, the opportunities to present their work with the curricular innovation at conferences). In the case of my proposed curricular interpositions, I anticipate that all three elements of ownership may play a role in the extent to which this curricular approach yields results. I conjecture that shared responsibility may be the weakest factor since it would depend on how the department defines responsibility for implementing interpositions. By design, no one professor, administrator or student group is accountable for the "outcomes" of the interpositions. This is likely to, therefore, dilute a sense of ownership. (Also see leadership as a factor, later in this section),

The second factor related to **resources**, operationalized as control over resources, distribution of resources and opportunities for professional development. Control referred to the ways in which the curricular innovation can balance between the research and teaching priorities of professors, distribution indicated the ways in which funding for the curricular innovation was spread over different tasks and groups, and professional development referred to the opportunities available to learn about the curricular innovation. In the context of my own proposals, resources as such may not play as big a role as with a large-scale curricular change such as the ones Anakin et. al. were investigating. While resources are no doubt necessary, the interpositional nature of the proposed curricular approach makes it a less demanding issue whether in terms of control, distribution or professional development, than in the case of a university-wide initiative. I conjecture that it would be unlikely that resources would play an inhibiting role in the adoption of my proposed curricular approach.

The third factor Anakin et.al. propose is **identity** as operationalized through teacher awareness, territorialness, and reputation. Awareness referred to the personal familiarity the professor had with the curricular innovation as a result of having engaged with it earlier. A territory force at the departmental level was typically an inhibitory factor encapsulated by the

perception that “People had no idea what is going in other faculties” (Anakin et. al., p. 212). Reputation indicated the standing of the university or department in terms of curricular innovation. It is difficult to hypothesize what role identity as a factor may play with respect my proposed curricular approach. Territorialness is very likely to inhibit interpositional elements: there would be the potential for creating duplicate elements or missing some altogether, under the assumption that it would fall under the purview of some other professor/department. It would be difficult to hypothesize about the role of teacher awareness and reputation as either enabling or inhibiting, since I am not aware of similar curricular approaches and empirical evidence around the same.

The fourth factor, **leadership**, is likely to be of the most relevance to my proposals. Leadership has been characterized by Anakin et. al. as vision for the curricular innovation, champions to promote it, and recognition for its appropriate implementation. I believe that vision would be central to enabling the curricular approach to lead to learning about spatial ways of knowing with respect to History. This relates closely to the factor of ownership and shared responsibility. I argued previously that ownership would be difficult to operationalize in the context of curricular interpositions since the approach points more to shared accountability, rather than shared responsibility. Shared accountability is a difficult-to-implement concept and has to, therefore, be replaced by leadership. I contend that a strong vision for a curriculum related to spatial ways of knowing, and champions who believe in its potential are more enabling in the context of my proposals than any other factor.

The fifth factor the authors identify is **students**, as exemplified by the learning needs of students and the benefit to students. I believe this factor too can play a strong enabling role in the adoption of my curricular proposal. In my inquiry, I have demonstrated the openness that students have towards spatial ways of knowing and the potential benefits it may bring them in professions within and outside academia. There is clearly a case for both student learning needs and benefit to students. Given that many universities are striving to be more student-focused (either due to curricular conviction or neo-liberal administrative impulses), it is a reasonable expectation that the student perspective will be at the heart of a curricular approach. If there is a student “demand” for spatial ways of knowing, universities will oblige.

The last factor regarding compliance with **quality assurance** refers to the mechanisms a university has to assess the quality of curricular innovations and outcomes and was found by

Anakin et.al. to be an enabling factor. In the case of my proposals, this factor is problematic since there would be no immediate measure of quality for such my proposed approach of curricular interpositions. The only parameter I can imagine at this juncture is whether the topics evenly cover the four tracks. It is conceivable that through continuous implementation of such an approach, other quality parameters will emerge and can be used for future evaluation of quality. In any case, I anticipate that such quality parameters will be highly context-specific.

In this section, I considered some pragmatic issues related to curriculum change in higher education and how they may relate to my proposals. I conclude in the next section with some reflections on the contributions of my inquiry to knowledge in the field and some possible ways forward.

Contributions of this Inquiry

This inquiry explored the spatial turn in History. Having established the meaning and nature of a spatial turn and its epistemological impacts on a discipline, I analyzed the ways in which the spatial turn was evident in the research and practice of History, and how spatial ways of knowing were employed to generate knowledge in the discipline of History. I examined the work and employment prospects for History graduates and how a spatial way of knowing may help or hinder such prospects. I also studied the tools and technologies that drive the spatial turn and the implications of their features and affordances for spatial ways of knowing in History. I reviewed History curricula both in traditional History departments as well as online, to determine to what extent these curricula were aligned with other developments in the ecosystem of spatial history. All these elements helped me draw a thick and rich description of the current status of spatial history and the curricular responses to the spatial turn. This state-of-the-art of spatial history is a clear contribution to knowledge. In painting this picture, this inquiry opens the doors to a variety of other research questions that have been raised in the discussion and the reflections sections.

The second contribution of this inquiry is the curricular proposals I make with respect to spatial ways of knowing in History. I propose the use of small curricular interpositions that work in tandem with existing curricular structures to offer History students multiple pathways to learn spatial ways of knowing and doing history. I also provide a curricular map to bring coherence to what might otherwise become a “conceptual heap” as described by Young (2010). The map not

only brings coherence from a pedagogical point of view, but also allows students to navigate the topic beyond the scope of the traditional curriculum. It allows them to access relevant learning from the vast resources available on the Internet, as well as to self-regulate in terms of how much they choose to learn.

The idea of using smaller learning modules is not new – it has entered the practice of education in various forms of mini-modules, micro-certifications and the like. Educators and education researchers are still establishing the educational or pedagogical merit of this approach. However, my contribution is a well-reasoned framework within which these small curricular elements gain an internal logic. This map, along with the sample topics to illustrate each element of the map is an original and, in my estimation, useful contribution to curricular thinking in higher education.

Spatial ways of knowing, as discussed in the initial chapters, are not unique to History. I chose History as one example to study, since it offered some interesting contradictions and tensions with respect to spatial ways of knowing. The method of inquiry I have designed and adopted has been created in the context of studying the spatial turn in History. Yet, I believe this same method (analyzing research, practice, work and employment, and technology affordances and then comparing them with actual curricular responses) could be used to study the spatial turn in other disciplines. I estimate that undertaking such an inquiry in say the discipline of Economics, would provide interesting insights into knowledge creation in Economics as well as the curricular alignment to prepare future economists with spatial ways of knowing. I anticipate that this method may well be applicable in its current form for several social sciences and the humanities disciplines. To this extent, I believe my work makes a methodological contribution as well.

This inquiry may possibly be extended in several ways, going forward. The first is an empirical evaluation of the curriculum proposals made here. That would provide some insight into the validity, usefulness, and practicality of these proposals. The second may be a similar exploration into other disciplines, which would enhance the reliability of the method. The resulting pictures from several disciplines would offer useful points of convergence and divergence from which the idea of spatial ways of knowing may be better understood. A third and perhaps ambitious research agenda would be to estimate if such inquiries may be undertaken with other kinds of turns such as the quantitative and cultural turns in the past, or the algorithmic

turn of the present/future. Comparing how curricula respond to turns, in general, would potentially offer insights into how disciplinary epistemology is taught and how it evolves.

'How we know' has a symbiotic relationship with 'what we know' in a discipline. Higher education curricula have a responsibility to explicitly explore this symbiosis.

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Appendices

Appendix A: Questions Used for Document Analysis

Adopting an "interview stance" with the data, I reviewed and analyzed documents in seeking answers to questions such as the following:

- What Spatial History projects are underway in North American and European universities and institutions? What is the quantum and nature of such projects? What technologies are being used? How are the projects staffed? In what ways are spatial technologies being used to communicate History knowledge? What kind of books are being published in the context of the Spatial Turn?
- What are the most popular careers for History Majors as seen by the History associations? What advice do the Associations provide to students with respect to developing their competencies for employability? Is there up-to-date employment data for History graduates? Are there jobs on LinkedIn and other platforms that seek History majors with spatial competencies? Could History majors fit into such jobs even if they are not explicitly defined as being for History majors?
- Is there a relation between the kind of research being done and the curricula adopted? How are teachers themselves prepared to handle this shift? Are there professional development opportunities for those that would like to enhance their ability to deal with the epistemic shift? Do departments in the discipline offer courses that prepare students for this epistemic shift? Are there other interventions such as workshops or course insertions? Are these courses for undergraduate students or graduate or for a general audience? These courses, where they exist, are they specific to the department or made available in an open format such as a MOOC? What informal learning avenues exist to learn about this epistemic shift? Where spatial history-related topics are taught, how are they taught? What technologies are available during the teaching process?
- Are there any published data about teachers' and students' perceptions about how the Spatial Turn must be accounted for in the teaching-learning process?

- Which features of Spatialization technologies lend themselves to Spatial History? How are technology companies seeing their products being used? Who are the primary users of these technologies? What are the flagship uses of these technologies in academia? What product and feature development plans have been announced for these products going forward? How might they impact the Spatial Turn?

Appendix B: Survey Instrument

The Survey was administered online using the following format. Respondents received the link via email and completed it anonymously.

History and the Spatial Turn

Students' perspectives on spatial ways of knowing in the History discipline

1. Please click <Yes> to indicate your willingness to participate in this study. Clicking <No> will take you to the exit.

- ○ Yes
- ○ No

2. How familiar are you with the following spatially oriented technologies?

	I have never heard of it	I know of it but have never used it	I am a novice user	I am an intermediate user	I am an expert user
Google Maps	◉	○	○	○	○
Arc GIS	○	○	○	○	○
Tableau	○	○	○	○	○
Other Maps (Ex. Open maps, Bing maps, etc.)	○	○	○	○	○
Other GIS software (ex. QGIS, gVSIG etc.)	○	○	○	○	○
Visualization using programming platforms (Ex. Python, R, etc.)	○	○	○	○	○

3. If you have used any of the technologies mentioned, please describe briefly what you used them for.

4. Would any of the following be possible uses for these technologies in the History discipline? Please select all that apply.

- [ ] They can be used to do History research (For example by overlaying historical records on map data)
- [ ] They can be a way to communicate Historical findings (For example, Historical analysis may be presented through an interactive map, rather than through an essay)
- [ ] They can be used to teach History at University level
- [ ] Other

5. Traditionally, History has relied on textual sources, and on writing as a means of doing History research. Do you think such spatial technologies can change the methods of doing History?

- ◯ Yes
- ◯ No
- ◯ Can't say

6. Please explain why you chose <yes<, <no> or <can't say> in the previous question.

7. Would you be interested in researching or studying History through such tools and methods?

- ◯ Yes
- ◯ No

- [ ] Can't say

8. Please explain why you chose <yes<, <no> or <can't say> in the previous question.

9. What career do you hope to pursue after your degree?

10. What skills do you think are necessary for such a career?

11. To what extent does your current program prepare you for such a career?

12. Would you consider a career that specifically demands spatial skills? (For example, working with maps, creating visualizations, analyzing spatial historical data, etc.) Please explain why or why not.

13. How would you describe your affinity for technology in general, or with digital ways of working?

- [ ] I don't like working with technology. I avoid it as much as possible.
- [ ] I prefer working with analog methods. But I can use technology when needed.
- [ ] I prefer working with digital methods. But I can use paper and analog methods if needed.
- [ ] Other _____

14. In your experience, how does your knowledge of technology compare with those of the teachers/professors in your program?

- [ ] They are better at using technology. I can learn from them.
- [ ] They know some things better than me. I know other things better than them.

- [ ] I know as much as they do.
- [ ] I am likely to know more than them with respect to technology.
- [ ]

15. Please provide more details regarding your answer in the previous question. (What technologies are you referring to? In what ways does the expertise differ... etc.)

16. What program are you currently in?

- [ ] Undergraduate
- [ ] Graduate - Masters
- [ ] Graduate - Doctoral
- [ ] Other

17. Which discipline will grant your degree?

18. Where is your university located?

- [ ] Canada
- [ ] United Kingdom
- [ ] United States

Appendix C: Interview Instrument

The following questions were used in a semi-structured format with the professors and experts interviewed for this inquiry. Depending on the background and expertise of the individual interviewee, the questions were sometimes modified, or certain questions were not used in the interview. Conversations were allowed to develop based on the responses of the interviewee.

Questions:

- Would you say there is a spatial turn in History at the present? Why or why not?
- How have technologies impacted the study of History in general? How have geospatial and visual-spatial technologies impacted History in particular?
- To what extent do the affordances of a technology drive History research?
- How do different open source and proprietary tools impact spatial history? In what circumstances do they limit the discipline of history?
- How do spatial history, quantitative history and digital history compare?
- Does a spatial way of knowing demand a specific kind of knowledge or skill beyond knowing the tools?
- Should universities teach spatial methods, you know, just like they teach among the methods courses within history? Do you think they should teach it?
- How are spatial ways of knowing or spatial ways of doing history taught?
- Should a university concern itself with the employability of its students? And to what extent and how does this play out in the context of spatial history?
- From your perspective, what are students looking for from a university education?
- Do students see themselves as more tech-savvy than their professors? What is your own opinion on the matter?
- How are curricula determined within History departments? Who makes curricular decisions and what criteria are the decisions based on?
- In what ways do you collaborate with other researchers or disciplines for spatial history?
- Could you share examples of spatial history work you are involved in – what were the challenges you faced? What was satisfying?

- How do you address the question of data availability for spatial history? How does it affect your work?
- What do you see as the future of the History discipline?
- Questions about the professor's specific work/publications/ contributions

Appendix D: Jobs Available for History Students

The jobs analyzed in this inquiry may be found in the table below. The second column indicates the source from which the job posting was taken. AHA refers to the American Historical organization. GD refers to Glassdoor, Ind refers to Indeep and LI refers to LinkedIn. The third column indicates the university, institution or commercial entity posting the job. The fourth column lists the job title as listed in the posting, the next indicates the level of job. “Ent” indicates and entry-level job and “Exp” indicates a job that demands previous experience. Field in the subsequent column refers to the domain area or specialization of the job. The next column titled job scope refers to the nature of work expected. The next column (Tenure / duration / Status) refers to the permanence of the position. The next two columns indicate the formal education being called for and the technical skills required. The last column shows the classification of the jobs based on my analysis. Numbers have been used for ease of representation and may be understood using the following legend.

0 = Traditional History job. (Non-Research, Non-Teaching)

1 = Traditional History job (Academic / Research / Teaching)

2 = A job that calls for a person with History education + spatial skills

3 = A job that calls for Spatial skills and to which History students could reasonably apply

NA indicates that the information was not available or indicated in the source.

	Source	Affiliation	Job title	Level	Field	Job scope	Tenure / Duration / Status	Req. Education	Tech. skills required	Job Type
1	AHA	Rice University	Spatial Humanities Initiative - Postdoctoral Fellow in Levantine Studies	Ent	Open	Research	Fellowship	PhD	mandatory GIS specialization	2
2	AHA	Watson Institute,	Lecturer Position in the Field of Security Studies	Exp	International Security	Teaching	Full Time, Non-TT	PhD	NA	1

	Source	Affiliation	Job title	Level	Field	Job scope	Tenure / Duration / Status	Req. Education	Tech. skills required	Job Type
		Brown university								
3	AHA	Indiana University	Visiting Assistant Professor and Assistant Editor, Journal of American History	Exp	US History	Teaching	Full Time, Non-TT	PhD	NA	1
4	AHA	The college of the Holy Cross	Full-time Visiting Faculty Position in History (Middle Eastern and North African History)	Exp	Middle East / North Africa	Teaching	Visiting Faculty	PhD	NA	1
5	AHA	American Historical Association	American Historical Review Editor	Exp	Open	Editorial	Management / Leadership	PhD	NA	0
6	AHA	CUNY Graduate Center	Director (Academic Center Director) – The Gotham Center for New York City History	Exp	North America	Management, organization, communication, networking	Management / Leadership	Bachelor's, PhD preferred	Digital skills - video, website management etc.	0
7	AHA	Bates College	Visiting Assistant Professor of Africana	Ent	Africa	Teaching	Full Time, Non-TT	PhD	NA	1
8	AHA	Columbia University Libraries	Curator of Medieval and Renaissance Collections	Exp	North America	Archival	Full Time, Non-TT	MLIS / PhD or equivalent experience	relevant web applications for the humanities	0
9	AHA	University of Miami	Visiting Assistant Professor, Nineteenth- and Twentieth-Century Caribbean and Latin American History	Exp	Latin America	Teaching	Full Time, Non-TT	PhD	NA	1

	Source	Affiliation	Job title	Level	Field	Job scope	Tenure / Duration / Status	Req. Education	Tech. skills required	Job Type
10	AHA	CUNY Brooklyn College	Associate Provost for Institutional Effectiveness	Exp	Open	Management, organization, communication, networking	Full Time	Bachelors	Background in qualitative and quantitative research	0
11	AHA	CUNY Brooklyn College	Director of International Programs and Study Abroad	Exp	Open	Management, organization, communication, networking	Full Time	Bachelors	NA	0
12	AHA	Bates College	Lecturer in Classical and Medieval Studies (Hellenist)	Exp	Classical Studies	Teaching	Part Time	PhD	Expertise in Digital humanities desirable	2
13	AHA	Penn State University	Post-doctoral Fellowships	Exp	Open	Research	Fellowship	PhD	NA	1
14	AHA	Smithsonian	Museum Curator	Exp	Open	Curation	Fellowship	"some college"	strong background in science, tech, engineering	0
15	AHA	Bates College	Lecturer in History (Chinese)	Ent	Asia	Teaching	Part Time	PhD	NA	1
16	AHA	Bates College	Lecturer in Classical and Medieval Studies (Romanist)	Exp	Classical Studies	Teaching	Part Time	PhD	Digital humanities desirable	2
17	AHA	Bates College	Lecturer in History (Modern European)	Ent	Europe	Teaching	Part Time	PhD	NA	1
18	AHA	American Historical Association	Editorial Assistant	Exp	Open	Editorial assistance	Non-exempt 35-hour week	Bachelors	Common design applications and willingness to learn new digital applications	0
19	AHA	Arizona State University	Clinical Assistant Professor of History, Online History MA	Exp	North America	Curriculum development, program planning, student advising	Full Time, Non-TT	PhD	NA	0

	Source	Affiliation	Job title	Level	Field	Job scope	Tenure / Duration / Status	Req. Education	Tech. skills required	Job Type
20	AHA	Arizona State University	Civic Education Assistant Professor	Exp	Political	research and teaching	Full Time, TT	PhD	NA	1
21	AHA	Rutgers University New Brunswick	Postdoctoral Associate	Exp	African American	Research	Fellowship	PhD	NA	1
22	AHA	David M. Rubenstein Center for White House History	Senior Vice President, White House Historical Association	Exp		Management, leadership	Full Time	An advanced degree in a related field.		0
23	AHA	Princeton	Fung Global Fellows Program	Academic exp	World / Global	Research	Fellowship	PhD		1
24	AHA	Cornell	Assistant Professor	Ent	North America	Teaching	Full Time TT	PhD	NA	1
25	AHA	Emory	Assistant Professor	Ent	Africa	Teaching	Full Time TT	PhD	NA	1
26	AHA	Lewis and Clark Trail Heritage Foundation	Executive Director	Exp	North America	Management, leadership	Full Time	4 year degree	NA	0
27	AHA	Colorado College	Professor	Exp	Latin America	Teaching	Full Time TT	PhD	NA	1
28	AHA	Concordia University	CRC Tier II in Indigenous Oral Tradition and Oral History	Ent	Native American	Teaching, Research	Full Time TT	PhD	NA	1
29	AHA	National Endowment of the Humanities	Humanities Administrator	Exp	Native American	Communication, coordination	Full Time	Bachelors. PhD preferred	NA	0
30	AHA	Texas Christian University	Associate Professor	Exp	African American	Teaching	Full Time TT	PhD	NA	1

	Source	Affiliation	Job title	Level	Field	Job scope	Tenure / Duration / Status	Req. Education	Tech. skills required	Job Type
31	AHA	Yale	Senior Archivist for American Diplomacy	Exp	International	Librarian / Archivist / Curator	Full Time	masters	NA	0
32	AHA	AHA	Managing Editor	Exp	Open	Management, leadership	Full Time	PhD or Masters	NA	0
33	AHA	NY Historical Society	Mellon Post Doc	Exp	Women / Gender	Research	Full Time. Fixed term	PhD	NA	1
34	AHA	Appalachian State University	Assistant Professor	Exp	ME / North Africa	teaching	Full Time TT	PhD	NA	1
35	AHA	Charles Koch Foundation	Program Manager, Higher Ed Philanthropy	Exp	Open	Management, coordination	Full Time	na	NA	0
36	AHA	Organization of American Historians	Executive Director	Exp	US	Management	Full Time, Non-TT	PhD	NA	0
37	AHA	NYU Abu Dhabi	Research Fellow	Exp	Middle East	Research	Fellowship	PhD	NA	1
38	AHA	Wesleyan University	Assistant Professor	Exp	US	Teaching	Full Time TT	PhD	NA	1
39	AHA	Lafayette College	Assistant Professor	Exp	Europe	Teaching	Full Time TT	PhD	NA	1
40	AHA	Smithsonian Institution	Associate Director	Exp	US	Curatorial	Full Time	PhD	NA	0
41	AHA	University of Wisconsin - Madison	Assistant Professor	Ent	US	Teaching	Full Time TT	PhD	NA	1
42	AHA	UCLA	Assistant Professor	Exp	ME / North Africa	Teaching	Full Time TT	PhD	NA	1
43	AHA	AHA	American Historical Review Editor	Exp	Open	Editorial, management, leadership	Full Time	PhD	NA	0

	Source	Affiliation	Job title	Level	Field	Job scope	Tenure / Duration / Status	Req. Education	Tech. skills required	Job Type
44	GD	Stanford	Academic Technology Specialist - Department of History	Ent	Open	Teaching support, teaching, consulting	Full Time, Non-TT	Bachelors, Advanced degree preferred	GIS, Mapping geo-humanities, programming	2
45	GD	University of Texas, Austin	Research Program coordinator	Exp	Open	Coordination, communication	NA	Bachelors	GIS, Data visualization, data management, content management, social media, public engagement	3
46	GD	Univ of Alabama	ATI Research Personnel	Exp	Open	Research	Staff, Non-TT	PhD or Masters	quantitative methods, GIS, statistics desirable	3
47	GD	Center For Strategic And International Studies	Research Intern	Some exp	History (or others)	research	Intern	Practical or academic background in History / GIS / statistical software	Data Science and GIS skills, programming	3
48	GD	University of New Mexico, Albuquerque	Research scientist	Ent	History (or others)	Research	1-year fixed term	Any bachelors	Experience with Statistical software or GIS	3
49	GD	Collectors Universe INC	Research Specialist	1-3 yr exp in History research	Cataloguing collectibles	research and Communication		Bachelor's in History		0
50	GD	Univ of Michigan	Research Assistant	Ent	Open	research	hourly	student at university	Quantitative analysis and experience with GIS	3

	Source	Affiliation	Job title	Level	Field	Job scope	Tenure / Duration / Status	Req. Education	Tech. skills required	Job Type
51	GD	Anaheim Police department, California	Criminal Research Specialist	Exp	Open	research, mapping, reporting	Full Time	Bachelors, in public administration or related field	Quantitative analysis and experience with GIS	3
52	GD	Global Research Institute	Deputy Director of Research, Policy Analysis Unit	Exp	Open	research and Communication	Full Time	Advanced degree in political science or related field	Preferred: proficiency in Python, SQL, GIS	3
53	GD	Recruiter in the UK	Graduate Research Analyst	Ent	Open	Research	temporary or permanent	Undergrad History	Preferred GIS	2
54	GD	Historic England Archive	Cataloguer Trainee	Ent	UK	Cataloguing, research	NA	not mentioned	open to Interrogate GIS mapping systems	0
55	GD	Oregon Dept of Human Services	Research Analyst	Ent / Exp	NA	research	Full Time	Bachelors with some courses in quant / stats or 5 years exp	Experience with Geo-spatial analysis	3
56	GD	Oregon Health Authority	Self management Research Analyst	Ent/ Exp	NA	research	Full Time	Bachelors with some courses in quant / stats or 5 years exp	Experience with Geo-spatial analysis	3
57	GD	University of New Mexico	Research scientist 1	Ent	NA	research	Full Time	Bachelors, PhD Preferred	Demonstrated experience with GIS, quantitative methods and qualitative methods	3
58	GD	Apex Systems	Field Maintenance GIS researcher	Ent	Na	research, communication	fixed term	NA	GIS, conduct research, ability to	3

	Source	Affiliation	Job title	Level	Field	Job scope	Tenure / Duration / Status	Req. Education	Tech. skills required	Job Type
									learn complex subject matter	
59	GD	Univ Texas, Austin	Research Associate 1	Ent	NA	research	fixed term	Bachelors in archeology, anthropology or related	Gis, ArcGIS	3
60	GD	CAN Corporation	Research Analyst	Ent / Exp	NA	research, communication	Full Time / Part Time	Masters. PhD preferred	Geo spatial analysis	3
61	GD	Univ Alabama	ATI research personnel	Ent / exp	NA	Research	Full Time / Part Time	Masters. PhD preferred	Geo spatial analysis	3
62	GD	Center For Strategic And International Studies	Research Intern	Ent	NA	Research	Full Time / Part Time	NA, Need experience in History or related area	GIS, data visualization, Statistical modeling	2
63	GD	William and Mary	Senior Research Analyst	Exp	NA	research, communication	Full Time	Advanced degree in related discipline	GIS and quantitative analysis	3
64	Ind	York County Government	Historian	Exp	Local	Supervise, communicate, network	NA	Masters + experience	Work with software and maps, plus other tools	3
65	Ind	University of California, Santa Barbara	K.S.N. Rancho Marino Reserve Director	Exp	Open	management, communication	Full Time	PhD in filed science	GIS, database management	3
66	Ind	Student Conservation Association Grants, NM	Archaeology Intern	Ent	open	Historic site preservation	Full Time	NA	GIS and mapping training provided on the job	3

	Source	Affiliation	Job title	Level	Field	Job scope	Tenure / Duration / Status	Req. Education	Tech. skills required	Job Type
67	LI	Colliers International	GIS research specialist	Exp	real estate	research, communication	Full Time	NA	GIS concepts, skills, mapping best practices	3
68	LI	Apex Systems	Researcher	Ent	NA	research	Hourly	NA	GIS analysis	3
69	LI	University of Iowa	research archeologist	Exp	NA	research or reporting	Full Time	Masters in Archeology or related field	Experience with GIS / Spatial	3
70	LI	City of Garland, Texas	Research Specialist	Exp	NA	research, communication	Full Time	Advanced degree in related discipline	GIS and quantitative analysis	3
71	LI	Univ of Michigan - Flint	Research Fellow	Ent	NA	research, communication	Fellowship	PhD in Related discipline	GIS and Historical Data Special Infrastructure (HDSI)	3
72	LI	Butte, Silverbow	Research Specialist	Ent	Silver bow	research	Full time	NA	GIS, Map skills	3
73	LI	Clearedjobs.net	Human Geographer, Apprentice	Ent	NA	Research	Full Time	NA	GIS skills,	3
74	Google	Jobfundaby	Architectural Historian	Ent	NA	Research, communication	Full time	NA	GIS skills a plus (along with office skills)	3

Appendix E: Spatial History Labs

The following is the list of spatial history labs and projects reviewed for this inquiry. The list does not claim to be exhaustive, but it does provide a comprehensive view of the kinds of spatial History projects and Labs in the United States, United Kingdom and Canada.

Column one indicates the university or institutional affiliation of the project or lab. Column two indicates the name of the lab or project. Column three includes a brief description of the nature and focus of the lab or project. In many cases, a succinct description of the lab is quoted directly from the associated webpage.

Affiliation	Name of Lab / Center/ Project	Brief Description
Stanford University	Spatial History Project	The projects in this lab "operate outside of normal historical practice in five ways: they are collaborative, use visualization, depend on the use of computers, are open-ended, and have a conceptual focus on space". The project is part of the Stanford Center for Spatial and Textual Analysis (CESTA). *(http://web.stanford.edu/group/spatialhistory/cgi-bin/site/index.php)*
Harvard	The Imperiia Project	"The Imperiia Project exists for a simple purpose: to study the spatial history of the Russian Empire.". Project Director Kelly O Neill describes the project as "a long-term, collaborative attempt to explain why "where" matters. Behind that question lurks the conviction that thinking spatially prompts us to ask new questions, work in new ways, produce new knowledge, communicate that knowledge through new media, and build new communities." *(http://dighist.fas.harvard.edu/projects/imperiia/)*
Michigan Technological University	Historical Environments Spatial Analysis Lab (HESAL)	The project describes itself as a community of "scholars and community groups who work together using geospatial technologies to understand how environments change over time. Through a combination of citizen science projects, GIS and geospatial technology training, and community-driven research we examine how social, human built, and natural environments are impacted by the forces of industrialization

Affiliation	Name of Lab / Center/ Project	Brief Description
		and deindustrialization. Our expertise is in the development of big datasets, web-based and mobile GIS applications, and spatial analysis" *(https://www.historicalgis.com/)*
Northeastern University	NU Lab for texts, maps and networks	The NU Lab focuses on text, maps and networks and describes itself as the university's center for Digital Humanities and Computational Social Science. Spatial History is just one component of the projects undertaken by this lab. *(https://web.northeastern.edu/nulab/)*
UC Santa Barbara	Center for the Spatially Integrated Social Sciences (CSISS)	The Center describes claims that it "recognizes the growing significance of space, spatiality, location, and place in social science research. It seeks to develop unrestricted access to tools and perspectives that will advance the spatial analytic capabilities of researchers throughout the social sciences." The focus is on the social sciences, which may still be of relevance to Historians who think of their discipline as a social science, as proposed by Landy. *(http://www.csiss.org/)*
University of North Carolina	Carolina Digital Humanities / Digital Innovation Lab	This is an umbrella unit to address all of Digital Humanities, including Spatial History, placing no specific emphasis on Spatial History. Apart from projects, the Lab offers a Certificate and a Graduate Certificate program in Digital Humanities including several courses explicitly dealing with spatial analysis for the Humanities. *(https://cdh.unc.edu/)*
University of Portsmouth	Great Britain HGIS Project	The University describes this project "a unique digital collection of information about Britain's localities as they have changed over time. Information comes from census reports, historical gazetteers, travellers' tales and historic maps assembled into a whole that is much more than the sum of its parts" The focus of the center is described as "the development of our GIS as a national resource" in addition to undertaking other Historical GIS projects and consultancy work. *(http://www2.port.ac.uk/research/gbhgis/)*

Affiliation	Name of Lab / Center/ Project	Brief Description
American Association of Geographers	Historical GIS Clearinghouse and Forum	Contains resources, gazetteers, databases, atlases etc. The project website describes itself as "The Historical GIS Clearinghouse and Forum provides a central reference point for scholars seeking to access or catalogue projects that apply geographic technologies to historical research." *(http://www.aag.org/cs/programs/historicalgis)*
Lancaster University	The Historical GIS Research Network	Set up by Ian Gregory and Paul Ell, this project has a four-pronged approach: "To provide a focus for HGIS in the UK; To advance knowledge of HGIS at technical, methodological and applied levels, To encourage the adoption of GIS amongst a broad audience of researchers who have an interest in the past; To investigate the setting up of an international association to act as a focus for historical GIS research." *(http://www.hgis.org.uk/)*
Indianapolis University	The Polis Center / Spatial Humanities	This project in which spatial historian David Bodenhamer is involved includes a variety of projects, publications, and collaborations *(https://polis.iupui.edu/)*
Brown University	Spatial Structures in the Social Sciences (S4)	The Center describes itself as follows: "At S4 our principal focus is to develop, support, and extend spatial research at Brown. To that end we both initiate and consult on a wide variety of research projects and proposals. … We also provide consulting services to the Brown community…. (The Center) is the scholarly space for exchange among faculty and students working on issues of geography, networks, and context in myriad settings. Work supported by S4 ranges from simple map-making, through a wide range of applications in Geographic Information Systems (GIS), to innovative research with the latest concepts and methods in spatial analysis." *(https://www.brown.edu/academics/population-studies/about/services/spatial-structures-social-sciences-s4)*
Rice University	Imagine Rio	This project within Rice University's Humanities Research Centre can be found on imaginerio.org and describes itself as "a searchable digital atlas that illustrates the social and urban evolution of Rio de Janeiro, as it existed and as it was imagined. Views, historical maps, and ground floor plans –from iconographic, cartographic, and architectural archives– are located in both time and space while their visual and spatial

Affiliation	Name of Lab / Center/ Project	Brief Description
		data are integrated across a number of databases and servers, including a public repository of images, a geographic information system, an open-source relational database, and a content delivery web system." *(https://www.citylab.com/equity/2016/05/the-real-and-imagined-urban-history-of-rio-de-janeiro-mapped/482889/)*
Harvard University	Open World Map	Open World Map is a project that is part of Harvard's Center for Geographic Analysis. The open world map tool is a low-barrier entry for scholars to engage with spatial representation and analysis. The center describes its goals as follows: "Working with entities across Harvard, the CGA strengthens university-wide geographic information systems (GIS) infrastructure and services; provides a common platform for the integration of spatial data from diverse sources and knowledge from multiple disciplines; enables scholarly research that would use, improve or study geospatial analysis techniques; and improves the ability to teach GIS and spatial analysis at all levels across the university." *(https://worldmap.harvard.edu/)*
University of Victoria, BC	Map of early and modern London	This project is part of the Humanities Computing and Media Center of the University of Victoria. "The Map of Early Modern London is a hyperlinked atlas of sixteenth- and seventeenth-century London based on the "Agas" woodcut map of the 1560s. Over 200 sites and streets are linked to pages that provide a full historical and archaeological survey, quotations from John Stow's Survey of London, and a bibliography of literary references. … For example, you can click on a street and find all the literary references in our database to that street. This site began as a pedagogical tool in 1999". *(https://www.uvic.ca/humanities/hcmc/projects/index.php#moeml)*
New York University	Irish Speakers and the Empire city.	This research project aims to catalog Irish speakers in New York area, based on the 1910 census. This is a student project at the New York University, and enlists citizen participation in identifying Irish speaking households from the census data and mapping them spatially. *(https://www.nyuirish.net/irishlanguagehistory/)*
University of North Carolina	Ancient World Mapping Center	"The Ancient World Mapping Center is an interdisciplinary research center ...(that) promotes cartography, historical geography, and geographic information science as essential disciplines within the field of ancient

Affiliation	Name of Lab / Center/ Project	Brief Description
		studies through innovative and collaborative research, teaching, and community outreach activities. AWMC is committed to facilitating discussion, guidance, information exchange, collaboration, and access to cartographic and bibliographic resources in cooperation with such projects." The center generates historical maps and atlases of several areas and periods. *(http://awmc.unc.edu/wordpress/about/)*
University of Richmond	Digital Scholarship Lab	This Lab positions itself under the broader scope of digital scholarship. Yet, many of its projects revolve around map making, data visualization and spatial analyses. Some examples of projects are The American Panorama, Hidden Patterns of the Civil War, Visualizing Emancipation, Fall of Confederate Richmond, Richmond Slave Trade 3D visualization etc. (*http://awmc.unc.edu/wordpress/about/)*
George Mason University	Roy Rosenzweig Center for History and New Media	The Center describes itself as "We use digital media and computer technology to democratize history: to incorporate multiple voices, reach diverse audiences, and encourage popular participation in presenting and preserving the past." Two of the projects relevant to this inquiry are Histories of the National Mall and Mapping Early American Elections. *(https://rrchnm.org/about/)*
Columbia University	Center for Spatial Research	The Center describes its mandate as "The Center for Spatial Research was established in 2015 as a hub for urban research that links design, architecture, urbanism, the humanities and data science. It sponsors research and curricular activities built around new technologies of mapping, data visualization, data collection, and data analysis.". Projects of interest to this inquiry are Mapping Historical New York City and Points Unknown: Cartographic Narratives. *(http://c4sr.columbia.edu/#/about)*
University of Saskatchewan	HGIS Lab	The HGIS Lab describes itself as "unit(ing) history and geography to explore change through time and variation across space. Merging historical methods with Geographic Information Systems technology opens up innovative analytical possibilities for historical research…Thematically, the Lab specializes in

Affiliation	Name of Lab / Center/ Project	Brief Description
		environmental and agricultural history, including studies of land use, wind erosion, and socio-ecological metabolism in historical farm systems.". The Lab has a robust spatial history research program. *(https://hgis.usask.ca/)*
Canadian Research Group	Canadian HGIS Partnership	The partnership describes its vision as providing "a forum for academic and public researchers and institutions, in Canada and beyond, to share data and best practices for mapping Canadian historical subjects on the web." Partner organizations include the libraries at the University of Toronto, Alberta, and Victoria, as well as ESRI Canada, the Neptis Foundation, And Toronto Green Community – Lost Rivers *(https://hgis.usask.ca/)*.
University of Southern California, Dornsife	Spatial Science Institute	The Spatial Science Institute is not dedicated to Spatial History, but has a broader mandate" "We collaborate with a cross-cutting array of researchers, businesses, non-profits, NGOs, and other entities from a wide range of disciplines and industries to analyze, model, and visualize location-based data". One of the institute's focus areas, The Meaning of Place, is of specific interest to this inquiry. the Institute also places emphasis on innovating in teaching spatial ways of knowing. *(https://spatial.usc.edu/about-us/)*
University of Oregon et al.	Mapping Rome	This project is a collaboration between Oregon University, Stanford University, Dartmouth College and Studium Urbis. The aim of the project is to collaboratively create "an encyclopedic geo-database comprised of multi-layered maps replete with vetted annotations, important dates, patrons, artists, relevant bibliography, photographic and historic images, and other metadata.". *(http://mappingrome.com/)*
University of Prince Edward Island	GeoReach Lab	The University of Prince Edward Island houses the GeoREACH Lab which stand for Geospatial Research in Atlantic Canadian History. As the website states, the focus of the lab is "the history of food and agriculture in Canada, and we study the ways that the modern food system has shaped our relationships with animals and the land. Prince Edward Island was a relative late adopter of modern industrial agriculture, and in many ways it is still going through this profound social-ecological transition. This presents an opportunity to

Affiliation	Name of Lab / Center/ Project	Brief Description
		interview, map, and otherwise study the causes and impacts of agro-ecosystem transformation in one place over time." *(http://projects.upei.ca/geolab/)*
DC Historic Preservation Office	DC History Quest	"DCHistoryQuest is an interactive GIS map that provides historical data on approximately 127,000 extant buildings in Washington, D.C. The map offers several operational layers of data for the reader, including historical data on individual buildings, information on properties listed in the D.C. …The featured layer in the map is the Historical Data on DC Buildings. The historical data found in this layer has been drawn from a variety of sources, including permits, permit index, maps, newspapers, tax assessments, city directories, site visits and more. *(https://dcgis.maps.arcgis.com/apps/webappviewer/index.html?id=4892107c0c5d44789e6fb96908f88f60)*
Multi-Institution Collaboration in the UK	Locating London's Past	This project is a collaboration between the University of Hertfordshire, the Institute of Historical Research, University of London, and the University of Sheffield. "Locating London's Past provides an intuitive GIS interface enabling researchers to map and visualize textual and artefactual data relating to seventeenth and eighteenth-century London against John Rocque's 1746 map of London and the first accurate modern OS map." *(https://www.locatinglondon.org/static/Project.html)*
Stanford University Libraries	ORBIS, Stanford Geo-spatial Network Model of the Roman World	ORBIS uses geo spatial modeling to uncover complex communication and transportation costs in the Roman Empire. "By simulating movement along the principal routes of the Roman road network, the main navigable rivers, and hundreds of sea routes in the Mediterranean, Black Sea and coastal Atlantic, this interactive model reconstructs the duration and financial cost of travel in antiquity. Taking account of seasonal variation and accommodating a wide range of modes and means of transport, ORBIS reveals the true shape of the Roman world and provides a unique resource for our understanding of premodern history." *(http://orbis.stanford.edu/)*

Affiliation	Name of Lab / Center/ Project	Brief Description
Historical Society of Pennsylvania	Philaplace	PhilaPlace "connects stories to places across time in Philadelphia's neighborhoods. PhilaPlace weaves stories shared by ordinary people of all backgrounds with historical records to present an interpretive picture of the rich history, culture, and architecture of our neighborhoods, past and present. The PhilaPlace Web site uses a multimedia format – including text, pictures, audio and video clips, and podcasts – and allows visitors to map their own stories in place and time. ... PhilaPlace is an engaging, meaningful way to understand more about where we live, and will serve as an enduring record of our heritage." *(http://www.philaplace.org/about/)*
University of Nebraska, Lincoln	Railroads and the making of modern America	"Railroads and the Making of Modern America collects and makes available a wide array of materials documenting the social effects of the railroad and the transformation of the United States to modern ideas, institutions, and practices in the nineteenth century. The project utilizes the digital medium to investigate, represent, and analyze this social change and document episodes of the railroad's social consequences. *Railroads* is meant to act as a research and teaching platform to test hypotheses, to create visualizations of complex processes, and to inspire scholarship" *(http://railroads.unl.edu/)*

Appendix F: MOOCs and Online Courses Relevant to the Spatial Turn in History

The table below shows the online courses that engage specifically with spatial ways of knowing. Column 1 indicates the name of the course. Column two indicates the level of the course where G stands for a Graduate level course and UG stands for an Undergraduate level course. Column three shows the department offering the course while column 4 indicates the subject focus of the course. The next column contains notes on the teaching format and the sixth column indicates the nature of assessments involved. The seventh column indicates if the course focuses more on spatial concepts and ideas or on the use of spatial tools. The last column indicates the prerequisite knowledge required for students in that course (Intermediate indicating that prior knowledge and exposure to spatial ways of knowing are required).

Course	Level	Dept	Subject Focus	Teaching format	Assessments	Concept / Tool Focus	Level
Transnational, Global and Spatial History M. Litt	G	History	Spatial History	seminars, fortnightly tutorials and practical classes	M.LItt Dissertation	concept	Intermediate
Intro to HGIS (HIST 201)	UG	History	Spatial History	seminar, Lab	projects, participation	concept	Beginner
Intermediate HGIS (HIST 202)	UG	History	Spatial History	seminar, Lab	Projects, participation	tool	Intermediate
Mapping History (HIST 1952)	G	History	Spatial History	Seminar, skills workshops, practical work	participation, Deep maps, paper	concept	Intermediate
Digital History (HIST 2284)	G / Advanced UG	History	Spatial History	seminar, projects	participation, blog posts, toolkit exercises, project portfolio	concept	Intermediate
Digital methods for the spatial analysis of the past (HIST 2736) part of World History Methods	UG	History	World History	Seminar, exposure to tools	Participation, weekly writing, project	concept	Beginner

Course	Level	Dept	Subject Focus	Teaching format	Assessments	Concept / Tool Focus	Level
Digital History (H393)	UG	History	Digital History	seminar, lab,	tool based assignments. Interesting grading system - student picks target grade	concept, tool	beginner
History 3816 G / Digital Humanities 3902G	UG	History	Digital History	not specified. No hands on mentioned, though students have to "try tools". Likely to be lecture and discussion based	assignments, essay, class presentation, final exam	concept	beginner
EALC 29527 The Spatial History of Nineteenth-Century Cities: Tokyo, London, New York	UG?	East Asian Languages and Civilizations	Spatial History	Concept, exploring ArcGIS,	Project	concept	beginner

Massive Online Open Courses (MOOCs)

The table below shows the MOOCs available as of August 2019 that were related to spatial ways of knowing. The MOOCs are aggregated across several MOOC platforms. Column one indicates the course name. Column two shows the insititution offering the MOOC, column three shows the country where the MOOC was developed and column four shows the platform that hosts the MOOC. Column five and six show the duration of the course in calendar weeks and the predicted number of learning hours. Column seven shows the average student rating of the course (out of a maximum of 5) while column eight shows the number of ratings available. The last two columns show the number of descriptive student reviews available for each course and the number of students enrolled in the course. The enrollment numbers typically indicate the total enrollment since the course was launched, and not necessarily the enrollments of the on-going cohort.

NA indicates that the information was not available. This was most problematic for the enrollments since they are not uniformly reported. In certain cases, I have indicated the number of people who have expressed interest in enrolling in the course.

Course Name	Institution	Origin Country	Platform	# weeks	# hours	Rating	# Ratings	# Reviews	# enrolled
Going Places with Spatial Analysis	ESRI	US	Independent	6	18	NA	NA	NA	NA
Spatial Informatics	IIT Kharagpur	India	Swayam	8	NA	NA	NA	NA	NA
Spatial Data Science and Applications	Yonsei University	S. Korea	Coursera	6	NA	4.4	134	43	6519
The Brain and Space	Duke	US	Coursera	6	30	4.7	259	71	28521
GIS, Mapping, and Spatial Analysis Capstone	U. Toronto	Canada	Coursera	6	36	4.9	7	NA	NA
Spatial Analysis and Satellite Imagery in a GIS	U. Toronto	Canada	Coursera	6	30	4.9	11	2	NA
Maps and the Geospatial Revolution	Penn State	US	Coursera	5	45	4.7	140	48	12745
From GPS and Google Maps to Spatial Computing	U. Minnesota	US	Coursera	NA	80	4.5	NA	2	"275 interested"
Imagery, Automation, and Applications	UC Davies	US	Coursera	4	NA	4.9	406	78	10948
Information Visualization: Advanced Techniques	NYU	US	Coursera	4	NA	4.5	13	4	NA
Geographical Information Systems - Part 1	Ecole P, Lausanne	Switzerland	Coursera	6	18	NA	NA	NA	5364 "recent views"
Introduction to Geographical Information Systems (GIS)	U. Western Florida	US	Canvas	6	NA	NA	NA	NA	NA
Vernacular architecture	MGR ERI	India	Swayam	8	NA	NA	NA	NA	NA
Exploring Geographic Information Systems	Simon Fraser	Canada	Canvas	6	NA	4	1	NA	444 interested
Geohealth: Improving Public Health through Geographic Information	U. Twente	Netherlands	Future Learn	4	16	NA	NA	NA	NA
Functional Programming in Scala Capstone	Ecole P, Lausanne	Switzerland	Coursera	5	30	4.5	438	76	7680
Digital Land Surveying and Mapping	IIT Rourkee	India	Swayam	8	NA	NA	NA	NA	NA
Fundamentals of GIS	UC Davis	US	Coursera	4	NA	4.8	2723	753	68904
Remote Sensing and Digital Image Processing of Satellite Data	IIT Rourkee	India	Swayam	8	NA	NA	NA	NA	NA
Introduction to Remote Sensing	IIT Rourkee	India	Swayam	4	NA	NA	NA	NA	NA
Introduction to GIS Mapping	U. Toronto	Canada	Coursera	6	36	4.9	64	17	2801

Course Name	Institution	Origin Country	Platform	# weeks	# hours	Rating	# Ratings	# Reviews	# enrolled
GIS Data Formats, Design and Quality	UC Davis	US	Coursera	4	NA	4.9	1182	222	19659
The Location Advantage	ESRI	US	Independent	6	18	4.5	715	NA	NA
Sagas and Space - Thinking Space in Viking Age and Medieval Scandinavia	U. Zurich	Switzerland	Coursera	8	40	NA	NA	NA	NA
Introduction to Geospatial Technology Using QGIS	Del Mar college	US	Canvas	NA	NA	NA	NA	NA	NA
Architecture 101 - Part I: From Nothingness to Place	iversity	Germany	iversity	6	42	4	1	NA	259 interested
Rethink the City: New Approaches to Global and Local Urban Challenges	Delft U of Tech	Netherlands	edX	6	24	NA	NA	NA	NA
Introduction to Geographic Information Systems	IIT Rourkee	India	Swayam	4	NA	NA	NA	NA	NA
Introduction to Urban Geo-Informatics	Hong Kong Polytechnic	Hong Kong	edX	6	36	NA	NA	NA	NA
Designing for Mixed Reality	Pacific Northwest College of Art	US	Kadenze	NA	NA	NA	NA	0	NA
Exploring Humans' Space: An Introduction to Geographicity	Ecole P, Lausanne	Switzerland	edX	10	40	NA	NA	NA	NA
Geospatial Analysis Project	UC Davis	US	Coursera	8	NA	4.9	139	40	2774
Urban Design for the Public Good: Dutch Urbanism	Delft U of Tech	Netherlands	edX	8	48	NA	NA	NA	NA
Creating an Analytical Dataset	Udacity	US	Udacity	2	NA	NA	NA	NA	NA
Development and Planning in African Cities: Exploring theories, policies and practices from Sierra Leone	Univ College London	UK	Future Learn	4	12	NA	NA	NA	NA
Skills for the Digital Earth	Elmhurst college	US	Desire2Learn	4	NA	NA	NA	0	60 interested
3D Data Visualization for Science Communication	Univ Illinois UC	US	Coursera	NA	NA	NA	NA	NA	4113 recent views
Intro to Mapping and GIS for Journalists	Knight Center for Journalism in the Americas	US	Independent	NA	NA	NA	NA	NA	NA
Intro to R for Journalists: How to Find Great Stories in Data	Knight Center for Journalism in the Americas	US	Independent	5	NA	NA	NA	NA	NA
GPS Surveying	IIT Rourkee	India	Swayam	4	NA	NA	NA	NA	NA

Course Name	Institution	Origin Country	Platform	# weeks	# hours	Rating	# Ratings	# Reviews	# enrolled
Cartography	ESRI	US	Independent	6	NA	4.5	11348	NA	NA
Do-It-Yourself Geo Apps	ESRI	US	Independent	4	NA	4.5	2335	NA	NA
Earth Imagery at Work	ESRI	US	Independent	6	NA	4.5	3262	NA	NA
Desktop GIS	Pace Univ	US	Open Education by Blackboard	12	72	NA	NA	NA	274 interested
Remote Sensing and GIS	IIT Guwahati	India	Swayam	8	NA	NA	NA	NA	NA
Global Navigation Satellite Systems And Applications	IIT Rourkee	India	Swayam	4	NA	NA	NA	NA	NA
Geospatial and Environmental Analysis	UC Davis	US	Coursera	4	NA	4.8	705	137	16756
Prediction X: John Snow and the Cholera Epidemic of 1854	Harvard	US	edX	1	5	NA	NA	NA	10172
Introduction to the Natural Capital Project Approach	Stanford	US	Stanford EdX	NA	NA	NA	NA	NA	NA
Data Visualization and Communication with Tableau	Duke	US	Coursera	5	NA	4.7	2000	423	117281
Analyzing and Visualizing Data with Excel	Microsoft	US	EdX	6	24	NA	NA	NA	771636
Data Visualization	Univ Illinois UC	US	Coursera	4	24	4.5	812	188	63543
Understanding and Visualizing Data with Python	U Michigan	US	Coursera	4	24	4.6	239	53	10952
Essential Design Principles for Tableau	UC Davis	US	Coursera	4	NA	4.5	1003	151	20008
Additional Tools Used for Data Visualization	Arizona State Univ	US	Coursera	3	15	NA	NA	NA	NA
Data Visualization with Tableau Project	UC Davis	US	Coursera	8	48	4.6	149	26	5169
Data Management and Visualization	Wesleyan	US	Coursera	4	NA	4.4	699	195	48116
Fundamentals of Visualization with Tableau	UC Davis	US	Coursera	5	NA	4.4	2443	501	57316
Applied Plotting, Charting & Data Representation in Python	U Michigan	US	Coursera	4	NA	4.5	3130	513	74513
Building Data Visualization Tools	Johns Hopkins Univ	US	Coursera	5	NA	4	125	31	7786
Introduction to Data Exploration and Visualization	Arizona State Univ	US	Coursera	5	25	3.2	13	6	2340
Data Visualization and D3.js	Udacity	US	Udacity	7	NA	NA	NA	NA	NA

Course Name	Institution	Origin Country	Platform	# weeks	# hours	Rating	# Ratings	# Reviews	# enrolled
Data Visualization in Tableau	Udacity	US	Udacity	3	NA	NA	NA	NA	NA
Data Visualization for All	Trinity College	UK	edX	6	NA	NA	NA	NA	NA
Data Analysis and Visualization	Georgia Inst of Tech	US	Udacity	16	NA	NA	NA	NA	NA
Data Analysis: Visualization and Dashboard Design	Delft U of Tech	Netherlands	edX	6	36	NA	NA	NA	NA
Data Visualization for Storytelling and Discovery	Knight Center for Journalism in the Americas	US	Independent	4	NA	NA	NA	NA	NA
Visualizing Data with Python	IBM	US	edX	5	20	NA	NA	NA	14023
Data Visualization: A Practical Approach for Absolute Beginners	Microsoft	US	edX	4	12	NA	NA	NA	22014
Temporal and Hierarchical Data Analysis	Arizona State Univ	US	Coursera	5	25	NA	NA	NA	NA
Information Visualization: Foundations	NYU	US	Coursera	4	NA	4.7	76	17	3251
Basic Data Processing and Visualization	UC San Diego	US	Coursera	5	45	4.4	45	11	3192
Data Visualization with Advanced Excel	PwC	US	Coursera	4	NA	4.8	1804	263	48667
Information Visualization: Programming with D3.js	NYU	US	Coursera	5	NA	4.7	66	20	3148
Information Visualization: Applied Perception	NYU	US	Coursera	4	NA	4.8	45	13	NA
Information Visualization	Indiana Univ	US	Independent	15	NA	NA	NA	NA	NA
Introduction to XR: VR, AR, and MR Foundations	Unity	US	Coursera	4	NA	4.3	38	13	3904
Data visualization nano Degree	Udacity	US	Udacity	16	160	NA	NA	NA	NA
Visual Analytics with Tableau	UC Davis	US	Coursera	4	NA	4.5	899	199	18390
Creating Dashboards and Storytelling with Tableau	UC Davis	US	Coursera	5	NA	4.6	469	82	15904
Crafting Data Stories	Knight Center for Journalism in the Americas	US	Independent	5	NA	NA	NA	NA	NA
Data Science: Visualization	Harvard	US	edX	8	16	NA	NA	NA	NA

Online courses from ESRI

This is the list of free online web courses made available by ESRI, making them comparable to MOOCs. While there are 175 courses overall, the 29 courses that are free are reported here. These are in addition to the five MOOCs made by ESRI and which are listed in the previous table.

Column one indicates the course name. Column two indicates the estimated learning duration. Since they are self-paced, there is no associated calendar time. Column three indicates the average student rating for the course (on a maximum of 5) while column four indicates the number of ratings available.

	Course name	Duration in min	Rating	# Rating
1	ArcGIS Maps for Office Basics	50	4.5	18
2	ArcGIS Pro Basics	50	4	269
3	Getting started with data Management	70	4.5	104
4	Getting started with Mapping and Visualization	75	4.5	171
5	Getting Started with Spatial Analysis	70	4.5	226
6	GeoPlanner for ArcGIS: Evaluating Plans	60	4	274
7	GeoPlanner for ArcGIS: Designing with real time feedback	60	4	181
8	GeoPlanner for ArcGIS: Exploring Green Infrastructure in your study Area	60	4	249
9	Building the foundation for Green Infrastructure Planning	120	4	352
10	Introduction to Green Infrastructure	60	4	769
11	Getting started with GIS	210	4	25900
12	Basic of JavaScript web apps	75	4	1467
13	Python for everyone	210	4	4107
14	Teaching with GIS: Introduction to using GIS in the classroom	285	4	507
15	Telling Stories with GIS maps	60	4	1157
16	Getting Started with ArcGIS Pro	330	4	6375
17	Using GIS to solve problems	90	4	811
18	Getting information from a GIS Map	90	4	1126
19	Exploring GIS Maps	75	4	1706

	Course name	Duration in min	Rating	# Rating
20	Putting your GIS skills to work	60	4	535
21	ESRI Technical Certification: Sample Questions for ArcGIS Desktop Professional	120	4	1333
22	ESRI Technical Certification: Sample Questions for ArcGIS Desktop Associate	120	4	1822
23	ESRI Technical Certification: Sample Questions for ArcGIS Desktop Entry	120	4	2899
24	ESRI Technical Certification: Sample Questions for Web Application Developer Associate	120	4	1126
25	ESRI Technical Certification: Sample Questions for ArcGIS Desktop Developer Associate	120	3.5	385
26	ESRI Technical Certification: Sample Questions for Enterprise Geodata Management Professional	120	4.5	235
27	ESRI Technical Certification: Sample Questions for Enterprise Administration Associate	120	4.5	432
28	ESRI Technical Certification: Sample Questions for Enterprise System Design Associate	120	4	239
29	ESRI Technical Certification: Sample Questions for Enterprise Geodata Management Associate	120	4.5	445

Appendix G: Assigned Readings as seen in the Open Syllabus Project

This table lists the assigned readings related to spatial ways of knowing as seen in the Open Syllabus Project. The first column indicates the title of the book / article and the second shows the authors. The third column indicates the number of times the reading appears in the OSP while the fourth shows the number of the times it appears in a History course. The last column indicates the countries in which the reading was assigned. The table documents the results of three separate search parameters. These are indicated in intervening rows.

Reading Title	Authors	Appearances	Appearances in History	Countries
Search parameters: <Spatial History> in Title + Second level co-assigned texts: 11 relevant results				
Toward Spatial Humanities: Historical GIS and Spatial History	A. Geddes, Ian N. Gregory	4	2	UK
Introduction: Governmentality, House Numbering and the Spatial History of the Modern City	Anton Tantner, Reuben Rose-Redwood	4	2	UK
Spatial History, Deep Mapping and Digital Storytelling: Archaeology's Future Imagined Through an Engagement With the Digital Humanities	Tiffany Earley-Spadoni	2	0	Canada
Space, Place, and Power in Modern Russia: Essays in the New Spatial History	Mark Bassin, Christopher David Ely, Melissa Kirschke Stockdale	2	2	UK
The Spatial Humanities: GIS and the Future of Humanities Scholarship	David J. Bodenhamer, John Corrigan, Trevor M. Harris	36	7	US, UK
Past Time, Past Place: GIS for History	Anne Kelly Knowles	35	11	US, UK
Placing History: How Maps, Spatial Data, and GIS Are Changing Historical Scholarship	Amy Hillier, Anne Kelly Knowles	27	4	US, UK
Historical GIS: Technologies, Methodologies, and Scholarship	Paul S. Ell, Ian Gregory	11	5	US, UK
Computers, Visualization, and History	David J. Staley	23	12	US
Digital History: A Guide to Gathering, Preserving, and Presenting the Past on the Web	Daniel J. Cohen, Roy Rosenzweig	217	101	US, UK, Canada

Reading Title	Authors	Appearances	Appearances in History	Countries
A Place in History: A Guide to Using GIS in Historical Research	History Data Service, Ian Gregory	2	2	UK
Search Parameter: <Spatial> in title, field <History>: 87 results (2005-2017), 3 relevant				
The Spatial Turn: Interdisciplinary Perspectives	Santa Arias, Barney Warf	68	21	US, UK
Toward Critical Spatial Thinking in the Social Sciences and Humanities	Donald G. Janelle, Michael F. Goodchild	17	6	US, UK, Canada
Placing the Past: 'Groundwork' for a Spatial Theory of History	Philip J. Ethington	8	8	US, UK
Search Parameter: <Maps> in title, field <History>: 91 results (2005-17) 9 relevant				
Maps of Time: An Introduction to Big History	David Christian	106	71	US, UK, Canada
Time Maps: Collective Memory and the Social Shape of the Past	Eviatar Zerubavel	68	44	US, UK
The New Nature of Maps: Essays in the History of Cartography	J. B. Harley, Paul Laxton	55	23	US, UK
Maps and History: Constructing Images of the Past	Jeremy Black	25	17	US, UK
How to Lie With Maps	Mark Monmonier, Mark S. Monmonier	333	19	US, UK, Canada
You Are Here: Personal Geographies and Other Maps of the Imagination	Katharine A. Harmon	107	9	US, UK, Canada
Rereading the Maps of the Columbian Encounter	J. Brian Harley	20	14	US, UK
Maps and Civilization: Cartography in Culture and Society	Norman Joseph William Thrower	37	11	US, UK
The Mapping of New Spain: Indigenous Cartography and the Maps of the Relaciones Geográficas	Barbara E. Mundy	21	8	US, UK