Charting a New Aesthetics for History: 3D, Scenarios, and the Future of the Historian's Craft

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Innovations in computing are presenting historians with access to new forms of expression with the potential to enhance scholars' capacities and to support novel methods for analysis, expression, and teaching. Computer-generated form can change the way we generate, appropriate, and disseminate content. If these benefits are to be realized, however, the discipline must make room for a new domain of practice-based research. The practices we have for knowledge generation were devised in association with print technology, and historians must now acquire and develop practices that can inform our use of digital forms of representation, as well as the platforms that sustain them.

Les innovations informatiques donnent aux historiens l'accès à de nouvelles formes d'expression et offrent la possibilité d'accroître les capacités des universitaires et de favoriser l'émergence de nouvelles méthodes d'analyse, d'expression et d'enseignement. L'ordinateur peut changer notre façon de générer, de nous approprier et de diffuser le contenu. Pour récolter de tels fruits, la discipline doit toutefois faire place à un nouveau domaine de la recherche fondée sur la pratique. Nos pratiques de génération du savoir sont fonction de la technologie de l'imprimé, et les historiens doivent maintenant acquérir et développer des pratiques qui pourront nous aider à maîtriser les formes numériques de la représentation de même que les plateformes qui leur servent d'assise.

IN THE LITERATURE devoted to history and computing, a common refrain has emerged, one suggesting that the sub-discipline has reached something of an impasse. Collectively, scholars in the literature are characterized as performing useful, challenging, even controversial work.[1] But

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1 Perhaps the exemplar of early work in history and computing that was both challenging and controversial was Robert Fogel's *Time on the Cross: The Economics of American Slavery* (Boston:

they are also characterized as boldly going where every twentieth-century scholar has gone before. Historians — within and without the history and computing community — remain constrained by metaphors and practices devised for paper and print.[2] There is nothing surprising about scholars' dependence on long extant conventions when using the computer. Communicants in the past have historically relied on established forms of expression when presented with a new communication technology.[3] There is no reason to expect that historians now, or in times past, could or should have done otherwise. The purpose of this article, however, is to suggest that it is now time for historians to do so. Innovations in computing are presenting the profession with access to new formalisms, forms of expression with the potential to enhance scholars' capacities and forms of expression with the potential to support novel methods for analysis, expression, and teaching. My purpose here is to suggest that these formalisms are susceptible to appropriation. My purpose is also to argue that such appropriation will require the historian to assume an unaccustomed role, that of aesthete.

These arguments stem from a simple observation, one offered by contributors such as John Lutz, William Thomas III, David Staley, Donna Peuquet, and others. Their writings suggest scholars limit themselves when they permit extant practice to govern their use of the computer. The computer should be seen as more than a book with hypertext links, and it is more than a super-efficient calculator with a database thrown in for good measure. Instead, these scholars suggest that the computer should be seen as a novel medium that presents novel forms of representation. The significance of this point stems from the realization that communication involves the representation of pattern and the recognition that not all signs, as instruments of representation, are equal in their capacity to make a pattern manifest to a researcher or audience. If one's aim is to communicate the historic trajectory of the stock market, the best sign to use is a graph, not a number. If one's intent is to unearth significant patterns in data, the best strategy is to have multiple forms of representation on hand to display and interrogate the data set. In short, scholars in history and computing and in related fields such as historical

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Little, Brown, 1974), a work that challenged prevailing assumption in the historiography regarding the material conditions and profitability of the American slave economy prior to the Civil War. The work, using quantitative methods, argued the southern United States economy was both efficient and profitable, and the book was condemned as misinformed and racist by reviewers in the aftermath of its publication.

2 John Lutz, "Riding the Horseless Carriage to the Computer Revolution: Teaching History in the Twenty-first Century", *Histoire sociale/ Social History*, vol. 34, no. 68 (November 2001), pp. 427–438.

3 Marshall McLuhan, *Understanding Media* (New York: McGraw-Hill, 1964), p. 8; Jay David Bolter and Robert Grusin, *Remediation: Understanding New Media* (Cambridge, MA: MIT Press, 1999), pp. 44–50.

and temporal geographic information systems (GIS) are recognizing that the successful integration of new formalisms into history will come at a price: the need to re-think and expand the aesthetics of the discipline. More specifically, scholars will need to focus on form, the characteristics of computer-generated form, and how such characteristics can be applied to support the analytical, expressive, and pedagogical methods that historians are likely to pursue in future.[4] Historians with a strong commitment to computing will need to form a new and distinct line of inquiry within the discipline, one devoted to practice-based research.

How might a research agenda focusing on form and practice be realized? I suggest a first prerequisite step must be the creation of scenarios that describe a particular innovation in computing and how that particular innovation can be applied to support historians' research and practice. I focus here on the rationale and methodological concerns associated with generating scenarios and provide concrete examples of what it will mean to create a scenario using Harold Innis's writings on communication as a point of departure. In this context, Innis's writings are of interest because they make a simple but very profound point. When thinking about communication, one should pay attention to what communicants do with form and the repositories that contain form. In times past, users appropriated form, generated form, and distributed form. They do so now, and doubtless in future will continue to do so. Accordingly, this

4 See Lutz, "Riding the Horseless Carriage"; David J. Staley, *Computers, Visualization and History: How New Technology will Transform our Understanding of the Past* (Armonk, NY: M. E. Sharpe, 2003): William Thomas III, "Blazing Trails Toward Digital History Scholarship", *Histoire sociale/ Social History*, vol. 34, no. 68 (November 2001), pp. 415–426; Chris Butler, "The Use of Flowcharts in the Teaching of History", in Orville Vernon Burton, ed., *Computing in the Social Sciences and Humanities – Wayfarer CD: Charting Advances in Social Sciences and Humanities Computing* (Chicago: University of Illinois Press, 2002). One facet of scholars' interest in aesthetics stems from possibilities inherent in information visualization, the translation of quantitative data into 2D and 3D shapes to facilitate discovery of patterns embedded in data. Gregory Marks and Larry Travis argue that visualization has changed the way physical sciences interact with data, and that scholars in the social sciences should follow suit: "It all started with Descartes, but computer-enabled display of an interaction with Cartesian representations of physical relationships radically changes how such representations can be explored ... [and] how animation reveals the dynamics of change.... One good use to which we might put all this adding and subtracting power is to do dynamic, three-dimensional, high-resolution visualizations of data.... It is with such tools [visualization software] that we can compute and interact with complex statistical reductions, abstractions, and regressions.... In short, we use this abundant computing to better understand our data." See Gregory A. Marks and Larry E. Travis, "Grand Challenges for Computing in the Social Sciences", in Burton, ed., *Computing in the Social Sciences and Humanities – Wayfarer CD*. Recent scholarship in the field of historical geographic information systems (GIS) includes Ian Gregory, *A Place in History: A Guide to Using GIS in Historical Research* [online publication], retrieved February 10, 2007, from http://hds.essex.ac.uk/g2gp/gis/index.asp; Anne Kelly Knowles, "Emerging Trends in Historical GIS", *Historical Geography*, vol. 33 (2005), pp. 7–13, and *Past Time, Past Place: GIS for History* (Redlands, CA: ESRI Press, 2002).

contribution offers three scenarios that respectively describe a potential application of the computer to appropriate, generate, and distribute digital content.

Developing Tools and Scenarios

I stress the need for scenarios because any research proposal, particularly one devoted to a new line of research, is at base an exercise in persuasion and an exercise in prediction. Proponents are obliged to demonstrate that they have thought through their proposal, indicating what they will research, the instruments they will use to support their research, how they will research, and with whom they will research. They are further obliged to predict what will result from that research. For researchers with a commitment to history and computing, creation of detailed scenarios — replete with narratives, storyboards, and graphics — provides a systematic means to conceive a practice-based research project and to predict what will result from it. Scenarios also provide reviewers and colleagues with a deeper understanding of what digital historians mean to do and how they intend to go about doing it.

The need for scenarios, however, raises the issue of the substance of which they will consist. At their core, all scenarios need to describe a fundamental thing: an altered relationship. Historians interact with information. They use tools to mediate that interaction. The tools determine what forms of information scholars can access. They further determine the formalisms that historians can express. Any scenario, then, must begin with an innovation stemming from the computer that will impinge on the scholar's capacity to create, use, or distribute information. But when we say "the computer", it is important to recognize that we are talking about a mutable thing. In fact, we are talking about a construct that refers to many components and capacities with the potential to contribute to our practice. Since the digital computer emerged some 60 years ago, new platforms, new forms of interaction, and new forms of expression have emerged in association with it. Users used to rely exclusively on mainframe computers; now they use desktop computers. Soon they will use mobile computers. Historically, researchers used the line interface to communicate with the computer. Now they use desktop metaphors, and in short order they will use voice and gesture. My point here is that computers are constantly evolving instruments. If we seek to use them to effect change, we must begin our scenarios first by identifying a constituent of concern, and then provide a description of the characteristics that define it as an innovation.

Aside from focusing on a given tool and the new capacities it brings to bear, the historian will need to describe what he or she, singly or in combination with others, will do with that tool. No tool has an *a priori* significance, and no tool has a generic significance. Tools are appropriated to meet the specific needs of specific users at different times in different

places. A contractor will use a hammer to insert a nail into a plank; a renovator will later use a hammer to remove it. It follows, then, that historians seeking to appropriate a given tool — be it a mobile computer, an item of software, a computer-generated 3D object — must in their scenarios relate that tool to a specific analytical, expressive, or pedagogical need. Put simply, the scenario must describe how the tool will be applied.

In multiple instances, historians will also need to describe how a given tool will be adapted. Historians are not used to adapting and developing tools. For the most part, we have been passive recipients of the expressive and attestive conventions and software that we deploy.[5] There are several reasons why this has proven to be the case. With respect to text, we have not needed to devise new conventions to govern communication. Text is an old communication technology. Its users over the centuries have already produced a rich array of conventions, from the paragraph to italicized text and the footnote.[6] There has been no need for scholars to reinvent the wheel. With respect to software, scholars have not been inclined to alter the applications at their disposal, first because most do not know how, secondly because the proprietary items they use are not subject to modification, and thirdly because market-based solutions have — for the most part — succeeded in anticipating their needs and the needs of other users. Software developers have succeeded in identifying the rich array of ubiquitous practices associated with text and in developing tools to support their expression. They have even appropriated established methods for interaction with a content generation device, such as the QWERTY keyboard and the pen.

There are, however, no commensurate sets of formalisms and practices for new media. We live in a time when scholars must begin the search for novel conventions that are either optimal or robust. By "search", I mean the invention of new conventions, or the appropriation of an extant convention from one domain of practice and its adaptation to meet the needs and purposes of another. Scholars, I suggest, will need to emulate Bakhtin's characterization of François Rabelais, who appropriated "the cries of Paris and the cries of quacks and druggists" into his masterwork

5 Such was not always the case. Anthony Grafton notes that the documentation practices historians traditionally employ did not emerge out of a vacuum, but were the product of scholarly innovation and debate that occurred in the seventeenth and eighteenth centuries. See Anthony Grafton, *The Footnote: A Curious History* (Cambridge, MA: Harvard University Press, 1997). In his latter published and unpublished writings, Harold Innis also argued that social scientists should experiment with various forms of information visualization to express the spatial and temporal topology of the long-term economic, social, and cultural trends that concerned them. See note 12 for a more detailed discussion.

6 On the emergence of print culture, see, for example, Elizabeth L. Eisenstein, *The Printing Revolution in Early Modern Europe* (Cambridge, UK: Cambridge University Press, 1983).

Gargantua and Pantagruel.[7] By "optimal", I mean that scholars will need to search for conventions that meet the specific needs of their discipline, sub-discipline, or individual research. Here, the object will be to devise a practice or set of practices that provide maximum support for a specific scholarly community or individual, without reference to the needs of a neighbouring community or individual. By "robust", I mean ubiquitous conventions, forms, and practices that are applicable in multiple scholarly contexts, even if they fail to align perfectly with the particular requirements of a particular scholarly community.[8]

The crucial point is that it is neither reasonable nor possible to expect software developers and computer scientists to undertake this task on their own, because communication practices and their associated technologies are the emergent properties of cultural ecologies. A cultural ecology can be defined here simply as many people in many domains doing many things. The discipline of history, for example, is a cultural ecology. It is comprised of multiple domains, each distinguished by a particular construction of the past: the history of social categories, the history of nation-states, the history of economies, and so on. Each domain, in turn, is distinguished by the research practices and methods it uses to construct the past. A social historian, generally, will appeal to different sources and methods than a counterpart, say, in diplomatic or economic history. Such distinctions — in construction, in practice, and in data — potentially have a bearing on the communication practices of researchers in history and practitioners in other cultural ecologies. When a novel understanding of a particular constituent of the past or present is obtained through these distinct practices, researchers can and do feel the need to devise novel communication practices — novel conventions — that better express that understanding. Such conventions emerge from research and practice and can comprise everything from specialist terminology to the creation or appropriation of methods for information visualization. My point here is that, if we — historians — are asking computer scientists to gain a deeper understanding of the inner workings of our discipline, then we ask too much of them. They have neither the time nor the inclination unilaterally to gain that understanding and use it to create the conventions and resulting software that will support the diversity of interests and practice we associate with the different domains within history.

7 Mikhail Bakhtin, *Rabelais and his World*, trans. Hélène Iswolsky (Bloomington: Indiana University Press, 1984; 1968), pp. 187–188.

8 Here I am adopting the paired concepts of "optimal" and "robust" from their initial domain of application, scenario planning. See, for example, Robert Lempert, Steven Popper, and Steven Bankes, "Confronting Surprise", *Social Science Computer Review*, vol. 20, no. 4 (Winter 2002), pp. 420–440; M. J. Rosenhead, M. Elton, and S. K. Gupta, "Robustness and Optimality as Criteria for Strategic Decisions", *Operational Research Quarterly*, vol. 23, no. 4 (1972), pp. 413–430.

Of necessity, then, scholars who propose to use the computer to support their research and expression will need to assume greater responsibility for the design and capabilities of their tools. The task of software development in future will be a distributed task performed by multiple practitioners in multiple disciplines.[9] "Adaptation" in this context will mean tasks ranging from construction of new categories of software to adapting extant applications. It will also mean assuming a new distribution of labour between the human sciences and computer science with respect to the design and modification of software. The fundamental tasks of tool conception (the invention of conventions) and tool construction (for expression of conventions) require the input of practitioners with deep knowledge of the contexts in which they will be applied. Both tasks are part of an iterative process in which user requirements are specified and a prototype is designed and then constructed, tested, and modified based on user feedback. The process of feedback, testing, and modification continues — at least ideally — until the tool proves sufficiently functional to meet all or most of the user's requirements. Some requirements will be discovered during the process of construction and testing.[10]

Aside from fulfilling the necessary requirements of identifying a tool and what will be done with that tool, historians producing scenarios will need to keep in mind a final point. They will never be more than co-authors of a given scenario, especially if that scenario is meant to be the precursor of a research proposal that is to be taken seriously. Since tool development will be an interdisciplinary, collaborative process, it stands

9 For an example of collaborative software development, in this case for the domain of art, see Jean-Paul Fourmentraux, "Internet Artworks, Artists and Computer Programmers: Sharing the Creative Process", *Leonardo*, vol. 39, no. 1 (2006), pp. 44–50. One interesting by-product of the collaboration described in this article is that artistic "ownership" of the resulting software and artwork became distributed. Fourmentraux argues that, for Internet art, "the interactivity postulated as a technical imperative of the work requires computing skills that the artist does not always possess. Computer programmers are needed for the algorithmic programming of the artistic *dispositiv* [artistic device]" (p. 45). As a result of the collaboration, aesthetic and technical ownership, particularly with respect to the interface for the project software, became distributed as "multiple collective and individual appropriations of the different dimensions of the plan". "The different negotiations focused alternately on the aesthetic and technical stakes of the artwork and of the software program; the realization of the interface in its plastic (formal) and technical (functional) dimension; its appearance, ergonomics, options; and finally on the appropriation and signature of the dispositiv. During this conception ... the artwork was truly an unlimited 'everything', invested as much by the artist as the computer programmer. At the boundaries of the cooperation, interests and motivations were intertwined. The artist became the initiator and discoverer of computer solutions. The computer programmer claimed his creative sense and intervened in aesthetic choices and in the artistic appraisal of the plan and its interface."

10 The iterative process described here is a central constituent of research in the field of human-computer interaction. See Alan Dix *et al.*, eds, *Human Computer Interaction*, 3rd ed. (New York: Prentice-Hall, 2004).

to reason that historians will only have the capacity to describe part of the iterative process outlined above.

"Research" in this context, I suggest, will mean three things. It will first mean determining user requirements. Historians in a specific domain of research analyse, express, and document specific things. The task of research will be to determine what those are and what computing applications in principle can be deployed to support those activities. The second task of research will be to shop for expressive metaphors. Here scholars will need to survey domains as diverse as computer games, Russian literature, art history, and architecture in search of novel forms of expression. The purpose will be to build a library of forms that are susceptible to appropriation for a new context and forms that serve as "inspirational objects", as the constituents of new forms of expression to support analysis, expression, and documentation.[11] The third task of research will be to test the efficacy of the proposed forms or associated tools on target audiences, be they historians, general viewers, or university or high school students. While historians will have the capacity to conceive and conduct research agendas for the first two domains of research, they will not have the capability to pursue this third line of research in isolation. Here, we will need the assistance of colleagues who are researchers in the domains of human-computer interaction or educational psychology. We will need their assistance in generating scenarios and their expertise in experimental design, field test performance, and data analysis if the proposed line of research is to be realized.

Applying Topographic Forms to Historical Research

With a sense, then, at least in the abstract, of what will be required of historians pursuing a practice-based research agenda devoted to computer-generated form, we may at this juncture shift our attention to the domain of the concrete. What kind of content can we expect to see attached to history and computing scenarios? What manner of research can we expect history and computing researchers to perform? The first task to consider is the historian's relationship with digital form, to ask why he or she would appropriate it and where he or she would apply it.

11 The concept of "inspirational objects" is taken from Ina Wagner's and others' ethnographic studies of architectural firms, in which objects — actual and virtual — are used to stimulate creativity and, in turn, to build design. See Monika Büscher, Martin Kompast, Rüdiger Lainer, and Ina Wagner, "Space for Inspiration: Ethnography and User Involvement in Designing the *Wunderkammer*", in *Proceedings, Workshop Ethnographic Studies in Real and Virtual Environments: Inhabited Information Spaces and Connected Communities* (Edinburgh, January 24–26, 1999) [online publication], retrieved February 10, 2007, from http://as15.iguw.tuwien.ac.at/desarte/SpaceforInspiration.pdf; Ina Wagner, "Persuasive Artefacts in Architectural Design & Planning", in *Proceedings of CoDesigning* (Nottingham, September 2000) [online publication], retrieved February 10, 2007, from http://as15.iguw.tuwien.ac.at/desarte/persuasiveartefacts.pdf.

For Harold Innis, the answer to this question was straightforward: people appropriate new forms because they have a bearing on knowledge construction. Innis routinely explored how cultures used, combined, and re-combined information and sought to explore the cognitive benefit they derived from their aesthetic and information management practices. Historically, he believed, Greek aesthetic practice — in the form of the Oral Tradition — had made a strong contribution to the development of Greek science. Combining and recombining data in different ways through the appropriation or creation of new metres of poetry enabled the Greeks to shift the burden of explanation regarding natural history from religion to science. He also believed that the task of combination and appropriation was facilitated when information was translated into different formats. Innis was a proponent of information visualization, based on his belief that not all sign systems are equally effective in transmitting patterns of conceptual, cultural, economic, or social interest to their users.[12] His insight regarding signs has found more recent expression in the literature devoted to Computer Supported Learning Environments, which suggests that users gain a deeper understanding of content when they are exposed to content that is simultaneously expressed in different forms.[13]

Innis's point is particularly relevant because historians are now in a position to appropriate a new domain of formalisms into their practice. Currently, the human sciences — and other domains of research for that matter — are undergoing what can be characterized as a Topographic Revolution in computer-mediated communication. The Topographic Revolution can be described as scholarly appropriation of forms of representation that are topographic (with two- or three-dimensional shape),

12 In his unpublished manuscript "The History of Communication", for example, Innis noted that Italian artists in the fifteenth and sixteenth centuries routinely used visual information to make difficult ideas understandable to a general populace. Referring to the "general inability to conceive abstract ideas", Innis noted: "The emblem book was devised by Andreas Alciati early in the sixteenth century.... Poetry, one of the oldest arts, combined with engraving, one of the newest. 'Emblems reduce intellectual conceptions to sensible images and that which is sensible strikes the memory and is more easily imprinted on it than that which is intellectual' [Bain]." See University of Toronto Archives, B72–003, Box 17, Harold Innis Papers, Innis, "Chapter 6: Printing in the Sixteenth Century" in "The History of Communication", pp. 35–36, 38. In "The Problem of Space", Innis emphasized the important role visualization played in the medieval church: "Stone in architecture and scripture emphasized permanence and durability. In the thirteenth century 'Tout ce que les théologiens, les encyclopédistes, les interprètes de la Bible ont dit d'essentiel a été exprimé par la peinture sur verre ou par la sculpture....' In the Reformation print was used to overwhelm sculpture and architecture as interpreters of scripture." See Harold Innis, "The Problem of Space" in *The Bias of Communication* (Toronto: University of Toronto Press, 1991; 1951), pp. 126, 128.

13 David H. Jonassen and Chad S. Carr, "Mindtools: Affording Multiple Knowledge Representations for Learning", in Suzanne P. Lajoie, ed., *Computers as Cognitive Tools, Volume II: No More Walls* (Mahwah, NJ: Lawrence Erlbaum Associates, 2000), pp. 165–196.

dynamic (meaning that they change their configuration over time), and autonomous (meaning that, while the rules governing their behaviour are set by an author, their actual performance of the prescribed behaviour is not).

The basis for this contention rests on the economic, social, and scholarly drivers that are encouraging increasing appropriation of two- and three-dimensional computer-generated form. To support this contention, one can point first to movement in the private sector that potentially will enhance the average user's access to 3D. In March 2003 five Japanese companies — including Sony and Sanyo — formed a consortium to support the development of products that generate 3D content and the establishment of standards and protocols that will support its dissemination. Consortium members expect that new 3D content and applications will generate some $25 billion (US) of business within Japan alone by 2008.[14]

Aside from the pursuit of profit, the move to novel forms of representation is being encouraged by a perennial social concern: the need to find engaging ways to present educational, recreational, and cultural content to students. Consider the case of *Kar2ouche* software in the United Kingdom. Through its products, the company has managed to make Shakespeare and opera palatable to young students. In its tutorials, the company uses composition software and 3D learning objects to enable students to stage the opening scenes of *MacBeth* as well as scenes from a Benjamin Britten opera. The process of construction — and educators' resort to 3D environments — led to students developing a heightened appreciation of both cultural forms, an appreciation that traditional forms of pedagogy for the most part had failed to produce. The results proved so impressive that the British Ministry of Education purchased copies of the software and accompanying teaching modules for every state secondary school in England.[15]

Additionally, human science researchers are expressing increased interest in the use of novel forms to support analysis and instruction. Geographer Michael Goodchild, for example, has proclaimed the emergence of a "spatial revolution" in the social sciences, an emerging belief that trends in attribute data can be explained if they are correlated with spatial data, and a concurrent belief that visualization — the translation of quantitative data into 2D and 3D form — can support the integration

14 "Japanese Consortium Formed to Create 3D Display Market", *Electronic News*, March 4, 2003 [online publication], retrieved February 10, 2007, from http://www.reed-electronics.com/electronicnews/index.asp?layout=article&articleid=CA281462&rid=0&rme=0&cfd=1.

15 "Kar2ouche", BBC News, June 28, 2003 [BBC website], retrieved February 10, 2007, from http://news.bbc.co.uk/media/video/39222000/rm/39222134_opera10_cheallaigh_vi.ram; Gillian Blatherwick, "Touché! Gillian Blatherwick Tries out Kar2ouche, Software for Creating Storyboards that Aims to Engage Children in Shakespeare", *Educational Computing and Technology*, December 2002, pp. 59, 61.

of attribute and spatial data and, in so doing, support the process of analysis. Aside from the interest in spatial pattern, social science researchers are also showing an emerging interest in the location and expression of temporal patterns. Researchers associated with temporal GIS, such as Donna Peuquet, Andrew Frank, and Michael Worboys, are searching for expressive forms that will transcend the limitations imposed by the cartographic conventions associated with GIS software. They are proposing the appropriation of formalisms from domains ranging from mathematics to everyday experience. Finally, researchers such as Kurt Squire and James Paul Gee are pointing to the potential applicability of "serious games" — computer games devoted to serious purposes — to support education at the high school and university levels. Their properties — such as three-dimensional form and non-linear narrative structures — can be deployed to support pedagogy in disciplines ranging from history to physics.[16]

There are grounds, then, to suggest that the constituents of the Topographic Revolution are becoming a part of the vernacular of our time. But how will they be applied? What analytical, expressive, and pedagogical purposes will they support? I suggest that one important implication of the Topographic Revolution is that it will assist scholars in gaining traction on a particular class of historical problem: the emergent event for which there is no obvious precipitating cause or set of causes. This is not an unknown occurrence in history and related disciplines in the social sciences, and opinion often bifurcates between scholars who point to environmental constraint to explain a given event and those who point to individual or group initiative. For example, consider William Cronon's *Nature's Metropolis*, a classic in which this discrepancy finds expression in the writing of one author. In his work, one of Cronon's concerns is to explain the emergence of Chicago as metropole to the American West in the nineteenth century. In his mind, Chicago's rise was not inevitable. Business leaders made the decision to compete for capital, build railroads, and in so doing undercut their competitors in St. Louis. Yet, in other sections, he seems to suggest that Chicago's geographical proximity to New York and concurrent success in acquiring its

16 Michael Goodchild, "Social Sciences: Interest in GIS Grows", *ArcNews*, vol. 26, no. 1 (Spring 2004), pp. 1, 3 [online journal], retrieved February 10, 2007, from http://esri.com/news/arcnews/spring04articles/social-sciences.html; Michael Worboys, "A Generic Model for Spatio-bitemporal Geographic Information", in Max J. Egenhofer and R. G. Golledge, eds., *Spatial and Temporal Reasoning in Geographic Information Systems* (New York: Oxford University Press, 1998), pp. 25–39; Andrew U. Frank, "Socio-economic Units: Their Life and Motion", in A. Frank, J. Raper, and J. P. Cheylan, eds., *Life and Motion of Socio-economic Units*, GIS Data Series vol. 8 (London: Taylor & Francis, 2001), pp. 21–34; Kurt Squire, "Replaying History: Learning World History through Playing Civilization III" (PhD thesis, Indiana University, 2004), and "Rethinking the Role of Games in Education", *Game Studies*, vol. 2, no. 1 (2002).

capital made the rise of the Windy City all but inevitable.[17] In the end, Cronon leaves us with a rich narrative describing Chicago's environmental history, but he also leaves us with competing constructs and no clear indication as to whether we should accept one, the other, or both. If both, he leaves us no way to assess their relative importance.

Philosophers refer to the process of selecting one explanation from many to explain a given event as abduction, a form of reasoning given prominence in modern times by C. S. Pierce. Unlike deduction, which starts with a construct and seeks to explore its necessary implications, and induction, which emphasizes abstraction of a construct from empirical data, abduction starts with an event and multiple candidate explanations. It is an iterative process of reasoning. Researchers interact with data, weigh data against competing hypotheses, and come to some conclusion about their relative viability. They reject some, reformulate others, and then begin the process of data interaction again. A standard form of reasoning in law and medical science, abduction reduces competing explanations down to few, and preferably one.

Multiple methods of reasoning exist to support abduction, but the process most applicable to historians employs scenarios to evaluate the relative plausibility of competing explanations, a method variously referred to as thought experiments, and counterfactual or possible-world reasoning. In this method, each potential cause or set of causes is differentiated from its competitors and placed in a scenario where it and it alone holds sway. The plausibility of the candidate hypothesis is determined by the scenario's outcome. If the thought experiment produces an outcome that maps, or nearly maps, with the historical record, then its governing hypothesis is deemed the presumptive explanation. If a candidate explanation fails to produce a similar result, it is not.[18]

There are two reasons to suggest the Topographic Revolution will encourage historians to reconsider the class of problem I have identified — historical events with no discernible hypothesis to explain them — and employ the method of reasoning of abduction. First, researchers now have access to computer applications capable of generating the dynamic, autonomous forms described above. The significance of this development is that it enables scholars to model the random, emergent, non-linear behaviour of human social, economic, and cultural systems in ways that were impossible with the logical syllogism and linear mathematical equation, the two

17 William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W. W. Norton, 1991), pp. 263–310.

18 John R. Josephson and Susan G. Josephson, eds., *Abductive Inference: Computation, Philosophy, Technology* (New York: Cambridge University Press, 1994), pp. 1–30; Tim De Mey and Erik Weber, "Explanation and Thought Experiments in History", *History and Theory*, vol. 42 (February 2003), pp. 28–38.

dominant forms that social scientists and humanists have traditionally used to support their reasoning in the past. Agent-based modelling — as practised by A-Life researchers and artificial society researchers in other disciplines — is devoted to modelling the dynamics of emergent economic, social, and biological systems. In simplest terms, it identifies an important agent — be it a virus, an individual, a firm, or a social grouping — and models its interaction with neighbouring agents. The modeller governs the interaction of agents by stipulating the rules of behaviour. The resulting simulations often produce emergent properties — social or economic structures — that result from agent-agent interaction and are unanticipated by the modeller. The significance of this line of inquiry is that artificial society structures produced in virtual space often resemble structures that emerge or have emerged in real space.[19]

The second reason to suggest historians will embrace the methods and instruments associated with the Topographic Revolution is that they have already been successfully applied in related historical sciences such as anthropology and archaeology. In the 1990s agent-based simulations were used to re-examine a long-standing controversy in archaeology: the circumstances behind the disappearance of the Anasazi from what is now the Long House Valley in the southeastern United States, circa 1300 AD. Since the 1920s scholars have offered multiple hypotheses, with most citing Anasazi exhaustion of the environment or internecine warfare. Researchers could point to reams of data documenting environmental conditions, settlement patterns, and demographic trends, but nothing in the data provided an obvious basis for preferring one or the other of the two dominant explanations in circulation.

In 1994 two economists from the Brookings Institution and one archaeologist from the University of Arizona — respectively Joshua Epstein, Robert Axtell, and George Gumerman — decided to model the history

19 Recent examples of social science analyses using agent-based simulation include: Joshua M. Epstein and Robert L. Axtell, *Growing Artificial Societies: Social Science from the Bottom up* (Cambridge, MA: MIT Press, 1996); Joshua M. Epstein, *Generative Social Science: Studies in Agent-based Computational Modeling* (Princeton, NJ: Princeton University Press, 2007) and "Remarks on the Foundations of Agent-based Generative Social Science", in Leigh Tesfatsion and Kenneth L. Judd, eds., *Handbook of Computational Economics*, vol. 2 (New York: Elsevier, 2006); J. Stephen Lansing, *Perfect Order: Recognizing Complexity in Bali* (Princeton, NJ: Princeton University Press, 2006), "'Artificial Societies' and the Social Sciences", *Artificial Life*, vol. 8 (2002), pp. 272–292 [online journal], retrieved February 10, 2007, from http://www.ic.arizona.edu/~lansing/ArtSoc.pdf, and "Complex Adaptive Systems", *Annual Review of Anthropology*, vol. 32 (2003), pp. 183–204; Margaret Boden, ed., *The Philosophy of Artificial Life* (Oxford, UK: Oxford University Press, 1996); Richard Smith, "Simulating the Past: SOCSIM and CAMSIM and their Applications in Family and Demography History", in Terry Coppock, ed., *Information Technology and Scholarship: Applications in the Humanities and Social Sciences* (Oxford, UK: Oxford University Press, 2000), pp. 95–106.

of the Anasazi as a way to re-examine the controversy. Using emergent spatial patterns of settlement as their measure for hypothesis plausibility, the three generated a simulation consistent with the environmental exhaustion hypothesis. The simulation created a geography and environment consistent with the archaeological record, equipped the cyber Anasazi with rules for farming, moving, and mating, and set accompanying rules defining family size, lifespans, and nutritional needs. Once the environment, agents, and rules of interaction were established, the three set their simulation in motion to determine what patterns would emerge. The result? Patterns of settlement emerged in the virtual landscape that matched, or nearly matched, the spatial and temporal patterns of settlement revealed in the archaeological record. If one accepts their criterion for plausibility for assessing hypotheses — namely, emergent virtual patterns of settlement that match those contained in the history — then Epstein, Axtell, and Gumerman can be credited with making a powerful case for favouring environmental exhaustion as the likely reason for the disappearance of the Anasazi.[20]

Successful appropriation of topographic forms to support analysis, however, leads to a second related concern. Since the class of problem indicated above relates to emergent systems that have spatial pattern and move through time, there are grounds to suggest that 2D and 3D forms will prove useful in representing the spatial extent and temporal behaviour of emergent systems. Given the rising prominence and promise of digital media such as virtual reality, and the advent of non-traditional narrative genres such as computer games, there are also grounds to suggest that historians in the near future will choose to use them to express their narratives and attending accounts of emergent systems. The key question, the key expressive challenge, is to determine how. How might one express the outcome of abductive reasoning in a narrative comprised of topographic — or more specifically 3D — objects?

One useful way to gain traction on this problem, I suggest, is to recognize that the force of counterfactual or possible-world reasoning rests ultimately on comparison. We view one scenario, then another, and in so doing we come to some conclusion about the time-line we call history. This process suggests that historians will need to consider the possible efficacy of simultaneous expression of two or more scenarios in their narratives, to facilitate user comparison and interaction while following the

20 For a general, non-technical introduction to agent-based simulations and the work of Epstein, Axtell, and Gumerman, see Jonathan Rauch, "Seeing Around Corners", *The Atlantic Monthly*, vol. 289, no. 4 (April 2002), pp. 35–48 [online journal], retrieved February 10, 2007, from http://www.theatlantic.com/issues/2002/04/rauch.htm. For a more scholarly treatment of the Anasazi project, see Robert L. Axtell *et al.*, "Population Growth and Collapse in a Multiagent Model of the Kayenta Anasazi in Long House Valley", *Proceedings of the National Academy of Sciences of the United States of America*, vol. 99, supplement 3 (May 14, 2002), pp. 7275–7279.

argument at hand. It also suggests that scholars, when faced with expressive challenges such as these, will need to begin shopping for novel metaphors to meet a new expressive need. There are places historians can look. The need for simultaneous expression of two or more time-lines has been faced before in the history of narrative. Literary critic Gary Saul Morson notes, for example, that Russian novelists such as Dostoevsky and Tolstoy frequently engaged in a similar practice that Morson refers to as "sideshadowing". He notes:

> In *sideshadowing*, two or more alternative presents, the actual and the possible, are made simultaneously visible....This is simultaneity not *in time* but *of times*: we do not see contradictory actualities, but one possibility that was actualized and, at the same moment, another that could have been but was not.... *Sideshadowing* therefore counters our tendency to view current events as the inevitable products of the past. Instead, it invites us to inquire into the other possible presents that might have been and to imagine a quite different course of events.[21]

To express a sideshadow, I suggest historians in future will resort to what I will characterize here as a fantastic form of representation. A realist form of representation in virtual space aims to generate representations that cohere with our experience of actual space. Fantastic forms, by contrast, intentionally represent and interpolate objects not encountered in real space. Objects that are normally distinguished — such as factual and counterfactual time-lines or macro and micro scales of history — are placed in proximity to enable users to assess their relationship. Metaphors — such as ghost images and tears or rips — are appropriated to represent and emphasize a relationship between one object and another. To see how sideshadowing and an aesthetic of the fantastic might be implemented, consider how a 3D narrative might express a counterfactual analysis of the problem posed in Cronon's book. Cronon's narrative suggests that railways were a central feature in the emergence of Chicago and the decline of St. Louis. It further suggests that St. Louis might well have protected its position had it competed earlier and more aggressively for New York capital to create its own railway network. Given that Cronon also points to the environment, however, there is a basis for engaging in counterfactual analysis.

There is also a basis for the simultaneous representation of the macro- and micro-scale features in the respective factual and counterfactual histories of the two cities. Both would require, as shown in Figure 1, simultaneous representation of the urban spaces for both cities and the

21 Gary Saul Morson, *Narrative and Freedom: The Shadows of Time* (New Haven: Yale University Press, 1994), p. 118.

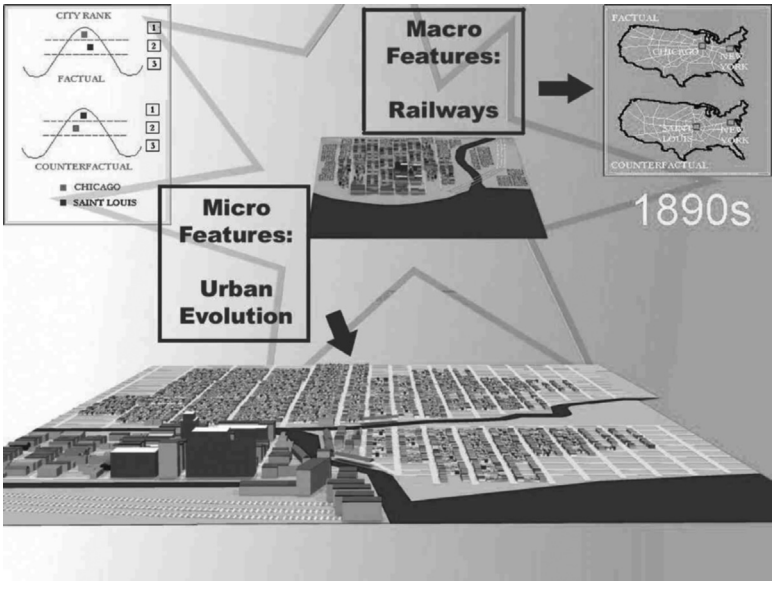

Figure 1: National Research Council of Canada.

railway networks that sustained them. The diagram shown here indicates the type of representation that a virtual narrative would need to express. Using a device common to electronic games, the 3D environment would need to feature a map that provides information cohering with the three-dimensional representation situated on the ground. The map would need to show each city's instigation of an alliance with New York, show the emergence of railway networks, and, through juxtaposition with the 3D representation of the city on the ground, illustrate the impact that each network — factual and counterfactual — had on the respective fortunes of Chicago and St. Louis as they rose to or retained metropole status in their respective time-lines.

To express the presence of a simultaneous time-line, two metaphors — the ghost image and a rip in the sky — might be applied to signify history as it might have been. To characterize an environment as belonging to a counterfactual time-line, the author would have the option of either rendering it as a translucent object or associating it with a translucent object to communicate a sense of simultaneous presence and absence, as indicated by the window metaphor shown in Figure 2. The purpose of the second metaphor, the rip, suggested by the paintings of Salvador Dali, would be to represent a counterfactual environment as the product of a bifurcation in history, located in a time-line that is neighbour to space/time and capable of erupting into space/time to facilitate comparison, as shown by the series of graphics in Figure 3.

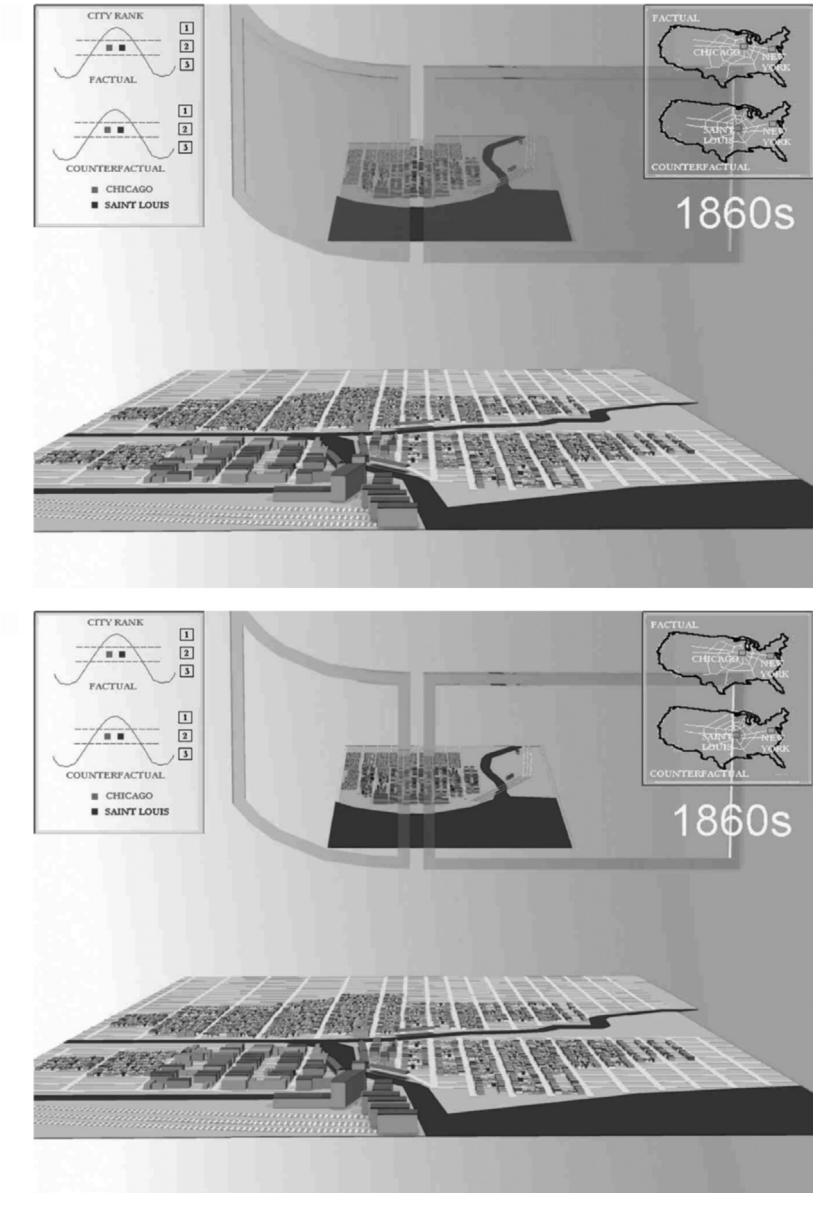

Figure 2: National Research Council of Canada.

Aside from deploying constituents of the Topographic Revolution to support analysis and expression, historians will likely also consider how these might be appropriated to support teaching. Research in this area, I suggest, will take two forms. One branch would concern itself with

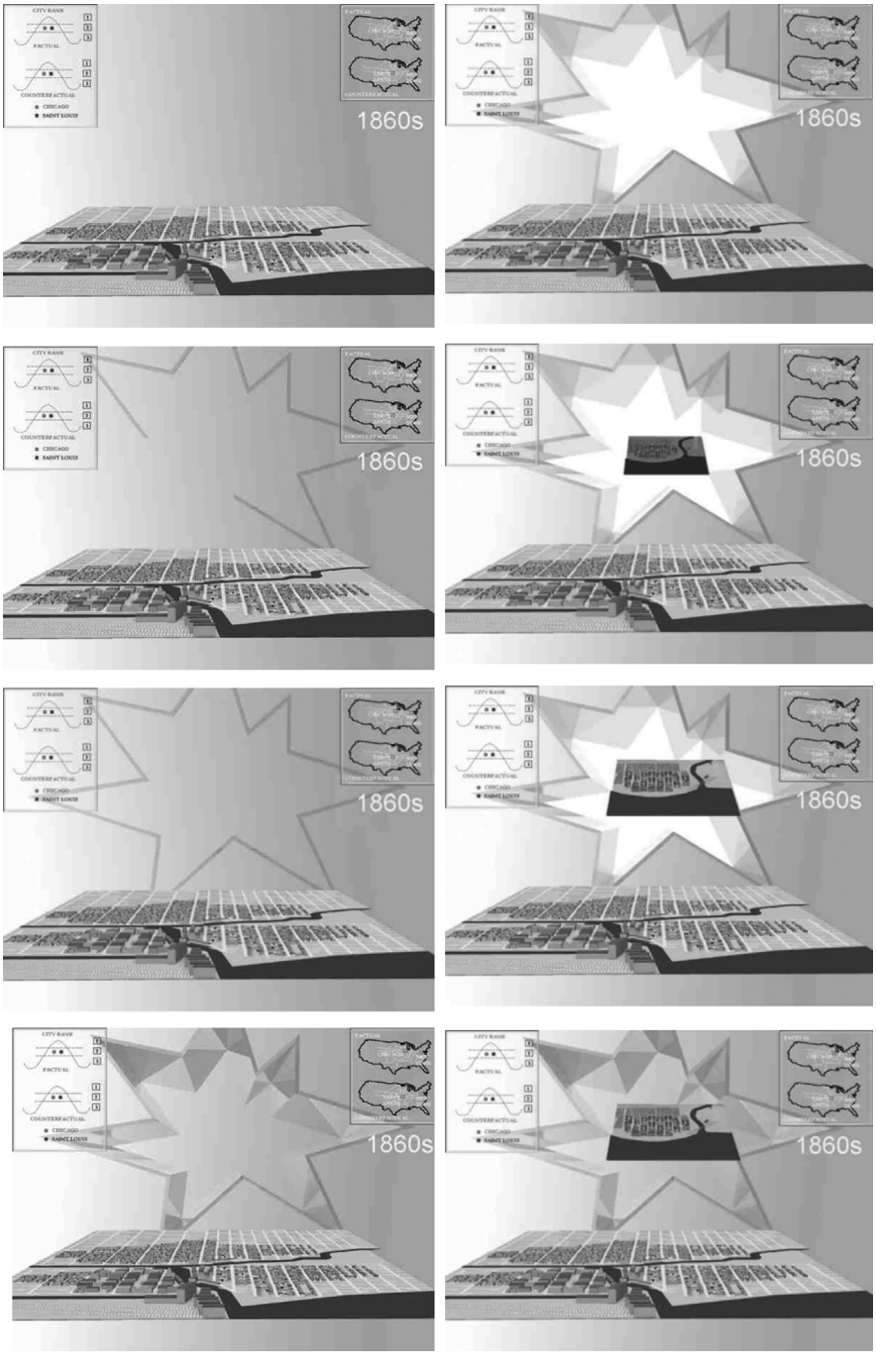

Figure 3: Diagrams 1 through 4, left column, top to bottom. Diagrams 5 to 8, right column, top to bottom. National Research Council of Canada.

genres governing users' interaction with 3D objects such as computer games and would seek to determine their best application, singly and in conjunction with other forms of representation such as books. The second branch would seek to devise a set of best practices for the use of 3D objects.

Two recent samples from the history and computing literature suggest how historians might benefit from such a research agenda, particularly in their teaching. With respect to genres, Tom Taylor's work using computer games suggests that students gain a better understanding of the processes governing historical change when they are exposed to the same content expressed through multiple genres of narration and forms of representation. In a world history course, he used the game *Civilization* as a complement to the book upon which it was based, Paul Kennedy's *The Rise and Fall of the Great Powers*. Over the duration of the course, Taylor discovered that students playing the game gained a deeper understanding of the core concepts underlying Kennedy's book than those students who did not play.[22]

With respect to 3D objects, the *3D Virtual Buildings Project* suggests they can be used to enable students to develop a deeper appreciation of the strengths and weaknesses of historical representation. The project was formed in 1998 as a partnership of the National Research Council of Canada, Industry Canada, and the Institute of Canadian Studies at the University of Ottawa. The purpose was two-fold: to enable students to develop three-dimensional representations of historic Canadian

22 Tom Taylor, "Historical Simulations and the Future of the Historical Narrative", *Journal of the Association for History and Computing*, vol. 6, no. 2 (September 2003) [online journal], retrieved February 10, 2007, from http://mcel.pacificu.edu/JAHC/JAHCV12/ARTICLES/taylor.HTML, and "Using the Simulation CIVILIZATION in a World Survey Course", *History Microcomputer Review*, vol. 10, no. 1 (Spring 1994), pp. 11–16. With respect to the utility of computer games in the history classroom, Paul Marty and Chris Butler note: "Our simulations, therefore, reinforce, not replace, the traditional methods of classroom teaching. We use all of our existing simulations to cap off the classroom unit to which it relates. Students are given the rule-books for the simulation during the unit, and we constantly refer to the upcoming simulation during the classroom lessons. This has two advantages. First, the anticipation of playing the game heightens the students' interest in the history unit and motivates them to learn the material more thoroughly. Second, the students are encouraged to focus on the issues and processes being discussed in the classroom since that information provides them with valuable clues on how to play the simulation successfully. Each of our simulations are designed in such a way that every lesson covered in the simulation is taken directly from the detailed textual material used in the classroom; the classroom materials and the laboratory simulations are tightly integrated, teaching the exact same lessons in two very different yet complementary ways. The simulation, therefore, provides an essential supplementary review to the classroom lessons which focuses the students' interest, increases the value of the lessons they learn in the traditional classroom, and drives the historical lesson home for each and every student." See Marty and Butler, "The Use of Simulations in the Teaching of History", in Burton, ed., *Computing in the Social Sciences and Humanities – Wayfarer CD*.

settlements, such as the model of 1878 Ottawa shown in Figure 4, and to develop critical thinking skills.

The core premise of the project was that the process of 3D model construction can be used to enable students to distinguish historical representations from the objects to which they refer. Student participants translate data contained in photographs and fire insurance maps into numeric information that in turn is used as the basis for constructing a 3D model. During the process of translation and construction, students also encounter a set of challenges common to all forms of historical representation. For example, in the project's tutorial, students are asked to construct the building shown in Figure 5, the building of James Hope, a nineteenth-century Ottawa stationer.

They are also asked to deal with a significant problem, a major gap in evidence. There is no record of the wall indicated in Figure 5. In addressing this gap, the tutorial emphasizes to students that historians continually face similar problems, but nevertheless go on to produce fully formed representations of the past by applying an accepted solution, namely informing their audiences of the problem and making an informed guess as to the probable content of the gap, based on a reading of the historical context of the time. For students, applying this procedure in the project at hand means examining photographs of neighbouring structures to get a sense of the nineteenth-century architectural conventions governing building appearance. It also affords them a basis to make a guess as to the wall's probable appearance and, in turn, to construct a wall.

Figure 4: Ottawa, 1878, corner of Sparks and Elgin Streets. National Research Council of Canada.

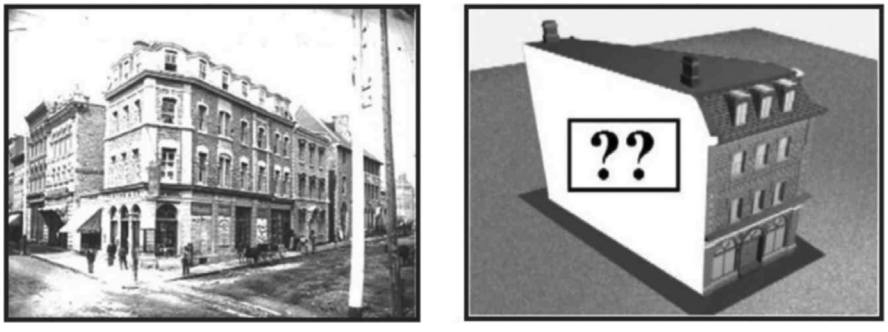

Figure 5: Building of James Hope, stationer, Ottawa 1878. National Archives of Canada, PA 9257; National Research Council of Canada.

In 1999 and 2000 the project conducted a set of limited field tests in Ottawa area high schools, with limited success. A few students reached the learning goal set for them, demonstrating recognition that historical representations are models and, as such, are imperfect. Most students, however, did not, in large measure because the complexity of the CAD software prevented participants from completing their models. The challenge of mastering the tool hindered students' realization of the learning process the tool was meant to support.[23]

This finding suggests historians interested in the aesthetics of 3D representation will need to do two things if 3D objects are to find ubiquitous use in the discipline. Over the long term, they will need to think about the process of human-computer interaction. If scholars — regardless of discipline — are to use 3D objects, they will need to work with colleagues in the information sciences to devise better ways to make 3D objects, a task that will mean devising novel ways to communicate one's intentions to the computer. Over the short term, they will need to consider the question of application. Until the process of content generation is rationalized, some scholars will doubtless conclude that it is not practical in the context of the classroom to use 3D objects to model specific events, such as the emergence and transformation of nineteenth-century Ottawa, or micro-scale environments, such as Sparks Street.

Historians who reach that conclusion would be well advised either to avoid use of 3D objects altogether or to use them in a different way. An alternative strategy would be to develop software akin to *Kar2ouche*, a composition software package and teaching programme in which students

23 For a fuller description of the *3D Virtual Buildings Project*, see John Bonnett, "Following in Rabelais' Footsteps: Immersive History and the *3D Virtual Buildings Project*", *Journal of the Association for History and Computing*, vol. 6, no. 2 (September 2003) [online journal], retrieved February 10, 2007, from http://mcel.pacificu.edu.JAHC/JAHCV12/ARTICLES/bonnett/bonnett.HTML.

can take extant 3D objects and generate historical representations. Such software could be used to model a macro-scale environment such as the emergence of a generic city or urban system. Here the objective would be for students to learn and model processes that can be applied to a variety of historic urban environments. Students would be provided generic houses, commercial buildings, churches, and so on to create models of settlements. They would also be provided with 3D objects to enable them to represent trade and communication flows, the emergence of an urban system, and the system's selection of a metropole. The point of such an application would not be to deepen their understanding of the history of a specific locale, but rather to deepen their understanding of historical processes — such as increasing returns in economic history — that governed the emergence of multiple locales or urban systems. In such a scenario, reference to a particular city or a specific building at a specific time and place would not be important.

Generating 3D Content

From the standpoint of appropriation and the standpoint of expression, it is hard not to conclude that the next half century or more will prove to be an extremely exciting, innovative time for practitioners associated with the digital humanities and with history and computing. If there is to be a meaningful appropriation of computer-generated from, however, historians will also need to devote attention to a more prosaic matter: its creation. Harold Innis's cultural histories suggest why. In his works, the communication theorist repeatedly centred his discussion around a fundamental question: how simple or difficult was it for cultures to create information? The issue was important because his histories were based on a simple premise: simplification equals agent participation. The simpler the communication system, the more likely it was that more rather than fewer agents were able to participate and that more rather than fewer domains of practice were supported, and the system throve accordingly. Hence, in his surveys of ancient history, Innis suggests Egyptian culture, science, and theology were stymied by Egypt's refusal to shift from hieroglyphics to a simpler system of signs. Fewer people were able to participate in Egypt's cultural life, in large measure because Egypt's religious institutions jealously guarded their control of the country's communication infrastructure. By contrast, more people in more domains were able to participate — and innovate — in the development of commerce, governance, science, and theology in Mesopotamia and ancient Greece due to the invention by those regions of simpler forms of representation, namely cuneiform and then the alphabet.[24]

24 Harold A. Innis, "Egypt", in *Empire and Communications* (Oxford, UK: Clarendon Press, 1950), pp. 13–29. For one interpretation of Innis's writings on the impact of communication technology

The issue of generation is important because, when it comes to 3D content, there is an argument to be made that we live in a time akin to ancient Egypt. By certain measures, such as photo-realism, one can make the argument that our culture is fairly good at generating 3D objects. But if one considers the measures that matter, the ones that ask whether 3D is infiltrating the way our contemporaries think, learn, communicate, make art, do business, worship, and play, then the answer is that our culture is not very good at this at all. As a domain of communication, 3D is akin to hieroglyphics, and by and large its production remains limited to sectors such as the entertainment industry and the military. For scholars in history and computing and humanities and computing, one important challenge in this century will be to make 3D an accessible form of communication.

There are two strategies scholars might follow, again one over the long term and the other over the short term. Over the long term, I suggest the optimal course will be for scholars to collaborate with colleagues in the information sciences to devise new methods for interaction with the computer, through voice and gesture.[25] Over the short term, if they are to generate content-rich 3D environments, scholars will have to find ways to transcend the limitations inherent in the practices and tools currently at their disposal.

With respect to practice, given that the construction of a virtual environment is a labour-intensive enterprise, and given that such environments will be beyond the ken of any scholar to construct in isolation, historians will need to commit themselves to the joint construction and improvement of a scholarly work. Put another way, they will need to redefine their conception of "author" to encompass not only the individual, but also the network of individuals. A changing medium and a distributed conception of authorship will in turn encourage a redefinition of what constitutes a scholarly work. In future, it will need to encompass not only fixed, printed objects, but also 3D web sites that are dynamic repositories of content, subject to expansion and correction.[26]

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in Egypt and other ancient cultures, see John Bonnett, "Communication, Complexity and Empire: The Systemic Thought of Harold Adams Innis" (PhD thesis, University of Ottawa, 2002), pp. 206–309.

25 Stéphane H. Maes and T. V. Raman, "Multi-modal Interaction in the Age of Information Appliances", *IEEE International Conference on Multimedia and Expo*, no. 1 (2000), pp. 15–18; Yigal Arens, "A Knowledge-based Multi-modal Interface", in *AI Systems in Government Conference, 1990: Proceedings, Fifth Annual* (1990), pp. 112–119; Kenneth Cox *et al.*, "A Multimodal Natural Language Interface to an Information Visualization Environment", *International Journal of Speech Technology*, vol. 4 (2000), pp. 297–314.

26 The suggestion that historians must collaborate to make effective use of information technology is not a new one. Robert Fogel notes that proponents of the "New Economic History" embraced this ethic in the 1970s. See Fogel, " 'Scientific History' and Traditional History", in Robert Fogel and Geoffrey Elton, *Which Road to the Past? Two Views of History* (New Haven: Yale University

With respect to tools, historians will need to work with colleagues in the information sciences to develop software capable of generating and maintaining such sites. Here, thankfully, it will not be necessary to start from scratch. The design and production of software capable of supporting computer-supported collaborative environments (CSCE) is already an established line of research in the discipline of computer science. What will be necessary will be to conceive and generate tools associated with CSCE software that meet the needs of historians and other scholars.[27]

Consider one fundamental need: the need to impose coherence on content. Without a structuring principle and the tools to express it, historians have no means — individually or collectively — to present a narrative, much less an argument. Now consider the characteristic of many virtual reality sites available on the Internet today. Most afford free navigation, and most enable users to interact with any object or building on the site, where and when they will. While sites that afford visitors the capacity to

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Press, 1983), pp. 60–63. Scholars in other disciplines are reaching similar conclusions. In the field of visual art, Joseph Squier, Nan Goggin, and Kathleen Chmelewski argue that "the most compelling reason for working as a group can be found in the inherent qualities of digital media. Electronic technology is creating a fusion across the formerly discrete disciplines of still images, video, text, and sound. Creative production no longer relies on expertise in one single area, but rather the successful integration of multiple skills. Digital multimedia is collaborative by nature. The artist as creative loner is an outmoded concept, and will not be the operative paradigm for the electronic artists of the future. Rather than basing their production on the premise of unique, precious, and valuable *objects*, they likely will create their work as transitory *experiences* that are multi-layered, multi-sensory, and instantaneously distributable to multiple locations." See Squier, Goggin, and Chmelewski, "Electronic Culture and the Training of the 21st Century Artist", in Burton, ed., *Computing in the Social Sciences and Humanities – Wayfarer CD.* Andrew A. Beveridge, Carmenza Gallo, Joanne Miller, Dean Savage, and Lauren Seiler suggest that the need to deal with ever-increasing quantities of data has encouraged a similar ethic of cooperation among scholars in the social sciences: "Since the early 1960s, the methods and content of sociology has been transformed. Where most sociologists used to carry out their research individually, using simple surveys or other one-person data collection techniques — 'little social science' — sociological investigation is increasingly the product of researchers working as teams. The advent of large scale social surveys — often of a longitudinal character; the analysis of historical and comparative historical materials; the conduct of social experiments with large populations ... all require the use of complex large-scale empirical methods." See Beveridge *et al.*, "Stimulating Social Research Findings to Aid in Teaching Introductory-level Sociology Courses", in Burton, ed., *Computing in the Social Sciences and Humanities – Wayfarer CD.*

27 For introductions to the concept of the computer-supported collaborative work environment, see "Section 4: Collaborative Virtual Environments", in Kate Fernie and Julian D. Richards, eds., *AHDS Guides to Good Practice: Creating and Using Virtual Reality, a Guide for the Arts and Humanities* [online publication], retrieved February 10, 2007, from http://vads.ahds.ac.uk/guides/yr_guide; Irene Greif, ed., *Comoputer-supported Cooperative Work: A Book of Readings* (San Mateo, CA: Morgan Kaufmann, 1988); Jonas Heide Smith, "The Architectures of Trust: Supporting Cooperation in the Computer-supported Community" (MA thesis, University of Copenhagen, 2002) [online], retrieved February 10, 2007, from http://www.itu.dk/people/smith/texts/the_architectures_of_trust.pdf.

explore their content freely enjoy a certain appeal, they also suffer a notable shortcoming: they provide users with fragmented bits of information that often bear no obvious relationship with each other or to a useful context. If the viewer is to emerge with a coherent message, some measure of constraint — some form of narrative structure — will need to be imposed to determine how, where, and when the user receives specified items of information.

One example of a tool capable of imposing such constraint would be based on the following premise: that coherence can be obtained when users are afforded fixed paths through space. A tool could be devised that generates units such as those shown in Figures 6 and 7, which could be combined to construct narratives in a fashion analogous to paragraphs. The units would be comprised of cylinders of varying length, each specifying a path of movement, and spheres, each specifying a fixed point where a user stops and views the next stage of the narrative, delivered in text, streaming video, or 3D.

The tool as envisaged would also be capable of supporting a very different operation, not the construction of a narration, but its violation, by enabling units to be appropriated from one narrative pathway and spliced into another. There would be nothing particularly novel about such a practice. Scholars routinely splice text from one context — in the form of a quotation — and insert it into another to support arguments they admire and to counter arguments they question. The tool — and

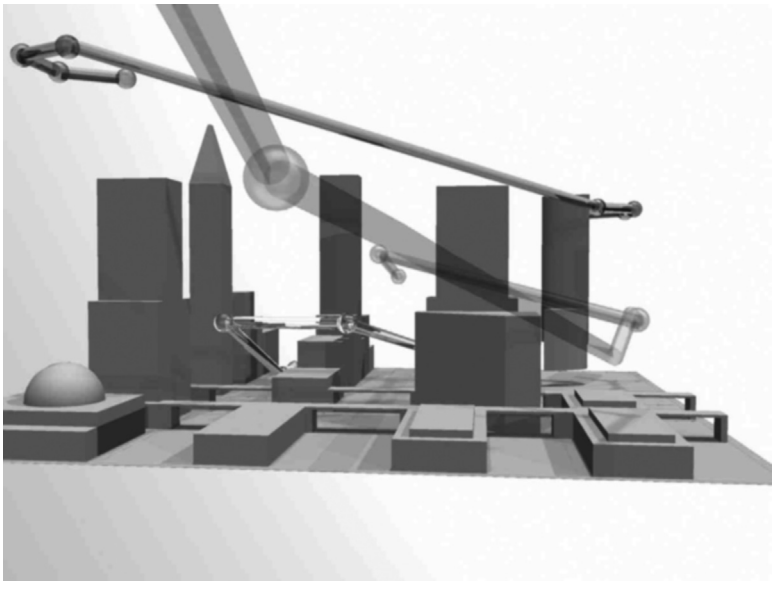

Figure 6: National Research Council of Canada.

Figure 7: National Research Council of Canada.

the cylinder/sphere convention it expresses — would support the combination and recombination of extant 3D content for the generation of new narratives.

Figure 8 shows how the process of securing a virtual quotation might work. The purpose of the exercise would be to afford one's viewers access to part of one of the virtual narratives shown in diagrams 1 through 5, to enable them to see exactly what the original site's viewers see. The process for obtaining the information would be akin to that followed in a word-processing package. Just as users use a mouse to "bold" sections of text to be copied or extracted, users in this scenario would use a selection arrow to copy or cut sections of interest.

In diagram 1, the user employs the selection arrow shown on the upper left to indicate to the CSCE software the narrative pathway of interest. The arrow is also used to communicate the narrative units the user wishes to appropriate. He or she places the arrow above a specified unit, clicks the mouse, and in so doing changes the colour of the section of interest. The software's "copy" command is then selected.

In diagram 6, the user moves to the next stage of creating a new narrative by creating a new file and pasting the appropriated content into it. Here, it is important to remember that, while the author of this file only sees the narrative pathway, the software will enable his or her audience to see the 3D content to which the pathway refers. Users will see the city skyline. Once the appropriated content is pasted and saved, the next step is diagram 7,

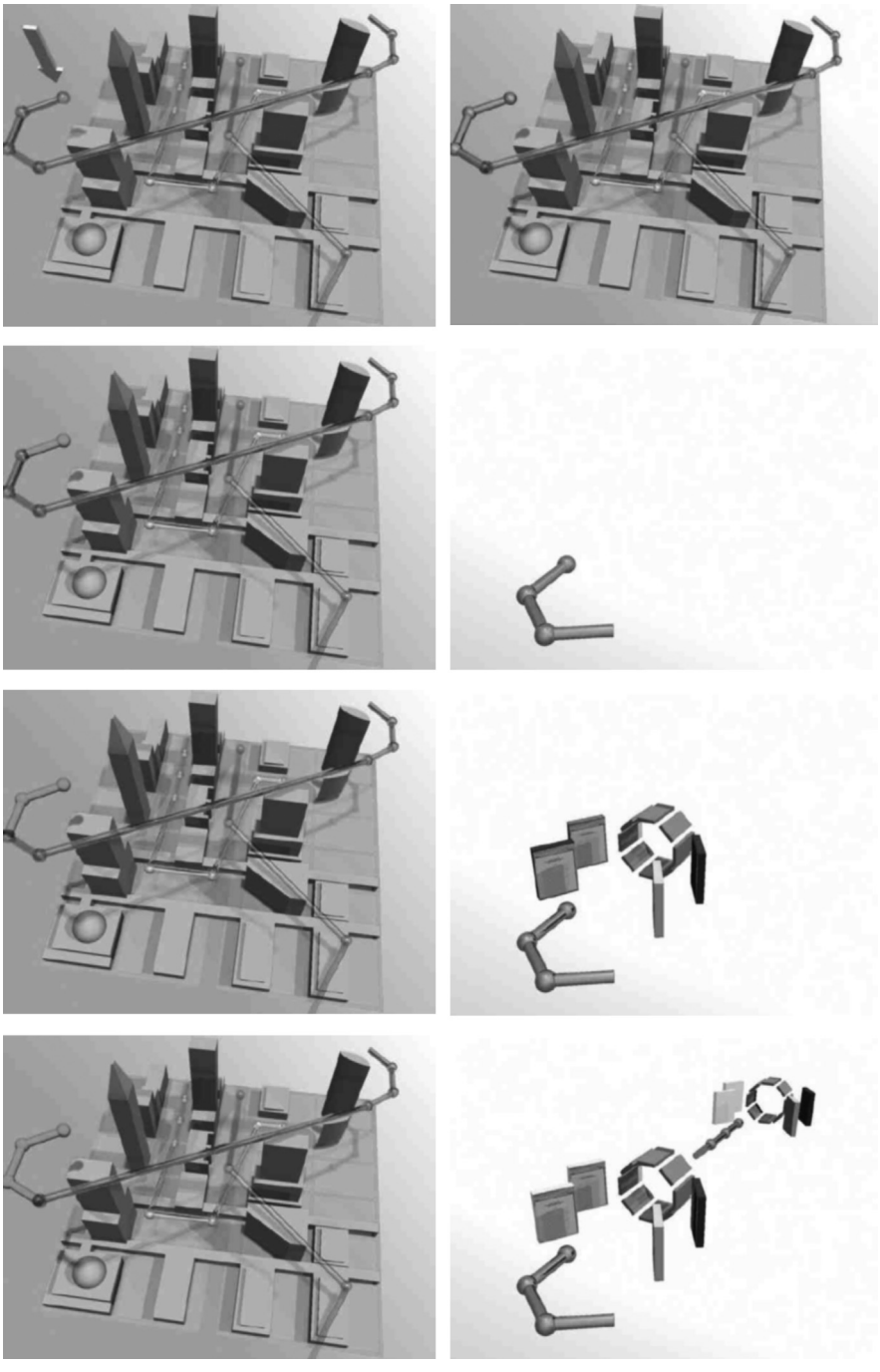

Figure 8: Diagrams 1 through 4, left column, top to bottom. Diagrams 5 to 8, right column, top to bottom. National Research Council of Canada.

which shows the addition of text and video content. In this step the software as conceived affords the author the opportunity to render his or her interpretation of the cited material, before repeating the process as shown in diagram 8. Each new section is punctuated by a cylindrical marker, which acts as a transition point between sections of appropriated content.

Platforms for Disseminating 3D Content

Aside from the generation and use of 3D content, historians and digital humanities scholars will also need to turn their attention to how it is disseminated. When we speak of dissemination, we are referring to multiple things. Generally, we are referring to the scholars who contribute to knowledge, as well as the individuals who support its distribution and categorization. We also refer to the infrastructure, the institutions and equipment that support the instantiation, distribution, and classification of knowledge. Perhaps most fundamentally, we are referring to the platforms that communicants use to store and structure knowledge.

What is a "platform"? To this point I have used the word as a synonym for the word computer and, more specifically, as a blanket term that refers to the multiple categories of digital computers that have emerged from the 1940s to the present. But platforms are more than that. Put simply, they are the repositories communicants use to store, structure, and distribute information from one locale to another. A book is a platform; so too is a scroll.

From the standpoint of a research agenda devoted to computer-generated form and the aesthetics of history, why is attention to dissemination and platforms important? The answer is straightforward: enhanced capacity. Dedicated networks of computers, for example, can be characterized as platforms. In the form of collaborative environments, they enhance scholars' capacity to acquire data and distribute scholarship. In the form of High Performance Computing clusters, they afford scholars access to unprecedented levels of computational power and, with it, enhanced analytical power through text and data mining.[28] For our purposes, however, the focus on new platforms is important because of one additional feature they provide: enhanced expressive power.

This enhanced expressive power, I suggest, stems from an altered platform ecology. No platform operates in isolation. When a new platform

28 Irina Kondratova and Ilya Goldfarb, "Virtual Communities: Design for Collaboration and Knowledge Creation", *Proceedings of the European Conference on Products and Processes Modelling* (Istanbul, Turkey, September 8–11, 2004) [online publication], retrieved February 10, 2007, from http://lit-iti-nrc.cnrc.gc.ca/lit-publications-iti/docs/NRC-47157.pdf. For information on High Performance Computing, see *Engines of Discovery: The 21st Century Revolution, the Long Range Plan for High Performance Computing in Canada* [online report, c3.ca website], retrieved February 10, 2007, from http://www.c3.ca/ce/archives/uploadedFiles/LRP_english.pdf. The consortium c3.ca is comprised of universities, colleges, industry, and government organizations in Canada devoted to promoting research supported by High Performance Computing.

emerges, it will have a bearing on the constitution and operation of extant platforms. Extant platforms, in turn, will impinge on the operation of the new.[29] This process of mutual impingement starts with the arrival of a new platform. Generally, it will present users with a new medium or array of media. It will also present users with a new order of constraints to govern expression, which arise from the physical properties of the platform and the instantiating medium within it. The new order of constraints, in turn, presents users with the potential to create new expressive forms. This occurs in two ways: through modification of extant expressive forms and conception of new ones, and through the modification of extant platforms and the evolution of new ones.

Harold Innis understood this point. Knowledge dissemination rests on an ecology of instruments. If you alter the ecology, you alter the forms and platforms that comprise it. For example, Innis argued that English prose changed in the nineteenth century due to the emergence of a new platform, the networks of machines and wires we refer to as the telegraph. The telegraph not only changed the form of written language, but also the extant platforms that thus far had been used to express it: "The telegraph produced a condensation in style and brought an end to 'the ten column articles and three-volume books'."[30]

For historians, then, I suggest the essence of a practice-oriented research agenda will be to understand how today's platforms — in the form of computers — are changing and to understand the implications those changes present for historical expression. I further suggest two trends shaping platform development today will be central concerns in future research: convergence and ubiquity. Convergence, put simply, is the integration of platforms, and attending functions, into a single platform. The process is now occurring in multiple sectors. In industry, for example, one can cite initiatives by manufacturers of electronics and communications equipment to integrate the functions of platforms ranging from PCs, personal video recorders, and games into a single platform: the home server.[31] In the university sector, projects such as the *Magic Book* suggest that eventually

29 This information is based on Innis's writings (see note 30) and is also an adaptation of Bolter's and Grusin's concept of "remediation", which contends that forms of representation in emerging media alter forms of representation in extant media, and vice versa. I argue here that a similar process of mutual modification applies to platforms. See Bolter and Grusin, *Remediation*, pp. 44–50; McLuhan, *Understanding Media*, p. 8.

30 Harold Innis, "The Newspaper in Economic Development", in *Political Economy in the Modern State* (Toronto: Ryerson Press, 1946), p. 13.

31 Karl Paulsen, "Home Media Server Concepts Evolve" [online article, TVTechnology website], retrieved February 10, 2007, from http://www.tvtechnology.com/features/Media-Server-Tech/F_Paulsen-03.09.05.shtml; "Home Media Servers and Entertainment Hubs" [online article, ABIresearch website], retrieved February 10, 2007, from http://www.abiresearch.com/products/market_research/Home_Media_Servers_and_Entertainment_Hubs.

even the book and the computer will undergo some form of convergence, as functions such as the display of 3D images and 2D animations are incorporated into the codex.[32]

The second important trend impinging on platforms is ubiquity. In computing, a new paradigm is emerging — ubiquitous computing — which will complement, if not replace, the paradigm of computing we know, desktop computing. For the past 17 years, information scientists have been articulating a vision of computing in which users enjoy access to computer applications anywhere, at any time. The literature also suggests that this vision will be realized in two ways: computers will be embedded in the surrounding environment; and users will carry small, light-weight computers known as wearable computers.[33]

The potential impact of these two trends for platforms generally, and historical expression particularly, can be illustrated in the following scenario. The scenario, expressed by text and the storyboard shown in Figure 8, examines the challenges associated with constructing a narrative set in nineteenth-century Ottawa devoted to a significant event in Canada's political history: the assassination of Thomas D'Arcy McGee, one of the Fathers of Confederation. In the scenario, which for the sake of argument we will place 50 years hence, our political historian has appropriated his university's football field in the off-season to construct a platform radically different than anything scholars currently deploy. The platform, as conceived, would converge two display technologies — electronic paper and augmented reality — with the mobile computer. Within the space delimited by the football field, information would be ubiquitous.

Electronic paper, or e-paper, is, in essence, "paper" — thin sheets of plastic — capable of displaying text and images that move. It matches the functionality of TV monitors and transcends many of their drawbacks, including mass and background light that fatigues the eyes. When commercialized, e-paper will allow users to affix dynamic images to locales ranging

32 Mark Billinghurst, Hirokazu Kato, and Ivan Poupyrev, "The MagicBoook: A Transitional AR Interface", *Computers and Graphics*, vol. 25, no. 5 (2001), pp. 745–755.

33 J. Peddie, "Digital Media Technology: Industry Trends and Developments", *IEEE Graphics and Applications*, vol. 21, no. 1 (January/February 2001), pp. 27–31; Eric Badiqué, "Under Construction in Europe: Virtual and Mixed Reality for a Rich Media Experience", in O. Balet, G. Subsol, and P. Torguet, eds., *Virtual Storytelling: Using Virtual Reality Technologies for Storytelling, International Conference ICVS 2001, Avignon, France, September 27–28, 2001, Proceedings* (New York: Springer, 2001), pp. 3–9; Wolfgang Broll, Leonie Schäfer, Tobias Höllerer, and Doug Bowman, "Interface with Angels: The Future of VR and AR Interfaces", *IEEE Computer Graphics and Applications*, vol. 21, no. 6 (November/December 2001), pp. 14–17 [online publication], retrieved February 10, 2007, from http://www.cs.columbia.edu/graphics/publications/CGandAProjVR.pdf.

from the living room wall to telephone poles. The process will be no more onerous than affixing wallpaper to a wall.[34]

Augmented reality (AR) is a new medium of representation akin to virtual reality. Both provide representation of computer-generated 3D objects. Augmented reality differs from virtual reality in where it situates its objects. Unlike virtual reality, which positions its objects in an artificial 3D environment viewed by a computer monitor, augmented reality situates and registers its objects with the user's view of real space. The user views the object using a wearable computer and a see-through, head-mounted display akin to glasses.[35]

The significance of augmented reality for historians is that the medium offers the possibility for generating and displaying life-sized replicas of historic environments. In principle, everything from ancient Rome to eighteenth-century Paris could be displayed in an open space designated by the viewer. Efforts in generating life-sized visual representations of historic structures have already been undertaken at Columbia University and in Olympia, Greece.[36] In 50 years' time, it is reasonable to suggest that scholars will be able to upload and display photo-realistic renditions of settlements onto open fields. The medium of augmented reality will present scholars with unique challenges in terms of devising methods for interaction, navigation, narration, and documentation.

To see how, consider the storyboard shown in Figure 9. In it, the political historian begins his "chapter" on the assassination of Thomas D'Arcy McGee as part of a larger 3D work devoted to post-Confederation political

34 On newly emerging display technology, see Y. Chen, J. Au, P. Kazlas, A. Ritenour, H. Gates, and M. McCreary, "Electronic Paper: Flexible Active-matrix Electronic Ink Display", *Nature*, vol. 423 (May 8, 2003), p. 136; Webster E. Howard, "Better Displays with Organic Films", *Scientific American*, February 2004, pp. 76–81 [online], retrieved February 10, 2007, from http://www.sciam.com/article.cfm?chanID=sa006&collD=1&article1D=0003FCE7-2A46-1FFB-AA4683414B7F0000.

35 For introductions to the field of augmented reality, see Steven K Feiner, "Augmented Reality: A New Way of Seeing", *Scientific American*, April 2002 [online], retrieved February 10, 2007, from http://www.sciam.com/article.cfm?collD=1&articleID=0006378C-CDE1-1CC6-B4A8809EC588EEDF; Ronald T. Azuma, "A Survey of Augmented Reality", *Presence: Teleoperators and Virtual Environments*, vol. 6, no. 4 (August 1997), pp. 355–385; Ronald Azuma *et al.*, "Recent Advances in Augmented Reality", *IEEE Computer Graphics and Applications*, vol. 21, no. 6 (November/December 2001), pp. 34–47; Steve Benford *et al.*, "Applications and Design Spaces: Unearthing Virtual History – Using Diverse Interfaces to Reveal Hidden Virtual Worlds", *Lecture Notes in Computer Science*, vol. 2201 (2001), pp. 225–232.

36 Vassilios Vlahakis, John Karigiannis, and Nikoloas Ioannidis, "Augmented Reality Touring of Archaeological Sites with the ARCHEOGUIDE System", *Cultivate Interactive*, no. 9 (February 2003) [online journal], retrieved February 10, 2007, from http://www.cultivate-int.org/issue9/archeoguide/; Tobias Höllerer, Steven Feiner, and John Pavlik, "Situated Documentaries: Embedding Multimedia Presentations in the Real World", *Proceedings of International Symposium on Wearable Computers 1999* (San Francisco, October 18–19, 1999), pp. 79–86 [online publication], retrieved February 10, 2007, from http://monet.cs.columbia.edu/publications/iswc99.pdf.

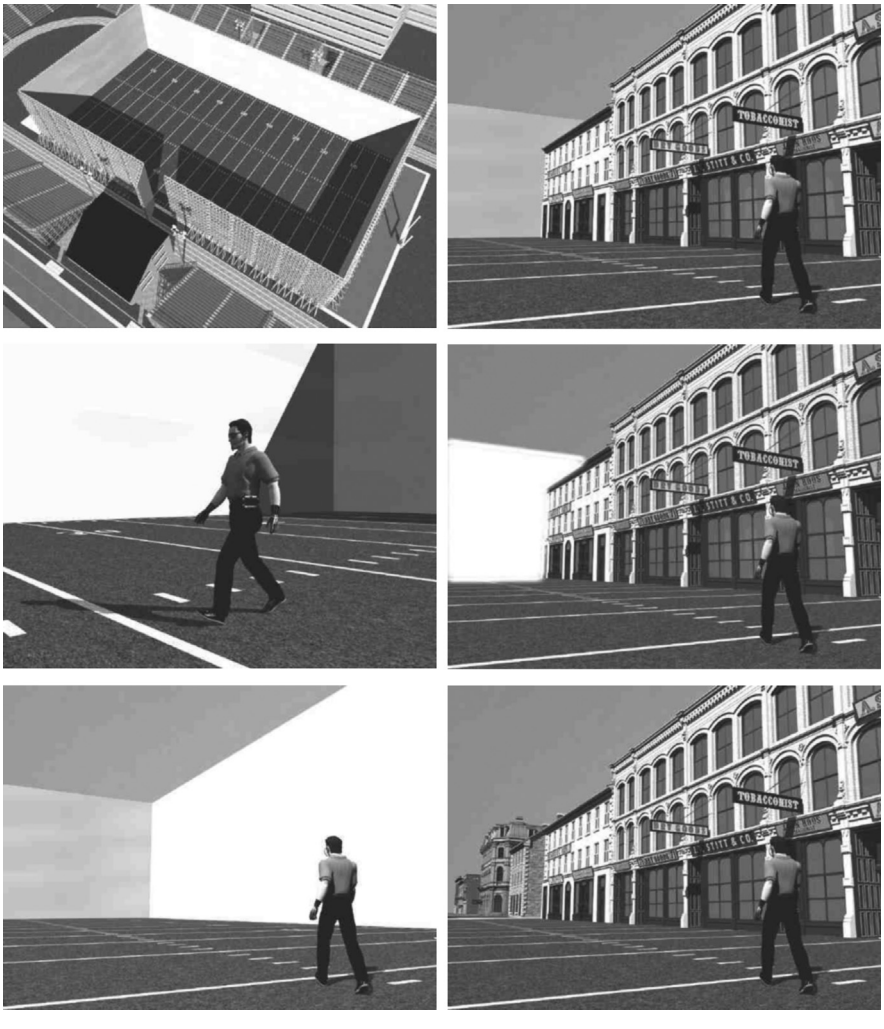

Figure 9: Diagrams 1 through 3, left column, top to bottom. Diagrams 4 to 6, right column, top to bottom. National Research Council of Canada.

history. Diagram 1 shows the platform he has constructed for this purpose. Before starting, however, the historian has to enter the platform as indicated in diagrams 2 and 3 and load the 3D representation he has of Sparks Street on screen and on site. By this point, scholars will have libraries of open-source 3D objects and representations at their disposal, which can be freely acquired and modified to suit their purposes. Accordingly, the historian acquires the one representation of nineteenth-century Sparks Street available to him, showing the street as it existed in 1878.

It is not precisely suited to his needs. McGee was assassinated in 1868. The historian will therefore need to replace some structures, modify others, and replace certain features such as signage to reflect properly the identities of the people, businesses, and organizations that occupied Sparks Street in 1868. Still, it is close enough, and resorting to an extant model is a more efficient method of composition than starting a 3D model of the relevant environment from scratch. Using a wearable computer the size of a wallet, shown in diagram 2, as well as voice and gesture to communicate with his computer, the scholar starts by opening the section of his representation that will be displayed in augmented reality. The buildings emerge into bounded space before him, as shown in diagram 4. Given that the platform's purpose is to generate an illusion whereby the twenty-first century is occluded from view, including the walls that form the perimeter of this space, the historian supplements his representation by activating a virtual reality representation of neighbouring sections of Sparks Street, one that merges seamlessly with the augmented reality buildings in front of him. He does so by turning on the display screens affixed to the platform's walls, as shown in diagrams 5 and 6.

While the representation he has generated thus far is impressive, it is also far from complete. It does not set the stage, however, for understanding the aesthetic challenges historians will face 50 years hence. The fact is that the representation situated in front is quite sterile, since it only contains Ottawa's urban structure. The historian and his colleagues have yet to add the array of objects, people, sounds, perhaps even smells that populated this nineteenth-century environment. More to the point, they have yet to impose a narrative structure that will communicate a coherent message to users, directing their attention to specific objects, events, people, or some combination of all three.

How will historians rise to the challenge of constructing narratives in augmented reality environments? What principles will they apply? I suspect a rich array will emerge over time, but three at this point can be identified. The first principle will be to appeal to precedent. As Janet Murray and other media theorists have noted, forms of spatial narrative already exist. None extant today enjoys any particular degree of prestige. Most, instead, are the stuff of pop culture, worlds of wonder that include amusement park rides, role-playing games, and 3D movies. These forms, Murray suggests, are subject to appropriation for ostensibly serious purposes, be it literature in her case or historical scholarship.[37]

37 Janet H. Murray, *Hamlet on the Holodeck: The Future of Narrative in Cyberspace* (Cambridge, MA: MIT Press, 1997), pp. 27–64.

Some may see such a move as a violation, a mixing of categories the spheres have proclaimed forever distinct, and such may be the case. But I find Mikhail Bakhtin's formulation of the relationship between popular and elite — or scholarly — culture the more persuasive one. As indicated above, in *Rabelais and his World*, he argued that scholars historically have appropriated popular cultural forms to meet the expressive needs of the present. They did so to lay the groundwork for the French novel and humanism. I suggest they will do so again to meet the expressive challenges posed by new platforms such as networked computers and new media such as augmented reality.[38]

The second principle that will govern narrative structure in augmented reality will stem from the first. In their appeal to precedent, scholars will appropriate a particular form of linear narrative now extant in amusement park rides such as *Pirates of the Caribbean* and *Jurassic Park*. They will do so because this form is capable of supporting the expression of content and concepts that historians now express. They will do so because the formalism is capable of supporting expression in the environmental contexts *through* which historians will express. There are two ways in which augmented reality could be applied to support historical narrative. One will be to inscribe information onto an open space. In this context, users will have leave to examine whatever historical content they choose. The second approach will be to inscribe information onto historically significant space, to augment it. Here, users will have leave to examine situated narratives that explain the significance of a given locale. The remains of Greek temples in Olympia, for example, have been supplemented by the *Archeoguide* project with virtual reconstructions of structures showing their probable appearance in fully assembled form.[39] Linear forms of narration will support augmented reality histories situated in both environments. Of *Jurassic Park*, Murray notes:

> The amusement ride occupies five acres and accommodates three thousand visitors per hour on its twenty-five person boats. The various events of the ride — the surprising appearances of the various dinosaurs, the flashing of warning lights, the glimpses of an overturned jeep, the attack of the dinosaurs, the destruction of the breeding lab — unfold as the boat passes the corresponding trigger point.... *Jurassic Park* is essentially a giant computer-driven machine for telling an immersive story, and the boat is the fourth wall, an enchanted threshold object that carries you into the immersive world —

38 Bakhtin, *Rabelais and his World*.

39 Axel Hildebrand *et al.*, "Archeoguide: An Augmented Reality Based System for Personalized Tours in Cultural Heritage Sites" [online article], retrieved February 10, 1007, from http://archeoguide.intranet.gr/papers/AR_paper_final.doc.

> and then out again.... The *Jurassic Park* boat is both part of the illusory world and also a reminder of the boundaries.[40]

Murray's description suggests the possibility of creating linear boundaries in augmented reality with the following features. At a minimum, they will be comprised of pre-defined pathways with several "stops", or trigger points, where users will acquire the content and concepts of the narrative. Future authors will then be faced with a choice. They will have the option of creating environments where the given stops may be visited in a random fashion. The coherence of the narrative will not depend on visiting stops A, B, and C in a given order. For users, the experience will be akin to visiting a heritage village like King's Landing in New Brunswick, where one may visit one building and then another in the order of one's choosing.

Other authors, however, will require users to visit the site's stops in a pre-defined sequence, one that will align with the temporal progression of the narrative. In that case, the narrative, in addition to a fixed pathway and stops, will require some "agent" akin to the boat in *Jurassic Park*. The agent does not have to be a boat or a vehicle; it can be a person, virtual or real, or combination of persons, virtual and real, or something as simple as a sign with directions. The essential point is that the agent in this context would be defined as a constituent that constrains the user's movement in such a way that he or she proceeds to the right stop at the right time.

Historians, however, will require narrative constructs of greater range and complexity than that afforded by a linear chain with an attending sequence of stops. To purchase that complexity, they will need to appeal to additional orders of constraint, including environmental context. Accordingly, the third principle that will govern narrative construction in augmented reality will be attention to environmental constraint: actual and virtual. In actual environments, historians will be required to attend to environmental constraint. In virtual environments, their mandate will be to impose it. Two examples will clarify my point.

The *Voices of Oakland* project is an excellent example of an historic augmented reality presentation in which the narrative structure and attending sequence of content were determined, in part, by the physical and cultural environmental constraints imposed by the Oakland Cemetery, the historic 88-acre cemetery set in Atlanta, Georgia. In use from the 1850s until the end of the twentieth century, the Oakland Cemetery houses the remains of some of the most significant figures ever to emerge from Atlanta and the American South, from Confederate soldiers to the author Margaret Mitchell and Maynard Jackson, the first African-American mayor of Atlanta. It offered the

40 Murray, *Hamlet on the Holodeck*, pp. 107–108.

authors of *Voices of Oakland* — researchers from the Georgia Institute of Technology — the opportunity to generate augmented reality histories touching on several of the most important periods in the history of the southern United States, from the Civil War to the Civil Rights movement.[41] It also posed unique challenges relating to the expression of the three biographies the creators chose to feature. The authors note:

> In cemeteries, as in traditional historic sites, computer-generated experiences must adapt to the topology of the space.... A cemetery's layout is determined naturally over time and cannot be manipulated. However, the fixed organization of the cemetery "content" can still be leveraged when telling a story because the layout of many cemeteries follows thematic and social patterns.[42]

In the initiating stages of the project, the site's authors started with a narrative template with characteristics markedly similar to the ones indicated here. The narrative is linear. It proceeds along a fixed path within the cemetery and is comprised of multiple stops. The grave markers of featured historical actors serve as the stops where users acquire the narrative's content. Finally, it features an "agent", a narrator representing the recently deceased unofficial historian of Atlanta, Franklin Garrett. Speaking in a disembodied voice, the narrator functions as a navigator to ensure that visitors follow the right path and receive the site's content in the right order and the right time.[43]

Once the site's authors began construction of *Voices of Oakland*, however, it soon became clear that they would have to make allowance for the physical and social topographies specific to the Oakland Cemetery. Like any series of constraints, some enabled, providing opportunities for richer history and narrative. The site's grave markers, for example, provided a natural series of stops in which to situate the narrative. Other constraints disabled, forcing the creators to remove content they would have otherwise retained.

The first order of constraint stemmed from the physical layout of Oakland and the cultural conventions associated with cemeteries. All story pathways had to traverse the walkways established by the cemetery.

41 Steven Dow, Jaemin Lee, Christopher Oezbek, Blair MacIntyre, Jay David Bolter, and Maribeth Gandy, "Exploring Spatial Narratives and Mixed Reality Experiences in Oakland Cemetery", *Proceedings of the 2005 ACM SIGCHI International Conference on Advances in Computer Entertainment Technology* (Valencia, Spain, ACM International Conference Proceeding Series, 2005), pp. 51–52 [online], retrieved February 10, 2007, from http://delivery.acm. org/10.1145/1180000/1178484/p51-dow.pdf? key1=1178484&key2=6731036611 &coll=GUIDE& dl= GUIDE &CFID=15151515 &CFTOKEN=6184618.

42 Dow *et al.*, "Exploring Spatial Narratives", p. 51.

43 *Ibid.*, p. 54.

No story pathway could violate the cultural prohibition precluding visitors from walking over graves.[44] The second order of constraint stemmed from the cemetery's social topography. The history of the American South was — to put it mildly — a history of social distinction. In the Oakland Cemetery, social divisions in life were translated into differing locations in the grave. Confederate soldiers are buried in one section of the site, African Americans in another. Joseph Jacobs, the first merchant to sell Coca Cola, is buried in the cemetery's Jewish section. In principle, the social geography of the Oakland Cemetery offers the site's creators rich opportunities to express the history of Atlanta and the southern United States. Blair MacIntyre and Jay Bolter, lead researchers for the Oakland project, have announced their intention to generate augmented reality narratives devoted to topics ranging from the Civil War and the Civil Rights era to the history of Atlanta's Jewish community.[45]

In practice, the cemetery's division along temporal, racial, and social lines forced the authors to reduce their initial narrative, devoted to Atlanta history, from five significant figures to three. Mayor Maynard Jackson's biography was cut, for example, due to the distance between his grave marker, located in the African-American sector of the cemetery, and the remaining three, located in Oakland's oldest section. To understand why, it is important to recognize that viewing of any augmented reality narrative currently requires users to deal with a final physical constraint: the need to wear bulky equipment. To hear *Voices of Oakland*, users must wear a backpack containing a laptop computer and other equipment. The assembled kit is heavy and, over time, uncomfortable to wear. In the end, the Jackson biography was cut because its inclusion would have required too much of the user. The equipment is too cumbersome, the walk too far.

While attention to environmental constraint will remain a perennial concern of scholars augmenting historic environments such as the Oakland Cemetery and Olympia, I suggest scholars generating historic augmented reality representations for open, generic spaces will be motivated by a different concern: the imposition of environmental constraint. Returning to our earlier scenario featuring nineteenth-century Ottawa and the assassination of D'Arcy McGee, the aesthetic challenge facing our future historian will be to construct a narrative that simultaneously dissuades and persuades. The scale of the challenge will be commensurate with the size of the model the researcher appropriates. If the 3D model is limited to Sparks Street, the job will be relatively easy. There will be less content to distract users from the event at hand: the assassination of

44 *Ibid.*, p. 52.
45 *Ibid.*, p. 56.

McGee and its aftermath. On the other hand, if the historian has access to a larger 3D model, say one representing downtown Ottawa, and chooses to use all of it to provide a greater sense of immersion, then the job will become harder. There will be more to see — the Dominion Parliament will be one block to the north — and a greater need to focus viewers' attention toward the scene of the murder.

Several strategies will be available to the scholar: locational, environmental, and conventional. With respect to the start of the narrative, one straightforward move would be to shift the initial locale from the corner of Sparks and Metcalfe streets, shown in Figure 9, to a point further west to reduce the number of potential distractions. A second strategy would be to modify the visual environment to discourage deviation from Sparks Street through the use of faded models on streets situated to the north and south. Finally, a third strategy would be to populate the environment with agents specifically designed to motivate users to move toward the desired locale and event. Such a conventional device could be realized in multiple ways. Some agents would be nothing more than auditory cues: the sound of gunfire, or voices indicating distress upon the discovery of McGee's body, or news of the assassination. Other agents would embody virtual individuals running, either toward or away from the scene of the crime.

A final tack would be to situate two forms of interlocutor into the narrative. One variant would be period-specific: a virtual individual, an avatar, present at the scene of the murder and indistinguishable from other Ottawans present, save for his or her decision to initiate a monologue with visitors to the site. The interlocutor's task would be to communicate content: the chronology of the assassination; suspicions extant at the time about the identity of the murderer; and contemporary speculations regarding the political implications that the assassination would present. The second form of interlocutor — again a virtual individual — would be non-period specific and would perform a function akin to authorial narration in a historical monograph. His or her task would be to accompany viewers to the designated points in the narration and to present the work's analyses. In the context of this scenario, the interlocutor would recount the historical controversy surrounding the identity of McGee's murderer, what other historians had to say about it, and what the augmented reality narrative's authors have to say about it. In appearance, the interlocutor's dress and speech would mirror whatever passes for contemporary in the mid-twenty-first century. Potentially, and perhaps probably, the interlocutor will emerge as a two- or three-dimensional representation of one or more of the narrative's authors.

Conclusion

Harold Innis, at base, was a philosopher. He was a constant proponent of what he called the "philosophical approach", and a constant preoccupation

of his career was a simple question posed by his mentor, the philosopher James Ten Broeke: "Why do we attend to the things to which we attend?"[46] Attention to that question induced Innis to press colleagues to consider the impact of communication technologies on cultures past and present. The central theme of this discussion is that we should consider Innis's point yet again and, in turn, reconsider the things to which historians attend.

When I speak on the topic of history and computing, I often remind my audience of two things. First, the communication environment in which we are immersed is like an evolutionary soup. It is comprised of forms and platforms that are mixing, combining, and becoming more complex. Secondly, I press historians to consider that there is nothing absurd in the notion that they too should play a role in the future trajectory of that expressive soup. In large measure, the reason is that our discipline has had a very long relationship with philosophy. The title of our most advanced degree is Doctor of Philosophy, and we consider it not at all strange that our practice and research should be informed by traditional philosophical concerns ranging from metaphysics (what is change?), to epistemology (how do we know what we know?) to politics (who benefits from our descriptions?).

The computer should influence historians to consider expanding their philosophical scope of attention to include aesthetics. Computer-generated form has the potential to enhance the capacity of our discipline. It can change the way we generate, appropriate, and disseminate content. It can enhance our capacities as analysts, authors, and pedagogues. If these benefits are to be realized, however, the discipline must make room for a new domain of research. Despite the traditional deprecation of practice at the expense of theory, historians value practice. We spend large quantities of time teaching students, undergraduate and graduate, the tenets of good research and expository practice. We are harshly critical of colleagues when they fail to adhere to the methods associated with good practice.

The practices we have for knowledge generation and dissemination, however, were devised in association with print technology. We have no commensurate set of practices to inform our use of digital forms of representation or the platforms that sustain them. If historians mean to acquire the potential benefits — analytical, expressive, and pedagogical — outlined here, and if we mean to support young scholars' migration to computing to support their research and teaching, then the profession must devise a set of optimal and robust practices that will stand the test of time. That acquisition, and that migration, must be supported by a domain of practice-based research. Now is a good time to create it. Now is a good time to start.

46 Innis, *The Bias of Communication*, p. xxvii.