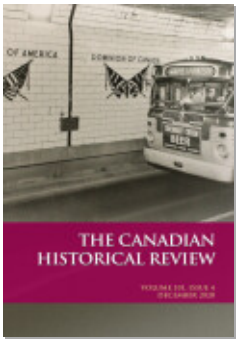
# Clio and Computers in Canada and Beyond: Contested Past, Promising Present, Uncertain Future




Chad Gaffield

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CHAD GAFFIELD

# Clio and Computers in Canada and Beyond: Contested Past, Promising Present, Uncertain Future

**Abstract:** *Historians began using computers in the 1950s and 1960s when their possibilities seemed unlimited in the private, public, and non-profit sectors of wealthier countries. In this societal context, Clio met computers. In the following decades, a few historians would predict, from time to time, that digitally-enabled scholarship was on track to become the disciplinary norm. They emphasized the impact of specific initiatives enabled by changing technologies, from the mainframe era to microcomputers, the web, the tsunami of "born-digital" and digitized data, mobile devices, and new computational approaches such as machine learning. However, their predictions routinely failed to materialize and, while all historians might use digital tools at least to some extent, a claim that "we-are-all-digital-now" downplays substantive questions about History's past and current relationship with new technologies. This article re-interprets the changing meaning of digital technologies within the disciplinary culture and institutional conditions of History. The evidence thus far reveals good reasons for both optimism and pessimism about digitally-enabled History at various times since the 1950s. By examining the complex and often surprising past and present, we can better determine and take the needed next steps in Digital History.*

**Keywords:** computers, digital history, cliometrics, quantitative, web, archives, teaching

**Résumé :** *Les historiens ont commencé à recourir à l'informatique dans les années 1950 et 1960, lorsque les possibilités des ordinateurs semblaient illimitées dans les secteurs privé, public et à but non lucratif des pays riches. C'est dans ce contexte sociétal qu'a eu lieu la rencontre de Clio avec l'informatique. Au cours des décennies suivantes, quelques historiens ont prédit, de temps à autre, que les travaux savants numériques allaient devenir la norme dans la discipline. Ils ont souligné l'influence d'initiatives précises rendues possibles par l'évolution des technologies, depuis l'ère des ordinateurs centraux jusqu'à celle des micro-ordinateurs, du Web, du tsunami de données « numériques au départ » et numérisées, des appareils mobiles et des nouvelles techniques informatiques telles que l'apprentissage automatique. Toutefois, leurs prévisions se sont souvent révélées fausses et, bien que tous les historiens soient en mesure d'utiliser les outils numériques au moins jusqu'à un certain point, l'affirmation selon laquelle « nous sommes maintenant tous numériques » minimise les questions*

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*de fond concernant les relations passées et présentes de l'histoire avec les nouvelles technologies. Le présent article réinterprète la signification changeante des technologies numériques dans la culture de la discipline et selon les conditions offertes à l'Histoire dans les établissements. D'après les éléments d'information recueillis à ce jour, il existe de bonnes raisons d'être à la fois optimiste et pessimiste en ce qui concerne l'histoire numérique à différentes époques depuis les années 1950. L'examen d'un passé et d'un présent complexes et souvent surprenants permet de mieux déterminer les prochaines mesures à prendre en matière d'histoire numérique.*

**Mots clés :** ordinateurs, histoire numérique, cliométrie, quantitatif, Web, archives, enseignement

Historians began using computers in the 1950s and 1960s when their possibilities seemed unlimited in the private, public, and non-profit sectors of wealthier countries. Following initial computational applications in code-breaking during the Second World War and in governmental administration in North America and Europe, creative thinking drove new visions of a computer-assisted transformed world.[1] In 1945, following his war-time role as Director of Scientific Research and Development in the United States, Vannevar Bush proposed a "memex," an imagined desktop machine that could provide access to the entire sum of human knowledge as expressed in diverse forms including books.[2] Five years later, Alan Turing, the English mathematician who decoded enemy messages during the Second World War, helped inspire the field of Artificial Intelligence by asking "Can Machines Think?"[3] During the early 1960s, Marshall McLuhan, Professor of English at the University of Toronto, developed an interdisciplinary and collaborative research project to develop computer analytics for predicting "mass human behavior" such that national governments could manage domestic economies "as easily as adjusting the thermostat in the living room."[4] Statistics Canada completed the 1951 and 1961 census enumerations with computers, and researchers such as Nathan Keyfitz began using them to analyze the results.[5]

It was in this societal context that Clio met computers. In the United States, William O. Aydelotte undertook a computer-assisted analysis of voting in the mid-nineteenth-century British Parliament.[6] Merle Curti used census enumerations to study rural inequality as European settlers migrated west across Wisconsin.[7] In Europe, scholars associated with the *Annales*, most notably Emmanuel

1 For the 1945 to 1970 period, see John Vardalas, *The Computer Revolution in Canada: Building National Technological Competence* (Cambridge, MA: MIT Press 2001).
2 Vannevar Bush, "As We May Think," *The Atlantic* (1945): 13–14.
3 A. M. Turing, "Computing Machinery and Intelligence," *Mind* 59, no. 236 (1950): 433–460.
4 Lee Belland, "He sees planners' paradise," *Toronto Daily Star,* 7 May 1964.
5 Barry Edmonston, "Two centuries of demographic change in Canada," *Canadian Studies in Population* 41, no. 1–2 (2014): 1–37.
6 William O. Aydelotte, "The House of Commons in the 1840s," *History New Series* 39 (1954): 249–262.
7 Merle Curti et al., *The Making of an American Community: A Case Study of Democracy in a Frontier County* (Redwood City, CA: Stanford University Press, 1959).

Le Roy Ladurie, began exploring how computer-assisted research could advance their efforts to understand the totality of historical change in past societies.[8] In 1967, the arrival of Michael B. Katz at the University of Toronto's Department of History and Ontario Institute for Studies in Education (OISE) launched a project to study social and economic change in mid-nineteenth century Hamilton, Ontario, by creating databases from records such as the census.[9]

Over the years, these and other examples encouraged a few historians to occasionally predict that digitally-enabled scholarship was on track to become the disciplinary norm. These predictions failed repeatedly and continue to do so today. While all historians now depend on digital tools at least to some extent, a claim that "we-are-all-digital-now" downplays substantive questions about History's past and current relationship with new technologies. Why did certain historians pursue computer-assisted scholarship and how did such a pursuit change over time? Why did the Clio-computer relationship not increasingly deepen after the 1960s with the acceleration of technological development and the multiplication of digital applications across society, including many parts of the campus? What accounts for the successes and failures? And why does Digital History now appear to be edging forward again with renewed optimism?

The following discussion interprets the changing meaning of digital technologies within the disciplinary culture and institutional conditions of History. In part, this discussion reflects my Canadian experience as a participant-observer in digitally-enabled History, since I began my doctoral studies in 1974 at the University of Toronto's OISE. In changing ways, my interest in computer applications has continued on campus, and in scholarly organizations and research funding agencies. Specific initiatives evolved with the changing technologies from the mainframe era to microcomputers, the web, the tsunami of born-digital and digitized data, mobile devices, and new computational approaches such as machine learning. Since 2015, I have also been researching and teaching the history of computers in History, and thus have begun situating my personal experience within a far larger context than I was aware of at the time.[10] The evidence thus far examined reveals good reasons for optimism and pessimism about digitally enabled History at various times since the 1950s. Rapidly developing technologies have interacted with History's contemporary disciplinary culture and institutional conditions in obvious and subtle ways. By examining this complex and often surprising interaction, we can gain a valuable historical perspective on Digital History today while also better positioning ourselves for promising next steps.

8 Emmanuel Le Roy Ladurie, *Les paysans de Languedoc* (Paris: S.E.V.P.E.N., 1966).

9 As a graduate student at Harvard University, Katz had used computers to analyze data in his acclaimed *The Irony of Early School Reform: Educational Innovation in Mid-Nineteenth Century Massachusetts* (Cambridge, MA: Harvard University Press, 1968).

10 Few historians have focused on the history of computing in History; see William G. Thomas, III, "Computing and the Historical Imagination," in *A Companion to Digital Humanities*, ed. Susan Schreibman, Ray Siemens and John Unsworth (Oxford: Blackwell Publishing, 2004).

## HISTORIANS IN THE MAINFRAME ERA

Two ambitions motivated the small number of historians who first turned to computers during the mainframe era of centralized, refrigerator-sized machines: a desire to compare actual societal behaviour with the well-studied ideas and ambitions of contemporary leaders; and, a desire to study the circumstances and itineraries of those at society's "bottom" to grasp the full dimensions of historical change and continuity in terms of both perceived and discursively hidden phenomena. The shared research strategy of these ambitions involved counting and statistically comparing individual-level evidence in sources created for administrative purposes. Some of the early computer-assisted projects played important historiographical roles in the larger re-thinking of historical change that swept through the discipline during the 1960s and 1970s under the general category of social history. Aydelotte's findings, revealing that nineteenth-century British MPs did not always vote in keeping with their stated political views, helped launch the "new political history", which included studies of electoral behaviour within and beyond governing bodies. Curti's challenge to the well-established "frontier thesis" inspired many studies that debunked claims about western migration and social levelling in the United States. Le Roy Ladurie demonstrated, in the case of Languedoc, the importance of cultural preferences in interpreting long-term historical change, thus helping to expand the *Annales* approach by situating specific people and events into societal patterns. Katz's linking of families and households to social and economic structures in Hamilton showed how transiency and inequality characterized the city's development during the mid-nineteenth century, thereby reorienting research on "modernization," and the relationship of urbanization to mobility.

The impact of these and other computer-assisted studies helps explain why some contemporary scholars perceived the genesis of positive disciplinary advance and transformation. In 1970, Sheldon Hackney, an award-winning American historian, claimed that "Like the fountain pen and the typewriter before it, the computer is now accepted as a tool that can make a historian's life more pleasant and more productive."[11] In 1980, Ian Winchester, who had developed computer applications for the Hamilton Project before becoming a faculty member, remarked that "'Quantitative social history' is now old hat in Canada, though it was shiny and new only twelve years ago."[12] Despite these observations, critiques of computers in History were becoming more important each year. Quantitative history may have been becoming "old hat" but practitioners faced intense academic and public scrutiny that revealed major difficulties in the nascent Clio-computers relationship.

The most widespread critique of computers in History questioned whether numerical description and analysis of the past had a legitimate place in the

11 Sheldon Hackney, "Power to Computers: A revolution in history?" in *AFIPS '70 (Spring): Proceedings of the May 5–7, 1970, Spring Joint Computer Conference* (Montvalle, NJ: AFIPS Press, 1970), 275.

12 Ian Winchester, "Review of Peel County History Project and the Saguenay Project," *Histoire sociale / Social History* 13, no. 25 (1980): 195–205.

discipline. Carl Bridenbaugh warned historians, in his 1962 presidential address to the American Historical Association (AHA) that they should never "worship at the shrine of that Bitch-goddess, QUANTIFICATION."[13] The second critique applauded the ambition of quantitative history but admonished historians for only taking a "cautious first step" toward serious data analysis involving sophisticated statistics.[14] Both critiques emerged during the 1960s and then erupted into an intense, high-profile controversy about Cliometrics, the new name for advanced statistical analysis of historical evidence. The flashpoint for these critiques in the United States was Robert Fogel and Stanley L. Engerman's *Time on the Cross: The Economics of American Negro Slavery*. Multiple historians roundly criticized these two economists for interpretive and methodological failures, including the authors' inadequate understanding of the data under study.[15] Critics far outnumbered the supporters of these authors, and their damning commentaries ensured that mainstream historians would henceforth interpret Cliometrics as poor historical scholarship or, at best, the work of a "secret club."[16] Internationally, the critiques of quantitative history prepared the way for Lawrence Stone's high-profile call in 1979 for the "revival of narrative." Stone claimed that quantitative work was characteristically error-filled. Using mathematical expressions, he concluded that "the sophistication of the methodology has tended to exceed the reliability of the data, while the usefulness of the results seems—up to a point—to be in inverse correlation to the mathematical complexity of the methodology and the grandiose scale of data-collection."[17] The implication was that quantitative history was a failed, wrong-headed experiment that did not deserve further attention.

None of the presidential addresses to the Canadian Historical Association (CHA) or AHA during the 1970s made more than a passing comment about computers in their annual observations on the state of the historians' craft. However, a sprinkling of book reviews and journal articles in Canada contributed to the larger disciplinary resistance to numerical analysis, as well as adding to the sophisticated methodological critiques. As elsewhere, critics in Canada were just as likely to be practitioners of quantitative research as they were to be opposed to it. Harvey Graff began publishing articles in the early 1970s based on his graduate work on literacy under Katz's supervision at the OISE.[18] In 1974,

13 See also Allan G. Bogue, *Clio and the Bitch Goddess: Quantification in American Political History* (Beverly Hills: Sage Publications, 1983).

14 Robert P. Swierenga, "Clio and Computers: A Survey of Computerized Research in History," *Computers and the Humanities* 5, no. 1 (1970): 20.

15 Robert Fogel and Stanley L. Engerman, *Time on the Cross: The Economics of American Negro Slavery* (New York: W.W. Norton and Company, 1974).

16 John F. Reynolds, "Do Historians Count Anymore? The Status of Quantitative History, 1975–1985," *Historical Methods* 31, no. 4 (1998): 141.

17 Lawrence Stone, "The Revival of Narrative: Reflections on a New Old History," *Past and Present Society* 85 (1979): 13.

18 Harvey J. Graff, "Notes on Methods for Studying Literacy from the Manuscript Census," *Historical Methods Newsletter* 5 (1971): 11–16; Harvey J. Graff, "Towards a Meaning of Literacy," *History of Education Quarterly* 12 (1972): 411–31; Harvey J. Graff, "Approaches in the Historical Study of Literacy," *Urban History Review* 1, no. 3 (1972): 6–11.

H. F. Manzl, a research assistant for the Peel County History Project, and Herbert J. Mays, a graduate student of David Gagan, jointly published a critical review of Graff's quantitative work to "raise methodological questions, to criticize sources, and to provide evidence to support our contention that the manuscript census has some very serious limitations for the study of literacy."[19] Since the census was the centerpiece of Graff's nearly completed dissertation, this critique had serious career as well as scholarly implications.[20] Graff's published response demonstrated that he understood as well as anyone the challenges of studying literacy using various types of historical sources, including the census, and he went on to successfully defend his dissertation.[21] Nonetheless, this example illustrates the potentially high stakes of attempting to meet the new challenges of digitally-enabled History in the 1970s. The message of such journal exchanges was clear: if you undertake a computer-assisted project, be prepared for detailed methodological critiques that analogue research publications would probably not receive. The publication of such critiques seemed to confirm horror stories that graduate students heard about drama-filled job interviews that descended into methodological attacks on quantitative analyses, sometimes indirectly targeting a candidate's thesis supervisor.[22]

The critiques of quantitative history exposed – implicitly and explicitly – the logistical and substantive obstacles to computer use by historians during the mainframe era. There were few formal opportunities within History to develop as a "computer-oriented historian" or to learn about the possibilities and pitfalls of statistical analysis since few History departments had any courses relevant to computer-assisted research. University of Toronto historian Edward Shorter's *The Historian and the Computer: A Practical Guide,* published in 1971, proved relatively successful internationally, partly because it was the only beginner-friendly volume during the decade. Understandably, therefore, historians had to compensate for their unpreparedness by looking beyond the disciplinary culture of mainstream History for support in using computers. By examining the various compensatory strategies, we can gain a better understanding of the contested relationship between Clio and computers during the mainframe era.

## INTERDISCIPLINARITY, COLLABORATION, AND RESEARCH FUNDING

The first generation of computer-enabled historians sought like-minded scholars elsewhere in the social sciences and humanities. *Computers and the Humanities,*

19 H. J. Mays and H. F. Manzl, "Literacy and Social Structure in Nineteenth Century Ontario: An Exercise in Historical Methodology," *Histoire sociale / Social History* 7, no. 14 (1974): 333.

20 Mays and Manzl were specifically reacting to Harvey J. Graff, "Literacy and Social Structure in Elgin County, Canada West: 1861," *Histoire sociale / Social History* 6, no. 11 (1973): 25–47.

21 Harvey J. Graff, "What the 1861 Census can tell us about Literacy: A Reply," *Histoire sociale / Social History* 8, no. 16 (1975): 337–349.

22 For another example of methodological controversy, see George Emery and José Igartua, "David Gagan's 'The "Critical Years" in Rural Canada West': a Critique of the Methodology and Model," *Canadian Historical Review* 62, no. 2 (1981): 186–196.

established in 1966, welcomed articles by historians and others in linguistics, literary studies, music, and the performing arts. Although historians continued to publish in the journal through the early 1970s, their social history research questions oriented them to the methods of the social sciences.[23] Consequently, historians began losing touch with innovative initiatives in the humanities to computationally analyze text that could not be directly structured into machine-readable files of variables. The new fields of computational linguistics and literary studies built on the achievements of Roberto Busa, now considered a founder of today's Digital Humanities, during the 1950s and 1960s.[24] The first major conference on computing in the humanities was held in Cambridge, England in 1970 and then moved around Europe and North America (including at the University of Waterloo) over the following decade.[25] The edited collections that resulted from these conferences testify to the multiple ways in which researchers were exploring the potential of digitally-enabled textual analysis. But no historian contributed to these volumes.

Historians also ignored computer-assisted innovations by scientists interested in historical documents for methodological reasons. The most important example, in the 1960s, was research on the long-debated question of authorship for the Federalist Papers that encouraged ratification of the United States Constitution.[26] While historians had used analogue methods to debate the attribution of specific writings to Alexander Hamilton, James Madison, or John Jay, two statisticians turned, in the early 1960s, to the Federalist Papers to explore the value of computer-assisted text analysis. Frederick Mosteller and David L. Wallace published *Inference and Disputed Authorship: The Federalist* in 1964 but it was ignored in the historical community despite its noticeable impact elsewhere on campuses.[27]

23 Decades later, the journal did publish an important special issue on "Computers and Historians," *Computers and the Humanities* 30, no. 5 (1996/1997).

24 Stephen E. Jones, *Roberto Busa, S.J. and the Emergence of Humanities Computing* (New York: Routledge, 2016). The importance of avoiding a "founding fathers" narrative in humanities computing is emphasized in Julianne Nyhan and Melissa Terras, "Uncovering 'hidden' contributions to the history of Digital Humanities: the Index Thomisticus' female keypunch operators," *Digital Humanities* (2017): 313–315.

25 The published conference proceedings emphasized the absence of digitally-enabled History by the 1970s: R.A. Wisbey, ed., *The Computer in Literary and Linguistic Research* (Cambridge: Cambridge University Press, 1971); A. J. Aitken, Richard W. Bailey and N. Hamilton-Smith, ed., *The Computer and Literary Studies* (Edinburgh: Edinburgh University Press, 1973), J.L. Mitchell, ed., *Computers in the Humanities* (Edinburgh: Edinburgh University Press, 1974); Serge Lusignan and John S. North, eds., *Computing in the Humanities: Proceedings of the Third International Conference on Computing in the Humanities* (Waterloo: University of Waterloo Press, 1977); Richard W. Bailey, ed., *Computing in the Humanities: Papers from the Fifth International Conference on Computing in the Humanities* (Amsterdam: North Holland, 1982). Such work began laying the foundation for the development of search engines and natural language processing systems by the late 1980s.

26 Douglass Adair, "The Authorship of the Disputed Federalist Papers," *The William and Mary Quarterly* 1, no. 2 (1944): 97–122.

27 Seven years after its publication one historian did publish an insightful review of the book. Stephen E. Fineberg, "Reviewed Work: Inference and Disputed Authorship: The Federalist by Frederick Mosteller, David L. Wallace," *Journal of Interdisciplinary History* 1, no. 3 (1969): 557–560.

In addition to borrowing social science methods, a second strategy for historians to pursue quantitative history was to form research groups and collaborations to confront substantive and technical obstacles. The leading opportunity in Canada was at OISE, the new graduate and research unit of the University of Toronto that encouraged the use of computers as part of its innovative character. OISE's Department of History and Philosophy partnered with the main campus' Department of History to recruit Michael B. Katz who soon attracted domestic and international graduate students including Graff, Alison Prentice, Ian Davey, and others whom he brought together in research meetings in the Hamilton Project office at OISE. Katz explained that "we tried to establish a model of research in which a group of people exploited a common database, each pursuing his own individual interests yet drawing on the group as a whole for support, criticism, and knowledge."[28]

Elsewhere, the historical research groups that used computers were smaller but played a noticeable role in supporting those engaged in quantitative history such as in the Peel County Project at McMaster University and the Landon Project at the University of Western Ontario. The Landon Project aimed to build "an ideal historical database" by creating data from southwestern Ontario's historical records.[29] Its legacy includes those graduate assistants and emerging scholars who went on to highly successful careers including George Emery, José Igartua, Diane Newell, and Peter Baskerville. At the Memorial University of Newfoundland, David Alexander, Keith Matthews, and Gerald Panting successfully launched the computer-based Atlantic Canada Shipping Project in 1976, with the central involvement of postdoctoral fellows (and future major scholars), Lewis R. Fischer and Eric Sager, and in 1978, Rosemary Ommer. The Project hosted annual conferences that became important international events for quantitative research.[30] In Quebec, the new Université du Québec à Montréal (UQAM) featured a History department positioned within the social sciences and with an unusual appetite for methodology and interdisciplinarity. Jean-Claude Robert, Paul-André Linteau, and Jean-Paul Bernard founded the Groupe de recherche sur la société montréalaise au XIX$^{e}$ siècle in 1972, partly inspired by Katz's Hamilton Project.[31] At the Université du Québec à Chicoutimi, Gérard Bouchard launched the Saguenay project with Normand Séguin in 1972. Within

28 Michael B. Katz, *The People of Hamilton, Canada West: Family and Class in a Mid-Nineteenth-Century City* (Cambridge, MA: Harvard University Press, 1975), 11. Also see, Alison Prentice, "Michael B. Katz, 1939–2014: A Tribute," *Historical Studies in Education* 27, no. 1 (2015): 1–3.

29 Diane Newell, "Published Government Documents as a Source for Interdisciplinary History: A Canadian Case Study," *Government Publications Review* Part A 8, no. 5 (1981): 381–393.

30 See, for example, David Alexander and Rosemary Ommer, ed., *Volumes Not Values: Canadian Sailing Ships and World Trades: Proceedings of the Third Conference of the Atlantic Canada Shipping Project, April 19-April 21, 1979* (St. John's: Maritime History Group, Memorial University of Newfoundland, 1979).

31 Paul-André Linteau, "Un Temps Nouveau: Au Cœur d'une histoire en transformation," *Canadian Historical Review* 101, no.1 (2020): 101–124.

several years, this initiative was achieving international acclaim for computer innovations in regional socio-cultural historical demography.[32]

The above description of Canada's research groups and centres that nurtured quantitative history does not do full justice to the extent of computing in History during the mainframe era in Canada, but it does come close.[33] The formation of research groups and centres that could nurture computer use depended on funding to support everything from data creation and processing to technical support.[34] In looking back on the Atlantic Canada Shipping Project, Lewis R. Fischer emphasized that "without the benefit of six years and more than $1 million, this project to examine the rise and decline of eastern Canadian shipping in the nineteenth century would never have produced the results it did."[35] The financial obstacles for digitally-enabled historical research included the dearth of funding opportunities and the dominant disciplinary view of funding as either inappropriate or as a threat to true scholarship, which was apparent in the critiques of quantitative history. University of Toronto historian Michael Bliss remembers in his memoirs that "An enterprising American social historian at the Ontario Institute for Studies in Education, where standards were notoriously suspect, went through more than $100,000 in grant money to show there was a lot of mobility in mid-nineteenth-century Hamilton, Ontario – expensive verification of what many of us thought was obvious." Bliss admitted his disgust at that time for the "probably corrupt, certainly corrupting, public trough." He wrote in his diary about the "insufferable shittiness of the Canada Council," the research funding body that preceded the launch of the Social Sciences and Humanities Research Council (SSHRC) in 1978.[36] Even contemporary supporters like Swierenga described Katz's project as "lavishly funded by private and government grants."[37] When I received my first SSHRC grant in 1982, a senior colleague found the news disappointing since he thought that I had the makings of a "pure" scholar. In a review essay, Ian Winchester emphasized "the impact of

32 In 1978, the project was formally named the Programme de recherche sur la société saguenayenne; see Gérard Bouchard and Yolande Savoie, "Le projet d'histoire sociale de la population du Saguenay : l'appareil méthodologique," *Revue d'histoire de l'Amérique française* 32, no. 1 (1978): 41–56.

33 Other smaller research groups included those at the Wellington County Project at McMaster University.

34 Funding for computer-assisted research in the social sciences and humanities often included private sector support. In 1965, for example, IBM gave funds to allow the American Council of Learned Societies to offer a program of grants and fellowships for humanists undertaking research with computers; see Franklin J. Pegues, "Computer Research in the Humanities," *The Journal of Higher Education* 36, no. 2 (1965): 105–108.

35 Lewis R. Fischer, "The Enterprising Canadians: An Assessment of Canadian Maritime History since 1975," in *Maritime History at the Crossroads: A Critical Review of Recent Historiography*, ed. Frank Broeze, (Liverpool: Liverpool University Press, 1995), 33.

36 Michael Bliss, *Writing History: A Professor's Life* (Toronto: Dundurn Press, 2011), 173, 190.

37 Robert P. Swierenga, "Computers and American History: The Impact of the "New" Generation," *The Journal of American History* 60, no. 4 (1974): 1057.

large-scale, collaborative research in social history on the practices of historical research as a whole."[38] In 1983, I was reminded that this impact was still limited in mainstream History when the university faculty's evaluation committee for my promotion and tenure application put to the side my co-authored articles to focus exclusively on individual publications.

These conditions help explain why participation in digitally-enabled History depended upon personal experiences outside the mainstream disciplinary culture. In my case, I had always liked arithmetic in school and had gone on to study differential and integral calculus when beginning as an undergraduate at McGill University. By chance, I discovered that set theory in mathematics closely resembled formal logic in philosophy. An introductory class led me to the history of ideas, taught by the dynamic and riveting Charles Taylor, and, in turn, to various professors in the History department, such as John Hellman, under whose supervision I completed an MA using analogue text methods and oral history. By chance again, I learned outside my History program that my interests in both numbers and words could be combined in computer-assisted historical research, most notably at OISE, where I began doctoral studies in 1974, with an immediate welcome into the Canadian Social History Project.

During the 1970s, I was aware of – but did not fully appreciate – the extent to which my appreciation of both numbers and words was inconsistent with the dominant disciplinary culture of History. The more important concern for me as I finished my PhD was that, following the hiring boom of the 1960s and early 1970s, the university job market was exceedingly tight, and it had become unrealistic to anticipate finding a university position. Much to my surprise, however, I discovered that experience with computers could be an asset if leaders in the hiring department were themselves among the supportive minority. In 1978, McGill hired me as a one-for-two sabbatical replacement for Brian Young and Louise Dechêne, both of whom deeply appreciated computer-assisted research. Young, Richard Rice, and graduate student Robert Sweeny were already using computers in the Montreal Business History Project that they had founded in 1976 as a collaborative research initiative. Similarly, the support of Peter Baskerville and other computer-friendly colleagues explains why the University of Victoria offered me a tenure-stream position the following year that led to new computer-relevant History courses and research collaborations. In the same spirit, the University of Ottawa, where *Histoire sociale / Social History* was co-founded in 1968, was offering quantitative history courses by the time of my arrival there in 1985. Given the continuing paucity of opportunities elsewhere, it is not surprising that University of Ottawa graduates became some of the key figures in the next generation of leaders in digitally-enabled History.[39]

The critiques of quantitative history during the mainframe era exposed the growing pains of computer-assisted interpretation of the past. In 2010, looking back on *The Literacy Myth,* Harvey J. Graff admitted that "The quantitative

38 Ian Winchester, "Review of Peel County History Project and the Saguenay Project," *Histoire sociale / Social History* 13, no. 25 (1980): 195–205.

39 These graduates include John Lutz, John Bonnett, Barbara Lorenzkowski, Steven High, Betsey Baldwin, John Vardalas, Jo-Anne McCutcheon, and many others.

analysis is the most problematic aspect of the book. While I must admit that the presence of numbers in such a quantity of tables and graphs by itself sufficed to persuade more than a few readers, the statistically-minded were not always swayed... To put it squarely: for statistical purposes, the numerical data are weak, albeit suggestive."[40] Graff insightfully and candidly pointed out that quantitative history during the mainframe era was only beginning to identify the key epistemological questions raised by this new approach. Moreover, historians were learning how to participate in teams, usually on-the-fly, and with considerable external pressure. In describing the Hamilton Project's meetings, Katz noted how each draft "was argued over, sometimes fiercely, and there remained differences of interpretation among us." One advantage was that this experience helped prepare the early computer-assisted historians to respond in their subsequent research projects to the negative feedback. In a follow-up study of Hamilton's later urban development, Katz collaborated with former students Michael Doucet and Mark Stern in using statistical methods that addressed concerns about confounding and multicollinearity among designated independent variables as well as methodological issues with nominal dependent variables.[41] Graff similarly followed up *The Literacy Myth* with a vast synthesis of all types of historical research on literacy in western countries since early Athens and Rome. His ambition was to move beyond the qualitative-quantitative dichotomy by critically and inclusively examining the strengths and weaknesses of diverse interpretive and methodological approaches.[42] By the early 1980s, therefore, digitally-enabled History was not transforming the discipline as predicted a decade earlier, but it was continuing to mature in ways that shaped further developments.

Another aspect of the mainframe era, that is surprising in retrospect, is the extent to which historians did not engage with the early efforts to use computers in archives and libraries. When Vannevar Bush conceptualized the "memex" in 1939, he illustrated its value by describing historians interpreting computer-revealed research "trails" through the entire corpus of human writing.

> The historian, with a vast chronological account of a people, parallels it with a skip trail which stops only on the salient items, and can follow at any time contemporary trails which lead him all over civilization at a particular epoch. There is a new profession of trail blazers, those who find delight in the task of establishing useful trails through the enormous mass of the common record.[43]

In 1965, J. C. R. Licklider, a leading computer expert in the United States, built on Bush's memex by envisioning a completely digital library. In his detailed

40 Harvey J. Graff, "The Literacy Myth at Thirty," *Journal of Social History* 43, no. 3 (2010): 635–661, 806.

41 Michael B. Katz, Michael J. Doucet and Mark J. Stern, *The Social Organization of Early Industrial Capitalism* (Cambridge, MA: Harvard University Press, 1982).

42 Harvey J. Graff, *The Legacies of Literacy: Continuities and Contradictions in Western Culture and Society* (Bloomington and Indianapolis: Indiana University Press, 1987).

43 Bush, "As We May Think," 13–14.

report for the American Library Association, Licklider aimed to provide access to the entire corpus of all repositories by way of a "procognitive" system of networks with computers using tagging and retrieval methods that today remain works-in-progress.[44] Licklider coined the term "procognitive" for his imagined system to emphasize the goal of greatly advanced computer-assisted thinking. This system redefined libraries as repositories of knowledge rather than of books. The procognitive system would allow researchers to address questions by instantly exploring all established knowledge (as expressed in books). In keeping with his earlier work on human-computer communication,[45] Licklider anticipated a natural language processing capacity that remains aspirational in libraries six decades later.

While such thinking about libraries of the future remained far ahead of institutional change in any country, a new model for repositories began gaining currency in public discussion. An editorial in *The Globe and Mail* explained in 1973 that "In this age, we do not build monuments for knowledge and information. In this age, we put up information receptacles whose prime function is to be adaptable to the changing technology of information that will continue to burst upon us in the years ahead." The editorial predicted that in fifteen years, reference libraries would be "a simple shell for a data bank retrieval system. ..."[46] For its part, the National Library of Canada soon began adapting software that enabled cataloguing, information retrieval, and flexible searching with browsing.[47] In 1973, the Public Archives of Canada created the Machine-Readable Archives Division for computer-generated records. In keeping with initiatives in the United States and Sweden, this division included data archivists as well as computer scientists who developed new forms of appraisal, acquisition, preservation, and reference services.[48] Their often-heroic work lost momentum during the 1980s, with the eventual closing of the division, in order to devote full attention to the traditional priority of paper-based records.[49]

The new thinking as well as the first experiments in libraries and archives during the mainframe era did not include meaningful participation by History professors. This disconnect was evident in 1981, when Alan Artibise, Peter Baskerville, and I began designing a digital tool that would facilitate research

44 J.C.R. Licklider, *Libraries of the Future* (Cambridge, MA: The MIT Press, 1965). Also see, M. Mitchell Waldrop, *The Dream Machine: J.C.R. Licklider and the Revolution That Made Computing Personal* (New York: Penguin, 2001), 184–186.

45 J.C.R. Licklider, "Man-Computer Symbiosis," *IRE Transactions of Human Factors in Electronics* HFE-1, no.1 (1960): 4–11.

46 "The Price of a Library," *The Globe and Mail*, 15 November 1973.

47 *The Canadian Government Version of DOBIS* (Ottawa: National Library, 1981); and William Newman, et. al, "DOBIS: The Canadian Government Version," *Canadian Library Journal* 36 (1979): 181–194.

48 Harold Naugler, "The Machine-Readable Archives Division of the Public Archives of Canada," *Archivaria* 6 (1978): 176–180. The background to this development is analyzed in Betsey Baldwin, "Confronting Computers: Debates about Computers at the Public Archives of Canada during the 1960s," *Archivaria* 62 (2006): 175–76.

49 Greg Bak, "Media and the Messengers: Writings on Digital Archiving in Canada from the 1960s to the 1980s," *Archivaria* 82 (2016): 55–81.

on specific historical topics. Our focus was on the history of Vancouver Island, and we wanted to begin our project with a complete list of all relevant primary and secondary sources. Faced with the two distinct institutional structures and cultures of libraries and archives, we aimed to create a computer system that could be interrogated about the relevant holdings of both repositories simultaneously. Launched in 1982, the Vancouver Island Project's (VIP) objective was to gain intellectual control of records by way of provenance and subject access. This objective contrasted with the work of archivists and librarians whose separate digital initiatives were precluding virtual integration from a user's point of view.[50] Completed in 1985, the VIP System helped users formulate queries with a similar Structured Query Language database to identify relevant historical research holdings related to Vancouver Island regardless of their repository. However technologically successful, the VIP proved to be highly controversial in part because of how the project was developed.[51] If we knew then what we know now, we would not have enthusiastically described the VIP as an "automated archivist," especially in the challenging economic context of the 1980s in which archivists were developing a professional association. Similarly, we would have found ways to co-create the VIP with librarians and archivists in a start-to-finish cross-sectoral collaboration.

While scholars continued to experiment with uses for computers in History, two historiographical developments contributed indirectly to the continuing maturity of digitally-enabled research during the 1980s: microhistory and the linguistic turn. While historians pursued these approaches primarily using analogue methods, some began incorporating their insights into quantitative research. In their revised methodologies, these historians viewed quantitative evidence as being both socially constructed and materially based; moreover, they paid attention to both patterns and unique occurrences. This approach optimized descriptive statistics without resorting to the statistical testing of null hypotheses, typical in the social sciences. These scholars sought to integrate narrative and analytic rhetorical approaches and did so without much methodological discussion. In 1980, for example, Joy Parr published her systematic examination of the case files of so-called child-saving organizations including the largest, the Barnardo homes.[52] Parr offered a sophisticated multi-dimensional interpretation of the British families who gave up children, the organizers and officials, and the children themselves. Similarly, Bettina Bradbury studied working-class families in Montreal by combining systematic research on census

50 Peter A. Baskerville and Chad Gaffield, "The Vancouver Island Project: Historical Research and Archival Practice," *Archivaria* 17 (1983): 173–187; Chad Gaffield and Peter Baskerville, "The Automated Archivist, 'Interdisciplinarity' and the Process of Historical Research," *Social Science History* 9, no. 2 (1985): 167–184.

51 Unlike many at the time, Terry Cook, a leading thinker about archival theory and practice in Canada and internationally for many years, engaged encouragingly and critically about VIP; see "Archives, Automation, and Access: The Vancouver Island Project Revisited," *Archivaria* 20 (1985): 231–237.

52 Joy Parr, *Labouring Children: British Immigrant Apprentices to Canada* (Montreal and Kingston: McGill-Queen's University Press, 1980).

enumerations with a wide-ranging documentary study. As a member of the computer-interested Montreal History Group, Bradbury's focus on two wards and her robust evidentiary commitment reflected methodological influences of the "new social history," micro-history, and the linguistic turn. In my case, I responded to the critique that quantitative history was not adding substantive value to mainstream historiographical concerns by re-examining what many considered at the time to be the central drama of Canadian history, French-English relations. The resulting study of the language-of-instruction controversy in nineteenth-century Ontario integrated digitally-enabled computation with documentary research to study all those involved, including politicians, religious leaders, and residents of the province's townships and municipalities.[53] Marta Danylewycz also integrated analogue and digital approaches in reconstructing the lives of women in two religious communities, in Montreal, during the nineteenth and early twentieth centuries.[54] This reconstruction drew upon empirical pattern-recognition as well as detailed documentary evidence about specific individuals.

While the relative importance of quantitative history declined after the mid-1980s,[55] historians who responded to both the earlier critiques and the new historiographical insights met a relatively warm disciplinary reception in Canada. In 1988, I observed that "achievements, thus far, do indeed suggest the possibilities of a more general collaboration of machines and minds as part of a truly revolutionary paradigm shift."[56] This observation was too optimistic at the time but, unexpectedly, the changing scholarly context soon began intersecting with expanding digital technologies to launch a new era in the relationship between Clio and computers.

## PERSONAL COMPUTING AND THE WORLD WIDE WEB

During the 1980s, university officials began seeing computer use by professors as an extension of institutional computer-assisted administration, and they installed computers in university offices and homes with modems for dial-up connection. Scholars no longer needed to prepare research grant applications, to navigate time-sharing systems, or to depend on specialized support to use computers. Early laptops also permitted on-site computer use in some archives

53 Chad Gaffield, *Language, Schooling and Cultural Conflict: The Origins of the French-language Controversy in Ontario* (Montreal and Kingston: McGill-Queen's University Press, 1987). This project began as my dissertation completed at the University of Toronto (OISE) in 1978.

54 Marta Danylewycz, *Taking the Veil: An Alternative to Marriage, Motherhood, and Spinsterhood in Quebec, 1840–1920,* eds. Paul-Andre Linteau, Alison Prentice and William Westfall (Toronto: McClelland and Stewart, 1987).

55 Peter Baskerville and Kris Inwood trace the lower proportion of historical journal articles with graphs and tables after 1985 in their article "The Return of Quantitative Approaches to Canadian History" in this issue.

56 Chad Gaffield, "Machines and Minds: Historians and the Emerging Collaboration," *Histoire sociale / Social History* 21, no. 42 (1988): 312–17.

and libraries by the end of the decade.[57] The speed of this change was remarkable. In 1992, Ian Winchester observed that "all (or nearly all) historians are now acquainted with microcomputers as very effective word processors and that quite a few are using them as data organizing tools as well, exploiting various commercially available database packages."[58] Together with improved software for writing and routine communication, the continued development of the Internet and the arrival of the World Wide Web opened a new phase in digitally-enabled History that touched the majority of historians. In this context, some historians began to see digital technologies as relevant to more than quantitative research in scholarly activities. Specifically, they expanded the disciplinary meaning of computers to include teaching, and what would later be called knowledge mobilization (KMb). Like their counterparts in the mainframe era, these digitally-enabled historians had limited influence in the short term but, in hindsight, we can see how their successes and failures prepared the way for today's Digital History.

In the United States, William G. Thomas III and Edward L. Ayers created "The Valley of the Shadow" in 1993, as a website and as CD-ROMs, offering four digitized Civil War-era newspapers that invited "alternative readings."[59] The project challenged established limits on the form and content of scholarly communication by developing innovative KMb strategies beginning with a web design that facilitated access by non-specialists. While the Valley of the Shadow's target users included students and historians, the digital availability of thousands of documents and related historical evidence attracted public interest, and thus, was an early demonstration of how analogue public history could be moved into the digital environment.[60] Another example of the new effort to use computers for teaching and KMb was John Lutz's and Ruth Sandwell's "Who Killed William Robinson?" launched in 1997. As the first such initiative in Canada, the website reflected insights from microhistory and the linguistic turn by enabling the intensive study of one crime as an opening to questions of nineteenth-century racism and the justice system in a settler society.[61] The website attracted noteworthy use in high schools and post-secondary institutions.

57 The importance of researcher-created archival images today is discussed in Ian Milligan's article in this issue, "We Are All Digital Now: Digital Photography and the Reshaping of Historical Practice."

58 Ian Winchester, "What Every Historian Needs to Know About Record Linkage for the Microcomputer Era," *Historical Methods: A Journal of Quantitative and Interdisciplinary History* 25, no.4 (1992): 149–165.

59 The Valley of the Shadow: Two Communities in the American Civil War (website), Virginia Center for Digital History, 2007, http://valley.lib.virginia.edu.

60 Ibid. Also see William G. Thomas III and Edward Ayers, "The Differences Slavery Made: A Close Analysis of Two American Communities," *American Historical Review* 108, no. 5 (2003): 1299–1307.

61 John Lutz and Ruth Sandwell, Who Killed William Robinson? Race, Justice and Settling the Land (website), 2003, https://bit.ly/3epsVIf. Now called "Great Unsolved Mysteries in Canadian History," this initiative includes multiple units on diverse topics as well as numerous guides for instructors. See John Lutz and Ruth Sandwell, Great Unsolved Mysteries in Canadian History (website), 2018, https://canadianmysteries.ca/en/about.php.

In 1998, Andrew McMichael, a graduate student who designed the first AHA website, predicted that "Historians reflecting on the last years of the 20th century will look back on this time as the moment when the 'net became ensconced in our culture."[62] This ensconcing did not mean, however, that History had entered the digital era. Most historians, like their counterparts during the mainframe era, generally did not associate their computer use with the possibilities for disciplinary transformation. In 1995, John Lutz was blunt in admitting that "We in history and the humanities have not yet figured out what the computer is really for." He regretted that "We use our computers constantly, but as souped-up typewriters, faxes, and post offices, instead of asking, 'where are the critical and productive affinities between our methods and epistemology on the one hand, and the inherent structure and capabilities of interactive technologies, on the other?'"[63] Andrew McMichael remarked that "The problem for historians is not a lack of useful places on the Internet. Rather there seems to be no clear consensus among us as to what makes the 'net useful."[64] Despite his apparent success in demonstrating the value of content-rich historical websites, Edward Ayers admitted in 1999 that "As rapid as the changes have been, however, the actual writing of history has remained virtually untouched and unchanged. New technology has not affected the books and articles that form the foundation of what we teach."[65]

Similarly, the rapid introduction of computers into historians' daily lives did not halt the decline of historians' interest in quantitative history during the 1990s.[66] As in the mainframe era, the exceptions were collaborative, interdisciplinary initiatives with knowledgeable leadership and funding. One new common feature that foreshadowed key twenty-first-century developments was the use of mapping and spatial analysis as tools to help interpret historical change. In Québec, the Centre interuniversitaire d'études québécoises (CIEQ) was founded in 1993 by merging the Laboratoire de géographique historique at Université Laval with the Centre d'études québécoises from the Université du Québec à Trois-Rivières. In keeping with its origins, CIEQ promoted research that balanced time and space as fundamental analytic approaches. Two years later, Eric Sager and Peter Baskerville launched the Canadian Families Project (CFP), the first pan-Canadian digitally-enabled team research effort that brought together humanists and social scientists in an interdisciplinary collective.

62 Andrew McMichael, "The Historian, the Internet, and the Web: A Reassessment," *Perspectives on History* 36, no. 2 (1998): 29–32.

63 John Lutz, "Riding the Horseless Carriage to the Computer Revolution: Teaching History in the Twenty-first Century," *Histoire sociale / Social History* 34, no. 68 (2001): 427–435.

64 McMichael, "The Historian, the Internet, and the Web," 29–32. Also see, Michael O'Malley and Roy Rosenzweig, "Brave New World or Blind Alley? American History on the World Wide Web," *Journal of American History* 84, no. 1 (1997): 132–155.

65 Edward L. Ayers, "The Pasts and Futures of Digital History," Virginia Center for Digital History, 1999, http://www.vcdh.virginia.edu/PastsFutures.html

66 John F. Reynolds, "Do Historians Count Anymore? The Status of Quantitative Methods in History, 1975–1995," *Historical Methods* 31, no. 4 (1998): 141–148.

Designed to ensure comparability with related research in the United States, the CFP intended to enable research on Canada at the turn of the twentieth century by creating an innovative database with georeferencing from the 1901 census. The resulting studies ranged from those on social and economic topics to those on religion, language, and discursive change, always with attention to time and space.[67] As illustrated by CIEQ and CFP, the emergence of Historical Geographic Information Systems (HGIS) during the later 1990s was central to the development of today's Digital History.[68] HGIS helped scholars move toward partial resolution of the quantitative-qualitative debate by showing how evidence can be computationally studied while acknowledging that numbers are always "qualitative" since humans use them to represent perceived realities.[69] As the prominent historian Daniel J. Bodenhamer has argued, "of all modern information technologies, GIS may have the most potential for breaching the wall of tradition in history," given "its ability to integrate disparate information drawn from the same place at the same time allows scholars to simulate the complexity of history."[70] However, the realization of these research ambitions as well as those in teaching and KMB depended upon a convergence of changing disciplinary conditions at the turn of the century. This convergence favoured the development of digitally-enabled History for the first time.

## THE MAKING OF TWENTY-FIRST CENTURY DIGITAL HISTORY

In the late 1990s, retirements and enrolment growth ignited the Canadian academic job market. By 2008, more than half of all full-time professors on Canadian campuses had been hired during the previous decade. Unlike previous cohorts, many of the new hires, including historians, had been using computers both within and beyond academic life, and as "digital immigrants" they increasingly were teaching "digital natives."[71] This demographic change was paralleled by leadership changes in major archives and libraries. Most importantly, Ian Wilson, a supporter of the VIP, returned the digital dossier to prominence soon after he was appointed the National Archivist of Canada in 1999. Wilson

67 Eric W. Sager and Peter Baskerville, eds., *Household Counts: Canadian Households and Families in 1901* (Toronto: University of Toronto Press, 2006). Other major studies with integrated approaches include José Igartua, *Arvida au Saguenay: Naissance d'une ville industrielle* (Montreal and Kingston: McGill-Queen's University Press, 1996).

68 Anne Kelly Knowles, ed., *Past Time, Past Place: GIS for History* (Redlands, CA: ESRI Press, 2002); and Ian Gregory, "A Place in History: A Guide to Using GIS in Historical Research," History Data Service, 2002, https://bit.ly/2TFmuJb

69 See Sherry Olson and Patricia Thornton, *Peopling the North American City: Montreal 1840–1900* (Montreal and Kingston: McGill-Queen's University Press, 2011); and Jennifer Bonnell and Marcel Fortin, ed., *Historical GIS Research in Canada* (Calgary: University of Calgary Press, 2014).

70 Daniel J. Bodenhamer, "History and GIS: Implications for the Discipline," in *Placing History: How Maps, Spatial Data, and GIS are Changing Historical Scholarship*, ed. A.K. Knowles (Redlands: ESRI Press, 2008), 222, 225.

71 Marc Pensky, "Digital Natives, Digital Immigrants," *On the Horizon, MCB University Press* 9, no. 5 (2001): 1–6.

also championed the institutional merger that created the Library and Archives of Canada, where he became the inaugural Librarian and Archivist of Canada. In my presidential address to the CHA in 2001, I argued that "Long gone is the claim that computers have no place in disciplines like History; indeed, in contrast to the initial ways in which the question of computerization divided the historical community, information technologies are now seen to offer an infrastructure to support unprecedented connections not only among historians but among all those involved in teaching and research including archivists, librarians, computer scientists, and students."[72] Margaret Conrad used her 2007 CHA presidential address to contribute to a "larger discussion that will also almost certainly preoccupy CHA presidents for the foreseeable future: where academic history and the arts disciplines generally fit into the postmodern university and the rapidly expanding world of knowledge fuelled by the Internet and its related technologies."[73] These presidential addresses accelerated the decline of active opposition to digitally-enabled History.

In addition to demographic changes, historians in Canada also benefitted from significantly increased research funding support beginning in the late 1990s. This increase followed a deep change in how scholars such as historians viewed such funding. In stylized terms, research grants had moved from being scholarly questionable to a sign of scholarly excellence in tenure and promotion evaluations. After a series of significant cuts in the early 1990s, the budget of SSHRC grew from $100 million in 1995–6 to $157 million in 2002–3. Similarly, the new Canada Research Chairs program soon began funding 2000 positions, many of which had interdisciplinary profiles. The new Canada Foundation for Innovation became a world leader in supporting the creation of databases including those in History. Taken together with some provincial research support (most notably, Québec's Fonds de recherche société et culture), these funding agencies were able to increase support for digitally-enabled research. In 2000, following a report submitted to the Governing Council, SSHRC launched the "Image, Text, Sound and Technology" funding opportunity, providing support for experimental research using computers to study the past and present. The funding agency emphasized that "Digital technologies now pervasively inform how research is conducted in the humanities and social sciences, whether it is simple word processing, database searches, or highly complex multimedia presentations."[74]

These research grants gave increased legitimacy to digitally-enabled collaborative research on the past. SSHRC's new program architecture in 2009

72 Chad Gaffield, "Historical Thinking, C.P. Snow's Two Cultures, and a Hope for the Twenty-First Century," *Journal of the Canadian Historical Association* 12, no. 1 (2001): 3–25.

73 Margaret Conrad, "2007 Presidential Address of the CHA: Public History and its Discontents or History in the Age of Wikipedia," *Journal of the Canadian Historical Association* 18, no. 1 (2007): 1–26.

74 The success of the ITST funding opportunity led to its integration into all SSHRC programming by 2008; see "Image, Text, Sound and Technology," Social Sciences and Humanities Research Council, Government of Canada, last modified 9 September 2013, https://bit.ly/2ZKekmZ

welcomed research partnership applications to its Talent and Connections funding opportunities, allowing historians to better embrace the expanded disciplinary meaning of computers for teaching and KMb in innovative projects.[75] Under the leadership of Joanne Burgess, the Laboratoire d'histoire et de patrimoine de Montréal became a model of campus-community engaged scholarship enabled by multiple digital tools.[76] Founded by Geoff Cunter, the Historical Geographic Information Systems Lab at the University of Saskatchewan now plays an important international role in advancing research and training in fields such as environmental history by uniting "history and geography to explore change through time and variation across space."[77] Greater research funding also led to the interdisciplinary and collaborative creation of the Canadian Century Research Infrastructure composed of census micro-data, textual contextual data, and complete geo-referencing for Canada between 1911 and 1951.[78] Similarly, Steven High and colleagues received funding to open the Centre for Oral History and Digital Storytelling in 2006, which has brought together diverse campus and community contributors to undertake innovative research as well as produce multimedia outcomes that connect the past and present.[79] In addition to these examples from Canada, other countries such as the United Kingdom similarly increased funding for digitally-enabled scholarship during the early twenty-first century. In his review of "History and Computing" in 2008, Ian Anderson concluded that changes including better research funding and more user-friendly infrastructure "all provide for a more positive outlook than a decade ago."[80]

75 "SSHRC Partnership Grants – Stage 1," Social Sciences and Humanities Research Council, Government of Canada, last modified November 4, 2019, https://bit.ly/2TG4VJa. SSHRC's requirement for a knowledge mobilization plan as part of each application encourages scholars to use digital tools; see "SSHRC Guidelines for Effective Mobilization," Government of Canada, last modified 17 June 2019, https://bit.ly/2XuQxVf

76 Burgess along with Paul-André Linteau, Léon Robichaud and other researchers are co-creating digital initiatives with collaborators in archives, museums, schools, and government agencies; see "À propos," UQAM, https://lhpm.uqam.ca/le-laboratoire/a-propos/

77 "The Historical GIS Lab," University of Saskatchewan, https://hgis.usask.ca/index.php#AboutUs

78 For a description of this project, see the special issue of *Historical Methods: A Journal of Quantitative and Interdisciplinary History* 40, no. 2 (2007), including Chad Gaffield, "Conceptualizing and Constructing the Canadian Century Research Infrastructure," *Historical Methods* 40, no. 2 (2007): 54–64. Also see Gordon Darroch, ed., *The Dawn of Canada's Century: Hidden Histories* (Montreal & Kingston: McGill-Queen's University Press, 2014), 520. The CCRI and previous projects are now being deepened by The Canadian Peoples/Les populations canadiennes (TCP/Lpc) project; see Baskerville and Inwood, "The Return of Quantitative Approaches to Canadian History."

79 The Centre for Oral History and Digital Storytelling / Centre d'histoire orale et de récits numérisés (COHDS/CHORN), Concordia University, 2020, http://storytelling.concordia.ca

80 Ian Anderson, "History and Computing," *Making History: The changing face of the profession in Britain*, Institute of Historical Research, 2008, https://bit.ly/3grSQAS

In the changing demographic and financial context, historians increasingly defined their research as interdisciplinary. One indication was the 2008 survey results of Canadian full-time faculty members who were asked to describe their research by choosing categories from "exclusively disciplinary" to "extremely interdisciplinary." Only five percent of historians defined their research as "exclusively disciplinary" while one-quarter saw themselves as "extremely interdisciplinary."[81] These proportions resembled those for scholars in literature, sociology, geography, and related disciplines, and they illustrate the wisdom of the "big tent" approach of the Digital Humanities that disregards disciplinary affiliation in cultivating digitally-enabled scholarship.[82] Overall, the survey results revealed widespread openness to interdisciplinarity across the social sciences and humanities. They appear to help explain why historians have become less resistant to computational approaches to digitized evidence. Emmanuel Le Roy Ladurie predicted in 1968 that historians would stop arguing over "whether to quantify; they will, instead, argue over what, when, how, and to what end."[83] This prediction is just starting to be fulfilled as historians are now far more likely than their predecessors to see numbers as an acceptable way to represent perceived reality.[84]

As Trevor Owens and Thomas Padilla have recently remarked, "As the cultural record becomes increasingly digital the evidentiary basis of history expands and shifts. How must historical scholarship change when the evidentiary basis shifts toward the digital?"[85] One answer is that historians are taking a more

81 The pan-Canadian survey of all scholars listed in the SSHRC database was undertaken for *Promoting Excellence in Research: An International Blue Ribbon Panel Assessment of Peer Review Practices at the Social Sciences and Humanities Research Council of Canada*, Social Science and Humanities Research Council, Government of Canada, 2008, https://bit.ly/2XKNc4H. Harvey Graff discusses international trends in *Undisciplining Knowledge: Interdisciplinarity in the Twentieth Century* (Baltimore, MD: Johns Hopkins University Press, 2015).

82 For a crisp articulation of this inclusive approach, see Constance Crompton, Canada Research Chair in Digital Humanities, University of Ottawa, https://bit.ly/2MYeRKh.

83 Emmanuel Le Roy Ladurie's prediction in 1968 was reprinted in his collection, *The Territory of the Historian* (Chicago: University of Chicago Press, 1979).

84 This integrated approach has been particularly important in advancing knowledge and understanding of "hidden histories"; for example, see, Peter Baskerville, *A Silent Revolution? Gender and Wealth in English Canada, 1860–1930* (Montreal and Kingston: McGill-Queen's University Press, 2008). Also see former Katz graduate student Jordan Stanger-Ross' *Staying Italian: Urban Change and Ethnic Life in Postwar Toronto and Philadelphia* (Chicago and London: University of Chicago Press, 2009).

85 Trevor Owens and Thomas Padilla, "Digital sources and digital archives: historical evidence in the digital age," *International Journal of Digital Humanities* (2020). Geoffrey Rockwell, one of the founders of today's digitally-enabled Humanities agrees that the multiple origins of today's digitally-enabled scholarship remain largely unrecognized; see "An alternate beginning to humanities computing," blog post, 2 May 2007. Also see Rockwell's "notes" collected in "History of Computing and Multimedia, Text Analysis," http://theoreti.ca/?p=1608. For a recent example, see François Dominic Laramée, "Migration and the French Colonial Atlantic as Imagined by the Periodical Press, 1740–61," *Journal of European Periodical Studies* 4, no. 1 (2019): 54–77.

inclusive methodological stance. As Ian Milligan recently pointed out, "This is the era of Big Data, which I define as simply having more data than you could read yourself in a reasonable amount of time – and which in turn thus lends itself well to computational intervention to make sense of."[86] This logic has a long history that has been encouraging the re-thinking of History's text-based disciplinary definition. In 1977, José Igartua observed that the use of computer data reminds us that "written evidence and nonwritten evidence may be viewed as a subset of all the potential symbolic evidence available to reconstruct the human past."[87] By the 1990s, Gérard Bouchard's Saguenay databases became an important research infrastructure for population geneticists and genetic epidemiologists as well as for researchers across the social sciences and humanities.[88] More recently, scientists in genomics provided research funds to expand the historical data of the Canadian Century Research Infrastructure to include the entire documented population of Newfoundland to enable individual-level studies in population genetics during the twentieth century.[89] John McNeil focused his presidential address to the AHA in 2020 on the "new information about the human past that has lately come, and will come in greater measure in the years ahead, from tools and techniques of the natural sciences, rather than from reading what was written on pieces of paper, parchment, or papyrus." By exploring the implications of this trend, McNeil compellingly encouraged cross-disciplinary engagement about the past by calling for "more efforts, more variety, so that we can find out more about what might work well and what does not."[90]

History's increasing openness to diverse sources and methodologies as well as cross-disciplinary collaboration in studying the past not only reflects the growth of historical Big Data but also shared new thinking across campus about the complexity of change and continuity. This new thinking in both well-established and new fields focuses on "outliers," micro-patterns, and emergent properties as much as averages, aggregate trends, and linear change trajectories.[91] To use expressions now common in the Digital Humanities, researchers in many fields now recognize the value of "close" and "distant" reading of the evidence. In History, this changing context helps explain why the proportion

86 Ian Milligan, *History in the Age of Abundance? How the Web is Transforming Historical Research* (Montreal and Kingston: McGill-Queen's University Press, 2019), 22. Also see Shawn Graham, Ian Milligan, and Scott Weingart, *Exploring Big Historical Data: The Historian's Macroscope* (London: Imperial College Press, 2015).

87 José Igartua, "Non-written documentation, 1977" textarchive.ru, https://textarchive.ru/c-2900360.html

88 Gérard Bouchard, Bernard Casgrain, Mario Bourque and Raymond Roy, "Le fichier de population BALSAC. Situation et perspectives," *Annales de Démographie Historique* 1998–2 (1999): 187–196.

89 Gaffield, "Conceptualizing and Constructing the Canadian Century Research Infrastructure," 54–64.

90 John R. McNeil, "Peak Document and the Future of Historical Research," *American Historical Review* 125, no. 1 (2020): 1–18.

91 For example, see John Bonnett, *Emergence and Empire: Innis, Complexity, and the Trajectory of History* (Montreal and Kingston: McGill-Queen's University Press, 2013).

of articles with quantitative evidence published in leading Canadian history journals has slowly increased since 2008 after two decades of decline.[92] Recent initiatives reflect this renewed interest in the epistemological issues of computation. In 2019, for example, an international "Workshop on Quantitative Analysis and the Digital Turn in Historical Studies" was held at the Fields Institute in Toronto to cultivate "a new inclusive, open, interdisciplinary community."[93] The Mellon-funded Sawyer Seminar at the University of Pittsburgh for 2020 is devoted to "Information Ecosystems: Creating Data (and Absence) from the Quantitative to the Digital Age."

## NEXT STEPS FOR DIGITAL HISTORY

Digital History has fewer critics today than in previous decades, but it would be misleading to think that historians are normalizing inclusive epistemologies within the discipline. In Canada, John Bonnett repeated, in 2014, the long-standing lament that "historians don't like computers much either. There are all sorts of reasons, some historical, some cultural, for why this is so. But the fundamental reason, I think, rests on the mental map most of us have when we think about computation. Put simply, it lies on the periphery of the fundamental tasks – be they in research and analysis, or teaching and communication – that we identify with being historians."[94] In 2017, José Igartua disappointedly admitted that "I have always thought that the use of computers could refine and make the analysis of the problems of research more rigorous. I am not sure that this objective has been achieved."[95] Alex Lichtenstein, the innovative editor of the *American Historical Review*, launched a digital initiative in 2020 by telling readers that "I would be the first to admit that the promise of digital history has, at least in the pages of the *American Historical Review*, been long deferred."[96] The same could be said of the *Canadian Historical Review* that is now focusing for the first time on the past, present, and future of digitally-enabled historical scholarship.

It is urgent, therefore, that historians update undergraduate and graduate curricula by developing systematic programming to enhance digital competencies for History. This updating should include specific methods courses in addition to the integration of digital competencies into standard courses to avoid

92 Baskerville and Inwood, "The Return of Quantitative Approaches to Canadian History."

93 See "Workshop on Quantitative Analysis and the Digital Turn in Historical Studies," The Fields Institute for Research in Mathematical Sciences, accessed 26 May 2020, https://bit.ly/3emwcYS

94 John Bonnett, "Historians and Technology/Les historiens et la technologie," *Journal of the Canadian Historical Association* 40, no. 2 (2020): 42–43.

95 See "Entretien avec José Igartua / Interview with José Igartua," *CHA Bulletin* 43, no. 1 (2017): 30.

96 Alex Lichtenstein, "Digitizing Migrant Networks," *Perspectives on History* 57, no. 9 (2019).

extending program lengths or sacrificing attention to historical contexts.[97] In his 1970 survey of computing and history, Robert P. Swierenga declared that "Borrowing from other disciplines is not the solution." While applauding the appearance of "computer-oriented historians" who were familiar with programming and the new standardized software developed for social science disciplines, he emphasized that historians deal with different kinds of evidence that call for different statistics and computer programs.[98] Swierenga repeated Robert Zemsky's earlier call for historians to "invent a methodology—including computer programs—of our own, a methodology designed to cope with the peculiar kinds of evidence with which we deal."[99] Swierenga defined that challenge as the central task for the next generation of leaders in digitally-enabled History. Several academic generations after these comments, curricula in History still lag well behind the fact that historians now increasingly rely on digital technologies.

In 2016, Sean Kheraj announced that "Digital History is coming to York University." While Kheraj's preparatory research on institutional websites did find that fifteen departments in Canada now offer at least one course, he understandably concluded that "there are many opportunities for curricular innovation and experimentation."[100] One encouraging sign in 2020 is UQAM's launch of their master's program in the "humanités numériques en histoire."[101] Fortunately, as the courses highlighted by Kheraj demonstrate, instructors can now draw upon a rich body of material that assumes digital competencies complement and interweave analogue competencies as central objectives of History programs.[102] Examples include the most comprehensive collection of lesson materials, *The Programming Historian,* which offers dozens of substantial instructional guides that continue to multiply as new topics become relevant in History.[103] Instructors can also draw upon specific applications such as Voyant Tools, a web-based open-source application that encourages close and distant readings of text as well as visualizations to enable integrated and flexible interpretive approaches.[104] History students create online exhibits with Omeka,

97 See, for example, Sean Kheraj's description of how he has integrated digital history skills, assignments, and exercises as well as collaborative class projects into his History courses: "Who Teaches Digital History in Canada?" Sean Kheraj: Canadian History and Environment (blog), 6 April 2016, https://bit.ly/2AG35RS

98 Swierenga, "Clio and Computers," 20.

99 Robert M. Zemsky, "Number and History: The Dilemma of Measurement," *Computers and the Humanities* 4, no. 1 (1969): 39.

100 Sean Kheraj, "Who Teaches Digital History in Canada?"

101 "Automne 2020 – Nouveau profil en humanités numériques de la maîtrise en histoire de l'UQAM," UQÀM, https://bit.ly/3efuPey

102 For an introductory discussion, see John Lutz, "Digital Literacy: What Every Graduate Student Needs to Know," *CHA Bulletin* 35, no. 2 (2009): 40–1.

103 Historians William J. Turkel and Alan MacEachern began *The Programming Historian* in 2008. Now an international collective effort, the French-language version was released in 2019.

104 Stéfan Sinclair and Geoffrey Rockwell, Voyant Tools (website), 2020, http://voyant-tools.org/. Also see, Jo Guldi, "Critical Search: A Procedure for Guided Reading in Large-Scale Textual Corpora," *Journal of Cultural Analytics* (2018): 1–35.

a web publishing platform primarily targeting archives and museums but also accessible for individual and collective initiatives including class projects.[105] Similarly, the sophisticated ARCGIS includes accessible applications that allow students to interpret and analyze historic maps, for example, to learn how georeferencing can stimulate thinking about spatial distributions.

These examples and many others make clear that historians are now well-situated to accelerate curricula updating in History.[106] John Bonnett develops the critical thinking skills of students by helping them learn 3D modelling software to create virtual models based on historical documents.[107] Kevin Kee has focused on how scholars can "playfully" use technology to teach and learn history both in his development of History-relevant apps with his students and in engaging with related teaching initiatives.[108] Shawn Graham won the Provost's Fellowship in Teaching Award and was designated a Carleton University Teaching Fellow for his innovative History courses in digital archaeology.[109] Léon Robichaud won the *La Tribune* award in 2017 given by the Société d'histoire de Sherbrooke for his impressive integration of digital skills and local history in courses at the Université de Sherbrooke.[110] These examples illustrate the societal importance of providing opportunities for students to engage in collaborative and interdisciplinary initiatives as well as individual work in digitally-enabled History.[111]

Ideally, graduates of History programs today should have acquired considerable knowledge and understanding of the past while developing integrated analogue and digital competencies. They should be familiar with descriptive statistics to think through historical evidence, explore with spatial and network analysis, and mobilize knowledge to engage different audiences in multiple digitally-enabled ways. These competencies must include a good algorithmic understanding of what is going on in the "black box" of digital applications as well as of the epistemological and ethical implications of studying digitized sources (including their limited coverage and relationships to analogue

105 See *Omeka*, Roy Rosenzweig Center for History and New Media, 2020, https://omeka.org.

106 See the compelling advice of Kim Martin in "Clio, Rewired: Propositions for the Future of Digital History Pedagogy in Canada," in this issue.

107 John Bonnett, "Following in Rabelais' Footsteps: Immersive History and the 3D Virtual Buildings Project" *Journal of the Association for History and Computing* 13, no. 2 (2003): 107–150; and John Bonnett, "New Technologies, New Formalisms for Historians: The 3D Virtual Buildings Project" *Literary and Linguistic Computing* 19, no. 3 (2004): 273–287.

108 Kevin Kee, ed., *Pastplay: Teaching and Learning History with Technology* (Ann Arbor: University of Michigan Press, 2014).

109 "About Shawn Graham," Electric Archeology, https://electricarchaeology.ca/about/

110 For example, see Lara Campbell and Christabelle Sethna, "Thinking Outside the Disciplinary Box: Historians and Interdisciplinarity," *CHA Bulletin* 42, no. 1 (2016): 30.

111 For an illustration of the possibilities, see Eric W. Sager and Peter Allan Baskerville, "Canadian Historical Research and Pedagogy: A View from the Perspective of the Canadian Century Research Infrastructure," *The Canadian Historical Review* 91, no. 3 (2010): 533–551.

evidence). History graduates should also have experienced first-hand the challenges and opportunities in collaborative and interdisciplinary projects as well as the importance of good historical data management plans by interacting with archivists and librarians. In these and other ways, historians can effectively respond to the long-ignored pleas of those like Zemsky and Swierenga to go beyond borrowing from other disciplines in pursuing digitally-enabled History.

There is also a continuing need for the professional development of both beginner and advanced scholars. This need explains the remarkable success of the Digital Humanities Summer Institute at the University of Victoria that attracts a thousand participants over three weeks every June. Over the years, historians have attended regularly as students, while others have offered courses. As an example, "An Introduction to Machine Learning in the Digital Humanities" has been co-taught by a historian and a statistics expert with a focus on "literary, historical, and social media data sets."[112] The success of this initiative reflects the increasing interest of those in the sciences to engage with historians and other scholars as computer processing approaches such as Machine Learning stretch the limits of established statistics. Over the past decade, as hiring on campuses has significantly declined, such professional development opportunities have become more important than ever. Beyond such academic programming, historians should also aim to remove disciplinary obstacles to Digital History. Internationally, the AHA has taken the lead in producing *Guidelines for the Professional Evaluation of Digital Scholarship by Historians* in 2015.[113] The AHA *Guidelines* have inspired several institution-specific versions but there is a great deal more work to be done, including in Canadian institutions. As Milligan has recently emphasized, "given the importance of born-digital scholarship to the future of the historical profession, even firmer action should be taken" to enhance recognition of achievements.[114]

These next steps to advance Digital History have deep roots in the false starts, failures, and successes of the contested past seventy years. The disciplinary culture and institutional conditions of History have been slowly and unevenly redefining the use of computers in historical scholarship. As historians have become more open to diverse rhetorical and methodological approaches in research, teaching, and knowledge mobilization, including collaboration, interdisciplinarity, and research funding, the disciplinary place of computers has been moving closer to History's mainstream in a promising present. However, past experiences suggest that historians must critically and constructively engage with digitally-enabled scholarship as an urgent priority for the discipline and, indeed, for all efforts to gain better knowledge and understanding of the past. Faced with an uncertain future, historians must increase research, discussion, and action to continue deepening the relationship between Clio and computers in ways that build upon the core values of historical scholarship.

112 Digital Humanities Summer Institute (website), Electronic Textual Cultures Lab, University of Victoria, http://www.dhsi.org

113 "Guidelines for the Professional Evaluation of Digital Scholarship by Historians," American Historical Association, 2015, https://bit.ly/2XCVQCe

114 Milligan, *History in the Age of Abundance?*, 242.

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CHAD GAFFIELD is University Research Chair in Digital Scholarship and Distinguished University Professor, University of Ottawa. His previous work is available at chadgaffield.com

CHAD GAFFIELD est titulaire de la Chaire de recherche de l'Université en recherche numérique et professeur éminent à l'Université d'Ottawa. On trouvera la liste de ses travaux antérieurs à chadgaffield.com