Making sense of the historical in H-GIS in Canadian universities.

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Our portal is a venue to help us better develop historical geographic information systems (H-GIS) in Canada. As such it is a forward-looking collaboration, bringing together diverse actors from various fields who share this common goal. Why then a White Paper on the past of only one of these fields?[1] The usual bromides of the importance of the past to understand the present had little to do with it. H-GIS in Canadian universities initially hoed its own row and this paper will argue that key lessons learnt along the way are important to keep in mind as we plan new and much larger collaborations.

This paper is structured in four parts. I start with a brief discussion of the bi-national character of historical geography in Canada. This sets the stage for a more extended analysis of the first, and, prior to the current partnership, only pan-Canadian H-GIS to date. This project, known as MAP, was by no means the only application of H-GIS in Canada, but unlike the overwhelming majority of H-GIS projects at the time and since, it was not developed to answer particular historical questions. Rather scholars from across the country developed MAP as a research infrastructure for both academics and the general public. MAP's attempts at outreach, including its legacy for two subsequent Canadian H-GIS research infrastructures, are then discussed. The paper concludes with what no doubt will be the most controversial point: why the evolution in computing appears to have already consigned to the dust-bin the most innovative and empowering aspects of this pioneering Canadian experiment.

This paper is not a history of H-GIS in the Canadian academy. Nor does it attempt to catalogue the wide variety of ways Canadian researchers have used GIS techniques.[2] Its aim is both more modest and far-reaching. I ground an unparalleled experiment in progressive pedagogy, by linking it to the diverse cultural formation that gave it birth and by rendering explicit the political nature of the choices it embodied. Clearly delineating this point of departure allows us not only to see how far we have travelled, but to better understand how much further away we are now from creating historical geographic information systems to serve an informed and empowered citizenry. I argue this uniquely Canadian story has implications for progressive scholarship more generally.

1. Truth be told, this was not part of the initial plan. The history of academic H-GIS in Canada was to be dealt with as a minor element in Don Lafreniere's paper on the use of H-GIS in teaching and it was only after a debate involving the whole partnership, followed up by discussions at the Executive Committee, that a separate historically-oriented white paper was authorized.

2. For a representative sample of case studies see the open access *Historical GIS Research in Canada*. Edited by Jennifer Bonnell and Marcel Fortin. University of Calgary Press, 2014. Their bibliography from pages 291-313 provides a useful introduction to HGIS work in Canada.

Two qualitatively distinct traditions

Historical geography in the Canadian academy dates from the late 1920s, with the work of Harold Innis in English Canada and Raoul Blanchard in Quebec. Although neither was an historian, both would develop particular, albeit conflicting, historical meta-narratives that are still remarkably influential. To explore adequately these different approaches and their legacies would take us too far afield, so I have opted for a brief comparison of the two most important publication projects to build on their initial insights: the *Historical Atlas of Canada*, in three volumes, 1987-1993, and the *Atlas historique du Québec*, currently nine volumes, 1995-2012.

The principal editors of all three volumes of the *Historical Atlas* were historical geographers with different historians for each volume acting in important advisory capacities. Although the title suggests a reference work, where one would find answers to basic spatial questions about Canada's past, the series is an eclectic collection of plates. They reflect the widely differing interests of the first generation of historical geographers and historians to be produced by the greatly democratised access to higher education of the late 1960s and early 1970s.

The progressive intentions of the editors were aptly captured by Cole Harris, co-editor of the first volume, when he told the Canadian Historical Association that there would not be any maps depicting European explorations as arrows through blank space.[3] Plates for all three volumes were commissioned at the apex of the renewed interest in social history and political economy characteristic of the late 1970s to mid-1980s in Canada. The emphasis is thus on the material, rather than the cultural or the linguistic, and depicts the unusual and the specific. Detailed studies graphically illustrate multiple interactions across time and space, but without any acknowledged comparative framework or shared methods across plates.

The coherency of this rich smorgasbord is provided by the presumed naturalness of the present boundaries of Canada and so even plates detailing the ice age respect the 49th parallel. Numerous plates on Newfoundland in the 17th and 18th centuries are included, but nothing on New France south of the Great Lakes. Indeed, it is this assumption that Canada was created because, not in spite, of geography, rather than any undue attention to staples,[4] that

3. A commitment made at the CHA annual meeting in Vancouver, 1983. Apparently no one informed Conrad Heidenreich, for his Plate 36 in Volume 1 contains just such Eurocentric maps for New France, a problem unfortunately reproduced in the online version where all the lines of exploration (admittedly not arrows) are presented as going through uninhabited space, save for the forts of the Europeans. Cole Harris went on, however, to make an exceptional contribution to understanding native newcomer relations, see in particular his multiple prize-winning book: *Making Native Space: Colonialism, Resistance and Reserves in British Columbia*. University of British Columbia Press, 2002.

4. Innis' interest in geography stemmed from his career-long interest in developing a staples approach to the political economy of colonies of settlement. For a critical assessment see my "The Staples as the Significant Past: A case study in historical theory and method." *Canada: Theoretical Discourse/Discours théoriques*. Edited by Jane Greenlaw, Terry Goldie, Carmen Lambert & Rowland Lorimer. Montréal: Association of Canadian Studies, 1994, 327-49.

demonstrates the profound and continuing influence of Innis on this ambitious nationalist project.

A quite different nationalism animates the *Atlas historique*. The approach adopted in the first volume became the model for the series. It combines American social science methodologies with a belief in the St Lawrence River as the key structuring element in Quebec history, what they call *l'axe laurentien*, a vision that respects Blanchard while transcending certain of his particularist tendencies.[5] This collection was designed to be, as founding editor Serge Courville informed the *Institut d'histoire de l'Amérique française*, a monumental intellectual gift by those formed by the Quiet Revolution to future generations.[6] Their achievement continues to grow long past the retirement of that generation. Focussed, definitive, and comprehensive, it would be difficult to find a greater contrast with the *Historical Atlas*.

Starting in 1995, with an analysis of the major changes in the St Lawrence valley during the mid-19th century, each volume advances a coherent historiographic argument. These are not reference books, but rather critical explorations of specific questions or areas. By 2001, six more volumes had appeared: on demography; territory; medical institutions; the North; Quebec City; and parishes. After a hiatus of almost a decade, two further volumes on the creation of rural society in the 18th century and on French-speaking North America appeared. Nor is the project yet complete, although any future volumes are likely to be virtual. Abundantly illustrated, nevertheless each volume does tend to privilege a particular source. As a result, the collection offers a rich cartography of differing visions of Quebec, but one where little dialogue between volumes is possible. Thus, despite their differing approaches, neither the *Atlas historique* nor the *Historical Atlas* are greater than the sum of their parts.

The future of the past.

The first large-scale H-GIS project in a Canadian university was *Montréal, l'avenir du passé* (MAP), hosted by the Geography department of McGill, but mobilizing the talents of thirteen academics from Victoria to St John's, literally *mari usque ad mare*. Formed in 2000, it was a conscious effort to create a viable model for H-GIS in Canada. In 1997, the federal Liberal government had announced "millennial" investments in higher education including a major new source for infrastructural funding, the Canadian Fund for Innovation. Only 5% of the $455 million in CFI funding in the first two years had gone to the social sciences, humanities or arts.[7] With that source effectively hi-jacked by researchers in science and medicine, MAP tested the

5. For a sadly unfruitful exchange on their theory and method see my «Recenser la modernité» and their response in *Cahiers de géographie du Québec*, 41, 114 (décembre, 1997) 423-42.
6. Congrès de l'Institut, Université du Québec à Trois Rivières, 1993.
7. It only achieved this amount thanks to a $20 million grant to the University of Ottawa's library, the other 24 funded projects shared less than one percent of the funding. CFI infrastructural funding for the social sciences, humanities and arts has remained at this abysmally low level, totalling only $275 million of the almost $5.5 billion in CFI funding since 1998.

waters of Géoide, one of the "national centres of excellence" that were also created as part of this federal foray into education.[8]

An important feature of these federal initiatives was their tying of funding to a matching grants formula, part of a conscious neo-liberal agenda to make university research more "relevant" to the concerns of the private sector. MAP effectively circumvented this barrier by partnering with the Montréal city planning department and having their loan of CAD and Mapinfo files treated as substantial in-kind contributions. Conceived from the outset as an interdisciplinary research infrastructure, MAP's application stressed the potential to explain medical anomalies through a better understanding of the city's environmental history. Thus, MAP was both a pilot project and a template for how to access infrastructural support for the social sciences in an increasingly hostile environment.

MAP was initially conceived in the late 1990s by the historical geographer Sherry Olson, in collaboration with Jean-Claude Robert. Both had been involved with the printed atlases and in many ways MAP aimed at overcoming their limitations. As Olson articulated it, the task was to design an accessible, open-ended, modular, research infrastructure, which would grow with each new person's contribution.

Olson worked at McGill, a particularly privileged place within the Canadian academy and not one normally given to collaborative efforts with francophone institutions. She had, however, come from John Hopkins in Baltimore and was well aware of both the high cost of segregation and the ethical responsibilities engaged social scientists share. An earlier publication series she created to allow the work of her graduate students to circulate more widely aptly summarized her position; it was called *Shared Spaces*. Through working with graduate students, Olson had developed an approach to spatial representation that became MAP's corner stone. It considers median rents, drawn from municipal tax rolls, to be the most sensitive social indicator for historical urban geography. These medians were calculated for streetscapes, generally both sides of a street for several blocks.[9] For the *Historical Atlas*, Olson and her graduate students had used these streetscapes to explore the relationship between rental values and topography and to map the evolution of occupational segregation in the city. Furthermore, they linked these values to differing architectural styles, permitting one to read the surviving built environment in new and revealing ways.

8. Education in Canada is constitutionally an exclusively provincial jurisdiction, but since the 1950s the federal government has used the ever more pressing financial needs of universities to carve an increasingly larger place for their programs. These millennial investments, which included the creation of 200 Canada Research Chairs and a major scholarship program, when added to the four federal granting councils ensured effective control of university research by the federal government. Only the Quebec government, long a defender of provincial jurisdiction, has established anything at all comparable to federal infrastructure funding.

9. David Hanna and Sherry Olson, « Métiers, loyers et bouts de rue: l'armature de la société montréalaise de 1881 à 1901. *Cahiers de géographie du Québec*, 27, 71, (septembre 1983) 255-75. Link.

A second major influence on the design of the project was Jean-Claude Robert. In the 1970s, under his co-direction, the *Groupe de recherche sur la société montréalaise au dix-neuvième siècle* at the Université du Québec à Montréal (UQAM), had conducted pioneering research on census returns that challenged the prevailing traditionalist interpretation of 19th-century Québec society. A leading social historian of 19th century Montréal, Robert wrote the standard reference work on historical maps of Montréal, co-edited the second volume of the *Historical Atlas* and co-authored the first volume of the *Atlas historique*. In the mid-1990s, Robert was part of a task force charged with developing an interpretive framework for *Vieux Montréal*. Building on an insight of Gilles Lauzon, the task force's final report argued the richness of the past in all its complexity should be the focus of heritage work.[10] Therefore, the historic significance of this former town centre should not defined by a particular time period or process, but rather in the way its surviving built environment evoked differing spatially adjacent, but temporally distinct, periods. The conceptual design of MAP, illustrated by its logo, aimed at making this inherent complexity accessible to all.

To achieve this the team selected dates for which highly detailed maps of the city had survived that could potentially be linked to nominal series from that specific period.[11] The earliest was an ordinance survey conducted in the summer of 1825 by John Adams of the British Royal Engineers. This map coincided with a pioneering sociological investigation by the city's future Mayor, Jacques Viger. A generation later, in 1846, James Cane drew a detailed commercial map of the city within years of a census and just prior to the first systemized municipal evaluation roll to have survived. In 1880, the year before the decennial census, Charles E. Goad & Co. published a 44 plate fire insurance atlas of the city. A similar proximity marked the 1912 Goad atlas and the 1911 census. In 1949, the planning department created an exceptionally detailed, colour-coded map of the city, two years prior to first post-war census.

To ground these period maps in virtual space, MAP constructed a new base map for 2000, from the set of MapInfo files of the city, known as the SIURS geobase, and an extensive set of CAD files lent by the *Service de géomatique de la Ville de Montréal*.[12] Rectifying a map means changing it so that the map shares the same co-ordinates as another map. This involves identifying points on each map that you believe to be the same location and treating them as control points or anchors. After enough anchors have been identified, GIS software warps the overlay map to fit the co-ordinates of the base map. Initially the plan was to use evidence from the built environment as our anchors, such as the corners of Notre Dame Basilica.

For reasons of both scale and accumulated expertise of team members, once the base map for 2000 was completed, work focused on the 19th century layers starting with the 1880 Goad. When rectified, MAP members thought it could be the basis for the rectification of the Cane 1846 map and then the Cane could be used to rectify the Adams 1825 map. Working backwards

10. Gilles Lauzon, Jean-Claude Robert & Robert C.H. Sweeny. *Vieux-Montréal: La Cité. Une identité façonnée par l'histoire.* Montréal, Ministère de la Culture et des Communications du Québec et la Société de développement de Montréal, 1996.
11. A discussion of the methodological choices and problems they caused is available on MAP's website.
12. Rosa Orlandini's working paper explain how this was done.

would maximise the number of buildings appearing on both maps and so ensure the most reliable rectification by increasing the number of potential control points.

Initial rectifications highlighted the challenge of variability from one plate to another and showed that need for many more anchors than the shared built environment was likely to provide. The margin of error on most plates ranged from five to ten meters; where the comparable error in a modern document created to current engineering standards from aerial photographs of contemporary buildings is in the order of one meter. This high level of inaccuracy was disturbing, as a coherent system depended on the centre of any lot actually be within that lot, because this was where data points linked to historical sources detailing the lots inhabitants and usages would be placed. An acceptable margin of error would be approximately three meters, or less than half the width of almost all lots in the city.

In many parts of the city there were no buildings from 1880 that had survived to the present and so, *faute de mieux*, existing property lines were used as anchor points. To the general surprise of the entire team, rectifying to property lines proved to be considerably more accurate than using buildings as anchors. Although property lines are invisible, imaginary lines through space, these abstractions proved to be remarkably stable features over 120 years. Their locations were recorded with considerably greater care than were those of actual buildings.

There were two types of lots visible on the 1880 Goad: building lots and cadastral lots. In Goad, cadastral lots appeared even where no building had yet been erected, and they usually appeared in the SIURS geobase even where buildings had been demolished. Since the extensive written information on the Goad plates meant that they were not good candidates for an automated drawing of the cadastral lines, MAP created a GIS layer of the cadastral lots based on the work by Louis-Wilfrid Sicotte between 1876 and 1878. A detail of Ste-Anne ward is shown here. Goad was then rectified to Sicotte. Cadastral lots made comparison between maps easier, and allowed greater confidence when moving between maps despite the frequent changes in addresses.

Establishing a shared geodesy, or geometry of the earth, was essential to the construction of an historically coherent geographic information system, but the visual centrality of these transformed period maps to anyone using the system is misleading. Although extensive work with period maps did underlay much of the system, the sources of reference for the 1846 and 1880 layers were the 1848 and 1880 tax rolls, because they alone provide both lot numbers and street addresses. Whenever there was a disagreement between two sources, including the period maps, the tax roll was considered to be the definitive source. This central methodological choice determined the architecture of the entire system.

According primacy to a particular source to govern each layer generated substantial debate within MAP. It was a debate that revealed the significance of differing ways of knowing (epistemologies) and doing (methodologies) depending on one's disciplinary training. Scholars trained as social scientists were on the whole comfortable with the idea of creating an external hierarchical structure of significance, humanists much less so.

It was often over mundane issues that these debates arose. How to handle the wide variations in spellings, including accents, and nomenclature was a particular sore point. While all could agree that a standardisation of spelling to facilitate queries did make the system more "user-friendly," the potential costs of such efficiencies were not as widely recognised. Historians' concerns, that such impositions of present-day conventions on the past denied possible future avenues of research, tended to be dismissed as source fetishism.

These interdisciplinary tensions were compounded in the early years by an understandable but regrettable tendency to assume that the geographers would handle the maps, while the historians dealt with period sources. Such disciplinary silos, reinforced by reliance on distinct software packages, effectively denied that maps needed to be understood as historical sources in their own right, and that period sources had intrinsic spatial logics that needed to be critically analysed.[13] It took years for the team to learn this dual lesson, by which time MAP's GIS was largely in place, without all the "H" it might legitimately be considered to require.

The exception to this hierarchical structure was the 1825 layer. There was no municipal tax roll to anchor the system for 1825. As a result, standardized linkages at the lot level were not possible across the myriad available sources. Instead, a series of stand-alone databases with context-sensitive query capabilities was developed in Visual dBase. These included the two extant city directories (1819 & 1820), two surviving listings of property owners (1825 & 1832), the official manuscript census for 1825 with the annotations from the enumerator's personal copy, notarial deeds of apprenticeship for a selection of trades and notaries (1820-29) and monetary protests by the city's two chartered banks (1820-1827).

Adams ordinance survey of 1825 was made fully compatible with the other layers, so researchers can drill down to 1825 to compare his visualisation of the city's built environment with the later ones of Cane or Goad & Co., as well as analyze the spatial logic of this unique representation of the city. Unlike the other layers, however, an integrated mapping of nominal series is not yet possible.

Where known, linkages to the map were provided, but the logic of this arrangement was much more in keeping with a quite different theory and method for understanding the past. This 'cubist' portrait of pre-industrial Montréal, treated each source as distinct, because endowed

13. Robert C.H. Sweeny, "Rethinking boundaries: interdisciplinary lessons from the Montréal, l'avenir du passé (MAP) project" *Digital Studies/ Le champ numérique 1, 2 (2009).* Link.

with its own historical logic. From this perspective, one should not privilege one source over another. Contradictions between sources are not problems to be resolved, but rather further evidence of the complexity of the past that needs to be interpreted.[14]

By contrast, the 1880 layer was much more representative of the MAP vision and it has been this approach which has had the greatest influence. Building on team members' long experience with routinely generated nominal series, such as tax rolls and census returns, the layer for 1880 offers users a fully integrated experience. On offer are complete linkages at the lot level to the 1881 census, databases of owners and tenants drawn from the 1880 tax roll and the complete alphabetical list from Lovell's city directory, as well as files on specific topics as varied as Protestant pew rentals, Catholic baptisms, Grand Trunk Railway wages, the last known address of people consigned to a pauper's grave and youth attending the High School of Montreal. MAP's modular structure allows the system to grow by simply linking new variables to the base map, creating an accurate spatial representation of each new dimension. The rich potential of such a research infrastructure inspired projects in other Canadian cities.

Outreach and take-up

Over the past 15 years, MAP has been the subject of dozens of presentations to national and international conferences, facilitated the completion of numerous graduate theses and been an important component of two major, prize-winning, monographs.[15] This research infrastructure might well be best known, however, for its pedagogical software. Complementing the earlier stand-alone databases for the 1820s, three Arc Explorer applications were released in 2003: *Protestant Schooling in Industrial Montréal; Occupants of the 1880 Montréal tax roll;* and *Montréal the built environment 1880 and 2000.* In 2004, applications based on the Adams and Cane maps were released, along with a 32 bit-edition of the 1819 city directory of Thomas Doige. In 2006, the most ambitious of the stand-alone databases was released, detailing the complete alphabetical listing from the 1880 Lovell's city directory. At the 2010 *Congrès de l'Institut d'histoire de l'Amérique française* a CD-ROM was launched, with eight French and English language Arc Explorer applications covering all three 19th century layers in both Apple and Windows formats. More than 500 copies of the CD were distributed to history and geography departments across the country. A supporting web-site went live the following spring.

The philosophy underlying this dissemination strategy merits explicit discussion, as it speaks to a form of engaged scholarship that now appears outmoded, if indeed still possible. This

14. I explain this in more detail in *Why did we choose to industrialize? Montreal, 1819-1849*. McGill-Queen's University Press, 2015, p.181-224.

15. Sherry Olson and Patricia Thornton. *Peopling a North American City, Montreal, 1840-1900*. McGill-Queen's University Press, 2011, was awarded an Honourable Mention in the Sir John A Macdonald competition in 2012, while *Why Did We Choose to Industrialize?* won the prize in 2016. The Macdonald Prize is awarded annually by the Canadian Historical Association to the work that has made the most significant contribution to understanding the Canadian past in the previous year.

ambitious outreach program gradually replaced a much more modest initial plan, which was simply to have the system available for use by the general public in the then newly opened *Grande bibliothèque* in downtown Montréal. As this might suggest, although members of the team sometimes did make use of it in their own research, MAP was never part of a specific research program. The idea was to allow people ready and easy access to a high-quality H-GIS for an entire city as it evolved over 175 years, so they could properly situate in time and place their own research, be it a student's thesis, a genealogist's family history, or simply a house one was interested in purchasing. In addition to having it publicly available in libraries, the system was designed to be installed on peoples' own computers, so they could easily explore the full power and potential of the differing layers. All releases included pedagogical guides as the hope was that academics would use this H-GIS not only in their research, but also in their classrooms. After all, understanding how a major North American city changed over the past two centuries is relevant to a wide variety of courses.

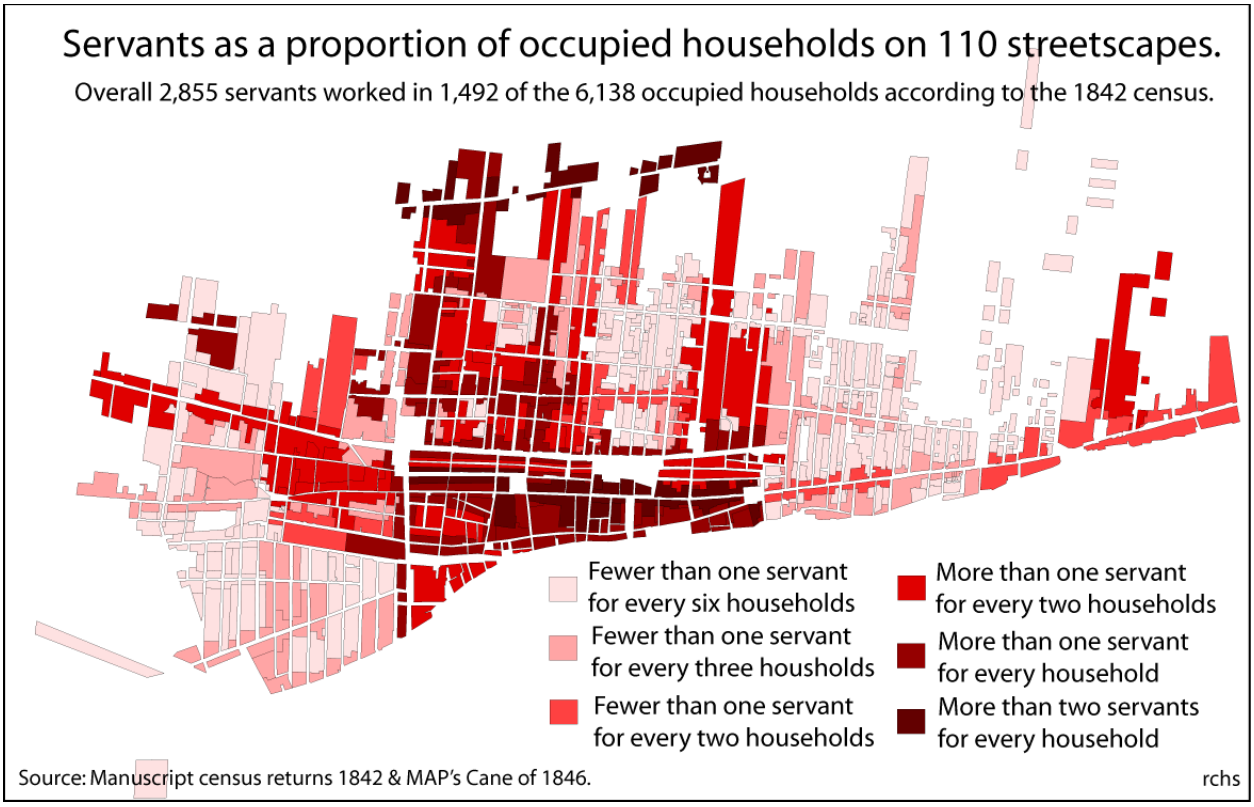
Now the overwhelming majority of H-GIS projects in Canada, and around the world, are created either to answer specific questions, or to elucidate an historical relationship already identified as important. Thus, MAP's designing an H-GIS without having a particular research agenda in mind was exceptional. In the preliminary discussion of this white paper, Joanne Burgess characterised it as altruistic; and as nice as that sounds, it fails to do justice to the politics. At the dawn of the new millennium, MAP was on the cutting edge of a decentralizing and democratising movement to harness the potential of personal computers for social change. This movement envisaged empowered communities of users creatively and collaboratively exploring qualitatively new terrain through radically different relationships to the production of knowledge.

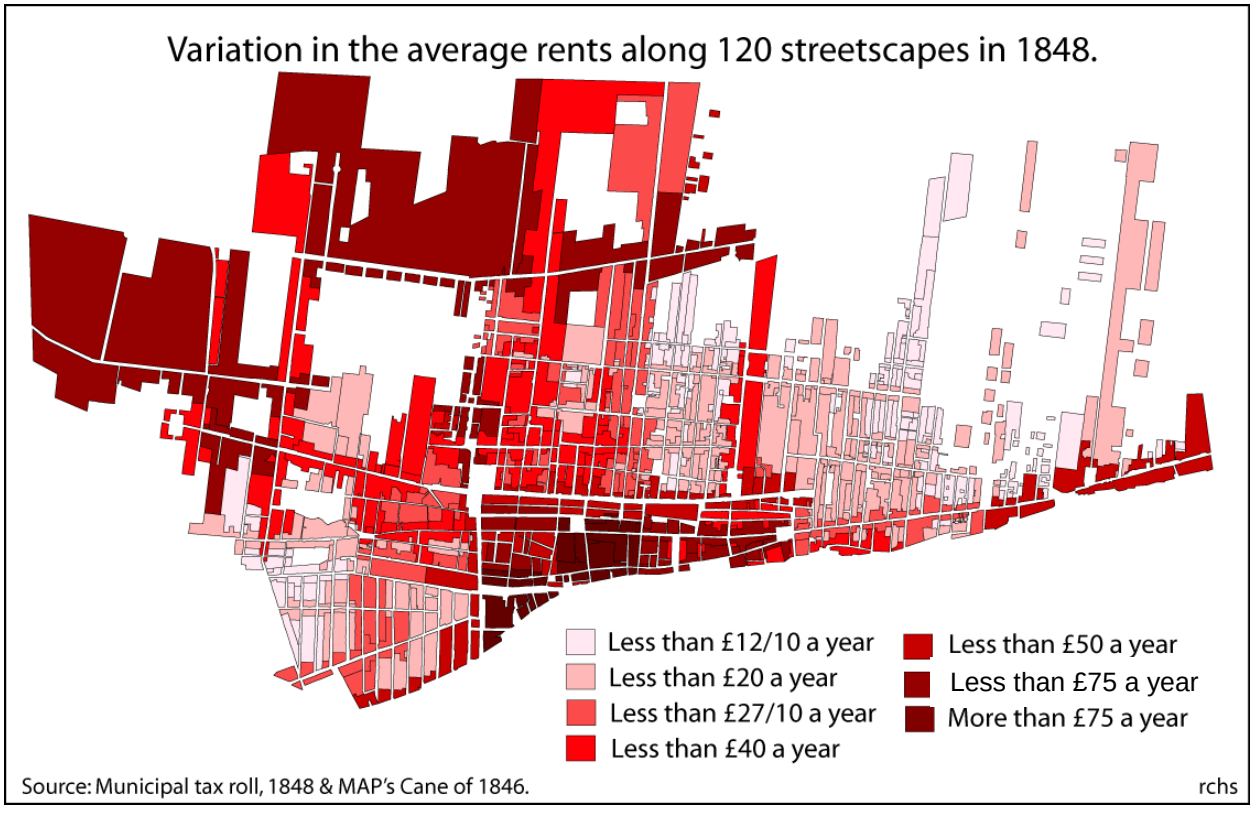
The idea was that the user could ask the questions they needed answering, if the system allowed for open-ended, complex queries that respected the provenance and context of diverse historical sources. Although rarely fully articulated, and certainly not wholly endorsed by all team members, this conception of MAP's purpose increasingly directed dissemination efforts towards public history and pedagogical engagement and away from scholarly publications. It also resulted in a qualitatively different approach to the look and feel of the system as a whole.

If the ideal user was an academic trained in GIS techniques, then there really was no need to fully polygonise the built environment of 1880, a point representing each building would suffice. But if the intended user was a student or a member of the general public, then the need to provide as detailed and as accurate a rendition of the built environment as possible became paramount. The less qualified the user, the more sophisticated the program needs to be, for there is so much less one can take for granted.

If people are to learn how to be historians through using H-GIS, then the H really does have to be both capital and foremost in system design. Take, for example, the streetscapes used to great effect by Olson *et al* in the *Historical Atlas* and elsewhere. Instead of representing these

as simply points or coloured lines on streets, MAP's 1846 applications linked the 110 streetscapes for the 1842 census and the 120 streetscapes for the 1848 tax roll to the actual lots. The visual effect is dramatically different, while vividly emphasising the exceptional wealth and scale of the Golden Square Mile then being developed to the west of McGill University.





MAP's extensive outreach moved few to actually use this research infrastructure. In Montréal, perhaps surprisingly, the take-up was greatest among epidemiologists.[16] Some of the software has been used by faculty and graduate students at both UQAM and Concordia, in addition to McGill, but there has been no integration of this H-GIS into any regular undergraduate course anywhere in Canada, save for my own at Memorial. This singular failure within undergraduate classes has many causes, some cultural and others systemic,[17] but here I would like to focus on two related causes that help explain the more general failure: the challenges to literacy posed by digital technologies and the increasing mismatch between MAP's initial technological choices and the subsequent evolution in computing.

Although we live in a digital world, this does not mean people are computer literate.[18] It simply means that people use computer technology all the time, albeit in quite specific and generally very limited ways, without really having to think much about it. Literacy means using technology to better understand something. Traditionally these technologies have been the three 'R's of reading, writing and arithmetic, but higher level literacy has always required both deductive and inductive reasoning. In this sense, literacy involves developing the cognitive abilities to make sense of the world. It means learning how to question and how to look. It is the opposite of not having to think much about it.

Our reflex is no longer to think to question, nor do we spend that much time looking, because the answer is only a Google™ search away. And as the distance to this answer grows, lodged as they increasingly are in clouds on far away servers, the immediacy with which a hierarchically ordered series of answers appears on our screens is now effectively instantaneous. Marx's observation that capitalism tends to annihilate both time and space has never been more evident. The whole purpose of H-GIS, however, is to enhance the significance of time and space. Yet people's lived experience daily confirms that these no longer matter in our world. This makes our task qualitatively more difficult than it was in the early 2000s, when MAP's outreach program was premised on a fundamentally different role for the user as an active participant in knowledge acquisition and, more importantly, creation.

One could argue that there is still a place for such counter-cultural practices, given the evident need, but this would seriously underestimate the power of both the forces behind the dramatic

16. The crisis provoked by a new form of tuberculosis imported from Russia made MAP's layer for 2000 an important tool in the public health response.
17. These would include: the aversion to computerised analytics within the humanities; the inadequate computer facilities in most Faculties of Arts that would allow for integration of computer labs into these courses; the perception that it would be too difficult for non-geography students to master within the compass of a course that is after all not about H-GIS; the perceived increase to the instructor's work-load, particularly in a context where reliance on precarious academic labour is so pervasive; and the institutional shift away from a respect for the mission of teaching and learning to a narrowly defined focus on funded forms of research.
18. For a discussion of academic literacy see Valerie Burton & Robert C.H. Sweeny, "Realizing the democratic potential of online sources in the classroom." *Digital Scholarship in the Humanities*, 30, (December, 2015) 177-184.

transformations in digital technology and the impact of these forces on our individual and collective capacities to imagine.

In 2000, when the web was still young, MAP chose a technology that privileged relational databases and shape files running on a personal computer. Given modem speeds and storage costs at the time, combined with the size of the databases, these were reasonable choices, but these were not the primary reasons. After all, others had already shown the viability of a web-based alternative.[19] Prior expertise in particular types of software played a key role in the choices, but so too did the corporate dominance of computing.[20] The major consideration in the decision to develop software packages as self-contained executable files was that they could be freely distributed to run in classrooms or on people's home computers without their needing to purchase any proprietary software.

Since then the technical constraints have almost disappeared, while an entirely new service model has developed. Mobile devices accessing distant databases through a wide variety of either free or relatively inexpensive applications, along with a limited array of social networks, are now the norm. Most people no longer pay for much of the software they use, rather advertisers pay a handful of powerful corporations to have access to their user base. Meanwhile, the ubiquitous Google™ map has introduced a particular form of GIS to billions of people. The qualitatively different ontology of both this model and the most widely used of these applications results in not just a new user experience, but a different relationship to knowledge acquisition and creation.

On the one hand, the immediate and in appearance unlimited access to knowledge transforms its acquisition into a form of consumption. It requires no advanced training or skill development. It flattens any learning curve, by effectively denying profundity. In this paradigm, knowledge simply is. On the other hand, the largely anonymous and inherently collaborative nature of knowledge creation offers the possibility of tailoring existing knowledge to fit new and quite possibly unintended purposes. This contradiction, between superficiality and innovation, is more apparent than real, for both acquisition and creation are conceived as responding to market mechanisms. Indeed, this neo-liberal epistemology is the antithesis of previous modes of knowledge acquisition and creation wherein culture and power, rather than the metrics of shares, likes and links, determined value.[21]

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19. As Edward L. Ayers remarkable site so clearly demonstrated: *In the Valley of the Shadow: Two communities in the American Civil War*. University of Virginia, 1993-2007.
20. As my 2001 paper to the XV International Conference on History and Computing in Posnań, Poland, made abundantly clear: "by their very nature computers pose substantive dangers for historical research. They do so precisely because computers are in history. They are neither neutral nor value-free. They are the product of a very particular time and place. As the quintessential technology of advanced capitalist society, computers simultaneously define and are defined by the social and gender relations characteristic of contemporary capitalism. It is no mere coincidence that the history of computers is coincident with that of monopoly capital."
21. For a discussion of everyday neo-liberalism see Philip Mirowski, *Never Let a Serious Crisis go to Waste: How neoliberalism survived the financial meltdown*. London: Verso, 2013, p. 89-156.

One can see how this restricts the potential for H-GIS by examining the literally hundreds of sites now available.[22] The "gee-whiz factor" predominates; H-GIS is used to illustrate, rather than instruct. The overwhelming majority limit user interaction to selecting a variable from a set range of results. These maps illustrate, often in highly entertaining ways, by sharing already known information. They do not train the user, nor do they allow users to pose their own questions of the underlying data. Only a handful of sites even allow for the download of complete databases and related shape files. None allow for open-ended complex queries, or respect the provenance of diverse historical sources, which were at the heart of MAP's pedagogy. I offer a possible explanation of this singular failure in my concluding remarks.

MAP was never designed for those simply interested in the history of Montréal. From its inception, it was conceived as both a laboratory for urban history writ large and a template for like-minded people interested in developing similar infrastructures for their own cities. In Canada, only two projects have taken up the challenge.

The most ambitious has been Jason Gilliland's Imag(in)ing London Historical GIS Project, which provides the historical and spatial basis for the Human Environments Analysis Laboratory (HEAL) at Western University in London, Ontario. Gilliland was a MAP team member in its early years and the initial structure of his project learnt from MAP's experience. This H-GIS with eight layers from 1871 to 2012 and over half a million individual records has been used to explore a wide variety of environmental and health issues.[23] Master's students in Western's program in public history, as well as undergraduates in geography, regularly use this remarkable research infrastructure.

Gilliland and his long-time project manager, Don Lafreniere, have been lynch-pins in connecting the H-GIS projects in Canada. Gilliland co-authored numerous articles with MAP members. They both participated in a joint SSHRC project with MAP on immigration and in recent years have collaborated with team members from the other major H-GIS in Canada, viHistory, as part of a SSHRC funded collaboration into space and race.

The remarkable achievements of Imag(in)ing London and HEAL, do not include any outreach program like that pioneered by MAP. Prospective users of this H-GIS can always contact the project for access, but no databases, shape files or applications are currently available for use by the public, nor are any planned. During the discussion of the draft of this paper, Don Lafreniere explained their reasoning: the power of H-GIS lies in it analytics and so it requires highly qualified personnel to fulfill its promise.

22. The following assessment is based on the extensive list of H-GIS sites around the world maintained on the University of Saskatchewan H-GIS laboratory's website.
23. HEAL's website currently lists 65 peer-reviewed publications, the majority of which relied at least in part on this H-GIS.

An H-GIS for turn of the century Vancouver Island, viHistory was started in 2003, but like MAP could build on substantial earlier work with census data.[24] It currently houses 150,000 entries drawn from census returns for Victoria (1871-1911), for the island as a whole (1881 & 1891) and for Alberni and Port Alberni (1911), city directories for Nanaimo and Victoria (1882, 1892 & 1902), tax rolls for Nanaimo (1881 & 1891) and Victoria (1901), as well as an extensive collection of building permits and construction proposals for Victoria (1877-1921). This data rich archive is all available on line, but unlike Imag(in)ing and MAP little of it is currently linked to a map. On the other hand, the members of viHistory have here, as elsewhere, pioneered in the use of web technologies to not just make the material available to a wider audience, but to introduce a degree of inter-activity. Of particular note is their use of the annotation capabilities of Web 2.0 to allow users to add comments on individual census returns. This facilitates correcting transcription errors, while, more importantly, building a community of users.

Despite the frequent presentations by members of all three of these projects to international conferences in history, geography and the social sciences, there has been no serious take-up of what might reasonably be termed the Canadian model for H-GIS. In part this is due to MAP's early start and the technological choices this entailed. Based on the response to my own presentations over the years, however, I suspect the primary reason is likely to be more philosophical. The practices and traditions I have been tracing in this paper are all progressive. They all aimed in varying ways at enhancing spatial and temporal understandings through new technologies in order to address perceived social, gender, racial or national problems. In its most fully articulated form, with MAP's innovative outreach program, the aim was to transform how knowledge is produced, disseminated and understood. The neo-liberal transformation of the academy throughout the OECD has rendered such ideals in the eyes of almost all of my colleagues, both here and abroad, certainly naïve if not simply wrong-headed.

Does this past have a future?

I think we may have been here before, but which before? Two possible analogies occur to me. The first is a fairly familiar story of technological change. In the late 19th century, cameras used photographic plates which provided exceptional resolution. They were replaced in the early 20th century with cameras using film, which had considerably less resolution, but were both cheaper and more convenient. Except in astronomy, where resolution trumped both cost and convenience. We now use digital cameras with even less resolution, but greatly enhanced ease

24. Peter Baskerville and Chad Gaffield, now two of the country's senior quantitative historians, cut their teeth on census data for the island in the 1980s. It in its conception and early history this earlier Vancouver Island Project shared more with CIEQ's urban census project on Quebec City, developed by Marc St-Hilaire, than with either MAP or Imag(in)ing London. Eric Sager, who worked closely with Baskerville for the past three decades, is a member of the viHistory team.

at costs reduced to almost nothing. Except in astronomy, where arrays of high-tech CCD cameras permit something approaching the earlier resolution of plates.

My second analogy is less well known, or at least less widely acknowledged. For its first 75 years the political economy we now call classical, from Steuart and Smith to John Stuart Mill, was pre-occupied by questions of value. Did prices reflect value or not? Were the claims of the owners of labour, capital and land of equal value or not? Then came what we now call the neo-classical economists, Walras, Jevons and Marshall and their marginal revolution. Questions of value no longer mattered. We could understand that which was significant by tracking change at the margin, because the whole was no longer in question. For late Victorian intellectuals, capitalism no longer needed justification.

Analogies are tricky things. They never line up properly, let alone stand to attention. Their purpose is to help us see something we thought we knew anew. Nonetheless, between technological progress and conceptual myopia, I suspect the latter might be most of use to us now. Or put another way, technological change only takes us so far, before we need to consider the system as a whole.

MAP's research infrastructure was designed without reference to the web. Instead, it used established technologies to achieve new ends. The technological challenge now facing MAP is complete. None of the databases engines, which is what allowed them to run without requiring additional software, will operate on a 64-bit computer. All of the Arc Explorer applications were rendered inoperative by a coding change to a Java release in the summer of 2014. In short, none of the tools to allow this empowering research infrastructure to run on your computer work any longer. One can still read the database and shape files and with sufficient expertise rebuild the layers, but the whole idea behind building such a research infrastructure in the first place was to democratise access. There was to be no longer a need for highly qualified personnel to intervene. You could ask your own questions on your own desktop.

This sounds a lot like my tale of technological change and in many ways it is. Although, a recent and quite fundamental change in the handling of data by the leading GIS programs suggest a more revealing set of relationships are at work.

MAP's research infrastructure used relational databases that were specific to each source. These databases frequently involved one to many relationships between databases, so a street address from schedule two of the census could be linked to numerous individual returns on schedule one. This relational capability minimized the size of databases and so ensured queries were handled as efficiently as possible. With changes in both broadband width and storage capacities, such efficiencies are no longer as necessary as they once were, but they were never the primary reason for MAP's reliance on relational databases. Numerous one to many relationships can be used to structure databases so that they mimic the structure of each period source. This serves an important pedagogical purpose. It helps users to learn to listen to

these diverse voices from the past in a manner consistent with the historical logic of each source.

Knowing, for example, that the address came from a different schedule than the one detailing an individual's age, gender, occupation, religion, race, ethnicity or birth place is important in understanding the purpose of the government's making of the census.[25] While our analysis might well reveal significant levels of segregation, this could not have been the government's intention, or they would not have had the location stored on a separate schedule; where, given the technology of their day, they could not have made the necessary linkages that our computers so readily do.

The leading commercial GIS software package no longer properly supports one to many relationships. ESRI's *ArcView* used to allow users to create both *links* for one to many and *joins* for one to one relationships, but ESRI dropped both in favour of a *relate* command that creates a flat file.[26] Being a much newer product, Q-GIS, the leading open-source package never did support one to many relationships. As the name suggests, flat files create uniform tabular data displays. Their structure can only mimic a spreadsheet, admittedly one with many repeating values and, as the number of databases *related* increases, an inordinate number of null values. This simple template reduces all historical sources to the same look and feel. No respect for the historical logic of diverse sources is possible.

In all fairness, this was never the intent, it is simply a form of collateral damage. The imposition of flat files ensures mobile devices can query distant databanks in standardized ways with the greatest possible speed and efficiency. What can be wrong with that? Well that's where my second analogy is I think useful.

The retreat to flat files does come at a cost. To answer complex questions users must now create numerous flat files. Fortunately, the speed of our computers means that this can be done relatively quickly. Furthermore, with the powerful analytics now at our disposal these various iterations can be made to reveal potentially significant new information. But the cost is not just a more complicated work flow. The historical dimension is perforce sacrificed, while the right to decide which questions to ask is increasingly restricted to highly qualified personnel or their employers. We are rapidly moving to an H-GIS environment where the only answers available to the general public are those that someone in the know has already asked and answered. Indeed, as my survey of H-GIS websites suggests, we may already be there.

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25 I borrow the idea that governments make, rather than take, a census from Bruce Curtis, *The Politics of Population: State Formation, Statistics and the Census of Canada, 1840-1875*. University of Toronto Press, 2001.
26. This is not quite the same thing as the old join command, because when you joined files that had a one to many relationship, only the first record matching the link was joined; with the relate command the number of "child" records linking to the "parent" record is respected, but the contents of the records themselves are disregarded. The fields of each of the child records are populated with the contents of the first "child" record that matches. As a result, any calculations made on these related records, other than a simple count, are invariably wrong.

We certainly have reached the point where the types of original research questions students in my fourth year course on industrialisation could routinely ask a decade ago, are simply beyond the capabilities of all but a select cadre of highly trained personnel. People can select known aspects of the system to be queried, but they cannot question the system as a whole.

There was a reason why astronomers were the odd people out in my story of technological change. Resolution matters to astronomers because they hope to find something completely new, worlds we have yet to encounter, things beyond our present imaginaries. The historical in H-GIS should stand for that same sense of wonder and exploration. We know so little of the past and there is so much we have to learn. But I fear we, as a community of privileged scholars, now share more of the complacency of those late-Victorian political economists than any us might care to admit.

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