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Rob Shields

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**Bergson's GIS:  
Experience, Time and Memory  
in Geographical Information  
Systems**

**ROB SHIELDS**

*University of Alberta, Canada*

*Media Theory*  
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**Abstract**

Geographical Information Systems (GIS) intended as digital forms of mapping struggle to represent time, change and temporality. The assumption of a static Cartesian, metric space of two or three dimensions only and defined by coordinates makes it difficult to create GIS and Historical GIS (HGIS) interfaces and representations that include the dynamics Bergson and later Deleuze describe. They argue that temporal memory is the basis of attention in encounters and perception of situations. This “affiliation” of the past enlivens the present perceptual life of experience. Video gaming and the combination of Google Earth and Street View are explored as limited alternatives that draw on embodied, kinaesthetic experiences of movement in space to open up or “uncurl” extra dimensions that allow more nuance in digital representations of spatiotemporal encounters, and the many modes and rhythms of duration found in the environment.

**Keywords**

Bergson, Geographical Information Systems, Google Earth, Spatio-temporal, Street View

**Introduction**

Geospatial media permeate a vast portion of those regions and places that humans are familiar with. Even inaccessible places are now easily surveyed by amateurs with drones to produce one representation or another of territory. Automatic weather equipment and webcams tweet or broadcast information about conditions not only

“locally” in an area but contribute images and weather data from multiple pinpoint sites. With fading batteries, lost mobile phones and keys with Bluetooth trackers listen for a digital summons to respond with their location and condition (and often a slew of data about orientation, acceleration, ambient temperature and so on that is bundled together in bursts of status information).

Geographical information systems (GIS) represent information in map formats. Broadly speaking, they respond to the problem of how to visualize geographical relationships that cannot be easily expressed in any other way than on a map. Unsurprisingly, the representation of time is not innate to this cartography. However, users have demanded that GIS represent both the spatial and temporal. I will argue that problems arise in the geospatial representation of time due to the construction of GIS on the basis of a Cartesian space that is metric, with two or three dimensions only, and defined according to coordinates. In relation to this coordinate system, the past can only be added as a narrative about a point, or implicitly represented through the changing location of a user or device. It can be understood by users' comparing two maps showing a changing situation over time or animating a digital map on screen to display this change. Alternately, an implicit trail of the coordinates of someone changing location traces a line on a map. This represents a geographical “before and after” but does not typically record any change to the user or device itself, just a trail of points. While location is innate, experience is a foreign concept to GIS. Thus, this technology poses a problem not only for temporal memory but also spatial duration in space.

To discuss memory in geospatial media, this article draws on Bergsonian and Deleuzian discussions of the virtual and fluid character of memory, supported by contemporary neuroscience that understands memories as “worked up” or actualized performatively by the brain in conjunction with the body and in coordination with environmental cues and affordances. Given the spatial and temporal simplification at the heart of GIS software, is it possible to talk about GIS, including historical and various multimedia approaches, as encoding memory?

Bergson provides a helpful orienting discussion for geographers and programmers: a classic description of becoming familiar with a strange city to the point that it

becomes taken for granted. In this example, attention is withdrawn from the surroundings. The environment becomes flattened and slips below the threshold of perception. The habitué no longer remembers the detail of their experiences learning landmarks and finding their way. But, at the same time, this experience or set of memories is the basis of habitual mobility. Memory is thus the unacknowledged continuation of attention. In a thick durational present, memory overlays or doubles present perception with images developed through attention. Sensation is compared with experience in a cyclical process of detail and fit (after Protevi, 2008).

At every street corner I hesitate, uncertain where I am going. I am in doubt. I mean by this that alternatives are offered to my body, that my movement as a whole is discontinuous, that there is nothing in one attitude which foretells and prepares future attitudes. Later, after prolonged sojourn in the town, I shall go about it mechanically, without having any distinct perception of the objects which I am passing. Now, between these two extremes, the one in which perception has not yet organized the definite movements which accompany it and the other in which these accompanying movements are organized to a degree which renders perception useless, there is an intermediate state in which the object is perceived, yet provokes movements which are connected, continuous and called up by one another (Bergson, 1988: 93).

## **Geographical Information Systems, Accuracy and Authority**

Amongst professionals and members of the public, GIS and maps have come to possess an objective and authoritative allure:

Ultimately, GIS privileges reductionism and disambiguation in its organization and analysis of knowledge, and the map has assumed a seemingly unassailable sense of spatiality, surety, and finality...Critics contend, however, that GIS privileges master narratives and categorical causation at the cost of contingent causation and

alternative interpretations and renderings of space and particularly place (Harris, 2017: 2-3).

For example, GIS is primarily channelled through spatial representations such as maps that poorly capture not only the passage of time but also the overlap of eras and sense of history in a city. There is a tendency to separate and disembodify spatial analytical geographies from the mixed methods approaches of social, cultural, and political geographies (Sui and DeLyser, 2011 cited in Harris, 2017). Geographical information systems (GIS) record spatial data only in the most reductive, Cartesian terms of latitude and longitude. Objects are represented firstly by their geographical location according to Euclidian geometry and Cartesian coordinates. In GIS programs, polygons, lines and nodes are treated as the actuality of spatial “data” rather than a type of information or representation that translates real-world data into the information and variables treated by the software.

This spatial information in turn references databases of descriptive information. For example, nodes are described as classes of object such as a type of street light, or a vertice of a property line, or a point along a fence. The attributes table for these objects is a linked set of characteristics dependent on this locational index. It is the coordinate structure that is the backbone that integrates GIS. While the spatial information can be tagged with qualitative detail, this “attributes table” is a database format akin to lists of information about a location or an area rather than any thick description of place. Even in its three-dimensional variants, GIS has been marked by a failure of ambition to go beyond conventional cartography with its traditional interest in topography and the placement of objects.

The focus has been on acquiring, categorizing and accurately plotting these nodes, including the distance and direction of lines between them and the topology of polygon areas. The net result is that GIS continues a Cartesian “grand narrative” about space and the spatialization of the environment. The assumption is that mapped objects are static and do not move in space. Their relationships define a relational space but that space has no qualities. Space has no character or agency: neither as a result of the presence of the objects, nor the relations between them, nor

as a result of objects that were at that location or in the area in the past (see Shields, 2013).

We might understand this through the challenge of Historical GIS (HGIS) that georeferences locations of events, objects and addresses in historical records. For example, an Ancient Places layer or digital overlay for Google Maps locates sites mentioned in historical texts.<sup>1</sup> The use of annual layers, or map overlays, that record changing annual mappings of the state of cities is another example (Thompson, 2011). Much HGIS is simply the geocoding of sites or objects mentioned in historical texts. One monumental example is the Harvard project on Chinese historical places, part of which has been actually carried out at Nanjing University of Technology.

HGIS tagging at its simplest marks “g was here” on a contemporary digital map, cross-referencing “g” in an attributes table to an entry that represents an object in a certain class of objects with latitude and longitude coordinates “x-y.” A more sophisticated example can be found in Aporta’s project to digitize Inuit trails in the Eastern Arctic in areas such as Baffin Island (2003; 2009). He describes mapping a trip taken by snowmobile:

The geographic information collected during the journey was integrated into a database that at present contains over 60 trails and 2,000 place names...This database allows the comparison, for example, of the trail we used in 2006 with the one followed by Hall in [the] 1860s, and the place names used in Iglulik today with the ones recorded by Parry and Lyon in the 1820s. Beyond the creation and use of the geographic database, the project involved several interview sessions where experienced travellers mapped all the routes and their variations connecting the two communities and recalled memories of their journeys. These interviews permitted the recreation of the experience of the journeys beyond the mere mapping of the route, both now and in the past (Aporta, 2009: 134).

However, it is difficult to capture the experiential nuance of a heritage area or the transition between areas, and even more difficult to appreciate them as contexts for action in the current data and representational modes of GIS. Harris argues that writers evoke a “world of emotions and place-based qualities [that] exceeds the representational dimensionality of a two-dimensional map” (Harris, 2017: 6), necessitating an expansion of strategies.

Stories and film are examples of competing representations of such contexts that resist reduction to material objects and aim at a “thick” description. A variety of hybrid methods, including digital media, have sought to weave, mash-up and fuse GIS mapping with other forms of representation (e.g. ArcGIS Story Maps; see also Caquard, 2011; Cope and Elwood, 2009). Sketch maps have been used as a participatory tool to develop qualitative GIS that embody the viewpoints and spatial narratives about areas and places that are held among subcultures, groups and individuals (Boschmann and Cubbon, 2013). However, as Dennis (2006) noted, the effective incorporation of a plurality of viewpoints collectivized as photographs, drawings and narratives remains elusive in GIS which has evolved as a technocratic tool for experts rather than communities or as a tool for stakeholder participation. Websites use maps to geo-catalogue photos,<sup>2</sup> video,<sup>3</sup> and audio field recordings<sup>4</sup> of everyday and threatened environments. While group mapping activities have potential for local collectives, they have not been engaged by GIS practitioners. Others respond that the question is “how,” not “whether,” this data can be integrated (Jones and Evans, 2011).

Walking with participants has attracted a good deal of attention as a means of accessing responses to specific locations and environments as these are passed through. Kusenbach (2003) refers to the practice of accompanying participants on their daily walks as “go-alongs,” although there are a number of different approaches to walking with participants utilizing greater or lesser degrees of freedom in the routes chosen (Carpiano, 2009; Hein et al., 2008; Hall et al., 2008). The action of walking with participants can give a variety of insights into their lives, such as Middleton’s (2009) examination of walkers’ understandings of time and Anderson’s (2004) walks with environmental protestors (Jones and Evans, 2011).

## **The Turbulence of Memory**

There is an irony about the difficulties with temporality that I argue are embedded in GIS: the stress on fixing objects and building up a digital map or environment according to their coordinates means that its focus on spatialization conceals but requires a preoccupation with endurance and thus with duration and resisting the passage of time. Objects in GIS, nodes, areas, have to “stay put” and this fixity must have practical meaning for the digital cartographer. In Bergsonian terms, GIS implicitly assumes that duration is permanent and only static. An inverse illustration of this irony is the complaint that an Open Street map of a downtown, created two years ago, is now out of date for new buildings have appeared, old structures have been demolished and street lanes have changed. The entire space has to be remapped because there is no specific pattern to these spatial and architectural changes. Time passes quickly even in an established central business district.

Drawing on Bergson and Deleuze, we might understand this as not just a line or thread (“filière”) but a “filiation” between past and present. In GIS, however, the software and its structure of coordinates and tables do not act as conduits of temporal transmission. One might imagine a user interface (UI) in which one clicks a point on a map and related historical information “pops up” or is displayed. Bergson and Deleuze understand the relation between the past and present in a manner that problematizes the treatment of history and memory in GIS. I will not present a detailed reading of their work but draw from philosophers such as Alia Al-Saji (2004), and from John Protevi’s reading of Bergson (2008). The focus is on GIS as a form of geospatial media in relation to memory.

Perhaps an obvious observation is that approaches such as the examples of HGIS presume a simple form of temporality that takes the form of homogenous, unidirectional (usually linear) progression. Time in general is a line between points that succeed each other. This linear spatialization of time fits well with the rectilinear coordinate system that is the foundation of georeferencing in GIS. It identifies reality primarily with presence. For GIS, this is a fixed and static snapshot. As if assuaging anxiety over change and dynamism of the world, GIS accommodates no temporality as such (i.e. as temporal change). There is also thus no diversity of temporalities or durations for the entities in GIS mapping. An historical event or a remembered



situation that seems “reconstituted by the new present” (Bergson, 1988: 58) is as if “trapped between two presents: the one which it *has been* [in the past] and the one [now] in relation to which *it is* past” (Deleuze, 1994: 80 italics added).

There can be no genuine constitution of the past qua past. The present, under different aspects and in different degrees of intensity, takes over the whole of time; the past is merely a present that has passed and the future is a present which is anticipated and prefigured in the now. However, this fails to account for the complex interrelations of past and present, since in this picture the present only has to do with itself. This flattens the heterogeneous relations of filiation that give rise to our experiences of temporalization and of remembrance and that make these experiences sometimes appear surprising, even aleatory. Time in the GIS “standard picture” forms a closed system where the new and the unpredictable are excluded – the future is the imminent prolongation of the present in action (Al-Saji, 2004: 205).

Bergson is, in a sense, a sympathetic critic. He sees perception as always a subtraction from the infinite potential of material and the dynamism of memory (cf. Bergson, 1988: 35 ff.). Yet for Deleuze and Bergson, time is not unidirectional from the past to the present but intermingled and entangled with it. Temporal duration “relies on a different ordering of past and present than that of succession, another kind of coexistence than the juxtaposition of now-points” (Al-Saji, 2004: 205). This would require a temporalizing of the space of GIS. To follow Deleuze, a relation of duration and transmission – an “affiliation” – is needed between the past and present as separate dimensions if GIS is to be temporal. The past bears on the present: we don’t act merely in the instant but in the light of experience. As we act in the present, this in turn bears on and changes the past. The linkage is a circuit and: whether the past and present are kept on distinct planes, or whether they blur so that we see the present as a repetition of a past experience, or the present as foreshadowing a future, they are ontologically entwined (Deleuze, 1988: 61; Bergson, 1988: 135). Memory is a working actualization. It is a process of temporal synthesis that inflects and constructs the present which otherwise exists only as a theoretical object: the punctual “instant” which is actually a mere interface between what will have been and what has already been (Bergson, 1988: 152-166). Thus “the present already

includes the past (in principle and not merely in fact); that presence implies memory and cannot be conceived without it” (Al-Saji, 2004: 208).

Your perception, however instantaneous, consists...in an incalculable multitude of remembered elements; in truth, every perception is already memory. Practically, we perceive only the past, the pure present being the invisible progress of the past gnawing into the future (Bergson, 1988: 150).

Again, present perception draws on experience. The present is an interval, an interface which “does not cease to pass.” By the time we have cognized it, the moment has gone, while the past is an independent presence in itself which “does not cease to be but through which all presents pass,” reverberating as experience (after Deleuze, 1988: 59). The past is not “an archive passively awaiting the present that will recover it...[but] the condition for the present’s fullness and succession... Memory...is a virtual and active reality that exceeds consciousness and presence” (Al-Saji, 2004: 299-30), or proximity. This implies that, for example, social interaction in the present is based on mutual attunement of affect and experiences rather than mere proximity that GIS would show (Al-Saji, 2004; Deleuze, 1988). For Bergson, memory is a remembering process at the end of which we get memory images. These are the product, not the origin (Bergson, 1988: Ch. 3).

## **Gaming the Past**

In part because of the limitations of GIS, and despite their different orientation (and the requirement of much higher computing and battery power), game designers have seen opportunities to apply their software platforms to the domain of geographic information and spatial data. Space is a central trope of any videogame (Aarseth, 1997; Lammes, 2008). These can be thought of as invoking an imagined “magic circle” or ritual space of play, or of the game which allows an “intensified place” of cultural expression (Huizinga, 1971). Alvaraz and Duarte argue that spatial design and placemaking could learn from videogames’ flexibility and multiple viewpoints, and from the element of participation that maintains a plurality of possibilities for players. Videogames allow rich diachronic environments rather than synchronic

space (Alvarez and Duarte, 2017). The virtual environments of computer games are designed with qualitative features foremost in mind. This contrasts with the quantitative orientation of GIS. The power of gaming platforms can be illustrated by historically based games. The best known is Ubisoft's *Assassin's Creed* which offers a fictional plot or pretext set against historically accurate cityscapes that have included Renaissance Florence, Medieval Jerusalem of the Third Crusade, Ottoman-conquest Constantinople and Egypt's Alexandria, roughly at the time of Ptolemy. One of the most historically attentive games is *Total War: Attila*. This videogame traces the changing climate and population pressures of Northern Europe and the Western Asian Steppe in a "living map" of change at the time of the fall of the Roman Empire (Hafer, 2017).

Lammes suggests that immersive virtual worlds be linked to everyday place and space of planning as "magic nodes" (2008: 264) like digital playgrounds that also tie in with many other domains:

A game can be perceived as a knot in a network or as a magic node. Some games are more concentrated as knots, holding stronger associations. When a game is such a stronghold, its associations are more durable and its extent wider. Other games may be conceived as weaker knots because they attract a smaller formation of associations. In addition, some games may have stronger boundaries than others, but boundaries are an outcome of a process and are not pre-given. How strong such produced boundaries are all depends on the strength of the formation and the way "representatives" are concerned with producing borders. Furthermore, the intensity of play depends very much on where the player is situated in this force field. At the center of the knot intensity increases, whereas at places where the ties become more loose or weak the player is less "lost in translation" (Lammes, 2008:264).

Bergson proposes that memory is not a matter of contemplation or reflection as much as it is a sensorimotor skill or capacity to draw on past experience to recognize sensation and process with the aim of directing this forward into the future. Rather

than fixed objects, recognition is part of the mastery of the flow of experience. This emphasis on the virtual or intangible rather than material quality of skill and of flow nicely fits the sensorimotor experience of immersive gaming environments. Some games demand the players master “the world” of the game using, making and transforming maps that, like the space of much GIS are two-dimensional diagrams. This interactive cartography, however, is “mutable instead of fixed, changing appearances and meaning according to where the player travels and what is being altered in environments (e.g., mining, founding trade posts or towns, expanding borders)” (Lammes, 2008: 266; see also Consalvo, 2005). This network is thus topological in that it is unstable but maintains the connectedness of the space and network of elements. Lammes argues:

Touring becomes entangled with cartography, and mapping is not a clearly delineated and ordered practice. Hence, dominant social categories are not reproduced but are translated into new spatial and hybridized connections...games differ from GPS applications in that they do not simply present us with an objectification of our personal spatial itineraries but forge...a stronger link with an application such as Google Earth, which also allows users to mix observant roles with subjective and personal experiences of space (Lammes, 2008: 266).

The reference to Google Earth is intriguing, for this is also a representation based on a Cartesian coordinate system. However, Google Earth is a web platform in which the relationship of the user’s point of view to the represented places is continuously variable. Rather than a map, Google Earth draws on satellite photographs of a spherical globe and is linked to Google Street View photographs of facades of buildings.

Google Earth combined with Street View allows one to zoom in from aerial heights to a viewpoint located within the fabric of the satellite photographs. Google has touted this as allowing users to “virtually walk the streets of a city, check out a restaurant before arriving, and even zoom in on bus stops and street signs to make travel plans” (cited in McQuire, 2016: 68; see also Graham, 2016). While Street View

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indexes the “city as data” (McQuire, 2016: 68), this animated shift in scale is also topological in that the third dimension provided by Street View is only added close to ground level, whereas the satellite photographs are two-dimensional. This transformation is the opposite of the reduction of three-dimensional volumes to two dimensions through cartographic projection. The opposite, adding dimensions, is properly “conjecture.” However, conjecture has a quality of “imagination” as the vertical dimension appears to extrude from the two-dimensional satellite photos. The animated detail of the third dimension is virtually present in the two-dimensional visual interface.

Syenko argues that Street View’s narrative thinness and encouragement of “the dull curiosity of a naive tourist” (2017: 147) creates a general erasure of the specificity of sites and can serve to obscure historical events, and the collectively experienced traumas associated with them, by ignoring anything but what the current environment bears witness to. At the same time, however, “by immersing in digitally mapped space, the user of the Street View images is pulled to reconsider some of the most basic assumptions” (Syenko 2017: 148) around maps and the ways sense is made of them.

The metaphor of navigation, in other words, is “replacing the conventional correspondence theory [which is] based on the illusory idea that maps should resemble as much as possible the territory and the phenomena mapped” (Caquard, 2011)...because Google’s cache of Street View images calibrates the recorded spatial environment with navigational tools, another set of questions must be addressed regarding the materiality of the digital image and the limited spatial experience that it allows (Syenko, 2017: 149).

Rather than map-reading, kinaesthetic and experiential methods are adopted to relate the user to the environment depicted in the Street View UI. The effect is thus often described as magical, or virtually magical. The topological transformation means that the spatial fabric of Google Earth together with Street View is mutable from two up to three dimensions. Users are challenged to attune their understanding of how to interact with and in the changing representation. It mimics in important ways the

everyday experience of space which varies between close-up contact with surfaces and the flatter distance perception of more distant objects. Cognitively, our spatial focus constantly shifts between dimensionalities in a topological transformation that is not merely a shift in scale or variation in distance.

The animated zooming effect is similar to flying, and less like the zooming-in and out effect of enlarging an area of a digital map. Street View deliberately exaggerates “swooping” trajectories which suggest a curving arc toward the area of interest, rather than a direct, linear zoom as might be experienced when looking through a zoom lens. The result is to evoke a virtual kinaesthetic reference to the motion of a body swinging or falling in an arc that might be experienced in a circus midway or on a playground swing. The body is the centre and site of this experience of pure spatial memory. This draws and builds on an intuited memory of experiences of spatial embodiment and mobility. With the erosion of the critically reflective position of the reader in favour of the kinaesthesia of a virtually mobile user there is, however, also reason to be suspicious of immersive maps:

The panoramic cosmology of Google Street View calls for a further reassessment of the intended visitor, or “subject,” of the digital spatial environment. By developing Kenderline’s (2007) observation that panoramic spaces enclose visitors in a total experience without any particular narrative support...further questions should also be raised about the way in which Street View panoramas uniquely participate in atomizing that experience (Synenko, 2017: 149).

Mobility is significant in that it encodes duration as “continuous variation” (Deleuze, 1988) rather than fixity. Mobility is the connecting thread against atomizing experience. But the thread traced is post-representational and not necessarily mimetic of an actual temporal trajectory or historical itinerary. Yet, it offers the promise of not only encoding the transformation in spatial dimensions, but also a temporality for what is represented – but this need not be an actually real or historical truth. This needs to be seen as a new form of narrativity and representation, an abstraction not a virtual-but-real temporality. The third dimension must always have been present in

the diagram in order to be discovered upon swooping in. That is, it is similar to the notion of time as a dimension. Also, if one can move through animation, so animated variation offers some possibility of representing the pace of change over time.

There is a fractal quality to the multiplication of dimensions from two to three and perhaps further. It yields a “thick” present rather than the sparse “thinness” of GIS’s diagrammatic maps. Interfaces such as Street View transmit a temporality based on user experience within the map-cum-immersive environment. This may easily become solipsistic and trivialize historical memory around actual sites. The challenge for digital media such as GIS and games is to support memory as a process rather than another fixed object to be geolocated, pinned down with latitude and longitude coordinates. This requires incorporating the plurality of rhythms of experience and duration.

## **Conclusion**

Much more can be said on the user as an embodied, cultural subject equipped with their own breadth experience that can be brought to bear in producing meaning in these interfaces. This paper has not considered debates about the precarious and easily hijacked linkage between maps and historical memory. It has sketched a Bergsonian and Deleuzian critique of the representation of temporality and memory in geographical information systems. While it allows a synoptic view of the spatial, too much is expected of GIS. They are structurally dependent on geolocation by coordinates and an emphasis on fixing the features of the environment abstractly by nodes, vertices, lines and polygons. While duration as durable presence is presumed by the focus on static locations in GIS, this temporality is unrecognized. The flow of time and the rhythm of other temporalities is only awkwardly incorporated in tagging locations on the spatial maps of GIS interfaces. However, the animated swooping effect of games and Google Earth in combination with Street View elicits bodily attention that layers the sparseness of the digital representations with an experience of virtual kinaesthesia. The uncurling of an additional third dimension to the two-dimensional map or satellite image as one zooms in and passes from Google Earth’s satellite photography to topography and the elevations of Street View suggest some promise. This might incorporate temporal rhythms according to a similar conceit of

adding additional detail, conceived as dimensions, that show the experience of time, the persistence of memory and the duration of the environment.

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## Notes

<sup>1</sup> <http://gap.alexandriaarchive.org/gapvis/index.html>

<sup>2</sup> <http://www.geoimgr.com>

<sup>3</sup> <http://kinomap.com>

<sup>4</sup> [www.aporee.org/maps/](http://www.aporee.org/maps/); <http://www.sesol.org>

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**Rob Shields'** work spans architecture, planning and urban sociology. He is an award-winning author and co-editor of numerous books on space, place and community. He founded *Space and Culture* journal and *Curb Magazine*. His most recent book is *Spatial Questions: Cultural Topologies and Social Spatialisation*. He holds the University of Alberta *Henry Marshall Tory Research Chair* and directs the City Region Studies Centre. See [www.ualberta.ca/~rshields](http://www.ualberta.ca/~rshields)

**Email:** [rshields@ualberta.ca](mailto:rshields@ualberta.ca)