Geographical technologies and the interdisciplinary study of peoples and cultures of the past [1]

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Introducing Geographical Information Systems (GIS)

Geographical Information Systems (GIS) – computer systems which combine database functionality with information about location – have existed for several decades. These systems were initially employed to enable quantitative data to be located, mapped and spatially analysed, with much of the early scholarly work being driven by the quantitative requirement of environmental scientists. Typically, traditional forms of GIS software were both expensive and relatively difficult to use. More recently, however, other related geographical technologies – such as Google Maps and Google Earth, both of which are not strictly full GIS software packages but clearly allow users to visualise and explore geographical data – have become widely accessible and, by extension, have democratised digital map-making practices. This proliferation of geographical technologies has unfolded, of course, alongside the growth of digital archives and libraries. A core question, then, is how scholars, working across and between multiple disciplines, can harness the functions of extant and emerging geographical technologies to facilitate the spatial understanding of digitised material. In this paper, we sketch out the potential for using geographical technologies as innovative research tools within the arts and humanities with especial emphases on the history and literature of the Victorian period. This introduction stresses methodology and this is inevitable at this stage of the development of the field. It is, however, important to remember that the full research potential of GIS will only be substantiated through the articulation of significant scholarly findings and outputs.

The field of *historical GIS* began to emerge around the year 2000.[2] Given the quantitative

foundations of GIS technology, it is perhaps unsurprising that the initial developments in this

field were primarily predicated upon the mapping and spatial analysis of quantitative sources

using social science approaches. Even at this nascent stage, however, it was clear that

geographical technologies opened up research strategies which could be applied to a

heterogeneous range of sources in a wide range of fields of historical research: from urban

history[3] to environmental history[4]; from historical demography[5] to transport history.[6] Much

of this early work in historical GIS reflected on the mappability of data and celebrated the

potentiality of the available technologies;[7] and significant resources were directed towards

the creation of datasets – for example, various national historical GIS projects - that would

provide platforms for further research.[8] Over the course of the 2000s, though, historical GIS

evolved and matured. By the latter part of the decade, and in the early years of the 2010s, the

emphasis shifted to applied research which focused on using geographical technologies to

facilitate contributions to knowledge within different, sometimes intersecting, fields of

quantitative history. This new research was increasingly labelled *spatial history* rather than

historical GIS: an evolution in terminology which foregrounded a conscious shift in emphasis

away from the technological.[9]

If geographical technologies were exclusively applied to quantitative history, however, then,

patently, their potentiality would remain intellectually circumscribed. Although historical

GIS has been dominated by the spatialisation of quantitative information, there were also

early attempts to apply its methodologies to less data-rich sources.[10] Over recent years, there

has been a growing realisation of the potential to use geographical technologies to map out

qualitative historical material and, by extension, the qualitative 'data' which preoccupies

researchers across the arts and humanities. Perhaps the most forceful advocacy of this research has been articulated by David Bodenhamer, John Corrigan and Trevor Harris who have collectively called for the development of the *spatial humanities*. Their shared aim is to "revitalize and redefine scholarship by (re)introducing geographic concepts of space to the humanities"[11]; and, as a result, their work can be seen to feed off, and back into, the widespread spatial turn across the arts and humanities.[12] Crucially, however, their vision of the spatial humanities is inextricably linked to GIS: they call for greater application of geographical technologies across the disciplines; and, simultaneously, they argue that GIS technology itself requires significant redevelopment and refinement in order to maximise its scholarly potential. A key concern which underpins the spatial humanities, therefore, is how geographical technologies can be used to manage, manipulate, visualise and analyse the geographies embedded within texts. By extension, the spatial humanities are concerned with the ways in which such technologies can allow us to explore the geographies within the large corpora which are increasingly prevalent in the digital age.

The spatial humanities, then, is underpinned by both methodological and intellectual lines of enquiry. In one sense, the field necessarily involves engaging with the challenge of developing computational techniques appropriate for handling the geographies represented in large-scale corpora. Alongside this, the spatial humanities involves a negotiation of the capacity of computers to summarise and present large volumes of material with the individual researcher's humanistic impulses to interpret and to inflect, to analyse and to argue. The spatial humanities, therefore, is alert to the ways in which digital technologies are opening up new scales of scholarly engagement and understanding which, in turn, allow the researcher to oscillate between the macro and the micro. How, then, might this willingness to interweave the qualitative and the quantitative, the macro and the micro, work in practice? How might

the emphasis on location, which is integral to the functionality of GIS, be used to present a palimpsestic vision of particular places which draws upon a diverse range of – often seemingly incompatible – resources?

Geographical Technologies and Historical Geographies

The Victorian era saw the start of mortality decline particularly among infants and children. The infant mortality rate for England and Wales fell from 153 deaths per 1,000 births in the 1850s to 128 per 1,000 in the 1900s.[13] From here deaths continued to fall throughout the twentieth-century to reach less than 5 per 1,000 in 2001.[14] The conventional explanation for this, which originated with the Victorians themselves, is that the decline was brought about by a series of major public health reforms including, for instance, sanitary improvements in urban areas and enhanced access to healthcare for mothers. This orthodoxy was, however, largely formed by examining national statistics or the experiences of those in the major conurbations, particularly London.[15] While there have been some attempts to reconfigure this model of understanding, the complexities of the data have meant that revisionist analyses have been almost invariably based on limited data sets: the highly aggregate data of individual counties which typically consist of both large urban centres and sparsely populated rural areas and, which, as a result, resist nuanced spatial interpretation;[16] or samples of registration districts which are difficult to contextualise.[17]

The use of GIS, however, allowed data for all 630 of the registration districts in England and Wales to be geo-referenced and mapped; and then, data from each decade from the 1850s to the 1900s to be located and explored. The geographical technology, therefore, facilitated the analysis of shifting infant mortality rates in each district over the second half of the nineteenth-century. This showed that, in rural areas in the south and east of England, infant

mortality rates had started to fall well before the Public Health Acts of the 1870s and 1880s; while rural areas in the north, the west and Wales failed to show much improvement over this period. Perhaps unsurprisingly, major urban areas generally followed the national aggregate; but, crucially, there were major variations within this. Ultimately, then, the use of geographical technologies served to undermine the orthodoxy which attributes the public health movement as the catalyst for infant mortality decline. What is more, it also problematises the dominant narrative – based upon the national aggregate statistics – to suggest that the comprehension of Victorian infant mortality rates requires an engagement with the geographies of health in at least three distinct zones – the major urban centres; the rural south and east; and the rural north and west – each of which contains, within its borders, additional complexities and further variations.[18]

Through the location and integration of a fairly large database of mortality statistics, then, the GIS allowed the study to explore what happened, where and when. This, in turn, enabled the study to destabilise the existing orthodoxy of the reasons undergirding the decline of infant mortality. What this study was not able to achieve, however, was to advance a convincing explanation as to why these trends occurred. This is not a limitation of the GIS technology, but a limitation of the source data which simply consisted of raw numbers of infant deaths, births, plus a few additional statistics in fields such population density. This original data is an extremely valuable source in that it provides information on almost every birth and infant death over a sixty years period and locates those life events in both time and space. The raw data, however, is so abstracted from the material conditions in which the babies were born – and often died – that it is unable to open up possible explanations as to the causes of infant deaths and the reasons for geographical variations in mortality rates. It is not an invalid criticism, therefore, to suggest that this methodological approach is purely descriptive rather

than analytical. The counter-argument, though, is that the ability to describe can be profoundly useful and, in fact, provides a foundation for further scholarly reflection. In this particular instance, orthodoxy was challenged through the geographical visualisation of statistics. Digital maps, then, many not provide answers in themselves; but, as this particular example illustrates, they can serve to open up salient research questions.

So how can we go on to formulate an explanation? Quantitative approaches based on 'explanatory' variables will not work as there are few, if any, such variables available in consistent form over the period; and, even information on such variables is present, the explanation can be critiqued for being data-led and for marginalising key issues – such as breast feeding or access to safe cows' milk – for which there will be no useful data. Yet, rich sources of information on social conditions during the second half of the nineteenth-century are available from a disparate range of textual sources including the notes accompanying the Registrar General's reports and newspapers; and, significantly, such texts are becoming increasingly accessible in digital form. Although, traditionally, such material has not been read into a GIS, the process of marrying text and map is becoming relatively straightforward. Natural Language Processing (NLP) techniques allow for the identification of proper nouns – including place-names – within texts. These place-names can then be matched to a digital gazetteer in order to provide – wherever possible – accurate geographical co-ordinates for the cited location. Beyond this straightforward mapping of toponymy, it is possible to draw upon research strategies used in corpus linguistics to search for key words that occur in close textual proximity to place-name references.[19] This approach thereby builds upon the quantitative to facilitate qualitative analysis of how particular places were described in large bodies of historical texts.

Geographical Technologies and Literary Geographies

So far, we have concentrated on the problems and possibilities associated with the use of geographical technologies to map out historical information and texts; but, in the next section of this paper, we want to redirect the focus onto the potentiality and limitations of the use of GIS in literary studies. If the study of the literature of space, place and landscape is to be regarded as a cardinal sub-strand of the emerging field of spatial humanities, then how can GIS be embedded in new ways of practising critical literary geography?[20] In his seminal work of literary cartography, *Atlas of the European Novel 1800-1900*, Franco Moretti famously offers spatial readings of nineteenth-century fiction by plotting his own maps of canonical texts: reader-generated maps which seek to 'dissect the text in an unusual way, bringing to light the relations that would otherwise remain hidden'.[21] Since the publication of his influential *Atlas*, much of Moretti's critical energies have been focused on the articulation of his (not uncontroversial) practice of 'distant reading': a speculative attempt at rewriting literary history which unapologetically eschews detailed textual engagement and 'in which the reality of the text undergoes a process of deliberate reduction and abstraction' in order to reveal large-scale '[s]hapes, relations, structures. Forms. Models.'[22] Moretti calls for nothing less than a new form of critical practice which, in turn, converges with the ongoing digitisation of large-scale corpora. In other words, instantaneous access to scores of digital texts can – and perhaps should – be recalibrating the ways in which literary criticism is performed. As N. Katherine Hayles puts it, 'reading, interpretation and theorizing are still part of the picture', in Moretti's new vision, but they happen not through a direct encounter with a text but rather as a synthetic activity that takes as its raw material the "readings" of others.'[23]

There are clear correspondences between Moretti's iconoclastic model of 'distant reading' and the type of large-scale spatial visualisations which have been produced through the ways in which GIS has been used in historical research; and this commitment to macro-mapping has similarly informed the practices of some literary critics who have been turning to geographical technologies to reveal patterns and structures in literary history. Unsurprisingly, these methodologies are underpinning work – particularly 'A Geography of Nineteenth-Century English and American Fiction' - being carried out at Stanford's Literary Lab: an innovative research centre which is dedicated to the exploration of digital and quantitative methods and directed by Moretti.[24]

The methodological move towards 'distant reading' also underpins – at least in part – our ongoing work on the 'Spatial Humanities: Texts, GIS, Places' project based at Lancaster University. A major strand of this interdisciplinary project involves the digitisation and geo-referencing of a large corpus of Lake District landscape writings published between 1750 and 1900. One of the principal objectives of this digital literary mapping is to chart the shifting geographies of textual representations of the Lakes between the emergence of proto-Picturesque responses in the middle of the eighteenth-century and the post-Romantic touristic retracings of the 1890s. In purely quantitative terms, which locations appear most frequently within the corpus? Conversely, which towns, villages and valleys are marginalised on this multi-layered literary GIS? Do these processes of textual privileging and peripheralisation change over time? By extension, then, the creation of these surface, large-scale digital cartographies can either reinforce or reconfigure critical orthodoxies, to return to a term used in the previous discussion of historical GIS. Did touristic writers of the 1860s, for instance, uniformly gravitate – as might be expected – towards sites of Wordsworthian interest and association following the Poet Laureate's death in 1850? Or did writers defy convention by

visiting, and representing, Lake District locations which did not figure prominently within the Romantic writer's life or *oeuvre*? As in historical studies, the large-scale literary GIS might offer nothing more than a geo-visualisation; but, to apply Moretti's maxim which has informed all of our interdisciplinary work on digital literary cartography, the mapping of the literary text 'is not the conclusion of geographical work; it's the beginning. After which begins in fact the most challenging part of the whole enterprise: one looks at the map*, and thinks*'.[25]

The type of macro-mapping championed by Moretti is clearly not the only way of practising digital literary cartography, however, and a number of researchers are presently working on interdisciplinary projects which use geographical technologies to facilitate qualitative approaches to the literature of space, place and landscape: methodologies which are frequently predicated on the good, old-fashioned business of close reading.[26] In seeking to spatialise the detailed particularities of individual texts, such researchers are demonstrably involved in a deep literary mapping which is alert to, amongst other things, the dialectical ways in which outsiders and insiders articulate their respective experiences of named places. Moreover, such work implicitly draws attention to the representational textures and nuances which are necessarily lost in Moretti's exploratory desire to map overarching spatial patterns and forms: a preoccupation which also feeds into the 'Spatial Humanities: Texts, GIS, Places' project. The manual and microscopic mapping of an individual geo-specific poem by Wordsworth, for instance, serves to underline the textual detail which is sacrificed by a macro-mapping approach reliant on the identification of real-world place-names. What happens to the use of fictional place-names which are not listed in the digital gazetteer? What happens to textual references to locatable geographical sites – villages, fells, lakes and so on – which are not explicitly named within the literary text?

The textual representation of space, place and landscape is much more 'slippery', to apply a term used by Sally Bushell in a recent article on critical literary cartography, than the quantitative, large-scale approaches would allow; and, as a result, the digital literary map-maker needs to explore methodologies which endeavour to encapsulate this nebulous fluidity.[27] Ultimately, then, the 'Spatial Humanities: Texts, GIS, Places' project is moving towards a mode of digital literary cartography which seeks to explore the tensions between quantitative and qualitative approaches to texts by oscillating freely between different scales of macro- and micro-mapping and between a suite of geo-visualisation strategies.

Conclusions

The preparation of this paper has been informed by two interconnected ambitions: to offer a partial survey of the dynamic ways in which the use of GIS technology has influenced historical geographies; and to suggest some of the major possibilities and problems associated with the use of GIS in literary geography. To return to an issue articulated in the introduction to this paper, however, this initial, methodological work clearly needs to be substantiated with significant scholarly findings: these will undoubtedly emerge particularly from projects that are prepared to use collaborative and interdisciplinary approaches. These in turn will help to situate the practices and thinking facilitated by geographical technology within wider theoretical frameworks and critical debates.'

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[2] For reviews of the field see Ian N. Gregory and Paul S. Ell, *Historical GIS: Technologies, Methodologies and Scholarship* (Cambridge: Cambridge University Press, 2007); or Ian N. Gregory and Richard G. Healey, 'Historical GIS: Structuring, mapping and analysing geographies of the past', *Progress in Human Geography*, 31 (2007), pp. 838-653. For examples of work in the field see the essays in: Anne K. Knowles, ed., *Placing History: How GIS is Changing Historical Scholarship* (Redlands, CA: ESRI Press, 2007); or in a special edition of *Social Science Computer Review*, 27:3 (2009) ed. by Timothy J. Bailey and James B.M. Schick.

[3] See the essays in a special edition of *Social Science History*, 35:4 (2011) on 'Historical GIS and the study of urban history' ed. by Don A. DeBats and Ian N. Gregory; and Colin Gordon, *Mapping Decline: St. Louis and the fate of the American City* (University of Pennsylvania Press: Philadelphia, 2008).

[4] See, for example, Geoff Cunfer, *On the Great Plains: Agriculture and Environment* (College Station, TX: Texas A&M Press, 2005); and Brian Donahue, *The Great Meadow: Farmers and the Land in Colonial Concord* (New Haven, CT: University of Yale Press, 2004).

[5] See, for example: S. Orford, D. Dorling, R. Mitchell, M. Shaw and G. Davey Smith (2002) 'Life and death of the people of London: A historical GIS of Charles Booth's inquiry', *Health and Place*, 8 (2002), pp. 25-35.

[6] See the essays in a special edition of the *Journal of Interdisciplinary History*, 41:1 (2011) on 'Railways, population and Geographical Information Systems', ed. by Jordi Marti-Henneberg; and in a special section of *Social Science History*, 34:2 (2010) on 'Railways and political economy in Britain, France and the United States, 1840-1950.'

[7] See, for example, the essays in Anne K. Knowles, ed., *Past Time, Past Place: GIS for History*, (Redlands, CA: ESRI Press, 2002) or the special edition of *Social Science History*, 24:3 (2000) on 'Historical GIS: The spatial turn in Social Science History' ed. by Anne K. Knowles and compare these compare with later works cited in the footnote above.

[8] Anne Kelly Knowles, ed., 'Reports on National Historical GIS Projects', *Historical Geography*, 33 (2005), pp. 134-158.

[9] Richard White, 'What is Spatial History?' *The Spatial History Project* (2010) <http://www.stanford.edu/group/spatialhistory/cgi-bin/site/pub.php?id=29> [accessed 25 February 2013].

[10] See, for instance, B.M.S. Campbell, *English Seigniorial Agriculture 1250-1450* (Cambridge: Cambridge University Press, 2000) and Philip C. Brown, 'Corporate land tenure in nineteenth century Japan: A GIS assessment', *Historical Geography*, 33 (2005), pp.99-117.

[11] David J. Bodenhamer, John Corrigan and Trevor M. Harris, 'Introduction', *The Spatial Humanities: GIS and the Future of Humanities,* ed. by David J. Bodenhamer, John Corrigan and Trevor M. Harris (Bloomington, IN: Indiana University Press, 2010), p. vii

[12] For more on the rapprochement of geography and the humanities see, in particular, Michael Dear, Jim Ketchum, Sarah Luria and Douglas Richardson, eds., *GeoHumanities: Art, History, Text at the Edge of Place* (London: Routledge, 2011); and Stephen Daniels, Dydia DeLyser, J. Nicholas Entrikin and Douglas Richardson, eds., *Envisioning Landscapes, Making Worlds: Geography and the Humanities* (London: Routledge, 2011).

[13] Registrar General's Decennial Supplements.

[14] Ian N. Gregory, 'Comparisons between the geographies of mortality and deprivation from the 1900s to 2001: Spatial analysis of census and mortality statistics', *British Medical Journal,* 339: b3454 (2009), pp. 676-679.

[15] Robert I. Woods, 'Infant mortality in Britain: A survey of current knowledge on historical trends and variations', *Infant and Child Mortality in the Past*, ed. by Alain Bideau, Bertrand Desjardins and Hector P. Brignoli (Oxford: Clarendon Press, 1997), pp. 74-88.

[16] Clive H. Lee, 'Regional inequalities in infant mortality in Britain, 1861-1971: Patterns and hypotheses', *Population Studies,* 45 (1991), pp. 55-65.

[17] Naomi Williams and Chris Galley, 'Urban-rural differentials in infant mortality in Victorian England', *Population Studies,* 49 (1995), pp. 401-420.

[18] Ian N. Gregory, 'Different places, different stories: Infant mortality decline in England & Wales, 1851-1911', *Annals of the Association of American Geographers*, 98 (2008), pp. 773-794.

[19] Ian N. Gregory and Andrew Hardie, 'Visual GISting: Bringing together corpus linguistics and Geographical Information Systems', *Literary and Linguistic Computing*, 26 (2009), pp. 297-314.

[20] See, for instance, Andrew Thacker, 'The idea of a critical literary geography', *New Formations*, 57 (2005/6), pp. 56-73.

[21] Franco Moretti, *Atlas of the European Novel 1800-1900* (London: Verso, 1998), p. 3.

[22] Franco Moretti, *Graphs, Maps, Trees: Abstract Models for Literary History* (London: Verso, 2005), p. 1. For a useful introduction to Moretti's work, see Rachel Serlen, 'The Distant Future? Reading Franco Moretti', *Literature Compass*, 7 (2010), pp. 214-25.

[23] N. Katherine Hayles, *How We Think: Digital Media and Contemporary Technogenesis* (Chicago: University of Chicago Press, 2012), p. 28.

[24] Stanford Literary Lab: <http://litlab.stanford.edu/?page_id=13> [date accessed 1 March 2013].

[25] Moretti, *Atlas of the European Novel*, p. 7.

[26] See, for example, 'A Literary Atlas of Europe': <http://www.literaturatlas.eu/?lang=en> [date accessed 1 March 2013); and 'Digital Literary Atlas of Ireland, 1922-1949': <http://www.tcd.ie/trinitylongroomhub/digital-atlas/> [date accessed 1 March 2013].

[27] Sally Bushell, 'The Slipperiness of Literary Maps: Critical Cartography and Literary Cartography', *Cartographica*, 47 (2012), pp. 149-60. For more on the need for a fluid digital literary cartography, see Damian Walford Davies, *Cartographies of Culture: New Geographies of Welsh Writing in English* (Cardiff: University of Wales Press, 2012).