

# EarthTextSpaceTime: making historical sources in cities available through the agency of GIS

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## Abstract

We are all constrained by our location on the planet, as has also been the past. The capacity to place historical information accurately within a geographical framework can open sources of information which may previously have been obscured. This is particularly so in the most intensive land use areas – cities. Whilst geography may not consciously influence analysis, the use of GIS to collate, analyze and investigate historical material, creates new possibilities for understanding the agency of the environment with our cities. As tool and technique combined, GIS provides tools to read the landscape differently and to map against the landscape information from other sources, not traditionally thought of as spatial. A finely-grained investigation of cities, can subsequently, become the driver for a better understanding of human agency in the creation of our urban environment and reveal the connection between place, source, space and history. Such understandings, in turn, become the catalyst for a reassessment and refreshment of the urban environment through the rediscovery of its unique characteristics.

*Key words:* cities, urban, GIS, history

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## 1 INTRODUCTION

This paper is the outcome of a presentation given in the "ECAI: e-Resources – Space, Time and Text" stream of the CAA 2009 "Making History Interactive" Conference at Williamsburg, Virginia on Tuesday 24 March 2009. As such, it does not exactly mimic the presentation – rather it explores some of the underlying concepts upon which the presentation rested. The title of the paper refers both to the sources that are made available and to the impact of place, source, spatial attributes and history in our analysis of those sources. It also touches on similarities between Perth, Western Australia and the host town of the conference, Williamsburg Virginia.

Derrida wrote 'We are acting as if the difference between space and time were given as an obvious

and constituted difference'<sup>1</sup> and, he goes on to argue, both space and time are constructed paradigms rooted in language and assumed to have a congruency of meaning in their use. As he identified, these concepts mean different things to different users – and historians are no exception. For the purposes of this paper, a small investigation of the concepts will realize how differently they are treated depending on the professional base from which one operates. This can cause some confusion but also, I believe, opportunities to revisit sources in the light of a new interdisciplinary understanding of what concepts may mean to others.

The paper is structured to explore to give an overview of concepts of earth, text, space and time in relation to cities from the point of view of an

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<sup>1</sup> Jacques Derrida. *Margins of Philosophy* [1982] Translated from the French by Bass, Alan. Chicago: University of Chicago Press, 1982, 55.

historian. For the purposes of this paper we will adopt Earth = Place; Text = Source; Space = Spatial Qualities; and, Time = History.<sup>2</sup>

## 2 EARTH = PLACE

We are all constrained by our location on the planet, as has also been the past. In 1938 Gordon East wrote: 'Since every historical event occurs both in space as well as in time, history cannot, except in its more specialized branches, be disassociated from country or place'.<sup>3</sup> He saw geography as both place and text and argued that the geographical location of an event was equally important as the underlying political, economic, social, cultural and military events that had caused it and – that in some instances – geography was causation.<sup>4</sup> Once spatial characteristics are identified, this seems self evident but spatiality as a concept in its own right is comparatively new in historical research – the field of spatial history developed in the late 1980s – notably in the work of Paul Carter.<sup>5</sup>

My interest lies in cities, the influence of the environment on the establishment of a city and how a city is formed and reshaped to meet changing needs over time. As such, geographically based sources are important in understanding, in the first instance, which physical factors influenced growth and development and, second, what contemporaneous sources reveal about the response to those factors.

<sup>2</sup> John Maynard Smith, "The Origin of Altruism," *Nature* 393 (1998): 639.

<sup>3</sup> W. Gordon East, *The Geography Behind History* (London: Nelson, 1938; reprint, 1965), 4.

<sup>4</sup> Writing in 1938, *lebensraum* could not have been excluded from assisting to form this philosophy.

<sup>5</sup> Paul Carter, *The Lie of the Land* (London and Boston: Faber and Faber, 1996); Paul Carter, *The Road to Botany Bay. An Essay in Spatial History* (London: Faber and Faber, 1987). The academic field of spatial history investigates the relationships between people and space, the use of space and the influence of the perceptions of space in history. It differs from historical GIS in that it operates without geographically coding its spatial relationships.

## 3 TEXT = SOURCE

Cities are, by their nature, the most compressed form of development on the globe. In 1900, only two cities (London and Beijing) had populations over one million in population; by 2005, 450 cities contained that number with twenty cities containing populations exceeding ten million.<sup>6</sup> As centers of wealth, commerce, trade and social and cultural interaction they are rich sources of data but potentially overwhelming in their complexity.

Cities are not necessarily thought of as spatial by historians who traditionally concentrate on the social, cultural, political and economic facets of their development; however, they are defined in time, in space and are territorially particular. As such they can be read as a 'text' articulating a set of spatial values through their form (plan), shape (subsequent growth), governance (structure) and sense of identity (*genius loci*). In essence, a city becomes the substantive text of the values of the society that creates and inhabits it. It carries within its structures messages about hierarchy, power, morality and conformity even if they are couched in antithetical protest.

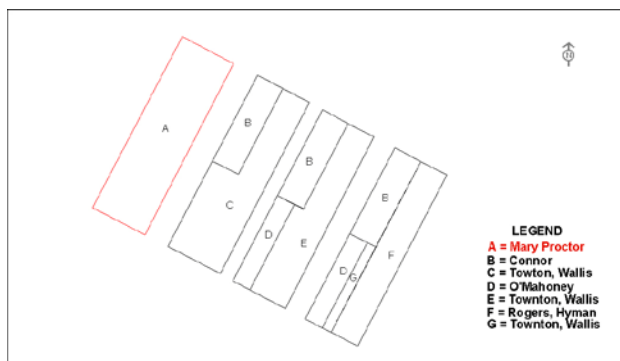
The capacity to place historical information accurately within a geographical framework can open sources of information which may previously have been obscured. This is particularly so in the most intensive land use areas – cities.

As GIS allows sources to be bound together by their one immutable common denominator – that of their geo-spatial specificity, it creates, effectively, a giant electronic 'paperclip' whereby diverse sources can be collocated and used for integrated research. Whilst this is a crude analogy, this capacity to collocate information from diverse sources – which I term "geo-clip" – overcomes a key problem when dealing with multitudinous sources over time which may be obscure in their spatial identity. This is a major

<sup>6</sup> Ricky Burdett and Deyan Sudjic, eds., *The Endless City. The Urban Age Project*, London School of Economics and Alfred Herrhausen Society (Deutsche Bank) (London: Phaidon 2008), 58, 60.

benefit for historical research because, whereas previously the corporeal nature of source materials limited what a researcher could physically access, digitization of records with the increased use of computing and the ease of transfer of information, has dramatically altered the availability of source materials. The capacity to link together sources from different periods through their geo-spatial specificity means that diverse sources can be collocated, pending further information.<sup>7</sup> Serving as a sophisticated placeholder for future research, sources can be explored *in situ*, which reduces research time. With the complexity of data associated with cities, the capacity to ‘drill down’ to increasingly particular data sets on a lot by lot basis adds considerable richness to research.

The layering capacity in GIS can visually render the type of complex land transactions that can occur rapidly in a city. For example, in a scant sixteen year period, 1871 to 1887, in a period before the hyper-development of the gold boom, town lot N35 in Perth underwent successive land subdivisions and sales (Figure 1).



**Figure 1.** The subdivision of town lot N35 over time (from left to right) showing the layers with individual land parcels. Shown here separated, the parcels sit one upon the other in the GIS.<sup>8</sup>

<sup>7</sup> Felicity Morel-EdnieBrown, "Layered Landscape: The Swamps of Colonial Northbridge," *Social Science Computer Review* 27, no. 3 (2009), 25 of 31. This is, of course, not limited to cities or town lots but this is my focus in this paper.

<sup>8</sup> Felicity Morel-EdnieBrown. *Town Lot N35 over Time*. map, 1 inch: 1.5 chains, Perth: writer's collection SW-224, 2005.

The amount and rapidity of sub-division shows that land parcels were far from static and prior to the discovery of gold after which land values rapidly rose and subdivisions became *de rigueur*. By using the device of putting the subdivisions on different layers according to their year, there became visible finely grained changes in the urban fabric. Previously, it had been thought that land transactions in the area were relatively static until the 1890s but this case alone shows that not to be the case, showing changes and partial subdivisions well before the gold-driven leap in land values.

The mapped information was extracted from data contained in fifteen different land transaction records.<sup>9</sup> Combining the layers in the GIS simplified deconstructing the purchase of land over time because the data was able to be presented visually. The visual presentation made understanding the changes easy to understand and track and, as they remain as a layer, available for subsequent use to analyze other data as it came to hand.

Town plans alone do not show such complexity because they are not necessarily indicative of the actual occupation or sale of land – they can be, misleadingly, a cartographic representation of a projected cityscape. Likewise, cancelled public plans, with their numerous amendments are for the purposes of historical research neither chronologically transparent in their amendments nor collocated with sufficient other material to

<sup>9</sup> Department of Lands and Surveys, "N035 Enrollment 2998," (State Records Office of Western Australia, L & S Red Books; Consignment 684/6. Reproduced by permission of the Western Australian Land Information Authority (Landgate), WA, 2007); Department of Lands and Surveys, "Town Lot N035 Memorial Ix-526 Dated 3 May 1884; N035 Memorial Ix-523 Dated 7 May 1884 N035 Memorial X-607 Dated 7 July 1885 N035 Memorial Ix-1424 Dated 2 July 1886; N035 Memorial X-218 Dated 24 June 1887; N035 Memorial X-148 Dated 20 August 1887; N035 Memorial X-471 Dated 28 August 1888; N035 Memorial X-511 Dated 24 September 1888; N035 Memorial X-512 Dated 24 September 1888 N035 Memorial X-603 Dated 7 December 1888; N035 Memorial Xii-251 Dated 8 November 1895; N035 Memorial Xii-286 Dated 11 January 1896; N035 Memorial Xv-53 Dated 5 July 1905; N035 Memorial Xx-277 Dated 25 August 1928," (Titles Office, Memorials of Deeds 1831-1955, State Records Office of Western Australia, WAS 417, Consignment 1800. Reproduced by permission of the Western Australian Land Information Authority (Landgate), WA, 2007).

distinguish ownership. In this, GIS is a valuable tool, allowing different sets of information to be amassed by virtue of its geo-spatial specificity and readings to be made of this material overtime. Using GIS in this manner will enable us to see our cities differently, concurrently historical and modern, increasing the capacity for interpretation of the city as text.

#### 4 TIME = HISTORY

Time is often used as a metaphor for history<sup>10</sup> Ironically, for a discipline that studies 'the past', historians frequently have a narrow view of time – it is a short hand for that which is in the past or, alternatively, a self-referential tool from which to take a view with some 'perspective'. Further, in the study of history, the capacity to articulate the passage of time becomes the essential, if somewhat taken-for-granted, component of analysis. It is so much embedded in our understanding of history, that when it is absent, the view is that the result is a *mélange* deemed 'ahistorical'. This sells time short. For, throughout the fabric of history, time as a concept has underpinned human activities in different ways not constrained to an intellectual construct that allows one to take stock of events with a semblance of impartiality brought by a temporal distancing of author from event.

Finely grained notions of the passage of time – as distinguished from the measurement of time (a scientific field of enquiry in its own right) – hours, minutes, seconds are primarily an economic and social construct. For agriculture-based economies, time was articulated by the annual seasons, the monthly rhythm of the moon and the daily passage of the sun. As such the definitions of time were essentially large scale, natural and easily discernable. To the nobility, their activities set to social rhythms set by the Court, clocks were a tool to ensure that they were 'in the right place at the right time' so as to distinguish themselves and win favors from their Monarch. For those outside the Court it was

relational – effectively still natural. The concept of an artificially defined and minutely dissected time arose with strength as the industrial revolution took hold. In the development of capitalism, it meant a way to structure the means of production into a cyclic, repeatable and reliable rhythm. With the construction of the first railways in Britain, regulated time ensured uniformity of operation in different parts of the country – the introduction of the railway station clock was often the first public clock in a village. As such, time became inextricably bound up with the concept of capitalism – it is summed up in the saying "time is money".

But, time also means temporality – an abstracted concept, devoid of a face over which hands move or numbers silently reconfigure on an LED screen. By introducing this more expansive concept of time, history is freed from the causality imposed by a lineal understanding of time. More particularly, time is, itself, a construct independent of Newtonian or Einstein concepts. It is played out by defining and then demolishing a 'point' of existence in which the drama of everyday life can be played. In time, there is the past and there is the future – the present is so fleeting as to not exist – one cannot define a point in time but only the event that marked its passage. Thus, time and its passage cannot of itself be conceived except in the present which is the only cognition we have of its actual, rather than perceived, existence.

#### 5 SPACE = SPATIAL QUALITIES

When place and space are conceived of as distinct concepts – place: the geographically defined location and often imbued with a particular and defined meaning as in a 'sense of place'; space: the continual and continuing, able to be defined both physically in the landscape and also in an imagined sense as lying behind two-dimensional cartographic representations on maps and computer screens – where does that lead?

Spaces in cities are commonly thought of as that which is encapsulated so as to serve a specific

<sup>10</sup> Anne Kelly Knowles, ed., *Past Time, Past Place. GIS for History* (Redlands, California: ESRI Press, 2002).

purpose with external spaces conceived in such a way as to be subservient to constructed space.

Architects, planners and urban designers have long had cities as their professional palette. Their concepts of space are that which enclose, articulate and define. The modernist concept of city space was always in relationship to constructed space: either formed by it or in relationship to it – such as the forecourt to a building or as a formalized space in cities serving as a defined function, e.g. squares, gardens or streets.<sup>11</sup>

This space is always in relationship to structure, rather than having an independent existence external to form. These uses of space are positive in so far as they actively conceive space as purposeful, in relationship to a need. This paradigm, however, establishes also the converse – negative space – that which is not included in a defined relationship but sits outside it. This concept is rooted in space being geometrical and intrinsically defined by its perimeter. In the absence of a perimeter, space becomes other – remaindered space – and in doing so, is able to interpretation at a psychological and social level instead of as a geometric form. As a result it can assume a complex social construct, even when physically expressed.

The influence of a spatial relationship can be independent from a shared place in so far as human activities can migrate through the agency of different texts to travel and create influences beyond their immediate geographic realm. This can be a powerful colonizing force either in relatively close proximity or symbolically distant. Colin Flint's work on the Nazi Party argues that activities in one area of Nazi Germany influenced the activities of citizens in other areas even though there was not a direct causal link. He indicates that the 'diffusion' of activity from neighboring areas influenced actions of citizens that resulted in similar outcomes but were not the result of the independent and specific activities that occurred nearby. Furthermore, place influenced the outcomes as much as individual actions, so that the

diffusion effect was not uniform but unevenly spread, resulting in dissimilar responses to the same stimuli depending upon where they occurred.<sup>12</sup>

While Anthony Giddens would argue that this is a modernist concept: 'The advent of modernity increasingly tears space away from place by fostering relations between 'absent' others, locationally distant from any given situation of face-to-face interaction. In conditions of modernity, place becomes increasingly phantasmagoric: that is to say, locales are thoroughly penetrated by and shaped in terms of social influences quite distant from them,'<sup>13</sup> I believe this is too restricted a reading because the use of spatial power structures has been well established through centuries. They existed well before modernity and are fundamental to concepts of Empire.

Empire shows how powerfully ideas of place and its extended spatial relationship to a centralized power could be stretched. The establishment of a settlement such as Perth – the most isolated outpost of the British realm – did not happen in isolation; it was an outpost of symbolic power articulated in the construction of a (nascent) city. In a complex amalgam of the spiritual authority of the prevailing monarch and the might and force of military conquest> Empire, by definition, sets about to establish a new realm 'locationally distant' from that of the Emperor. In Perth Western Australia, these spatial characteristics were articulated in the form of the city and can still be read as 'text'.

## 6 PERTH'S SYMBOLIC FORM

Selected for its defensive capabilities and cast in a symbolic form, Perth has been identified by its spatial qualities from the outset. In Perth, the central

<sup>11</sup> Le Corbusier. *Toward an Architecture*. Vers une architecture, [1923] Translated from the French by Goodman, John. (Los Angeles: Getty Publications, 2007).

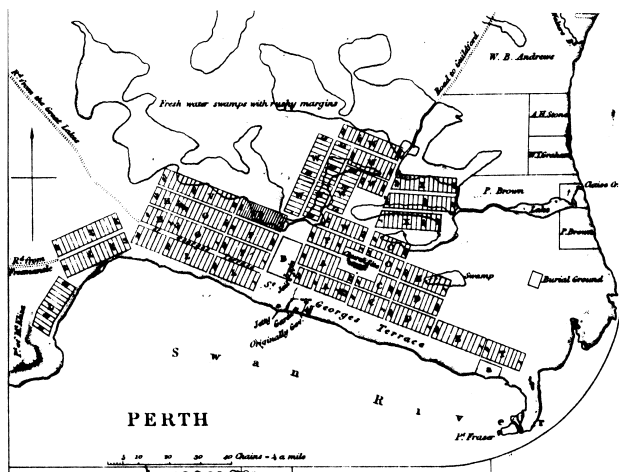
<sup>12</sup> Colin Flint, "The Theoretical and Methodological Utility of Space and Spatial Statistics for Historical Studies: The Nazi Party in Geographic Context," *Historical Methods* 35, no. 1 (2002), 4-5, 8.

<sup>13</sup> Anthony Giddens, *The Consequences of Modernity* (Cambridge: Polity, 1990).



core of the city is little different from that of its foundation. The continuity of the streetscapes and the geographical features which determine and define the city, do not, of themselves, impart a sense of history in the landscape or the definition of a city sense.

Settled in 1829, the first town plan (Figure 2) showed a town defined by the Swan River to the south and east; by the promontory of Mount Eliza to the west above the curve of the bay; and, by 'Fresh water swamps with rushy margins' to the north. A saddle-back ridge ran east-west (punctuated by a 'Church Site') and the town plan was laid out in a grid pattern oriented to the Swan River.



**Figure 2.** The 1833 town plan of Perth.<sup>14</sup> It is constrained by the river to its south and east, swamps to the north and Mount Eliza immediately to its west.

The topographical constraint was deliberate. The founding Governor, Captain James Stirling, was a

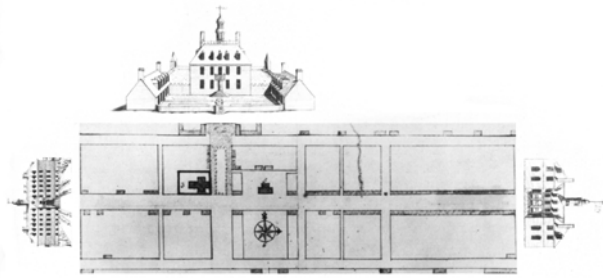
military man and the combination of high land to the west and swamps to the north provided advantage in terms of defense. In addition to containing 'the greatest number of Musquitoes [sic]' Stirling had ever encountered,<sup>15</sup> the swamps provided not only fresh water (important in an arid climate) but, potentially, a difficult to negotiate swamp system which would hinder the landward advance of an invading force. The form of Perth also reflected a spatial expansion of the culture of Empire. Perth was not to be an ever expanding commercial city – it was to be a symbol of Britain's power on the west coast of Australia. As such, its form was also highly symbolic.

The town plan echoed the layout of Williamsburg in Virginia which employed the device of broad (99 feet), long street with key buildings terminating its vistas (Figure 3). The centre supported the three key institutions of the Governor's Palace, the Capitol and the College and was the spatial rendition of the three main elements of power on a trafficable street within a compact form in the centre from which the rest of the town expanded. Williamsburg, conceived of as the capital of a large and productive hinterland, rather than as a trading town, was the place to which the wealthy landowners traveled for social intercourse and the accoutrements of polite society. Its plan was the spatial expression of the idealized state capital, 'a city in miniature for polite society, not for commerce'.<sup>16</sup> This simple but elegant design, which emphasized the symbolic status of the capital, would influence the plans of subsequent capitals in America – Philadelphia and Washington – and through them, of colonial capitals worldwide.

<sup>14</sup> John Arrowsmith. *Perth, Western Australia. Inset in Map Entitled 'Discoveries in Western Australia' Compiled from Documents Furnished to the Colonial Office by J. S. Roe, Esq., Surveyor-General to the Swan River Colony. By Permission Dedicated to R. W. Hay Esquire, One of H.M. Under Secretaries of State for the Colonies, by His Obligated Servant, J. Arrowsmith.*, London: J. Arrowsmith, 33 East St. Red Lion Square 1833.

<sup>15</sup> This near the current causeway and is the eastern edge of the area to which the lakes drained. Commonwealth of Australia. *Historical Records of Australia. Series Iii. Despatches and Papers Relating to the Settlement of the States*: Canberra, 556.

<sup>16</sup> Mark Giroud, *Cities & People: A Social and Architectural History* (New Haven CT: Yale University Press, 1985), 251.



**Figure 3:** Plan of Williamsburg, Virginia. Its simple design has echoes in the plan of Perth, with the important buildings centralized along a broad street.<sup>17</sup>

The symbolism associated with city form and understanding of the importance of spatial relationships in cities and individual building was further developed by Michel Foucault<sup>18</sup> and subsequently taken up and expanded into a whole field of 'spatial history' investigating the historical and cultural meanings of negative spaces. Foucault puts space and history on a collision course. He writes 'history: with its themes of development and of suspension, of crisis and cycle, themes of the ever-accumulating past' clashes with 'space ... the epoch of simultaneity: we are in the epoch of juxtaposition, the epoch of the near and far, of the side-by-side, of the dispersed'.<sup>19</sup> His rendition of sacred, profane, protected, exposed and celestial spaces finds echoes in Lefebvre's findings wherein he talks of three forms of conscious spatial identity: practices of everyday life and the space they inhabit; design and conceptual representations of the form of space as evidenced in structures, town plans and technical language; and, symbolically representational space, wherein acts take place which

allow an intellectual appropriation of space at a societal level.<sup>20</sup>

Similarly, Spiro Kostof has identified the cosmic pre-capitalist model, which represents cosmological forces on earth and postulates a physical interpretation of social hierarchy.<sup>21</sup> It is characterized by defined boundaries such as a wall, an area of land that could not be sold or a topographical feature that restricted development. In effect, the town was simultaneously set apart from its hinterland, the centre elevated in importance and the hinterland subjugated. The town form, so constrained, was highly defensible and also expressed the spatial rendition of society's power base – a physical connection between places of importance and a statement about domination of the landscape.

Likewise, in Perth a gracious wide street, Saint George's Terrace, links the monarchical, temporal and ecclesiastical core of the capital (Figure 2). It, too, originally was conceived with a broad boulevard running northward from the central square to open the town to the north.<sup>22</sup> Here were established the principal parts of the town: the Governor's residence, the Government officials, the Barracks, the largest buildings and the finest homes. Within the town site, Perth was divided into distinct areas with the military, spiritual, governmental and temporal centers located centrally and differentiated spatially to emphasize their importance in a manner Amos Rapoport has described as representing different 'patterns and regularities of various social groups, their hierarchies and roles'.<sup>23</sup> A town lot was provided for every 1000 acres of land that was

<sup>17</sup> *Plan of Williamsburg, Virginia, 1737*. New Haven CT: Yale University Press, 1985, 251.

<sup>18</sup> Michel Foucault. *Discipline and Punish. The Birth of the Prison*. Surveiller et Punir [1975] Translated from the French by Sheridan, Alan. Paris, Trans. New York: Pantheon, 1977.

<sup>19</sup> Michel Foucault, "Of Other Spaces," *Diacritics* 16, no. 1 (1986); Knowles, ed., *Past Time, Past Place. Gis for History*.

<sup>20</sup> Henri Lefebvre. *The Production of Space*. La production de l'espace [1974] Translated from the French by Nicholson-Smith, Donald. Paris: Editions Anthropos [1974], Oxford: Basil Blackwell, 1985, 33.

<sup>21</sup> Spiro Kostof, *The City Shaped: Urban Patterns and Meanings through History* (Boston: Little Brown, 1991), 15ff.

<sup>22</sup> The importance of opening up towns to fresh air and light was gaining currency at the time of the Swan River Settlement. Lloyd Jenkins, "Utopianism and Urban Change in Perreymond's Plans for the Rebuilding of Paris," *Journal of Historical Geography* 32, no. 2 (2005), 3, 7.

<sup>23</sup> Amos Rapoport, "The Study of Spatial Quality," *Journal of Aesthetic Education* 4, no. 4 (1970), 81-82.

owned<sup>24</sup> and visits to 'town' from the country confirmed social status: 'I am not much of a visitor but feel it to be for the interest of my family to keep up a distant acquaintance with the higher circle that they may feel it to be their natural position when they grow up'.<sup>25</sup>

Subservient to the prevailing social hierarchy, it emphasized the places of societal importance, power and privilege, such as the barracks or the church, and excluded alternative uses. This spatiality was further underpinned by differentiated values imposed for building in the town reinforcing the wealth-based geographies of privilege in the town form. Thus a social structure was translated into a spatial concept which in turn determined the constructed reality. The poor were excluded from living in the centre of the town, thus 'perpetuating the privileges of the property-owning classes descendant from the original settlers, and bolstering a territorial aristocracy'.<sup>26</sup> The use of GIS in investigating the city further to the north disclosed that the shape and form of the city had, in fact, been laid out in response to the former swampland.

## 7 GIS AND CITIES

We spoke earlier about the introduction of the field of spatial history in the late 1980s; historical GIS and its use for city history is even newer.<sup>27</sup> The lack of a neat fit between GIS and the expression of temporality within GIS has hampered the use of it for historical analysis although great inroads have been made in the past decade. The introduction of temporality into GIS has been pioneered through the

TimeMap Project in conjunction with ECAI.<sup>28</sup> The recent adoption of Google as a methodology for mapping online by the general public and the capacity to edit HTML codes so as to add a temporal element are exciting if not particularly sophisticated tools.<sup>29</sup>

In a paradox, the use of GIS and this inbuilt tension will, of itself, allow investigation of historical sources structured with a temporal aspect but able to be treated as if one atemporal text. There becomes the capacity to conceive of time within GIS as a series of definitions, or 'events', by which time is the activator of seemingly disparate activities.<sup>30</sup> These activities, in turn, can be analyzed by their relationships – dislocating sources from a lineal structure and creating instead cross-linkages through time to see connections that would otherwise not be visible.<sup>31</sup>

As Gregory and Richard Healey have indicated, the capacity to deal with large, previously seemingly overly complex datasets with greater ease in GIS will lead to some revision of currently held historical theories. The examples in this paper are extremely simple, yet even in their simplicity, they have

<sup>24</sup> Surveyor General's Office Department of Lands and Surveys. *Land Regulations: State Records Office, Accession 49, Volume 1, 12 August 1829.*

<sup>25</sup> Peter Cowan, ed., *A Faithful Picture. The Letters of Eliza and Thomas Brown at York in the Swan River Colony 1841-1852* (Fremantle: Fremantle Arts Centre Press, 1977), 78.

<sup>26</sup> Kostof, *The City Shaped*, 99.

<sup>27</sup> Ian Gregory, *A Place in History: A Guide to Using Gis in Historical Research*, 2 ed. (Belfast: Oxford University Press, 2003); Knowles, ed., *Past Time, Past Place. Gis for History.*

<sup>28</sup> Ian Johnson and Andres Wilson, "The Timemap Project: Developing Time-Based Gis Display for Cultural Data," *Journal of GIS in Archaeology*, 1 (2003).

<sup>29</sup> Jeanette Zernecke, Howie Lan, and Maggie Exon, "The Preparation of Data, Mapping Techniques and the Use of Services Such as Google Earth and Google Maps," in *Local space, global connections: visualizing cultural data through space and time: The 4th Congress of Cultural Atlases* (Curtin University of Technology, Perth: 2008).

<sup>30</sup> Lewis Lancaster, "Event Markup: A Potential Revolution for Metadata," in *International Joint GIS-IDEAS 2008, Pacific Neighborhood Consortium and Electronic Cultural Atlas Initiative Conference: 'Towards Sustainable and Creative Humansphere'* (Hanoi, Vietnam: Japan-Vietnam Geoinformatics Consortium, Kyoto University and Hanoi University of Science, 2008); M Worboys, "Event-Oriented Approaches in Geographic Phenomena," *International Journal of Geographical Information Science* 19, (2005).

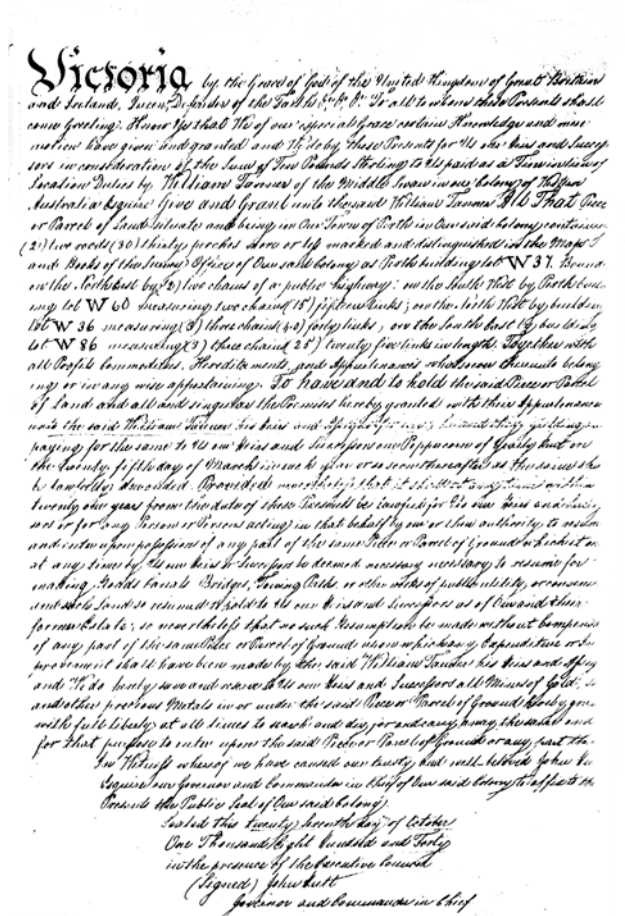
<sup>31</sup> Howie Lan, "Data Management of Buddhist Texts: Blue Dots View of Traditional Buddhist Text - a Forward Perspective and Practice in the New Digital Age," in *International Joint GIS-IDEAS 2008, Pacific Neighborhood Consortium and Electronic Cultural Atlas Initiative Conference: 'Towards Sustainable and Creative Humansphere'* (Japan-Vietnam Geoinformatics Consortium, Kyoto University and Hanoi University of Science, Hanoi, Vietnam: 2008).



pointed to different factors being at play in the establishment of Perth than were previously thought. GIS has enabled the landscape of the colonial town to be seen in relation to the swamp systems and the purchase of land parcels seen to be regarded differently by contemporaneous sources, borne out by land purchase, than that of modern analysts.

In Perth, the original swamplands in the northern part of the city are all but invisible. After settlement in 1829, the swampland became a resource for the growth of the town, abetted by a process of drainage that began in 1833. Within twenty-five years, the swamps were drained and no longer represented on official town plans although intermittent flooding, until the end of the nineteenth-century, vexed landowners.

The use of GIS has allowed the partial rediscovery of these swamplands in the landscape and their influence on parts of the city. In doing so, sources that listed land transactions (Figure 4) – a source very familiar to historical research but not necessarily thought of by historians as spatial - were collated into a database.



**Figure 4:** The Enrollment for town lot W037. The Enrollments contained locational data in the description but although the documents had been used for other types of historical research, they had had not previously been thought of as having spatial attributes.<sup>32</sup>

Based on information from these records the growth of the town site in the first twenty-five years after settlement showed an irregular, stuttering development in direct relationship to the former swamp system. Lots laid out in 1833 shown in red on Figure 5 were deleted from the town plan and recast

<sup>32</sup> Department of Lands and Surveys, "Town Lot W037 27 October 1840," (Perth: Titles Office, Memorials of Deeds 1831-1955, State Records Office of Western Australia, WAS 417, Consignment 1800. Enrollment 387. Reproduced by permission of the Western Australian Land Information Authority (Landgate), WA, 2007, 1840).

within the first three years so as to allow streets to align with the northern edge of the deepest swamp,. This altered grid continues to influence the form of Perth today, giving a more pleasant solar penetration to the area, which has become the city's primary *al fresco* dining area.



**Figure 5:** The final shape of Northbridge with all its complexity and change. The overlaid red lots bottom right are those represented on the 1833 town plan; purple centre top those of 1834 and the aqua within that the 1836 amendments; blue the changes of 1838; pink below the blue the 1840 amendments; green those of 1845; orange those of 1853; dark grey those of 1854; the brown those of May 1855 and the curved lots in scarlet those of November 1855.<sup>33</sup>

In the nineteenth century, swamps were deemed to be the source of miasmas – the ‘unwholesome atmosphere which results from the exhalation of marshy districts’ – and the cause of disease.<sup>34</sup> Furthermore, the miasmas were deemed to be the progenitor of moral turpitude and held to encourage undesirable characteristics, such as indolence or ‘intemperance’. Residents of swamps, slums and less-than-sanitary conditions were assumed to be

both physically and morally a danger. Such sites often became the places of rascality, where drinking, whoring and gambling were both indulged vices and the means of earning a daily living. As such they were places to be shunned – remaindered spaces on the edges of town, unwholesome and undesirable. But this proved not to be the case in Perth.

Contrary to previous historical scholarship, the evidence showed that the land in the swamps were the first parcels to be transferred from the Crown. Although a paradigm of swampland as undesirable land – full of miasmas and mosquitoes was prevalent in the nineteenth century prevailed, there is little evidence to suggest that the colonists found this a deterrent when applying for land. Frequently the colonial record cites requests for town lots close to the town – and these had traditionally been thought of as having value because of the close proximity to opportunities for employment and good transport networks. However, when the land transactions are mapped in GIS, a surprising discovery emerges.

Nearly four hundred blocks had been released in the area and seventy-nine of those available for purchase were to remain unsold until the end of 1874. Mapping the town lots against the swamp system in GIS enabled the changes in the town lots to be understood more clearly. Consistently, the land parcels that were taken up were those on or in the swamps, not the high land as would otherwise be expected despite the high land being serviced by a good network of roads, close to town and near Russell Square – one of the few urban squares in Perth (Figure 6).<sup>35</sup>

<sup>33</sup> Felicity A. Morel-EdnieBrown. *The Final Shape*. map, scale 1 inch: 17.12 chains, Perth: writer's collection SW-200, (2004).

<sup>34</sup> C T Onions, ed., *The Shorter Oxford English Dictionary on Historical Principles*, 3rd ed. (Oxford: Clarendon Press, 1973), 1265, 1319.

<sup>35</sup> In 1845, development in the town had even gone so far as to leap-frog the regular extensions of the streets to specifically occupy the land around a western swamp (shown in green on Figure 5 above)



**Figure 6:** Land Enrollments for the whole of Northbridge viewed in relation to the swamp system. Land transfer in Northbridge shows a consistent trait – the predominance of the land transferred by 1875 is in the area of the swamps, or on the site of the drained swamps.<sup>36</sup>

By 1875 there were still significant parcels of land that had not been taken up. Apart from two lots of high land that had been reserved by the Government for the site of the Perth Jail and other government purposes and two squares (Weld and Russell), the rest of the land was available for purchase but was not sold. This was the case even though the land, at release, sold for the same price per lot. Given that price differentiation was not a factor, the take-up of the town lots is proof of the preference for swampland over other seemingly more desirable land on offer in the area.

However, in a reiteration of earlier prejudices, the place of the swamps became the red-light district of Perth in the 1890s in response to the railway lines which had been laid through the low land of the

<sup>36</sup> Felicity Morel-EdnieBrown, "Land Transactions over Swampland 1829-1900", map, scale: 1 inch: 13.12 chains, Perth: writers collection SW-363 (2005).

former swamps; the construction of hotels and boarding houses near the railway; and, a substantial influx of single males searching for gold.<sup>37</sup> However, rumors as to the behavior of the some of the female residents of the area had been circulating from the earliest days of the Colony. In part, this reflected a nexus between the swamps as degraded places and the internalization of negative values associated with them. It was popularly thought that those women in swamp locations, particularly women owning property, were whores or madams.<sup>38</sup>

Mapping land records enabled a clearer picture of the activities of women in the swamplands – and overturned some of the previous assumptions. The map showed a more diffuse pattern of occupation with lots more scattered than otherwise thought and sole ownership almost exclusively on higher land; land considered more respectable (Figure 7).



**Figure 7:** Women as grantees from the Crown in the transfers of land ownership by Enrollment.<sup>39</sup>

A closer investigation of those which were in close proximity to a swamp revealed a different reading again (Figure 8). There was a significant

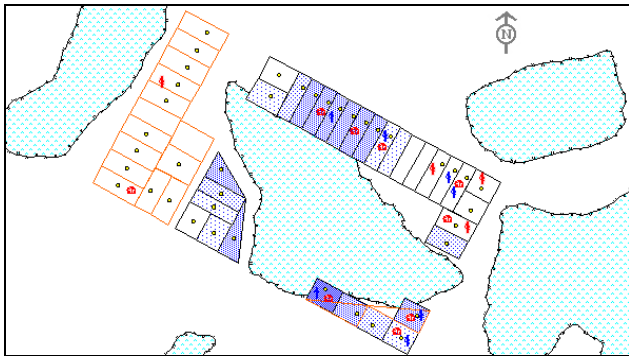
<sup>37</sup> The population of Perth trebled in eight years.

<sup>38</sup> "The Curse of the Fallen Woman and Why Should She Succeed?" *Swan River Mechanics Institute* 1861.

<sup>39</sup> Felicity A. Morel-EdnieBrown, "Women Grantees." Map, scale 1 inch: 16.84 chains," Perth: writer's collection SW-331a. (2005).



concentration of women mentioned in the land records. Of the eleven, four were sole owners and, thus, those most likely thought of as keeping a house of ill repute. Of the balance, five were listed as wives and two as daughters. Excluding those town lots upon which there was no construction, one lot had a house and was owned by a woman. However, this has nowhere been documented as having been run as a brothel or having the owner a madam. There was a known brothel in this area (shaded blue) but that was owned by a widower, with his daughter mentioned in the land transaction in case of his death but not involved in the business. Interestingly, it is the land almost completely within the margins of the swamp.



**Figure 8:** The women in red are sole owners. The women in blue are mentioned in the documents but are not necessarily owners. The darkly shaded square on the lower edge of the swamp is a known brothel.<sup>40</sup>

Thus, the mapping of historical records in GIS can, in some small ways, start to overturn preconceptions about the behavior of those in the past who had traditionally had a quieter voice. The connection between prostitution, land ownership and being female has, at least in this instance, been disproved because GIS allowed different data to be collocated for analysis.

<sup>40</sup> Felicity Morel-EdnieBrown, "The Distribution of Women Owning Land in Relation to the Swamps". map, scale: 1 inch: 8 chains, Perth: writer's collection SW-115 (2004).

## 8 VIRTUAL PERTH

At the moment, datasets in Western Australia are diffuse across stakeholders and unable to be accessed easily. The current storage methodologies are based on an archival paradigm which inherently presupposes a system of classification and the capacity to align ontologies associated with those classifications. As more and more electronic information is amassed, problems in the interoperability of different systems are emerging and organizations are faced with high costs to align their datasets with those of others so as to be useful. The advantages of using geo-enabled spatial information to collocate datasets into a virtual library has the capacity to deliver significant benefits to research capacity.

Source materials can be accumulated digitally in one place for research purposes. Collocation through the agency of GIS allows information to be drawn from an array of different sources not previously used for historical research. This, in turn, allows a stratification of knowledge about a place to occur, and permits cumulative research to be developed. Flexible structuring of information allows rapid and easy interrogation of the sources and information in previously examined sources can be identified and new meanings gleaned.

By using the world-wide web to share information, the potential for geo-spatially specific research to be undertaken anywhere in the world about a specific place is enormous. As more historical information is added within global GIS, an ever-expanding cumulative history is possible.<sup>41</sup> Such online mapping is envisaged in a *Virtual Perth* web

<sup>41</sup> As historical information tends not to be in a form immediately accessible for use within a GIS, there are issues of availability to resolve and costs associated with assembling materials that can be used within the GIS. The construction of databases, even from materials that lend themselves to such formats (census records, memorials, rate books, etcetera) mean that considerable time re-keying historical resources needs to be undertaken, initially. Once captured, resources do not have to be re-keyed again but can be imported into GIS once given a common identifier. Apart from issues of copyright or closed access, these records can also be accessed, via links to other software, outside the GIS.



interface, drawing upon the resources of key partners in the city. Virtual Perth proposes to develop a model of geographic information system (GIS) that will allow information relating to Perth to be mined via an online interface. Using the research expertise of the university institutions and the records and resources of the industry partners the GIS will incorporate information from a variety of sources and will be accessible through a website. Those who access the website will be able to find information relating to Perth over time – historical information but also daily activities and schemes proposed for the future.

Industry partners include the Western Australian Department of the Premier and Cabinet, the City of Perth, Town of Vincent, Heritage Perth, Heritage Council of Western Australia, State Records Office of Western Australia and Western Australia Police who will contribute both datasets and funding. Government partners included Landgate with access to the State Land Information Portal (SLIP) with a focus group (RetroMetro) to drive this corporately. Use of SLIP will permit access existing geo-coded data sets across selected government agencies and external bodies (industry partners) through a user-friendly online interface. The Department of Planning and Infrastructure will be the lead agency with responsibility to ensure data validity and to resolve any cross-loading problems for period of grant and extended to ten years. Access to the interface will be at three levels: public; policy/academic and legal (interest reports). Murdoch University will administer the academic component with Curtin University of Technology, and the University of Western Australia, University of California Berkeley (ECAI) and Sydney University so as to include temporal elements via TimeMap and Heurist programs.

## 9 CONCLUSION

Using GIS to investigate city sources gives a greater depth to the understanding of city centric sources than analysis by traditional historical research methodologies alone. The capacity to place a

geographic, spatial and temporal analysis can only add richness to traditional texts. For urban historians, policy makers and other researchers, access to an expanded range of information sources is particularly attractive for analyzing the factors that affect the sustainable development of cities.

The capacity to render the urban landscape within GIS and to layer historical information over the modern landscape provides precious insight into a city's development and human occupation. Visual presentation of spatial information embedded in written sources and the capacity to collocate copies of source documentation electronically means that both researchers and audiences will benefit from this new tool for capturing information about a place in history. New readings of established sources and more sophisticated reading of overlooked or underutilized sources can be woven into a new type of document: one that transcends the physical constraints of time and form.

Whilst geography may not overtly influence analysis, the use of GIS to collate, analyze and investigate historical material, creates new possibilities for understanding the agency of environment within our cities. Certainly scholars have employed these methodologies previously but laboriously. GIS gives the capacity to do it by drawing on the robustness of computing power, enabling the 'number crunching' to be done electronically and freeing the researcher to see the connections that were otherwise obscured.

Space as a part of our constructed reality embodies our relationship to time, geography (earth) and causality, therefore time, as a key component, is part of our experience of both space and earth. GIS, and in particular 3D GIS, is an avenue to recreate the sense of space and geography in an online environment – to reference actual places in a real geography and to create a sense of their physicality on earth.

Such understandings, in turn, become the catalyst for a reassessment and refreshment of the urban environment through the rediscovery of its unique characteristics.

GIS is able to give us a visual rendition of imagined historical spaces. However, there are meanings veiled in our understanding of history seen this way. The two dimensional expression on the screen becomes imbued with a set of meaning derived from an experience of cities and three dimensions with our sense of temporality implicit in our understanding. Making this temporality explicit is one of the challenges because our sense of space in cities is, itself, interpreted through the veneer of our experience, so it is simultaneously a psychological construct as well a concrete reality. Perhaps it is only by recognizing that the past is a foreign country, as David Lowenthal writes of Hartley,<sup>42</sup> that we can understand our place in history and in doing so discover the unique characteristics of our cities which will survive into the future.

A finely-grained investigation of cities, can subsequently, become the driver for a better understanding of human agency in the creation of our urban environment and reveal the connection between place, source, space and history.

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<sup>42</sup> David Lowenthal, *The Past Is a Foreign Country* (Cambridge: Cambridge University Press, 1985), 191. See also John Berger, *Ways of Seeing* (London: Pelican/Penguin Books, 1972); Susan Sontag, *On Photography* (New York: Anchor Books, 1977).

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