

THE USE OF SPACE SYNTAX IN HISTORICAL RESEARCH: current practice and future possibilities

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KEYWORDS: *Space Syntax, History, Historical Research, Sheffield, Cutlery Industry*

THEME: Historical Evolution of the Built Form

Abstract

Space syntax theory and methods have long been deployed in a wide range of research with a substantial historical component. By facilitating the comparative study of urban form through time space syntax research has opened up a number of possibilities for exploring the relationship between urban transformations and social activity. Some historical disciplines, notably archaeology, have engaged with space syntax methodology at various times. However, it is notable – given the well established interest of the field in the study of the past – that the insights of Hillier and Hanson and the wider contribution of space syntax researchers have received little attention within the discipline of urban history itself. However, this is perhaps not surprising when the contrasting disciplinary research traditions are taken into account. This paper proposes that a dialogue between space syntax theory and urban historians could advance understanding of the extent to which historical modes of spatial organization in urban communities have bearing upon the possibilities for urban communal life. Such a consideration should also help space syntax researchers to reflect critically on how they use history. To explore the proposition this paper reviews a number of historical studies produced by space syntax researchers in the light of the distinction made by the historical geographer Baker between ‘spatial histories’, ‘histories of spaces’ and ‘place histories’. While these categories are found to be broadly useful in characterizing different approaches to historical space they are also found to be problematic in their overriding concern to draw well-defined boundaries between research involving spatial analysis and more qualitative and interpretative approaches. By discussing examples of the author’s own historical research into social and cultural change in Sheffield c.1750-1900 the argument is advanced that while the theory and methods of space syntax have a positive contribution to make to historical research these should not be restricted to a single spatial analysis ‘mode’ but be integrated within a multifaceted research framework in which their latent descriptive and hermeneutic potentials can be developed.

1. INTRODUCTION

Despite boasting a proud record of historical research space syntax has gone relatively unnoticed within mainstream urban history. This is not entirely surprising given disciplinary boundaries and the fact that historians have traditionally dealt with texts rather than maps and architectural plans. There is certainly no reason why space syntax *should* be accessible to historians – it is, after all, an architectural discipline. Nevertheless, this paper maintains that there are some good reasons why historians might wish to engage with space syntax research. Chief among these are those urban historians whose interest in the relationship between the characteristics of urban space and the social life of the city leads them into theoretical and methodological areas that are relatively uncharted in historical research (Pooley 2000: 465; Morris 2000: 193). As a starting point it would be useful to develop an improved method of describing urban space as it is presented in historical cartographic sources, that could help in interpreting the historical record (such as it is) of what people actually *did* in these spaces. Notwithstanding their own problematic identities as historically mediated representations of reality, cartography remains one of the few relatively reliable ways in which urban historians can access the material reality of the past.

Gaddis (2002) has argued that whereas historians prefer to embed generalizations about processes within a particularist narrative in which the outcome are known, social scientists are likely to “embed narratives within generalization” in order to prove or disprove a given theoretical hypothesis (62). In the first case any number of theories are asked to contribute to understanding sources derived from the past; in the second case the theory itself (and ultimately its predictive power) is the point. It follows that Gaddis’ distinction between historians “preference for parsimony of consequences but not causes” can come into conflict with the importance in much empirically-based social science for identifying the single result (variable) that can explain many things (*ibid.* 105). The intention here is not to state a preference or set one mode of practice against the other – or indeed, to claim that all historians or all social scientists would tidily conform to Gaddis’ characterization. Rather, the purpose of this discussion is to hold up to scrutiny the often assumed epistemological incommensurability between ‘space’ (objective-analytical) and ‘place’ (socially constructed-experiential) – (for example, Gieryn 2000) and make the case for an historical epistemology of space in which both these research modes are acknowledged – but crucially, where the generalizations of formal spatial descriptions are put to work in the understanding the specificity of time and place.

Neither does the approach advocated here seek to undermine histories concerned with the ideological construction of space, a perspective pioneered by social theory of Lefebvre (1991 {original 1974}), Harvey (1973) and Foucault (1991). Rather the need is for a critical balance between understanding the ideological forces that shape the material world and what the psychologist Gibson referred to as the material ‘affordances’ of life itself (Gibson 1979). Following Hillier and Hanson (1984) the potential of space syntax for historians, it is argued, is in providing a starting point for identifying and – importantly – *describing* the nature of these spatial ‘affordances’. A consideration of this theme runs through both halves of this paper: firstly, in a review of the dominant strands of historical research in space syntax research and secondly, through a reflection on how these approaches informed research into the history of one urban community (Sheffield c.1750-1900) that was undertaken by this author.

2. ‘SPATIAL HISTORIES’, ‘HISTORIES OF SPACES’ AND ‘PLACE HISTORIES’

In his comprehensive survey of the relationship between history and geography Baker distinguishes between ‘spatial-locational histories’, ‘histories of space’ and ‘place histories’ (Baker 2003: 62-71; 219-222).

Baker's primary concern is with defining the core field of historical geography, a subject that is necessarily broad in scope. However, this tripartite distinction is of particular relevance to the discussion here because it expresses the firm boundary that Baker establishes between histories that address 'space' and 'place'. He argues that 'spatial histories':

...would be best reserved for those studies which are concerned directly with spatial concepts, with the significance of spatial and locational relations at a time in the past or through periods in the past at particular places (*ibid.* 68)

Research that falls within in this category includes studies of spatial diffusion, time-geography (Hägerstrand, 1967; Pred 1977; 1984; Carlstein *et al* 1978), Conzenian morphology (Conzen 1960) and historical approaches that draw extensively on quantitative historical geographical approaches such as Fernand Braudel and the French *Annales* School (for example, Braudel 1976). In Baker's categorization the vast majority of historical research using space syntax would undoubtedly be regarded as 'spatial-locational history' – this body of work will be addressed in the following section of the paper. Much formative urban history research that takes place at the boundary of history and geography – for example that of Dyos (1961) – also belongs in this category. Space syntax researchers will, naturally, object to the conflation of 'spatial' and 'location', the latter term suggesting a negation of the relational ontology underlying the methodology – but allowing this adjustment would not affect Baker's association of 'spatial histories' with spatial analysis. 'Histories of spaces' by contrast, are concerned with the "social construction and use of spaces" (Baker 2003: 65) and are associated with those major social theorist of space such as Lefebvre and Foucault who have provided the basis for what Gunn and Morris (2001) and Kingston (2010) have referred to as a "spatial turn" in historical research. The term is perhaps most appropriate where the theoretical influences are most pronounced as foregrounding a spatial approach to the research subject, perhaps in the exploration of 'gendered space' or examining the symbolic imprint of hegemonic ideologies in the built environment. 'Place histories' are at the core of what Baker understands by historical geography and are defined against spatial-locational histories: they are "fundamentally concerned with place synthesis, not with spatial analysis" (Baker 2003: 219). It is interesting in this respect that this category comes closest to what many urban historians would, arguably, refer to as their domain, that is an holistic approach to the life of an historical community – Baker gives the eminent urban historian Charles Pythian-Adams as example of someone working in this tradition. 'Place histories' in this sense are distinguished by a concern to understand places in the past in terms of their own particular historical contexts. The concern here is that notions of time and space are not externally imposed onto the past but embedded in these particular cultural contexts.

While the categorizations presented by Baker are practically useful there is a risk that they become an impediment to the interdisciplinary research and holistic approach to 'place' that his thesis generally advocates. Clearly what he terms as 'spatial-locational' and 'place-based' approaches to the past can both contribute to historical understanding. 'Space', for example, clearly helps to articulate 'place' in relational terms (i.e. not as an isolated time-space phenomenon); whereas some notion of 'place' is essential in addressing the historical experience of being meaningfully situated in the world (see Massey 2005). While many space syntax researchers may be content to be bracketed in terms of 'spatial analysis' there is something limiting here. It suggests why theorists of the built environment including the sociologist Gieryn (2000) and the archaeologists Hodder and Hutson (2003), will continue to regard space syntax as a niche mode of formal spatial analysis with little to offer broader, interpretative, approaches to 'place'. This is

unfortunate when – one might speculate – aspects of space syntax theory have the potential to inform a broader project of a built environment hermeneutics – one with implications for research in urban history.

3. HISTORICAL RESEARCH USING SPACE SYNTAX

Given its disciplinary origins in architectural research it is interesting just how many space syntax researchers have chosen to explore historical themes or perspectives in their work. In many respects this is a testimony to the emphasis of Hillier and Hanson in advocating a specifically architectural knowledge of spatial configuration that enables comparative analysis of buildings and settlements across both space and time – thereby preventing the casual projection of sociological discourses onto architectural form that may be better approached in terms of other, less discursive, perspectives (Hillier 1973). Given this distinctive contribution it worth examining, from a broader inter-disciplinary perspective, exactly what kind of history space syntax researchers do and how it might contribute to urban history more broadly.

Four typical approaches to ‘spatial history’ were identified: firstly, and least significantly for this paper, history as ‘background’: research in this category principally provides historical information in order to introduce the location(s) of a particular case study. Secondly, history as syntactic ‘growth processes’ in settlement forms or the evolution of architectural typologies. Thirdly ‘syntactic morphological histories’: these bring the social context of the spatial configuration of settlement and architectural form to the foreground, often with the primary intention of understanding the contemporary built environment. Baker’s category of ‘spatial histories’ is used without qualification to describe the fourth category in order to indicate research concerned with the way in which social phenomena organize and become organized in time-space, that goes beyond morphology itself to explain particular socio-economic or cultural aspects of an urban culture. It should be noted that none of these categories are intended to create rigid boundaries there is, naturally, much overlap between them.

In reviewing this work there is no intention to imply a preference as to the different ways in which historical perspectives are deployed in space syntax research. Rather each of the approaches is considered in terms of its own contribution, with the intention of raising the question as to how they could be integrated into a more substantive historical research method. This project involves considering space syntax as a descriptive and contextual approach to historical space in which the interpretative domain is kept open in order to acknowledge all kinds of human activity. To embed structure in the historical narrative without raising the functionalist spectre of what Geertz (1973:20) referred to as mapping a “bodiless landscape” in which people are reduced to little more than passive objects within a timeless social system.

i. Background

Presenting some historical ‘background’ to a case study is generally considered good practice in research and naturally many space syntax publications do just this. Typically, ‘background’ might consist of an extension of the introduction and include illustrations that serve to ground the analytical or speculative aspects of a case study by providing historical material that is of particular use to the reader in developing a critical perspective on the principle research focus. Examples might include Desyllas (1997) who provides a detailed historical account of Berlin’s morphological development since 1650 as a preliminary on his principal focus on the difference to the city’s economic life made by the removal of the Berlin Wall; Raman (2003) offers an historical background to his case study into spatial cultures of religious communities in the walled city of Ahmedabad, and de Melo Nunes (2007) does the same for an observational study of

University of Brasília. Many other examples could be found. Where history serves as background for the main case study in this way it follows that the principle concern of the paper is not with the history *per se*; instead the background serves to provide a basic context for the study. 'Context' in this sense refers to the minimal of *prima facie* background knowledge necessary for the reader to engage with the arguments presented rather than a contingent explanatory framework or structure which itself forms part of the arguments presented. This does not mean that the background does not in itself draw on substantive research but rather that the information it contains is presented as unproblematic 'reference'. The only danger to treating history as 'background' is that the 'history' and the main topic of research can be seen as occupying rather separate epistemological spheres, unless precisely what the history is supposed to clarify in the main body of work is indicated.

ii. Syntactical Growth Processes

A second category draws on syntactical modelling to understand more about urban growth processes. Such work does not have to be specifically historical: Carvalho and Penn (2004), Figueiredo and Amorim (2007), and Wagner (2007) have all demonstrated the scaling properties of urban systems that indicate a structural 'signature' of diachronic process – a process also identified by Griffiths (2009) drawing on longitudinal syntactic data from Sheffield. Shupza (2007) uses a large sample of cities to investigate the relationship between the configurational and shape properties of urban forms in research that has evident implications for understanding the historical reasons for the emergence of a particular morphology. Hanna's (2009) work on graph spectra has fascinating world-historical implications for the 'migration' of distinctive urban forms. Other studies have used space syntax as a basis for specifically longitudinal studies aimed at identifying generative or emergent patterns in urban growth patterns. Al Sayed *et al* (2009) draw on a detailed longitudinal analysis of Barcelona and Manhattan, using segment angular analysis in order to identify generic 'bottom-up' syntactic rules of urban growth. Shupza (2009) examines the historical growth patterns of Adriatic cities and uses syntactic variables of connectivity, line length and integration to model the evolutionary trends in a manner sensitive both to identify generic 'rules' of urban growth and to specific historical factors. As the author implies this makes his work this a potential 'bridge' between the more quantitative approaches advocated by Batty and his colleagues (1994; 2007; 2008) and more traditional urban history. Pinho and Oliveira (2009a; 2009b) and Serra and Pinho (2011) have pioneered a GIS-based methodology for the analysis of historical urban areas using space syntax. Their approach involves an exhaustive 'cartographic redrawing', of each historical period, working backwards to remove non-existent elements and making adjustments where necessary. Krafta *et al* (2005) innovate in introducing an explicitly cognitive element into their modelling of the historical growth of Porto Alegre. Interestingly, they suggest how agent-memory may serve to cluster discrete spaces into larger – more attractive integration cores. Kigawa and Furuyama (2005) develop a model based on entropy to examine the grid properties of Kyoto over time and suggest how these relate to the spatial culture of the city.

Most of these studies have in common recourse to historical cartography as a basis for their models of urban growth. Although, as with most work in the field of space syntax, care is taken to understanding the social logic of such processes, the principal research focus here is, nonetheless, the modelling of the configurational object itself. This work tends to have a strong quantitative component and an historical dimension typically consisting of a diachronically calibrated comparison of distinct stages in the evolution of urban forms. It provides a useful resource for urban historians who are interested in understanding more about the emergent properties of urban form that are encountered in historical maps. The scaling properties

of urban space are particularly interesting in suggesting how temporal information may be 'inscribed' into urban space (Griffiths 2011 forthcoming) both through internal socio-spatial dynamics and in reaction to external perturbatory events such as natural calamities.

iii. Syntactical Morphological Histories

The third category, 'syntactical morphological histories' is by far the largest and what follows must, necessarily be an abbreviation of space syntax work in this area. In general terms morphological histories are distinguished by a concern to understand morphological transformation in the social context of morphological 'events' – in the sense of historical occurrences with a direct bearing on the evolution of urban form. Such research often begins by presenting a diachronic sequence of historical-syntactical analysis map analysis but the dialogue between the morphology and the question of social context is perhaps rather more open and interrogative than with those concerned mainly with growth processes. This is because the focus is more on understanding the history of a particular settlement or configurational object than with the modelling process. Of course, the distinction is an approximate one. This is illustrated by the work of Medeiros *et al* (2003); Medeiros & de Holanda (2005); Medeiros & de Holanda (2007) and Medeiros *et al* (2009) who present rich comparative morphological histories of the growth of Brazilian cities with a research emphasis on the question of the distinctiveness of the Brazilian city both nationally and ultimately in a world-historical perspective in a manner that has some parallels with Hanna's work with graph spectra (Hanna 2009). The work of the 'Brazilian School' balances an emphasis on modelling and methodology with a deep critical insight into the historical development of urban settlement morphology in Brazil.

A characteristic of morphological histories in space syntax research is that the problem is posed by the structure and social embedding of the contemporary urban 'palimpsest' and which is then used as a starting point to 'unpack' its distinctive historical layers. This approach is set out in a paper by Stephen Read (2000) and is evident in much of his work that explores the different ways that movement in and occupation of space has emerged in Dutch cities. The work of Azimzadeh and his colleagues on Iranian Cities and Swedish cities (2001, 2003, 2005, 2007) has also explicitly drawn on the idea of the urban configuration as layered, with a focus on understanding the difficulties facing urban historic cores in the modern city – a recurrent theme in space syntax research, see also (Trigueiro and Medeiros 2007; Perdikogianni 2003). A similar historical approach is also adopted by Karimi (2000) in identifying the 'spatial spirit' of traditional English and Iranian towns, and van Nes (2001) to the effect of ring road development on traditional English towns. Griffiths *et al* (2010) have investigated how space syntax segment angular analysis can distinguish layers of the 'suburban palimpsest' in Greater London.

The revealing of complex layers of historical morphology has important implications for urban design and social policy, which is the main concern of many of these syntactical morphological histories. This tends to give the research a strong 'directedness' towards the contemporary urban problems that it is intended to inform, including framing future solutions. This future-orientation in no way imputes the quality of the historical work as such but it naturally a different emphasis from the historian who seeks to understand the past on its own terms; such a concern means that the questions asked of the historical source material are likely to be different. Nevertheless, a sound grasp of morphological history (both in the Conzenian and syntactical sense) within its broader social context must be an important aspect of any historical concern to reconstruct the communal life of the past.

iv. Spatial-Locational Histories

The historical work of Julienne Hanson is too varied and central to the development of space syntax as a discipline do it full justice here. Clearly Hanson's work falls into two distinctive sections, that relating to the urban scale, notably London (Hanson 1989a, 1989b, 2000) and that relating to the domestic scale summarized in her book *Decoding Homes and Houses* (1998). I would tentatively suggest that the two areas of work are distinguished by a slight difference in emphasis. In her PhD study of London Hanson (1989a: 393-397) is interested in the interplay of morphological (syntactical) history and the "history of events" in the sense of those events that had an effect of the morphology of London and, in some sense, remain historically conserved within it. She argues that for this reason morphology is fundamentally an historical subject. In two important papers on structure and order in the plans for the redesign of London after the Great Fire (1989b) and the transformation of the Somers Town area of London (2000) she makes good this claim. In many respects this work could be considered as 'morphological history' in the syntactic tradition since – going back to Gaddis (2002) the historical work is, ultimately, not embedded in an historical narrative but seeks to draw general theoretical *lessons* (for example the relationship between parts and wholes, structure and order) that can usefully inform contemporary design. Having said that, the two characteristics are not necessarily mutually exclusive and the depth of historical knowledge of London's urban growth displayed in Hanson's work is such that it could usefully inform any general history of the city. For this reason it seems to be a good example of what Baker refers to as a 'spatial history'.

Interestingly, a slightly different emphasis is detectable in Hanson's work on domestic space *Decoding Homes and Houses* (1998) where several of the chapters are less concerned to extrapolate general spatial principles from historical case studies rather than to provide substantive historical accounts that stand on their own terms. In Chapter Two ('Tradition and Change in the English House') Hanson even goes so far as to acknowledge the ambiguity inherent in any interpretation of historical space, she states:

The interpretations which we place on space will never be absolute, can never be certain. The best we can offer is internal coherence of an argument which is consistent with the world as it presents itself to us – but this, after all, is the stuff of theory" (*ibid.* 79).

One could envisage the sentence ending "...this is the stuff of history" where coherence of the historian's account both in itself and in reference to those of other historians is the true test of its value. Certainly, Hanson's acknowledgement of the ambiguity of space is essential if historical interpretation into how spaces have been used in the past is able to be truly open to the range of practices likely to be encountered. It is just this openness to ambiguity that tends to be closed down when the historical research is designed to provide 'lessons' for the future.

Perhaps unsurprisingly, given their traditional disciplinary concern with the structure of the built environment and in 'reading' its implications for social life, there is a longstanding tradition of archaeologists experimenting with space syntax and a number of studies have resulted from this (for example: Letesson & Driessen 2008; Letesson 2010; Clark 2007a; 2007b). While archaeologists undeniably like the way in which space syntax provides a method of spatial description associated with a social theory that their broader scholarship can engage with – particularly, for example in suggesting how architectural complexes such as palaces may be related to rituals structuring social encounter in past societies, its adoption takes place in the context of a well-defined archaeological disciplinary tradition to which space syntax's contribution is, as yet, uncertain. For example Thayer (2005) in a useful survey of the relationship between space syntax and archaeology, is careful to advocate a conservative approach to the methodology and clearly distinguishes

between those aspects of social practice that space syntax can help to explain and those which it cannot. Moreover it is clear that archaeological research is not driven by space syntax methodology but by a concern for the ancient past itself – and this necessitates a great deal of specialist contextual knowledge to be brought to interpretation of the results that may sometimes reveal simplifications in space syntax theory (Hohmann-Vogrin 2005). Nevertheless, where space syntax methodology is deployed then such work seems to fit Baker's definition of 'spatial history' – although the archaeologists concerned may feel this is a rather reductive label to apply to their work as a whole

A relatively small range of studies have drawn on syntactical ideas to inform historical questions; also drawing on methods from historical geography. These include Vaughan's work on the location of Jewish (and non-Jewish) migrants in nineteenth-century Leeds and Manchester, which uses space syntax analysis to undermine simplistic notions of the 'ghetto' and Griffiths' account of the complex distribution of cutlers and metal works in eighteenth and nineteenth-century Sheffield (Vaughan 1999; Vaughan and Penn 2006; Griffiths 2005; 2008). Craane (2009a; 2009b) has used space syntax to help explain the distribution of retail function within towns and the relation between towns in medieval Holland. Griffiths (2009) has examined how the arrival of new transport technologies exploited the properties of the pre-urban road network in Sheffield Parish while Heitor *et al* (2000) explore how the ceremonial potential of Lisbon's morphology was transformed by the earthquake of 1755. All these papers have in common data addressing the spatial distribution of non-morphological-syntactical phenomena and the use of space syntax analysis to understand the relationship of this data to urban space. A substantial architectural history of the spatial-symbolic constitution of imperial Beijing is provided by Zhu (2011), which draws extensively on space syntax methods.

All these historical and archaeological studies may be considered as making distinctive contributions to our knowledge of urban structure in particular historical periods and in this sense constitute part of the explanatory context for future research in urban history. In themselves however, they are largely restricted to exploring the relationship between configurational and other social data and the interpretative act is mainly external to this process, being informed by the authors' broader knowledge of the settlement and period in question. In this sense the space syntax component has limited interpretative purchase where the analytical component is found to explain little – i.e. a correlation can or cannot be established. However, I have argued elsewhere (Griffiths 2011 forthcoming) that space syntax is primarily a theory of time-space description. For historical work at least, the task of description of past urban spaces has barely begun – at least in the cities of the industrial revolution (a state of affairs suggested by Morris 2000). The 'unpacking' of multiple syntactical (and other) descriptions of historical space might create more ambiguity from an analytical perspective but, it is suggested, it would also create fresh hermeneutic possibilities. The next section of the paper reviews the variety of syntactic approaches brought to the author's research into the history of industrial Sheffield c.1750-1990 with this proposition in mind.

4. DESCRIBING HISTORICAL SPACE IN EARLY INDUSTRIAL SHEFFIELD: THE CASE OF ROCKINGHAM STREET

In researching the history of Sheffield the main intention was to understand how the socio-economic and processional culture of this urban community adapted to rapid changes in the built environment as a consequence of industrialization (Griffiths 2008). Space syntax methodology was attractive in this light because it allowed for the possibility of describing the built environment of an industrial city in a manner that was open to enquiry, making it easier to avoid simply endorsing the popular historical narrative of

environmental degradation partially alleviated by the heroic efforts of Victorian 'civic pride' and subsequent planning regulation (classically expressed by Mumford 1961; more recently by Hunt 2004). The promise of space syntax for historians is that it provides a way into conceptualizing and thinking about the role of 'space' and its relation to life in the built environment that does not rely uncritically on powerful images imported from well-established historical discourses, in this case the language of social reform. In examining aspects of communal life in historical Sheffield from a built environment perspective there seemed no need to be restricted to a particular category of space syntax methods (quite apart from non-space syntax methods) but rather to draw upon those which seemed most appropriate for the different aspects of the research and the available evidence. The combined use of axial, segment angular and visual graph analyses, for example may seem messy but each was able to make a contribution to the overall aims of the research.

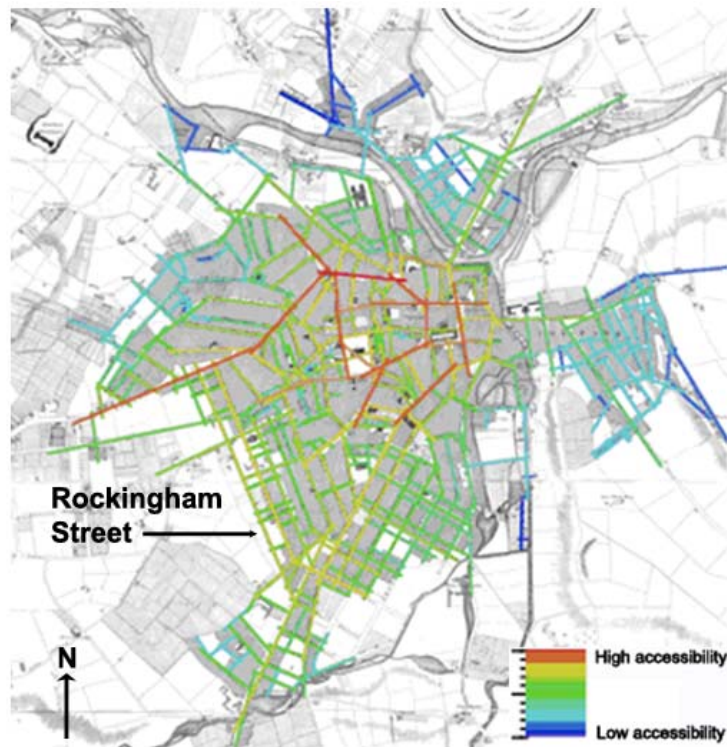
For example, Carvalho and Penn's (2004) work into scaling processes suggested employing a longitudinal dataset of axial line lengths as a basis for studying the scaling properties of Sheffield's morphology. This analysis provided a basis for thinking about the emergent organization of Sheffield's cutlery industry and for questioning the absolute distinction between urban and rural space in Sheffield Parish (Griffiths 2009). In this manner assertions about the *universal* nature of scaling processes were embedded within a *particular* historical narrative. This analysis also raised interesting questions about the constitution of spatial-configurational relations over time, since the assembly of a materialized entity such as a 'road' could be conceived in terms of its piecemeal assembly over time as well as its 'assembled' or synchronic description in space at any given time (Griffiths 2011 forthcoming). Such a perspective opens up the possibility of a phenomenological level of description in which the manifold relationalities of the space-in-time are acknowledged in relation to the construction of social practices.

A syntactical-morphological history of Sheffield was an essential basis for providing a substantive basis for interpreting the particular situatedness of multiple historical 'events'. For example, the industrial revolution in early industrial Sheffield was characterized by the increasing occupation of its urban space by cutlers and metal workers in an ever more specialized division of labour (Griffiths 2008). The organization of this system of production was highly complex and defines straightforward description but the relationship between the industry and the city itself was evidently of central importance. A syntactic morphological history (in axial mode) shows clearly how Sheffield's topological centrality shifted from the eighteenth-century medieval institutional centre to a more linear structure by the nineteenth century with a particular focus on Rockingham Street as a highly integrated axis connecting the north and the south of the city Figure 1(a-c)). An attempt to understand this apparently chaotic system of workshop-based industrial organization, therefore, was able to start with the manageable question of what effect, if any, such a change in centrality may have had.

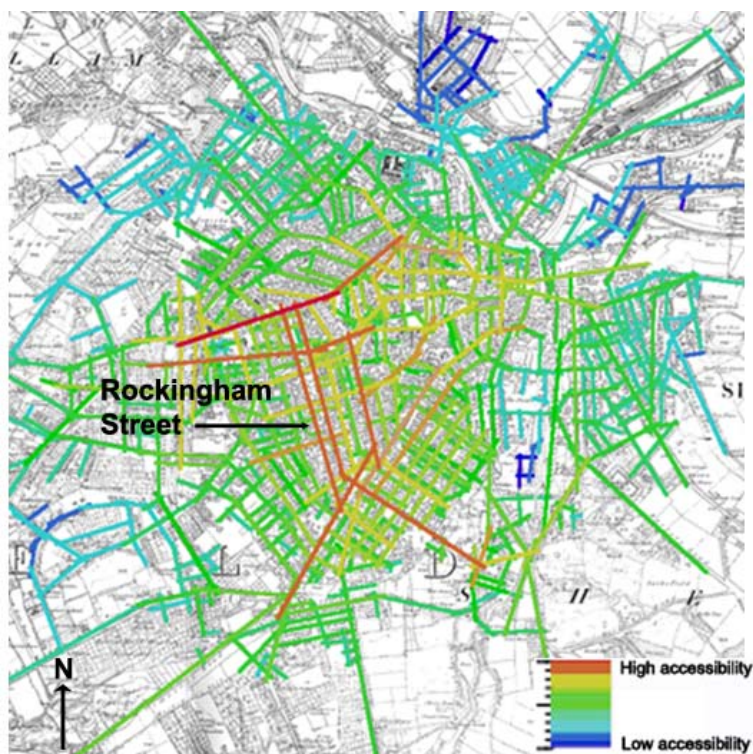
Figure 1 (a-c): axial integration analysis radius-n showing a westward shift of topological centrality between mid eighteenth and nineteenth centuries
(a) 1736 – Gosling’s map



(b) 1808 – Fairbanks’ map



(c) 1851 Ordnance Survey first series



At this point the research enters the domain of Baker's category of 'spatio-locational histories' by introducing an extensive locational dataset of industrial functions derived from a time-series of six business directories 1774-1841. Figure 2 represents the aggregate number of industrial functions on sampled industrial streets during this period. The industrial streets are coloured according to the phase in the time series (one to six) when they first contained an industrial function. The thickness of the line represents the absolute number of industrial functions relative to the number of times that the street appeared in the time series, in order to make comparison between recently constructed and older industrial streets easier. Rockingham Street, indicated with an arrow, is clearly at the centre of a heavily industrial area. With this syntactic-morphological and functional data it becomes possible to examine the relationship between them. Table 1 presents some baseline data in which the spatial and locational datasets are brought together. (These arguments will be developed in a full paper on Sheffield's industrial milieu currently being prepared by the author).

Figure 2: mean functions on industrial streets by time series 1774-1841

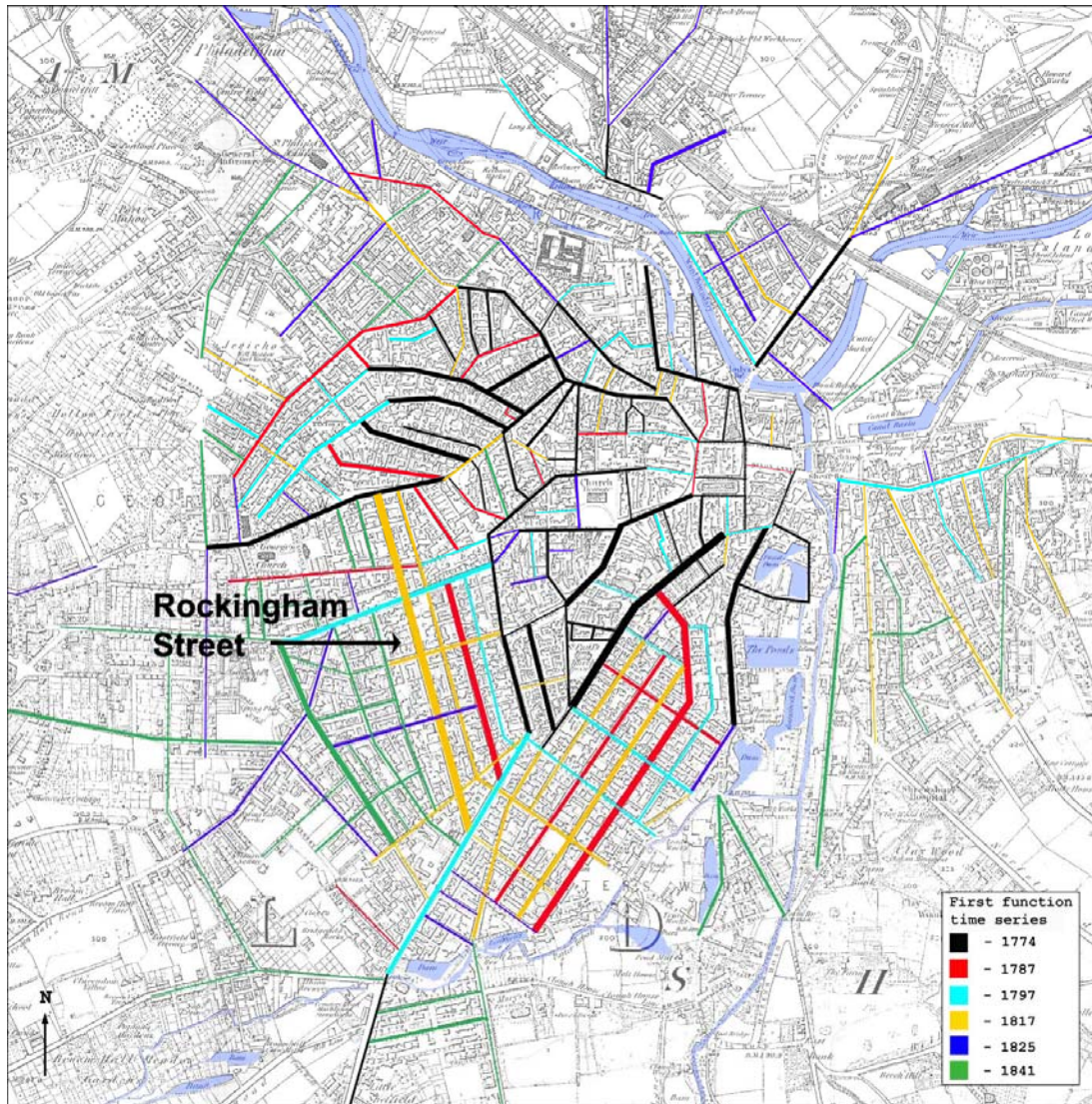


Table 1: baseline space syntax and functional statistics for early industrial Sheffield

time-series elements				syntactical values				functional values			
Figure	map date	directory date	t/	no. axial lines	mean rn	mean r3	synergy (rn:r3)	industrial functions	<fns per line>	Industrial streets	<fns per ind. street>
1a	1736	n/a	0	145	1.0082	1.9144	0.5832	n/a	n/a	n/a	n/a
-	1771	1774	1	141	1.1513	2.1476	0.6593	430	3.0	64	6.7
-	1797	1787	2	261	1.2267	2.5044	0.4917	673	2.6	85	7.9
1b	1808	1797	3	441	1.1595	2.3825	0.4255	699	1.6	116	6.0
-	1823	1817	4	434	1.1835	2.4079	0.4285	1037	2.4	152	6.8
-	1832	1825	5	592	1.1965	2.4997	0.3743	1713	2.9	188	9.1
1c	1851	1841	6	772	1.1619	2.4723	0.4198	2383	3.1	226	10.6

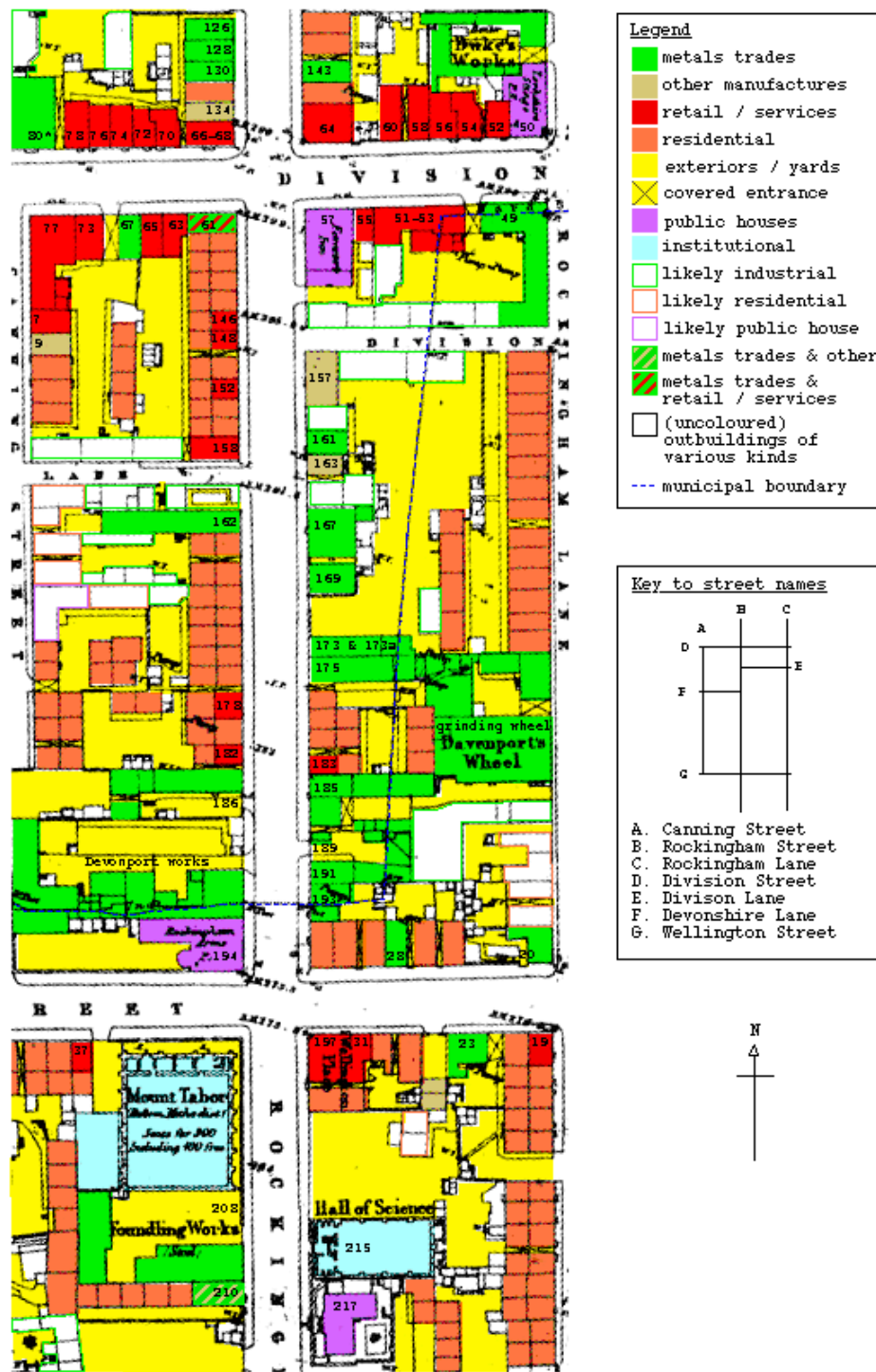
The worth of such spatio-functional data should not be regarded as being restricted to quantitative correlation. Rather the 'cross-examination' of the syntactic descriptions with the distribution of industrial functions provided a basis for a hypothesis-generating interrogation of the data in relation to Sheffield's urban form that was generally productive in understanding this relationship, even where the quantitative analysis was inconclusive. The focus on Rockingham Street as a powerful, central organizing axis, for example, naturally begged the question of 'what went on there?'

This led to the extension of the spatio-locational history to include a detailed reconstruction of land use in several urban blocks along Rockingham Street in order to locate industrial activity in the context of other urban land uses. Figure 3 portrays the highly localized scale on which the routines of day-to-day working life and lifecycle (institutional) rituals could develop in a mid-Victorian Sheffield neighbourhood. Locally-based trades (coloured green and tan), dense residential areas including areas of back-to-back housing (in orange), multiple retail premises (in red), four public houses (in purple), a Methodist Chapel and Sunday School (bottom-left block, in light blue) and a centre for practical and political education (bottom-right block, in light blue) were all present in an area approximately 75x230 metres square. Figure 3 presents a strong image of how a highly localized milieu would have had the potential to generate an intensively rich and varied field of social activity that would have been in continual flux with the comings and goings of individual residents and businesses. Accounting in a spatial sense for such a contingent social milieu clearly requires a less generalized level of description for Rockingham Street than was provided in the syntactic morphological history.

Figure 4 provides a somewhat counter-intuitive representation of the same section of Rockingham Street using the visual-control-HH measure, a more localized form of VGA analysis. This formal description of space immediately lends itself to a more qualitative level of description. Firstly, the unity of the central axis is here decomposed into sections that are clearly differentiated by the extent of visual access to adjoining roads, yards and courtyards available to different locations on Rockingham Street while remaining relatively inaccessible itself. While in systemic terms, Rockingham Street is clearly the most 'controlling space', the analysis also suggests how the thresholds between the off-street courtyards and the public street would have been powerful visual positions for individuals occupying those locations who would be able to mediate communication between public and private spaces.

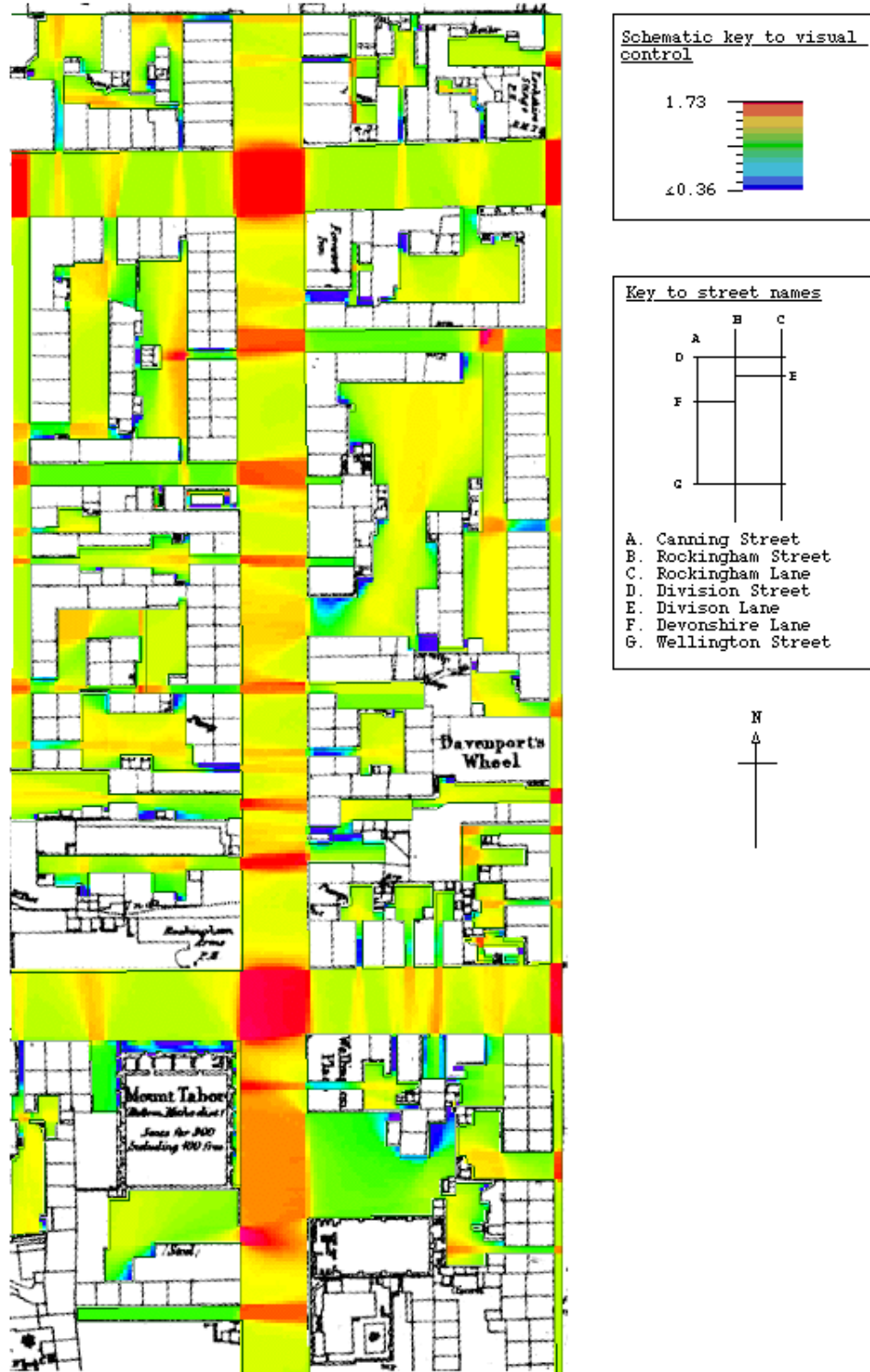
Of course, this analysis of visual control and land use can only be suggestive in regard to the constitution of social co-presence on Rockingham Street. Unless other information becomes available regarding (for example) when gates to yards were opened and shut and, in general terms, the social practices of life and work that characterized the cutlery industry, it can do little more than this. However, even through this study it has been possible to raise questions regarding how the built environment is constituted at different scales of social practice that would have been more difficult to do so in the absence of the analytic element. If nothing else the built environment of the street becomes less of a passive backdrop *to* social activity and more of a dynamic 'context' that is productive *of* activity. It has raised the question 'what *is* Rockingham Street?'

Figure 3: details of land uses in a section of Rockingham Street 1865
 Street numbers refer to addresses in Kelly's Directory of Sheffield for 1865 – see Appendix.
 The data is presented using the 1:1056 Ordnance Survey map of Sheffield surveyed 1850-51, published in 1853.



Principal sources: Kelly, E. R. (1865) (ed.) *The Post Office Directory of Sheffield with the Neighbouring Towns and Villages*. Kelly and Co., London; Ordnance Survey map for Sheffield 1851, sheet 25.

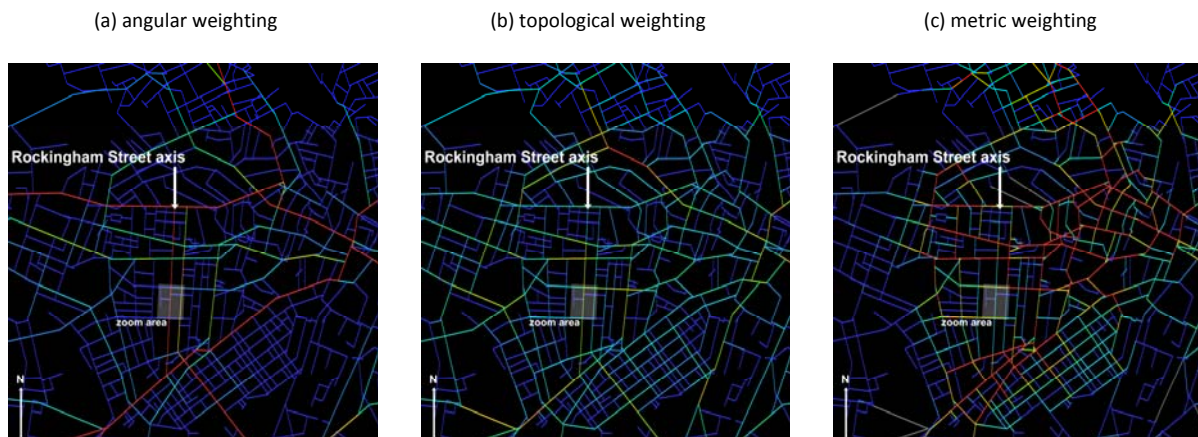
Figure 4: visual control-HH (of a maximally contiguous area of exterior space in a section of Rockingham Street 1851
Grid set to 0.8mm



5. INTERPRETATIVE POSSIBILITIES: 'HISTORIES OF SPACES' AND THE SPECIFICITY OF PLACE

Hillier and Iida (2005) have proposed that spatial configuration can be approached in terms of angular, topological and metric 'distance concepts'. Figure 5(a-c) represents a segment-angular analysis of Sheffield with radius measures weighted in angular (a), topological (b) and metric (c) modes; the Rockingham Street axis is indicated with an arrow and the block represented in Figures 3 and 4 is highlighted. For the purposes of this paper a precise account of the measures represented or how they might be interpreted does not matter; suffice to say that angular weightings tend to more 'global' linearizing descriptions, topological weightings to more 'web-like' descriptions and metric weightings to descriptions of proximity. Hillier and Iida's work opens the interesting question of how a particular historically named space (for example, a 'street') might be implicated in a number of different materializing 'assemblages' of time-space relations according to contrasting distance concepts where these have afforded social performance. Such descriptions may be thought to accumulate (and depreciate) in time as the urban built environment and social context themselves change. At the most basic level it is productive for the urban historian to critically engage with the idea that the potential of space to accumulate multiple descriptions has implications for the 'naming' urban areas that goes beyond the conventional labels that tend to make it on to the historical record.

Figure 5: Rockingham Street axis at different modalities of scale 1851



Such a formal analysis as Hillier and Iida's may seem a long way from Baker's understanding of the 'histories of spaces' in which space is conceived as socially constructed in terms of its meanings for given historically situated populations – or even individuals. However, when spatial description is regarded less as a single determining variable and more as a multiplicity of possible time-space constituted descriptions then the distinction seems less stark. Rather than environmental determinism what is being proposed are time-space affordances that are continually 'emplaced' or 'inscribed' in the material world and that are available to be socially constructed in a different ways; these social constructions are not necessarily mutually exclusive, depending on the historical period and practices that are being referred to. Certainly urban historians interested in how routine and ritual practices exploit the more explicit symbolic properties of the built environment (for example Goheen 1993; Harrison 1988, Gunn 2000) might find it worthwhile to consider how these semiotic systems are themselves mediated – and contested – in terms of a primary layer of phenomenological time-space description. Far from precluding engagement with theorists of the social production or symbolic ordering of space, such an approach can help to ground such studies in a thorough

empirical description of the manifold affordances of space in the material world where 'places' are constructed.

6. CONCLUSION

A heightened sensitivity to environmental 'affordances' and their description can improve historians' understanding of how changes in the shape of habitable space affected people's lives and urban culture in particular times and places. Such a proposition implies Baker's argument that historical-geographical research should be concerned with 'place histories' does not, of necessity, entail a rejection of spatial-locational histories in the syntactical mode. Rather it requires that such research acknowledges the particularity of historical context and that configurational description is not insisted upon as the determining or even principle component of the historical narrative. More ambitiously it is hoped that the availability of multiple time-space descriptions can help precipitate the development of a distinctive hermeneutic of historical space. The historian can ask how and why and when descriptions were assembled.

Drawing both on Baker's categorizations of approaches to space in historical research and the range of perspectives on historical subjects conducted by space syntax researchers, this paper has argued for a more integrated methodology for researching historical space. Such an integrated approach can begin to extend the interpretative field available to the urban historian with regard to the built environment, not only by generating multiple syntactical descriptions but also by inviting other theoretical positions into productive dialogue with space syntax theory. It follows from this argument that Baker's distinctions between 'spatial histories', histories of spaces' and 'place histories' should be understood not simply as having porous boundaries but also as being productive and mutually constitutive of one another. To argue otherwise risks closing down the possibility of creative dialogue between descriptions of space and constructions of 'place' such that the latter will be rendered according to dominant ideological discourses at the expense of the historical contingencies of communal everyday life.

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APPENDIX: ENTRIES IN TRADE DIRECTORY FOR A SECTION OF ROCKINGHAM STREET 1865

Source: *The Post Office Directory of Sheffield with the Neighbouring Towns and Villages*, ed by E.R. Kelly M.A (London, Kelly and co., 1865)

† location uncertain, most likely location shown on Figure 8.26

* corresponding building not identified, function not represented in Figure 8.26

<u>number</u>	<u>Details</u>
	A. Canning Street (east side, north to south)
	[Division Street]
7	furniture broker
9	rope & twine maker
	[Devonshire Lane]
	B. Rockingham Street (east side, north to south)
143	steel furnace manufacturer
	[Divison Street]
	[Devonshire Lane]
157	coach builders
157	coachsmith
161	comb maker
163	enamelled patent gentlemen's collar manufacturers
167†	scale cutter
169†	file manufacturer
173	Enterprise works: –manufacturer of joiners' tools & braces, bits, augers, gimlets & skates etc. –manufacturer of augers gimlets, brace, bits &c.
173a†	dealer in bone waste
175	(old Rockingham Works) –manufacturer of table, pen, pocket & sportsman's knives, plated dessert, razor, scissors &c.
183	shoemaker
185	manufacturer of spring fasteners
191	agent for soaps & fruits
191	surgical instrument manufacturers
191	bellows manufacturer
193	saw manufacturer
	[Wellington Street]
197	shop keeper and beer retailer
215	Hall of Science
215	Sheffield Secular Hall
217	Chandos Inn
	(west side, north to south)

126	beer retailer & grindstone merchant
128	manufacturer of table cutlery, butchers' knives &c.
130	table fork manufacturer
134	furniture dealer
	[Division Street]
146	shopkeeper
148	dressmaker
152	straw bonnet maker
158	shopkeeper
	[Devonshire Lane]
162	scale, blade & spring manufacturer
178	shopkeeper
182	dressmaker
184*	beer retailer (possibly a street-facing partition of number 186)
186	table knife manufacturer
?	Devonport works*: – merchants & manufacturers of table cutlery, pen, pocket & sportsmen's knives, shoe, bread, butchers' and cooks' knives – spring knife manufacturers – horn, haft, scale cutter – spring knife manufacturer – silver buffer public house: Rockingham Arms
194	
	[Wellington Street]
208	steel refiners &c.
210	furniture dealer and garden shears manufacturer
	C. Rockingham Lane (west side, north to south)
	[Divison Street]
96*	boot & shoemaker
?	Devonport's Grinding Wheel – proprietor – ivory cutter – scale cutter – bone cutter – bone & scale cutter
	[Wellington Street]
126*	bone & scale cutter
	D. Divison Street (north side, from east to west)
	[Rockingham Lane]

50 public house: The Yorkshire Stingo
52 butcher
54 watchmaker
56 ironmonger
58 furniture dealer
60 milliners
64 grocer

[Rockingham Street]

66 & 68 Druggist
70 second-hand book seller
72 smallware dealer
74 news vendor
76 tobacconist
78 hairdresser
80 general [metals] stamper

[Canning Street]

(south side, from east to west)

[Rockingham Lane]

49 Union Works
– merchants & manufacturers of saw edge & joiners' tools &c.(Moulson Bros.)
51† saw manager to Moulson Bros
53† butcher
55 second hand clothes dealer
57 public house: Foresters & Blacksmith

[Rockingham Street]

61 beer retailer
61† ferrule maker
63 furniture broker
65 shoemaker
67 whitesmith & bell hanger
67 whitesmith &c.
77 fruiterer

[Canning Street]

E. Divison Lane

(no functions specified)

F. Devonshire Lane

(relation between street numbers and map insufficiently clear)

G. Wellington Street

(north side, east to west)

[Rockingham Lane]

20	spring knife maker
28	pen, pocket & pencil knife maker
	[Rockingham Street]
	(south side, east to west)
	[Rockingham Lane]
19	shopkeeper
23	table knife manufacturer
?	wheelwright
31	grocer
	[Rockingham Street]
	United Methodist Free Church
37	boot & shoemaker