CHAPTER 6
A CONSTRUCTIVE EVALUATION OF METHODS ON URBAN FORM

Introduction

Any new method for studying urban form and the built environment in particular cannot stand in isolation. Attention to the topography of cities has been part of academic discourse in Germany since the late nineteenth century (see Rietschel 1897; Whitehand 1981a). Later Geddes (1915), who was influenced by the currency of evolutionary thought in biology (the relationship between biology and urbanism is still being explored, e.g. Marshall 2016) and is credited for introducing the term conurbation, made important contributions to the architectural planning aspects of the development of cities in the UK.

It is difficult to precisely trace the development of the study of urban topography and the morphographic approach to plans of city layouts. Initially, this was mainly practised in Germany, as reviewed with a rich bibliography by Whitehand (1981a). According to Whitehand, ‘topographically conscious urban history’ gained firmer footing during the interbellum (through the work of e.g. Rörig 1928 and Hamm 1932). After the war, this area of urban history grew swiftly (cf. Keyser 1969) and formed the basis for the morphogenetic approach (see Whitehand 1981a; Whitehand & Larkham 1992a). This has become the predominant kind of urban morphology, also referred to specifically as Conzenian urban morphology (after M.R.G. Conzen, see below).

The aims of this book are not served by reproducing a comprehensive historical overview. Reviews by Whitehand (1981a), Stoob (1985), Slater (1996) and Rutte (2008), including the practice of preparing atlases of historic towns,¹ and for urban history in particular by Denecke

¹ The research practices discussed in this chapter often use the word ‘town’ rather than ‘city’. Not all languages differentiate between village/town/city (see Clarke & Simms 1985). Town can be
(1988) and Dennis & Prince (1988), all explain the respective disciplinary backdrops against which (historic developmental) interests in the built form of cities could establish research practices (also see e.g. Dyos 1968; Fraser & Sutcliffe 1983, for edited volumes exemplifying various urban historical approaches).

This chapter is at once broader and narrower in scope. Chapter 1 already indicated that my boundary approach to a comparative urban methodology will be reified by using Geographical Information System (GIS) software. Vector-based GIS data offer the appropriate data format and functional flexibility for the geographical representation of line features, such as BLTs (Chapter 5). This chapter will show how a GIS-based research practice applying BLTs (as in Chapter 7) could be developed. I contextualise and demonstrate how its tenets relate to, and result from, preceding methods and techniques.

The pivotal nature of GIS first leads to a consideration of the relation between GIS and urban (social) history as a branch of the rapidly developing field of historical GIS. More specifically, I will evaluate the relevance of GIS for studying historically developed urban form. This includes both historically reconstructed town plans (a promising data source for diachronic applications of BLT mapping), and the analytical potential of GIS data structures to apply the recent OH_FET ontology. As Gregory & Ell (2007) explain, historical GIS (HGIS) demonstrates the well-known ability of GIS software to compile, order and visualise (urban historical) spatial data. This sets the stage for the GIS operationalisation of BLT Mapping.

Going forward, two dominant methods for the comparative study of urban form are reviewed: urban morphology and space syntax. The former is thematically related to the preceding historical GIS approaches in this chapter. Therefore, urban morphology proves especially important to BLT data preparation, description, geometry and diachronic analysis. The latter is a closer match to the social scientific interpretation pursued here, and introduces the continued computational progression of a set of measures. Computationally, space syntax represents the topological mapping and analysis on conceptual grounds to which BLTs are susceptible.

Both urban morphology and space syntax have inspired and strengthened analytical possibilities of BLT Mapping. Various ideas for more flexible, because it is not tied to administrative city status. In this research the term city is used throughout, but town and city are seen as interchangeable words to refer to urban places, according to the definition laid down in Chapter 1.
measures and techniques will be proposed and explored in Chapters 8 and 9. All approaches share that they are based on mappable and geographically anchored information. This paves the way to integration in GIS, maintaining each method’s respective merits. While BLT Mapping is not especially devised to effectuate such multi-method integration, it complements these extant methods and aims, and exploits the technological and data advancements of born-digital GIS approaches. Accumulatively, tenets identified here form the foundation for Chapter 7’s empirical operationalisation and Chapter 8’s explication of social analytical potential.

**Considering methods for studying urban built form**

In positioning my methodological development in liaison to other methods, the work pre-emptively transforms from a conceptual treatise into empirical practice and analytical operationalisation. The mapping practice does not inherently require computation, but a digital environment will improve its utility. By preparing BLT data in digital form, the BLT information becomes a versatile dataset for visualisation and advancing its rich formal redescriptive potential (see Chapter 5) – but it also enables additional geocomputational opportunities to unpick and navigate the complexity of urban contexts. A critical review of useful aspects of related methods stimulates our appreciation for the innate abilities of a GIS interface to systematically prepare, generate and structure BLT data.

It will be explained why the grounding and purpose of extant methods renders them unsuitable for understanding and analysing ‘boundaries’ as defined in Chapter 5. Yet, parsing the processes proper to BLT Mapping is enhanced by elucidating terminology and approaches similar to those that have been developed for historically reconstructive mapping, urban morphology, and space syntax. Extant methods are not necessarily critiqued for how they sustain what they claim to do, but to what extent they could support the comparative urban research commensurate with the aims set in Chapter 1. There I established a common frame of reference to develop long-term comparative urban research – which was previously lacking (Smith 2009b, 2012; Yoffee 2009; Fletcher 2010) – that subsequently was given specific purpose and expression through boundaries.

One gap preventing comprehensive understanding of urban form has been noted specifically through the lack of integration of urban
morphology and space syntax (Kropf 2009; Pinho & Oliveira 2009a; Whitehand 2010a, 2010b; Griffiths et al. 2010). Such expressions of dissatisfaction are accompanied by an acknowledgement of the benefits of methodological integration, but this remains an underexploited field. Boundaries are proposed as one way to bridge the conceptual gaps in studying urban form, where disparate research efforts also have been lamented (e.g. Clarke & Simms 1985; Whitehand & Larkham 1992a; Tilly 1996; Conzen 2004). It is paramount to stress that BLT Mapping, whilst a complementary practice, avoids increasing current disparity. Instead, Chapter 7’s operationalisation will show that BLT Mapping explicitly maintains the opportunities to combine, analyse and imbue its data with some ideas that reside in extant methods. However, the development of BLT Mapping is not purported to directly serve or advance the integration agenda of other methods.

One could easily argue that quantification and (associated) computation necessarily create comparative and comparable methods. Thus, it must be emphasised that using quantitative measures will not intrinsically lead to (the same) meaningful interpretations. ‘A GIS system [...] is a tool, a point of departure for comprehensive analysis rather than a scientific result in itself’ (Kalmring 2012: 259). So when, like Kalmring (2012), one is assembling and compiling information into a GIS, this recording and documenting practice still tends to adhere to what the tool prescribes. For analysis and interpretation proper to one’s conceptual frame of reference, it is necessary to go beyond the tool and its application as a method. Instead, I find quantitative research must devise methods that incorporate the theoretical concepts which have been formulated in order to comprehend the phenomenon under scrutiny (Chapters 3–5). Tools can be used or designed to operationalise these concepts in analytical measures that are commensurate with the questions asked.

GIS software is not inherently neutral. One should ensure that the way conceptual information is stored and conveyed suits the understanding one has acquired as well as the associated analysis one desires. Putting qualitative data in a GIS does not spontaneously invest the tool with qualitative powers of its own. Hence, I argue that my boundary methodology ensures that the qualitative use of the tool in aid of interpretation is comparative also, not just its computational underpinnings and its

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2. The computational basis of GIS requires empirically measured (quantified) data entries. In recent years concerns have been raised on the positivist and reductionist perception this causes amongst qualitative researchers, and how to advance the qualitative or critical non-empirical use of GIS (e.g. Kwan & Schwanen 2009). It is acknowledged that the quantitative nature of GIS, despite its limitations (see Leszczynski 2009), does not prevent its use for qualitative
quantitative output. Quantification per se often substitutes ordering and objectification for understanding.

Urban historical GIS

Historical GIS (HGIs) for cities

Through Chapters 4 and 5, it transpired that the study of inhabited urban built environments based on boundary concepts relies on surveyed and mapped evidence, whilst leading itself towards a mapping practice. GIS software has become the new standard in draughting maps and plans, storing mapped and spatial data in general. GIS adds a spatial database and statistical analytical powers to digital mapping abilities. While already a popular tool of research and applications in the disciplines of geography, planning and archaeology, recent years saw a distinct rise in the use of GIS for the historical study of cities. This development is part of what could be called a ‘spatial turn’ in the humanities (see Griffiths 2013), which complements the ‘spatial turn’ in the social sciences from the 1980s. In history this has led to the rise in popularity of the use of GIS in a variety of research practices (e.g. Gregory & Ell 2007; Lünen & Travis 2013). Increasingly there is also attention for the built environment, seeking integration with archaeological applications of GIS (attested by Paliou et al. 2014).

Chapter 1 discusses the considerable interest in the deep historical origin and definition of cities. Consequently, social and economic generative factors of settlement patterns are emphasised. Much twentieth-century historical work retained that focus on the market as the generator of cities, taking after the influential meta-theoretical ideas of Marx and Weber (Arnade et al. 2002). These ideas attempted to characterise the historiography of the urban in terms of what the city is, what the city is used for and what the city is understood to be. The influential and essentially economic ‘central place theory’ of Christaller (1933) subsequently guided attention towards city networks and city regions, both in urban geography (Parr 2005, 2007; Meijers 2007) and deeper history purposes and approaches that are sensitive to societal complexity, diversity, and becoming. In archaeology, McEwan & Millican (2012), Gillings (2012) and Hacgüzeller (2012) published, within the space of a single year, on the need and opportunities to push GIS approaches further with proper theorising and ontologies, phenomenological sensitivity, understandings of affordance, and non-representational thought. This book takes initial steps towards progress by following such approach in studying the inhabited urban built environment, all the while aiming to avoid the ‘black box’ effect in employing GIS technology (cf. Griffiths 2013).
As shown earlier, the discipline of history has paid only slight attention to how urban space functions within cities. Griffiths (2013: 154) argues that history's foci on the study of maps as cultural objects and historical space as representation have 'created something of an epistemological blind spot for historians wishing to access and substantively describe “spaces of practice” produced by everyday activity'.

Space in the discipline of history used to be reduced to a meta-narrative (Arnade et al. 2002), but when history shifted its interest to space it did so on grounds provided by critical and cultural human geography. Historical interest in (urban) space became primarily guided by Lefebvrian (1991) metaphorical, representational and socially produced concepts of space draped over geographical locations (Arnade et al. 2002; Griffiths 2013) – i.e. social notions and actions with spatial implications going beyond passive ‘container space’. Historians may have been especially susceptible to Lefebvre’s theses, because he attends pre-modern cities in his work. Arnade et al. (2002: 522) argue that the multivalence of space in the abstract notions of Lefebvre provides more concrete grounds to investigate historically produced space, because it connects ‘“the material” and “the discursive”, the physical and the ideological, or the experienced and the imagined. Lefebvre insisted that social space is produced and exists at each of these registers.’

Examples of spatial history (e.g. Estabrook 2002; Boone 2002) demonstrate that the empirical specificity of the material presence of space remains largely neglected. An interpretive role for space is claimed based on supposed empirical concreteness and theoretical sophistication for highly particular socio-cultural contexts and meanings. This leads to conflated historical concepts of space (cf. Chapter 1), because it is presupposed that certain spaces are ritual, political, legal, cultural, etc. Research in such predetermined contexts postdicts spaces’ existence and only characterises space in its respective social interpretive context.

Readings of produced and represented urban space cannot be reduced to the purely material (Arnade et al. 2002). However, I argue that space’s socio-spatially significant role for human inhabitation can only be understood through accepting the material nature of its construction and empirical presence. History’s dominant spatial approach is at odds with this view. Their source material might be locational (or contain geographical references), but rarely contains inherent spatial dimensions. Consequently, it is not spatial properties and development that are studied, but the events that happened in space.
This is demonstrated by historical GIS efforts: historians, like human geographers (see Jones et al. 2009), usually map to visualise what happened where and investigate resultant locational relations. Urban applications in the emerging practice of historical GIS are taking advantage of the flexibility in data collation and integration offered by a working environment founded on digital databases, in preference to draughting plans on paper (Lilley n.d.). Despite GIS’s geostatistical and geoanalytical underpinnings, historical GIS is aimed foremost at locating historical sources, data and events on a map to visualise them in spatial distributions. This may then help explain historical processes and relations (see Gregory & Ell 2007). Placing historical events and sources in urban space, however, inevitably relates them to locations and situations within a built environment. The physical properties of built environments increase our opportunities to use GIS in an analytically productive way, beyond illustrations and maps.

Urban examples of historical digital mapping practices show a preference for, on the one hand, locating the past on historical plans, and on the other, placing historical city plans in relation to the current city plan by using (semi-transparent) overlays (e.g. Frank 2013; Locating London’s Past (undated); Tokyo Cityscape (Amherst College, 2009); Paris Cityscape (Amherst College, 2010); imagineRio (Rice Humanities Research Centre 2016); Istanbul Urban Database (Tuzcu 2017); Jensen & Keyes 2003). Jensen & Keyes (2003) make an illustrative example of the spatially more intricate practice of locating sources, people and events onto a visualisation of the city plan in a specified historical period (nineteenth century). Their work demonstrates the possibility of applying a GIS approach on an intra-urban level. A city plan3 of Aarhus, Denmark is derived from historical maps and archives that form the basis for the historical GIS.

We are reminded that no map can represent the only truth (Chapter 5), but that all maps follow an (interpretative/research) agenda (e.g. Lilley 2012; Hutson 2012; Beisaw & Gibb 2013). Historically reconstructed maps, such as for Aarhus, are only one of many possible interpretations of the source material. The plots of which the reconstructed plan consists are invested with information on people (and their occupation) and property (tenure), creating a multi-linked

3. This derivation conveys the most credible cartographic representation of urban space on a specified level of detail. Jensen & Keyes (2003) limited themselves to using the 1870 register map as a basis, which is then cleared from irrelevant features and adjusted with reconstructed features from textual historical sources: the 1801 population census and the 1801 fire register (which contained all buildings). No physical empirical data is used.
database. Despite their intricate spatial compilation of information, most historical GIS applications also reveal limitations to spatial engagement. Eventually, GIS is primarily used to visualise the mapped location and distribution of e.g. the wealth and occupation of urban residents (i.e. social notions with spatial locations). In this sense, GIS produces little more than a progressive scatter plot, albeit directly linked to a transparently grounded representation of actual physical spatial organisation.

This implies that historically specific information is analysed against a map background, but the historicity of the physical space itself is not studied (Griffiths 2013). It permits researchers historical interpretation in a spatial dimension, making analogies to ideas on accessibility and centrality, without engaging in the creation of an understanding of such spatial (and material) properties and their development. Projecting social information onto space by geo-locating it is not the same as understanding the constitutive role of space. This is not to say that the researchers are insensitive to the dynamics and change within urban space, ‘rather we see it as something dynamic and constantly being contested and renegotiated between the inhabitants’ (Jensen & Keyes 2003: 11).

Looking at some other examples, Frank (2013) shows an even richer GIS and a desire to address the intricacies of urban life. However, the implementation does not move beyond the essential limitations of placing history in space. Amherst College’s (2009, 2010) Cityscapes demonstrate the potential of visual comparisons between time-periods by using the native ability of GIS to overlay city plans (the Amherst Mapping Application (aMapApp3) was used to develop these examples). Yet, Rice Humanities Research Centre’s (2016) work on Rio de Janeiro shows a sophistication of overlays and mapped data integration. This includes morphological mapping of implemented urban improvement schemes and viewsheds representing the perspective of historical sources.

Such cursory review concludes that urban historical GIS currently mainly utilises the opportunities to compile, collate, store, link and visualise historically sourced or derived information in selective spatial contexts. These examples do not equal a social study of urban space: interpreting the space itself in a social and temporal sense. In social scientific urban historical geography and archaeology, one will want to ask: ‘how was the spatial situation, or structure, of where something happened?’, instead of just ‘where did something happen?’ Both questions are part of studying the relationships between society and space, which according to Griffiths (2013) is one of the main reasons
for historical scholarship to engage with the geographical practice and theory of GIS.

At the convergence of urban geography and urban history, historical scholarship exists that involves the characteristics of urban space in more intricate ways: e.g. *The Study of Urban History* (Dyos 1968); *The Urban Landscape* (Whitehand 1981b); *The Pursuit of Urban History* (Fraser & Sutcliffe 1983); *Urban Historical Geography* (Denecke & Shaw 1988); *The Built Form of Western Cities* (Slater 1990); *Urban Landscapes* (Whitehand & Larkham 1992b). Justifying Jones’ (2004) insistence on welcoming an extension to human geography’s temporal frame of reference beyond the recent past, (prehistoric and classical) archaeology and ancient history are still virtually absent in this work. Yet, some counterbalance to Lilley’s (2011b) warranted alarm over historical geography’s neglect of the medieval is offered.

Having established (Chapter 1) that the endurance of the physicality of the built environment (Harris & Smith 2011) provides the evidence for cities throughout human history, the pivotal place of such evidence in the works cited here is explained. The substantial contribution made by archaeology (Clarke & Simms 1985) is clarified. When engaging this evidence, questioning the socio-spatial significance of the material presence of boundaries can prepare historical research for uncovering the entanglement of living in the material-spatial world over the long-term.

**GIS-aided historically reconstructed city plans**

Notwithstanding current restricted spatial engagement, the inescapable fact that a specific historical situation of a city needs to be mapped is paramount for historical GIS and the boundary approach alike. Regularly historical GIS applications achieve this by simply digitising and/or vectorising historical maps. A complementary tradition of work reconstructs a plan of the city more progressively. This practice predates GIS software’s accessibility.

First, there is the so-called ‘cross-section method’ (see Bisschops 2012) inspired by Keene (1985; Keene & Harding 1987). This approach

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4. Most volumes cited here are affiliated to urban morphology (discussed below), especially *The Urban Landscape* and *Urban Landscapes*, which are edited by urban morphologists, and more geographical in character than would be expected of history in general. *Urban Historical Geography* offers arguably the most diverse overview of the field. See also Chapter 1 for further thoughts on some of this discourse.
allows series of properties (usually plots of land) to be mapped with reasonable accuracy, while anchoring incidental properties or buildings within each sequence of properties (cf. the notion of plot series, Conzen 1960). Bisschops (2012) points out that his research uses both the ‘cross-section method’ and historically intensive regressive mapping. Complementarily, then, regressive sequence mapping on the basis of urban plans is derived from urban morphology (discussed below). Lilley (2000, 2011a; Lilley et al. 2007) is the strongest advocate of this approach. In regressive sequence mapping, urban morphology is employed to create a skeletal plan for earlier phases of a city, often departing from the first accurate urban plans from the nineteenth century. Advanced critical historical and archaeological methods are needed to flesh out the process of working backwards in time, producing a comprehensive mapping of the city (Lilley 2011a; Dean 2012a, 2012b). Lilley, Bisschops, and Dean respectively demonstrate that the comparative compilation and matching of information has much to gain from GIS technology.

In addition to historical and archaeological data, comprehensive cartographic reconstruction requires the careful and critical conjecturing of missing features (see Lilley 2011a); a data creation practice made more easily accessible by GIS. Only through composite conjecture can the resulting map approximate a complete and reasonably accurate snapshot that represents the town at a specified historical moment. The spatial morphology of a reconstructed plan provides referential shapes that are used to geo-locate and position (social) historical sources. Managing such linked data is greatly advanced by GIS. So far, the methods to reconstruct town plans appear predominantly developed and applied in western (European) historical contexts going back until the (high) medieval period. This implies there is a limitation to the data available – especially where ongoing inhabitation of cities inhibits expansive archaeological exposure – to work on historical situations of urban layouts. Where available, the methods of plan reconstruction become a prerequisite for analytical socio-spatial mapping, such as a boundary approach (see Chapter 7).

Dean (2012a, 2012b) shows that archaeology may uncover significant flaws in urban morphologically reasoned map regression. This renders accurate attempts at comprehensively reconstructing city plans an immensely labour-intensive and complex project. Consequently, the primary concern of many urban historical GIS projects is not with such reconstructions of the urban built environment, but is more usually confined to periods for which reasonably accurate maps exist.
Nonetheless, a growing body of meticulously reconstructed city plans using digital technologies\(^5\) opens up promising directions for future social and spatial research, as propagated here.

Since in the present context reconstructive mapping practice forms a methodological prerequisite, I will make no attempt here to further critique or improve this method. The sixteenth-century part of the Winchester test case (introduced in Chapter 7) is based on Keene's (1985) exclusively historical work (archaeological data was not consistently used in the preparations of these town plans), to contrast with the research practice on the basis of archaeological surface surveys (which here will be exemplified by the material remains of Chunchucmil). Both kinds of source data rely on historically critical reconstructive and conjectural mapping to prepare the basic spatial layout of a specific historical moment in a town’s development.

**GIS-based approach to studying urban built form**

Perhaps unsurprisingly, it is not historians or geographers, but archaeologists and conservationists who are specifically targeting urban built form in GIS. Lefebvre, Rodier, and Saligny (Lefebvre at al. 2008; Lefebvre 2009; Rodier et al. 2009; Lefebvre 2012) have developed a conceptual ordering of the urban fabric that emphasises temporal dynamics and function to store and analyse urban archaeological information. The underlying theoretical model is referred to as OH_FET and derived from the idea of temporal geographical information systems (essentially a simultaneously temporal and spatial database) (Peuquet 1994, 2001). Their practice is based on conceptual modelling: a hierarchy composed of simple and (aggregate) complex objects elucidating the intricate becoming and use of architectural complexes in an urban setting (Lefebvre et al. 2008; Lefebvre 2012). It focuses on eliciting the historical rhythms of built space in development.

Their method embraces the assertion that any understanding of the dynamics of urban fabric over time necessitates the conceptualisation of a constituent object of the urban fabric. In this object, all knowledge about its transformations culminates (*sensu* Galinié et al. 2004), hence the ‘historical object’. The historical object is an initial interpretation of analogies

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5. Excellent examples include: *Mapping Medieval Chester* (Faulkner n.d.); *Mapping Medieval Townscapes* (Lilley et al. 2005); *Pompeii Bibliography and Mapping Project* (Poehler n.d.); *Alpage* (Noizet & Costa n.d.; Noizet & Grosso 2011) and the GIS for medieval Antwerp (Bisschops 2012).
with other information, meeting three fundamental criteria: (1) location and surface area (where is it?); (2) date, duration, and chronology (when did it exist?); (3) function, social use, or an interpretation (what is it?) (Lefebvre et al. 2008; Lefebvre 2009; Rodier et al. 2009).

Lefebvre (2009) explains that any modification of these three criteria causes the disappearance and creation of a new historical object or interpretation. Theoretically this is a logical consequence of the aggregate complexity of historical objects, and not dissimilar to the logic that any change produces a new atomic situation for the entirety of a city (cf. Chapter 4).

Note that this methodological endeavour includes more information sets than the material-spatial data used for my boundary approach to emphasise socio-spatial constitution and experience. In contrast, studying the urban fabric with OH_FET ultimately pursues an understanding of the dynamics of the formation of urban space. To that end, detailed temporal information is the driving force for generating analytical spatial units, while it remains unclear what the meaning of these features is.

Conservationists might welcome this method, because it separates spatial locations according to how often they changed spatially and/or functionally (a chronographic representation). That on an urban level any change changes the whole social empirical reality of the city receives no particular attention. Prioritising temporal information over a socio-spatial understanding of how things occur to us and play a constitutive role in our inhabitation of the world inevitably leads to poorly conceived and conflated social use types (sensu Lynch 1981). In Lefebvre’s (2009) and Rodier et al.’s (2009) discussion, established socio-cultural interpretations, which only exist in particular time-space specific cases (cf. Chapter 1), are combined. Such implied specificity naturally precludes broad comparative application.

A further problem is the desire to treat temporal intricacy on the same level as spatial complexity. To achieve this requires equal information across the whole city for each unique moment of (spatial or functional) transformation. In principle, privileging temporal dynamics over the more conventional time-slice or snapshot approach is a laudable pursuit. However, such information is rarely consistently available throughout longer periods of development. No matter how much effort we put into completing information throughout a place’s history, we remain data dependent. In reality, retrieving like-for-like detail through time proves virtually impossible.

6. This practice bears some resemblance to the more complex hierarchical outcomes of morphogenetic analysis, determining the persistence, or morphogenetic priority, of form complexes (below) (see Conzen 1988, 2004).
Therefore, such GIS mapping conceals necessary extrapolations and may introduce conceptual anachronisms. That said, OH_FET accounts for an insightful critique of time-slices and periodisation (Lefebvre 2009: 1; cf. Mekking 2009) as ‘broken down a priori, either in an abstract manner and by century, or on the basis of specific periods in the political history of the town. This breakdown prevents any specific research into the temporality of the town and its own rhythm of functioning.’

In Chapter 4 I declared that taking urban space as a contiguous whole (locus) means that we must accept the atomic assumption of mapped data. As a consequence, the diachronic aspect of the boundary approach relies on time-slices. Temporally speaking, these may necessarily be coarser, but critical application will not allow the obscuring of historical reconstructive and conjecturing efforts when compiling a comprehensive urban plan for a historical moment. Thanks to the atomic assumption, time-slices are inherently better suited for spatial analysis of the whole, and thus the study of the process of inhabiting the urban built environment concerned.

OH_FET disaggregates complex historical objects into temporally specific features. Because of this it is better suited for the intensive study of smaller areas of urban development for which great amounts of historically detailed information are available throughout, which Lefebvre (2012) demonstrates. Working with reconstructed ‘time-slice’ plans relieves one from integral dependence on consistent and detailed historical information. Time-slicing may imply that, for each diachronic case, best practice is to choose a historical moment for which the best consistent information is available, or for which conjectures are equally justifiable across the entire area (cf. Lilley n.d.; Keene’s (1985) 1417 plan). I concur with Lefebvre’s (2009) warning that accepting the limitations of available data in this way could lead to a ‘source effect’ (bias) with regards to understanding temporal rhythms of development. However, not even Lefebvre (2009, 2012) overcomes organisation on a temporal scale (in years and periodic ranges) and, judging from his own chronographic representations, utilises periodic differences in availability of historical information. Alternatively, one might opt to strive for reconstructions of

Assuming a time-slice is atomic explicates its momentary indivisible nature as a whole. A time-slice is an abstract entirety which is immediate and inseparable: no time passes, everything occurs at once. The assumption that a material presence which is extant in one time-slice appears in a previous or succeeding time-slice constitutes a continuation, is akin to the everyday assumption that the house we live in remains a continuation of the same when we return after absence. This assumption does not withstand that the relative position of the house might have changed because of developments within any wholes (e.g. city) of which it is part.
the same historical moment across cases (time-slices). This second option would naturally make the historical period itself a significant object of research (cf. Chapter 1 on representation and meaning).

Evaluating OH_FET thus reveals that in consolidating the boundary mapping approach some historical and temporal detail on urban development may be lost. While interpretive temporal sensitivity is ensured by its constitutive theory, such understanding is perhaps less historical than it is part of the socio-spatial processes of inhabitation. In spite of its inherent risks, OH_FET may be preferred to a boundary approach where understanding temporality on the micro-scale is essential, or archaeological and historical documentation of locations through time is required. In this sense, OH_FET returns to the historically invested locations of historical GIS. We are still short of analysing the material record of urban built environments on a socio-spatial and comparative level.

**Urban morphology**

Background to the method

Urban morphology is often seen as an overarching term for all research on urban built form rather than a single method. As such it may encompass boundary mapping. “The study of urban morphology is concerned with the description and explanation of the form, development and diversity of urban areas” (Kropf 1993: 212). Explaining the process of formation forms the central tenet. When referring to urban morphology as a method, what is usually meant is the morphogenetic approach of Conzenian urban morphology (specifically town plan analysis) after the German founder of its most influential branch: M.R.G. Conzen. He was influenced by the German morphographic and urban topographic studies of the first half of the twentieth century (Whitehand 1981a, 2001). Since 1994, urban morphological interests have been united in the International Seminar on Urban Form (ISUF), which hosts an annual conference and publishes the journal *Urban Morphology*.

In an attempt to determine their identity, ISUF president Moudon (1997) traced the origins of urban morphology back to three schools of thought: German (Conzenian), French (Versailles) and Italian (Muratori and Caniggia). Nonetheless, the leverage of such ideas was carried wider, which makes the combined origin of the current mix of ideas difficult to pinpoint (see e.g. Larkham (2006) for an overview of the specifically British study of urban form). Whitehand (2007) mentions that Mumford’s (1961)
seminal work on the historical development of cities also influenced the field. Lilley (2000: 7) posits current urban morphology as a derivative of commonality in the work of the influential scholars Conzen, Hoskins, and Beresford, explaining ‘they shared an interest in understanding the physical development of medieval towns and they shared a common belief that the histories of medieval towns could be written using modern maps, coupled with aerial photographs and field work’.

The French school at Versailles was originally influenced by Muratori, but has since lost a coherent presence. Both strands display stronger architectural underpinnings than Conzenian urban morphology. Muratorian urban morphology is still practised, in particular under the guidance of Cataldi and Maffei from Florence (e.g. Cataldi et al. 2002). It can be referred to as a ‘process typological’ approach in which a hierarchy of ‘elements, structures of elements, systems of structures, and organisms of systems’ (Kropf 2009: 111) is formed, starting from the materials of architectural construction for buildings and the buildings as elements that establish a hierarchy towards structures of urban tissues (Kropf 1993 offers a full discussion). Process typology enables a study of urban tissue on various levels: the elements always create a whole within a context with increasing complexity, theoretically ad infinitum (Kropf 1996; see Fig. 6.1). This, in turn, compares to the structural logic in Conzen’s (2004: 123) morphogenesis: ‘It is an axiom of urban morphology that everywhere in the townscape the systematic form complexes are hierarchically nested in a physical sense.’

One should note how Muratorian ontology results from the constitution of form rather than a constitutive process (such as inhabitation). Chapters 4 and 5 establish that the operation of seclusion makes built structure also the ontological starting point for the boundary approach, which itself can be used to uncover a city’s intrinsic aggregates. What I have called the ‘ontology intrinsic to a city’ (Chapter 5) thus partially resembles the organism of a town, which refers to the system of structures altogether (Kropf 2009). Importantly, in Muratorian urban morphology types are forms occurring at all levels of the hierarchy, which is not the way BLTs are formulated. Moreover, as a building is not conveyed by a single BLT (Chapter 5), the ontological starting point is not equal to process typology. While comparing BLTs to process typologies may spur on interesting architectural dialogues, to devise an appropriate methodology as a research practice, I deem geographical Conzenian urban morphology more suitable.

Conzen’s morphogenetic approach grew out of the German morphographic and urban topographic traditions (Whitehand 1981a).
Conzen’s emigration to England initiated wide acceptance of his work in Anglophone discourse (Moudon 1997). Today the morphogenetic approach is therefore mostly a German–British research tradition (Whitehand 2001). Rather than reproducing Moudon’s genealogy of urban morphology as practised by ISUF members, the methodological and analytical tenets of Conzenian urban morphology are of relevance here.

It is generally recognised that previously unparallelled maturity and clarity of Conzen’s ideas was reached in his 1960 *Alnwick, Northumberland: A Study in Town-Plan Analysis* (Whitehand 1981a). In this work his foundational ideas about the research process known as *town plan analysis* became properly and comprehensively grounded;

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**Fig. 6.1** Example of mapping urban tissues (in Mery-la-Bataille).

Physically and historically distinct areas are mapped to identify and describe the character of the town, the units providing a framework for planning and conservation purposes. (Image source: Kropf 1996: 258, reproduced by kind permission of Karl Kropf.)
its units and terms defined. In the morphogenetic approach, the evolution or development, the origin and history, of the townscape (urban landscape) is traced. The general idea of ‘morphology’ helped shape the theory of evolution, relating the outside form of organisms to their internal structure and defining its relative constitutive parts (also seen in archaeological typologies and Muratorian urban morphology; cf. Kropf 2009). Urban morphology, then, refers to the study of the historical development of built form and its spatial structure (cf. Gordon 1981; Kropf 1993). Within Conzen’s (1960) study, it can be seen that from defining a pre-urban core (see Clarke & Simms 1985, for detail on this specific term) his approach pieces together a historical explanation of the origins and the formation of urban form and building fabrics of the town.

The principal premise of the approach holds that a town’s built environment is made up of an accumulation of traces of past activities. ‘The building or street, as a direct result of the act, can be taken to refer to the time in which it occurred. Buildings and streets are signs referring to particular events. The history of a town is thus written in its fabric’ (Kropf 1996: 255). This permits the assertion that the history of cities can be read by means of their physical form (Moudon 1997), which lies at the basis of town plan analysis (Conzen 1960). Acknowledging the tremendously persistent nature of historical built form into current built environments, Lilley (2000: 7) says: ‘the form of streets and plots revealed on a large-scale plan of a given settlement provide in themselves clues about their origin and development’. However, as the practice of town plan analysis relies heavily on the use of historical sources rather than urban form alone, the phrase ‘in themselves’ appears misleading (see Conzen 1960, 1988).

8. Architects Tang & Yang’s (2008) Urban Paleontology contains an eponymous approach to the evolution of urban forms. Instead of urban morphology, the authors connect their ideas directly to biology, archaeology and geology, ignoring the considerable likeness in the basis of both approaches. Rather than reading town plans in terms of persistence of urban tissue, they excavate plans (reversing urban design) to conceptualise urban form analogously in terms of urban fossils and species. Their aim is to understand the origin of urban forms to improve the planning and prediction of future urban developments. The somewhat forced ‘palaeontology’ is interesting, but falls short of the methodological rigour of urban morphology.

9. According to M.P. Conzen, M.R.G. Conzen did not give his consent to publish this version of his paper in this 1988 volume. The original was eventually printed in the 2004 volume Thinking about Urban Form. References to the 1988 paper have been verified using the original.

10. Similarly archaeological discourse displays a common belief that the built environment reflects the social organisation of its society. However, in reality this type of interpretation relies heavily on the use of analogies on the basis of ethnological sources (e.g. Carmack 1981; Hill & Monaghan 1987).
By constructing a comprehensive building and development history of a town, Conzenian morphology can read and assess the structure of the historical character of a town (e.g. Kropf 1996). Hence, nowadays urban morphology is often applied in planning studies and strategies to do with townscape conservation, growing awareness of the historical grain of cities11 (see e.g. Whitehand 2007; Kropf 2011). Although Samuels (2010) argues that its adaptation for historical conservation is not yet complete, applications to the management of townscapes have grown over the years, under the influence of Whitehand, as attested by contributions in Whitehand (1981b) and Whitehand & Larkham (1992b). Certainly, urban morphology is a field in motion. Whitehand (2010b: 361) remarks ‘the development of further specialities remains an integral part of the expansion of knowledge’.

The practice of town plan analysis

Town plan analysis as a methodological practice merits further attention as foundational aspects dominate research practice on urban form, including the mapping of BLTs (Chapter 7 expands on this adaptation). Town plan analysis explicates and maps the building history of the shape of a town based on historically and spatially coherent plan units (cf. Muratorian urban tissue), which are somewhat subjectively identified within the town (see Conzen 1960, 1968, 1981; Whitehand 1981a; Lilley 2000; Conzen 2004). It thrives on incorporating large bodies of socio-economic historical sources, as well as a degree of intuition, to inform its urban mapping outcomes as a spatial representation of plan units. This entanglement with historical particularities tampers with its comparative applicability. Town plan analysis structurally connects historical context (contrary to what I suggest in Chapter 1) with the processes that

11. Whitehand (2007) critiques architecture’s and planning policy’s limited focus on the historical grain allowing for a piecemeal of external aesthetics. Architectural design philosophies such as Alexander’s The Timeless Way of Building (1979) and A Pattern Language (Alexander et al. 1977) or Krier’s Urban Space (1979; see Carmona et al. 2003 for further ideas) approach the urban built environment from the pre-existing buildings and arrangements we already know, to arrive at idiosyncratic normative theories championing planning methods that should lead to aesthetically pleasing and well-functioning designs. The seminal works of Kostof (1991, 1992) use similar architectural complexes and sociocultural divisions to construct readings of urban form through history. These rarely take into account the constitutive elements of the historical grain of the city, but have had much larger public exposure, including architects, planners and policy makers, than more academic urban morphology. Lynch’s (1960) popular analytical approach to reading cities or townscapes provides wholly alternative concepts.
shape urban space to create a townscape consisting of the following form categories: the town’s plan, building fabric and land utilisation.

Reading of the town plan in turn depends on an ontology of its composition, envisioned to consist of three elements (see Fig. 6.2): ‘streets and their mutual association in a street-system, the individual land parcels or plots and their aggregation in street-blocks with distinct block patterns, and the buildings or more precisely their block plans and the arrangement of these in the town plan as a whole’ (Conzen 1968: 117;
for more detail see Conzen 1960). As the morphogenetic practice is based on European historical conduct as much as geographical conduct, it typically does not regress beyond the medieval period. Therefore, for all towns in the western and globalised world, from that period onwards, this ontology holds comparative morphological merit. Indeed, versions of the basic division of elements have become a common influence in urban built environment research. Conzen (2004) had clearly intended his ideas to travel even beyond European historic town, but its casuistic and disciplinary foundation fails to immediately facilitate more radical comparisons.

To conduct town plan analysis, one requires a town plan: a large-scale map ‘showing essential detail of layout in recognisable and measurable form’ (Conzen 1968: 115), which according to Conzen in practice is nothing greater than 1:5000. This permits one to see the block plans of individual buildings. Town plan can refer to both the cartographic representation (physical layout projected at a predetermined scale) and the physical layout of the town itself. The ‘town plan’, together with the two form categories ‘building fabric’ and ‘land utilisation’, are functionally and genetically connected in the townscape: as a palimpsest rather than an accumulation. The duration of persistence (conservation) decreases from townscape to building fabric to land utilisation (Conzen 1968). For the elements of the town plan, the street pattern, the plot and aggregate blocks, and the buildings and their block plans, this usually applies in reverse order.

On the basis of these characteristics, the researcher attempts to define plan units that display a sense of coherence in its historical and spatial development. Lilley (2000) clearly states this process is partly subjective and therefore follows a strategy of validation, entailing the verification of drawn plan units with archaeological and historical evidence.\(^{12}\) Conzen (1968: 120) himself meagrely proffers:

\[\text{[T]he recognition of distinct plan units is of great importance and can often illuminate the growth stages of a medieval town [...] when available written records fail to give any information. Such recognition depends on the careful scrutiny of plan detail such as the behaviour of street spaces and their bounding street lines, and}\]

\(^{12}\) Although Lilley's (2000) practice is more critical of intuition, it still runs the risk of creating a research fallacy similar to cultural historical and culture area research in archaeology (Lyman et al. 1997; Vis 2009). Here colonial, geographical or linguistic designations introduced biased boundaries around a people or region, the prevalence of which may seemingly be validated by research, because it forms the initial delimitation of analytical outcomes.
the shape, size, orientation, and grouping of plots, all such evidence leading to the identification of the 'seams' along which the genetically significant plan units are knit together.

Those seams are boundaries plotted to establish coherent areas or plan divisions. The behaviour and correlations that would give rigour to the method of identifying units remain unexplained. Continuing Conzenian urban morphological analysis, the genetic plan units act as one form complex, which is the most relevant here, but historical building types and land utilisation can also divide the townscape into coherent areas. Altogether these then combine to produce a map of morphological regions (see Fig. 6.3). The seams or boundaries of units and areas in urban morphology do not concur with BLTs. When identifying and mapping BLTs, rigour is provided by their definitions (Chapter 5) and their establishment through critical realist iterative abstraction (Chapter 2).

Fig. 6.3  Example of mapping morphological regions (in Ludlow).
Morphogenetic analysis and three mappings of form complexes combine to divide the townscape into morphological regions in Conzenian urban morphology. (Image source: Conzen 2004: 122, reproduced by kind permission of Michael P. Conzen and Peter Lang Publishing.)
It is common practice in urban morphology and historical town plan reconstructions to use the first accurate historical plan of a town, which is usually the nineteenth-century plan. A ground level base plan with relevant features can be produced based on this plan (see Conzen 1960; Keene 1985; Lilley 2000). Producing a base plan has become general practice among associated methods, including space syntax (see below) and indeed BLT Mapping (Chapter 7). Creating a skeletal base plan helps to trace phases of a town’s development and grounds historical reconstruction. However, ultimately the analytical unit of town plan analysis itself (the plan unit) is a relatively coarse spatial reference. Plan units cannot reconstruct a town’s precursory phases in great detail. The intellectual pursuit of town plan analysis comprises the recognition and comprehension of a town’s historical structure in terms of its plan units (Conzen 1960, 1968, 1981).

Emerging terms and processes

Through town plan analyses, an array of urban morphological terms and processes emerged. Conzen (2004: 239–261) provides a relatively comprehensive glossary of these, making repeat of such effort redundant. Together these terms provide a particular vocabulary which can logically describe the spatial processes of the development of urban built form. Some of the main terms convey processes that have the ability to be comparatively applied and elucidate urban development processes across the world.

Whitehand & Larkham (1992a), for example, recognise that development cycles and fringe belts have been successfully applied in divergent case studies. Nonetheless, Whitehand (2012) clearly identifies an under-representation of non-western cases in urban morphology. He argues that the lack of conceptual engagement and the loss of an overarching view are impeding the all-important comparative agenda in urban morphological discourse (cf. Whitehand 2009). It is telling that the development cycle is specifically based on the medieval burgage13 cycle. This is based on a particular historical property arrangement not strictly found in the same way elsewhere or in other periods.

Nonetheless, the process of ‘building repletion’ on plots of land, involving initial institution of the plot, repletion (development), climax, and recession (disuse and fallow, completed by demolition, clearance,

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13. A burgage refers to a burgage tenement, which typically comprises the property of the plot of a house with or without associated land that could be rented in medieval boroughs or towns.
obliteration or transformation of plot for redevelopment) (Conzen 1960, 1968, 1981), may have wider bearings. Furthermore, Conzen’s (1960) dissection of plots provides a nifty descriptive language for aspects of how its properties affect the built environment, such as: plot head, plot tail, plot dominant, plot accessories, plot series, street-line, building line and building frontage. This allows the precise formulation of logical constructions, e.g. arguing that closed building development is constituted by rows or serried lines that occur when the building line coincides with the plot head on the street line.

On the basis of the (burgage) plot, quantitative measures could further enrich the morphological description and study, as standardised measures\(^{14}\) of frontages can help to retrieve the original measures of transformed plots (Conzen 1960; see also Lilley n.d.). Building repletion can be measured in density ratios (percentages) that mimic figure-ground diagrams (see Trancik 1986), i.e. built volumes or solids vs. open space or voids (Conzen 1981).\(^{15}\) Measuring building coverage within the built environment has been developed for urban design purposes.\(^{16}\) Measuring the dimensions and surface areas of plots and plots per area could help express the effects of plot pattern transformations\(^{17}\) from intact to metamorphic, due to processes of truncation, absorption or amalgamation. While BLT Mapping also permits such quantitative measures, purely empirical measures are not intrinsically meaningful in terms of their socio-spatial significance (see Chapters 8 and 9).

Similarly, fringe belts (inner and outer) have been especially associated with modern planning challenges, such as the effects of ring roads (e.g. Whitehand 1977; Whitehand & Morton 2004; Conzen, M.P. 2009; Ünlü 2013). The related process of fixation lines, which occur when urban growth (temporarily) comes to a halt, may have comparative relevance. Fixation lines bring about distinctly patterned effects in the further development of the town plan, including circumscribing roads, town

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14. Conzen (1960) acknowledges that measures could have a cap for the maximum width of a frontage due to environmental or technical (rather than social, economic or historical) restrictions, and he also mentions the standardised measures could differ between building types.

15. In Chapter 7 it will be demonstrated that the first stage of BLT Mapping visually resembles a figure-ground plan, mapping out the built volumes from the open spaces.

16. If building coverage is used as a measure for the intensity of land-use, the vertical rise of buildings needs to be taken into account. This is demonstrated by the GIS adaptation of this measure by Liu et al. (2010). Conzen (1981) places this issue within the analysis of building fabric and land-use rather than town-plan analysis, which covers building repletion.

17. In cases where there are no previously instituted plots, the piecemeal building repletion of open or unstructured space is called transformative growth (Conzen 1960, 1968), with examples such as a market space being colonised by permanent building of stalls (cf. Rörig 1928; Lefebvre 2012).
walls and irregularly shaped open areas. Fixation lines often mark distinct patterns of morphological development on either side (see Conzen 1960, 1968). In appropriate diachronic cases, persistence patterns of boundary lines, due to their inevitable social empirical presence as well as their aggregation into entities (Chapter 5), may replicate some of the logic of fixation lines and other seams between plan units.

More generically, earlier forms (pre-urban nuclei of either natural or man-made origin) act as morphological frames for the formation of subsequent built forms, which in turn can modify the frames. Such process clearly exemplifies the dynamics of transforming the physical properties of the world (Chapter 3). Old field boundaries and country lanes may act as morphological frames for subsequent settling or expansions of towns. These shapes can become incorporated as e.g. streets in the layout of the plan (Conzen 1960; evidenced in the UK and The Netherlands by Hoskins 1977; Taverne 2008; Raue 1982). In transformative instead of additive changes, some traces of earlier phases may be retained. These are inherited outlines, which act as morphological frames, while other shapes will be obliterated.\(^\text{18}\)

The preceding terminological examples make clear that, although not explicitly its focus, Conzenian urban morphology features an abundance of references to boundaries. Plan units are delimited by seams; plots are delimited by plot boundaries; building lines indicate their extent; growth may stop in fixation lines; morphological frames delimit confines of development or persist as residuals; etc. The important difference with BLTs is purposive. The examples have been defined as spatial occurrences describing shapes which are conceptualised within (historical) processes of formation and transformation. Ultimately, urban morphology uses discrete surface areas as a priori spatial convention, although Conzen (1968: 117) recognises that all plan element complexes are interconnected and mutually condition each ‘other’s origins, physical relations, and functional significance, not just at present but in historical time’. Urban morphological ‘boundaries’ are likely to be maintained in BLT Mapping as boundary lines (feature outlines) (Chapter 4), but they do not directly concur in any way with the socio-spatial BLT definitions (Chapter 5).

Because Conzenian urban morphology aims to provide a socio-economic historical explanation of emerging urban forms, it counters the trend that the study of architectural and urban form is usually not

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\(^{18}\) Remaining traces from morphological metamorphoses are called residuals (Conzen 1981; cf. Tang & Yang’s (2008) urban fossils).
integrated in social and urban history (Tilly 1996). In Conzen’s (1960: 5) words: ‘plan analysis properly includes the evaluation of physical conditions of site and situation as well as of relevant economic and social development. The latter, indeed, provides the background for the interdependence of plan, building fabric, and land use, and the bridge between the morphological and the functional approaches in urban geography.’ Within this historicism the interest in ‘the social’ (cf. Chapter 2), which includes the decision-making processes by agents (sensu Sayer 1979; cf. Gordon 1981; Lilley et al. 2007), is subsumed in what can be known through a documentary background (especially Conzen 1988; see also Whitehand 1977). The social empirical reality of its bounded shapes is not regarded in terms of its social significance to inhabitation. Equally, morphological comparability is only ensured for the historically specific framing of the examples on which its practice was based.

Conzen (1988) makes some generic allusions towards the social utility of the town plan. He asserts that the street system as an access pattern is a long-term commitment of a whole urban community, while the social utility of the building fabric is the historically less constant commitment of the respective owners (vs. Mekking’s (2009) ideas on representational architecture). Generally it applies that the more people are involved, the more resistant form complexes become to change. So, a building is likely to change more often than the street system. The social utility of the pattern of land utilisation comprises the provision of viable locations for each land-use unit, depending on the access pattern. Conzen (1988) also makes a fleeting remark that suggests that the shape of a town’s morphological elements may impede internal communication and the ability to defend.

These social affordances and experiences are not structurally explored on the basis of the town’s built layout. However, Lilley et al. (2007) show that urban morphology is a good aid for comparing urban planning designs, and the effects of individuals and authority on their realisation in roughly ceteris paribus situations. En passant he also confirms the abolition of the traditional planned versus unplanned dichotomy and their associated organic and geometric patterns19 (cf. Smith 2007; Vis 2009) – a remark Conzen (1968) already made regarding European medieval towns.

19. Following from the openness as asserted by complexity theory (Bentley & Maschner 2003) and the outcomes of interactions leading to ‘unintended intentionalities’ (Chapter 4, cf. Abbott 1995), the possibility already follows that geometrically regular patterns could also emerge from individual development and settling activities (e.g. aligning houses and/or entrances with respect to their relative location).
In the posthumously published anthology *Thinking about Urban Form*, we find a short essay in which Conzen (2004) acknowledges that urban morphology is in need of a sounder philosophical foundation. This essay enables connections to the phenomenological thought in this book, and spatial cognition in space syntax (see below). Conzen reaches the insight that urban settlements are dynamic complexes in which the causality of the physical, biotic and social collides. This, finally, resonates much better with the social scientific foundations of the boundary approach. Such late realisation does not withstand urban morphology’s formative effect on the methodological development of BLT Mapping, as subsequent chapters will show.

**Space syntax**

**Background to the method**

An equally social scientific and architectural approach to studying urban form is found in space syntax. Space syntax has its origins in attempts during the 1970s to understand ‘the influence of architectural design on the existing social problems in many housing estates that were being built in the UK’ (Pinho & Oliveira 2009a: 110). Its theoretical foundation reached cogent completion in Hillier & Hanson’s (1984) seminal *The Social Logic of Space*. The general intention was to improve planning practice and normative (or generative) architectural design. Design practice lacked scientific grounding, and produced built form that seemed to harbour the ingredients for detrimental social effects by alienating its residents (Hillier & Hanson 1984; Hillier 2007; Marcus 2010). Hillier & Hanson (1984) propose a conceptual model in which space is a dimension of social life, yet their approach to studying built environment configurations is firmly connected to the quantitative tradition of the 1960s and 1970s (for morphological context, see Larkham 2006). According to Hillier (2005) this places space syntax somewhere between a phenomenological social scientific approach (e.g. Tuan 1977; Lefebvre 1991; Seamon n.d., 2012; and theoretically Griffiths & Quick 2005; this research) and a social physics or modelling approach (e.g. Batty & Longley 1994; Longley & Batty 2003; Bettencourt 2013; Brown & Witschey 2003; Brown et al. 2005; Volchenkov & Blanchard 2008; Wilson & Dearden 2011; Wilson 2012).

According to Hanson (2012), the objective of the research reported on in *The Social Logic of Space* was to develop a new language
for space, and each idea was extensively tested on a wide variety of the most challenging built form contexts. While Conzen’s (1968) initial comparative ambition was to enable the study of most British towns, justifying his selection of a medieval starting point, space syntax explicitly wants to be comprehensively comparative (e.g. Carvalho & Penn 2004; Omer & Zafrir-Reuven 2010). To this end the terms used for concepts and analyses were kept predominantly abstract (Hanson 2012). Comparability is evidently aided by the quantitative basis of its methods. Consequently the outcomes of space syntactic analyses tend to be quantitative and visualised accordingly, after which they can be compared to real world observations. Against the backdrop of developing its own suite of software, Depthmap (by Alasdair Turner), which is freely available and since 2011 also open source, the uptake of space syntax application and development has grown considerably. This not only applies to academic research, but also industry and policy applications through its commercial branch (e.g. Chiaradia & Lemlij 2007; Space Syntax Ltd. n.d.21).

Space syntax is now probably the best-known analytical approach to the study of ground-plan built environment configurations and represents a theory and associated family of tools (Hillier & Hanson 1984; Hillier 2007; Bafna 2003; Van Nes in prep.). In its foundation, substantial social scientific claims are made. Space syntax aims to contribute to the man-environment paradigm and the relations between society and space at large (Griffiths & Quick 2005; Griffiths 2013), but does so by initial empirical reference to built form rather than its emergence (cf. urban morphology). Being grounded in social theory, in this book BLT Mapping follows a kindred developmental pathway as space syntax. However, in The Social Logic of Space the link between the spatial empiricism of specific architectural analytical units and the human or social empirical purpose is not consistently explicit.

The apparent mismatch this causes between theory and tools is probably best explained by the structuralist antecedents that underlie space syntax’s inception. Hillier & Hanson declare that part of their thought exercise was to install a corrective for the over-emphasis on social theory rather than spatial theory, and to consider societies as spatial systems. They argue that ‘spatialising our concept of society’ works

20. See the Space Syntax Network (n.d.) website for a download link and full information on the current version: DepthmapX.
21. Space Syntax Ltd. is the commercial consulting company founded as a spin-off by the space syntax group at University College London, and showcases example projects on its website.
towards making structure appear ‘as a property of reality itself’ (Hillier & Hanson 1984: 201; original emphasis).

The primacy of configuration in the ‘social logic’ of space does not just happen to be the case. It originates in the logic of space itself (Hillier et al. 1987: 363, emphasis added).

So, the corrective nested an imbalance in space syntax’s development. It ends up being enthralled by capturing and elegantly reducing geometric complexity of spatial configurations into advanced analytical constructions which are only tentatively connected to social theoretical necessity (see Griffiths & Quick 2005; Vis 2009; Van Nes in prep.). This lack of a priori causation, in turn, is since incrementally being patched with correlative research outcomes.

Simultaneously, despite temporality forming part of the initial theoretical descriptions, time has been demonstrated to be a structurally neglected aspect in space syntax (Griffiths 2011). Although conducting space syntax can become part of narratives of historical explanations (Griffiths 2009, 2011, 2012a; Thaler 2005), it offers itself no (historically) constitutive logic informing its analysis. As a type of spatial analysis its temporal frame is always synchronous, inhibiting systematic subsequent constitutive theorising or interpretive conduct (Griffiths 2011). Arguably, the generative syntaxes formulated in Hillier & Hanson (1984: 66–81) offer physical boundaries a constitutive role in generating spatial morphologies for human purpose. However, social experience and transformative affordance within space are subsumed by expressing the ways in which the access purpose of design occurs. Particular types of built space configurations are captured in generative formulae that emphasise the connectivity of spatial continuity (accessibility) rather than discontinuity (boundaries).

Finally, but perhaps most frequently, the space syntax theory and analyses are criticised for pursuing cognitive argumentation without having a proper foundation of spatial cognition in place22 (e.g. Bafna 2003; Penn 2003; Conroy Dalton et al. 2012). Hanson (2012) states that space syntax was built on a hypothesis test approach (contrary to critical realism, Chapter 2). Indeed, its sustained practice correlates space syntactic measures with ethologically derived observations of social

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22. This is also an issue within the field of architectural communication theory (see Rapoport 1990; Smith 2011a). Applying experimental approaches (cf. Zacharias 1997) could help construct a theory.
behaviour. In contrast, in Chapter 1 I excluded a psychological line of argumentation towards interpretation, while spatial cognition resides in the psychological realm. How we understand and make decisions psychologically may ultimately explain all behaviour, but obtaining complete psychological knowledge on all individual people participating within space is untenable. Because critical realism suggests ‘the social’ has distinct causal power, even a full-fledged cognitive theory is no replacement for social theory on the outcomes of actions.\(^{23}\)

With regards to positivist hypothesis testing, space syntax deals its hand when supposing that people have an innate ability to ‘read’ the arrangement of spatial layout (Hillier & Hanson 1984; Conroy Dalton et al. 2012). On this basis space syntax can start seeking law-like regularities between, e.g., topological geometry and behaviour such as way-finding (pedestrian movement) to uncover the possible rules according to which we understand configurations topologically (cf. Penn 2003; Hillier & Penn 2004). Except for the development of space syntactic viewsheds (isovists) (see Franz & Wiener 2008; Paliou & Knight 2013), there is no direct inclusion of human or social experience. The cornerstones of space syntax methods are formed by spatially distinct convex spaces (conducive of co-presence in space) and axial (visual) lines (conducive to movement), and a somewhat speculative social distinction between visitors or strangers and inhabitants of a place (Hillier & Hanson 1984). Social theory would not deny the importance of co-presence or our senses (here vision) nor movement (cf. Chapters 2 and 3), but these empirical translations did not come forth from a constitutive social framework.

Space syntax applications

Despite theoretical and purposive differences, in continuation my methodological development will reflect various influences of how space syntax strives to connect built space to social life, including its sophisticated method for analysing the topological structure of built environment configurations. To begin with, space syntax analysis distinguishes the interior world (inside a built space, gamma analysis,\(^{24}\) or now more usually referred to as access analysis) and the exterior world

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\(^{23}\) One might venture the thought that cognitive theory is more apt to help understand how human beings relate to space, whereas the aim of this book is to enable contributions to understanding space’s stake in relating human beings.

\(^{24}\) Incidentally, in archaeology syntactic analyses of interior space are arguably yet more widespread than urban analyses (e.g. Fairclough 1992; Moore 1992; Cutting 2003; Fisher 2009).
(in a settlement, alpha analysis, or now more usually referred to as axial and segment analysis) (Hillier & Hanson 1984). A roughly similar distinction of ‘structurally comparable domains’ is maintained in this project as well. The urban scale naturally pertains to the exterior world, whereas the stringent seclusion of a building (Chapter 5), or indeed all major feature outlines, extracts the arbitrary internal arrangement of a socio-spatial system from further specifying negotiations with its outside. For me, however, the notion of occupiable ‘interior’ space remains part of the same domain as all subdivisions (also note that such social formulation acts contra Hillier & Hanson’s (1984) spatial ideography of generative elements).

Both gamma and alpha analysis depend on breaking up built configurations into constituent parts, i.e. the fewest convex spaces, and the connections between them. In settlements these are conveyed by axial lines, which are the longest lines intersecting convex spaces connecting up the whole system using the fewest lines (see Fig. 6.4).  

Subsequently, this can be plotted as a graph, which is justified (J-graph) by plotting it from a specified space or node (Hillier & Hanson 1984; see Fig. 6.5).

25. It must be acknowledged that, following sustained critique (e.g. Teklenburg et al. 1993; Ratti 2004a, 2004b; Ostwaldt 2011), geometric and topographical dimensions are being combined in analyses (e.g. Van Nes & López 2007; Mavridou 2012; Van Nes in prep.). For example, in current practice various space syntax measures use segment maps which can be generated from axial lines or road centre lines, which integrate the capacity to measure geometric characteristics (UCL Space Syntax 2017; Hillier et al. 2007; Charalambous & Mavridou 2012).
A ground level base plan featuring the built volumes of a town is used as input, which bears similarity to urban morphology and is echoed in applying BLTs (Chapter 5). Software can currently assist in the preparation of these building blocks, although Ostwaldt (2011) argues that the mathematics and theory behind the J-graph is poorly understood, leading to inconsistent interpretations.

While the above analytical building blocks are very abstract and naturally comparative they also clearly do not satisfy qualitative specifications, only quantitative specifications. While the analyses are topological and therefore not primarily interested in metric measurements, it is also clear that the representation of space entirely results from geometric reasoning rather than social causation. Surely, one could argue that a convex space is socially significant because it

![Fig. 6.5 Examples of J-Graphs from a variety of spatial configurations.](image)

The graphs are justified for their relation to one particular space (or node) (in interior analysis that is typically the outside), and showing a hierarchy of step depth from this origin. (Image source: Hillier 2007: 76, copyright Bill Hillier, reproduced by kind permission of Space Syntax Ltd.)
permits co-presence (of human beings), but the definition of the convex space is just a spatial derivative.\textsuperscript{26}

Similarly, axial lines may indeed hypothesise intervisibility, but they dramatically reduce the intricacies of inhabiting built form and topography (e.g. Hohman-Vogrin 2006, on elevation). This reduced spatial representation makes us realise that rather than the physical properties of built form as it occurs to us, space syntax studies the structure of the representation that follows from its own empirical logic (Griffiths 2012b). This space syntactic configuration\textsuperscript{27} (an abstract geometrical derivative) is analysed instead of the original empirical (social) reality of built environment morphology to produce an array of relational values, rules and probabilities (Hillier & Hanson 1984; Hillier et al. 1987; Bafna 2003; Batty & Rana 2004; Pinho & Oliveira 2009a; Van Nes in prep. present explanations and overviews).

Because the basic concepts of space syntax do not focus on specifying the properties of discontinuity (see Hillier & Hanson 1984), the actual characteristics of built space are lost. That includes the urban fabric (as in urban morphology), but also, more relevant here, the socially constitutive material differentiations created by built boundaries (Chapter 4).\textsuperscript{28} A notable example of mitigating this oversight is the constitutedness of streets (i.e. having a building entrance bordering its space) (Hillier & Hanson 1984). This incorporates a building density aspect shaping the sides of occupiable street space into space syntax (e.g. Van Nes & López 2007; and further qualified by Palaiologou & Vaughan 2012). Still, the relation between building and open space is not concrete without including its socio-spatially significant material properties. Nevertheless, space syntax is regularly applied for architectural analyses (see Hillier et al. 1987; Hanson 1989) and for creating typologies and classifications of urban form and land-use patterns (e.g. Jiang 2007; Wagner 2008).

The contemporary planning questions that space syntax is generally applied to produce analytical outcomes which tend to be correlated with social and economic observations of city life. In doing so, the probabilistic

\textsuperscript{26} The theoretical arguments presented in Chapters 3 and 5 prioritise occupiability of space over co-presence, and furthermore support indirect social interaction on the basis of materialisations.

\textsuperscript{27} Note that Hillier et al. (1987: 363) distinguish spatial relations (between two spaces) from spatial configuration which considers ‘at least, the relation of two spaces taking into account a third, and, at most, [...] the relations among spaces in a complex taking into account all other spaces in the complex’.

\textsuperscript{28} Following Ostwaldt’s (2011: 449) discussion, space syntax actually disregards most aspects of (architectural) form, as with its space shaping contours ‘a building delineates both the space it contains (its interior) and, to a lesser extent, the space in which it is contained (its site or context)’.
measures become connected to how configurative properties of the built environment (generally permeability, connectivity, accessibility, and movement) (Bafna 2003; Pinho & Oliveira 2009a) afford the occurrence of lively or less lively streets. Liveliness, in turn, indicates economic viability (e.g. Chiaramida et al. 2008; Narvaez et al. 2012; Griffiths et al. 2010; Valente 2012). The probability of liveliness is associated with the cognitive readability or intelligibility of space for way-finding as expressed by global and local integration measures at specified radii of operation (Van Nes in prep.). The otherwise strikingly good fitting correlations, especially pedestrian movement, economic viability, and land-value, again lack a cognitive theory for a true explanation.

Space syntax’s predictions for pedestrian movement and navigation are its most successful area (Bafna 2003) and have consequently been adapted for application in historical settings (e.g. Craane 2009; Stöger 2011; Griffiths 2012a). Also when space syntax contributes to social cohesion and segregation, argumentation is almost exclusively tied to movement and rudimentary accessibility (e.g. Conroy Dalton 2007; Hillier & Vaughan 2007). Movement – specifically natural movement as an intrinsic psychologically conducive property of configurations – has been theorised and the correspondent measures adjusted, confirming the suggestion that distance is governed by topology in way-finding (Hillier et al. 1993; Hillier & Iida 2005).

Ultimately, from the outset, the empirical operationalisation of space syntax is incommensurable with how BLTs have come to be theorised here. BLTs foregrounds understanding of inter alia social constitution, experience, discontinuity, and materiality, which remain under-explored in space syntax. Furthermore, while inspirational in methodical quantitative sophistication, we do not (yet) know if or how space syntactic measures are socio-spatially significant for the constitutive process of inhabitation.

Comparative applicability of space syntax

How does space syntax’s applicability fare in pursuit of radical cross-cultural and diachronic comparisons? As Steadman (2004: 484) puts it, one of its most significant findings is ‘that the pattern of movement in a city or urban area is likely to be shaped to an extent by the topology of its route network alone, irrespective of all other factors’. The focus on the connectivity of continuous space in association with lines of sight implies an emphasis on movement and accessibility along streets and grids (e.g. Hillier 2007; Omer & Zafrir-Reuven 2010).
While seemingly pervasive, requiring the presence of formal streets or grids actually limits space syntax’s immediate application to ‘strange towns’ (Hillier 2007: 171ff.). This includes the irregular and dispersed geometry of Maya low-density patterns. Hillier (2007) explains his symbolic characterisation of Maya built form in opposition to the instrumentality of ‘normal town’. Such opposition flagrantly brushes over the fact that these cities must be functional everyday living spaces just the same (also Hohman-Vogrin 2005, 2006). Maya cities are known to have few formal streets (Magnoni et al. 2012), while they do contain much differently organised open space (Chapter 7 demonstrates these can be designated with BLTs). Griffiths (2011; Griffiths & Quick 2005) suggests better suited social and historical analyses might become possible through critical reconsideration of space syntax’s foundation, and progressive adaptations of its spatial concepts and analytical measures. Indeed, explorative urban space syntax applications are carefully being attempted by Mesoamerican archaeologists (Morton et al. 2012a, 2012b; Parmington 2011 for an elaborate Maya example of architectural access analysis).

In radical comparisons the appropriateness of formal functional space categories such as streets and grids becomes dubious. For such purpose predictive and probabilistic claims seem misplaced, and are therefore best replaced by a more explorative mode of research. For that reason the theoretical framework of BLT Mapping will not contend probability. In other words, spatial dependence does not elicit a direct causal relation between built space and what will actually occur in space, including movement. Yet, social theory would not deny that spatial configuration affords the interconnectivity and permeability which promotes movement and land-use. Instead, movement is present as a presupposition; part of ‘acting man’. By mapping BLTs, the socio-spatial conditions in which movement or any other use takes place becomes qualitatively characterised with formal descriptions of each space and positioned within the configuration. Doing so may narrow down likely functions within materialised spatial settings (cf. Sayer’s (2000) spatial independence), but does not express the probability of something occurring within a specific space.

29. Interestingly, symbolic (culturally particular) interpretation is no stranger to anthropological and archaeological spatial layout analysis (e.g. Douglas 1972; Schwerkfeger 1972; Ashmore & Sabloff 2002; Atkin & Rykwert 2005). This approach has not disappeared, but now exists alongside a growing presence of more formal, especially space syntactic studies (Cutting 2003; Thaler 2005; Van Nes 2011; Morton et al. 2012a, 2012b, forthcoming; Fisher 2009; Stöger 2011; Paliou & Knight 2010).
When granting time a substantive role (see Griffiths 2011), the relationship between human action and layout is recursively constitutive (or continuously dialectical). Therefore preferential causal weight can neither be allocated to the configuration nor to land-use locations as fixed attractors in which specific actions dominate (cf. Hillier et al. 1993). Historically speaking, predicting what will occur is particular to present socio-cultural values and processes. It can be agreed that through its common application to road networks and pedestrian flows, space syntax offers persuasive correlations when applied to evaluate economic viability with pedestrian flows, and the ability to generate such correlations can lead us to significant questions. When we detach empirical sophistication from the particularism that underlies space syntactic probabilistic methods, radical comparisons and deep historical cases may be served by a family of ideas and tools with which it is good to think (Griffiths 2012b). In the explorative sense, studying the patterns of boundaries composing the socio-spatial ontology intrinsic to the city (see Chapter 5) could complement Vaughan et al.’s (2010) perspicacious discussion on the spatial signatures of activity centres.

What merits further attention is the apparent value of a topological method for connecting built environment configurations to social life. In the social study of urban built environments, the fundamental conceptualisation of spatial configuration is key for space syntactic innovations (Bafna 2003; Pinho & Oliveira 2009a). In Hillier’s (2005: 3) own words: ‘Cities are large physical objects animated and driven by human behaviour. By far the most interesting and difficult questions about them are about how the two connect: exactly how is the physical city linked to the human city?’ Space syntax chose to address this by applying meticulous topological rigour with great success. Space syntax may not offer the fundamental theory BLT Mapping requires, but paves the way for topological mapping and computation to investigate society–space relations.

How theoretically justifiable spatial analytical measures using BLTs are devised is the subject of Chapter 8. In the potential for topological spatial analysis the similarities go far beyond sharing similar input data. Applying BLT Mapping, boundary concepts come to describe the whole configuration’s topology in terms of constitutively significant interaction opportunities, starting with a single boundary merely conveying a spatial relation (sensu Hillier et al. 1987). Because BLTs hone in on spatial discontinuity, this contains much more detail on the relations between built volumes and open
space, as well as making distinctions within open space itself, without losing comparability.

Efforts to combine and integrate methods

The methodological development of BLT Mapping is indebted to all preceding methods. These methods have been discussed as related but disparate (cf. Whitehand 2010a). Some researchers are seeking to exploit the links between them. BLT Mapping contributes a complementary methodology rather than a resolution. Yet, the nature of a GIS-based boundary method is receptive to this advancement. Following Ley’s (2012: 78) characterisation, virtually all of the work drawn on in this chapter is conducted by urban morphologists: those engaged in working on urban form, featuring ‘tangible form and intangible processes, present fact and reconstructions of the past, shared usage and individual creation’. This unites practitioners from many disciplines (cited here are primarily geographers, historians, architects, planners and archaeologists), although their methods are appropriate for different aims.

Following Lynch (1981), Kropf (2009) argues that the branches of the theory of urban form should interconnect and support each other. Morphological approaches to studying city space should represent a confluence of the findings of other disciplines. However, known discrepancies may keep comprehensive unification beyond reach. Kropf (2009: 106) tenders an example: ‘There is the disparity between the fact that cities are the result of deliberate and coordinated human effort [design] on the one hand and exhibit characteristics of “self-organization” and emergent behaviour on the other.’ These approaches have in common that they work from an existing complex which lacks a clear definition for both its entirety and its composing objects (elements) (cf. Kropf 2009). The a priori understanding of the source material (i.e. urban built environments) constructed via Chapters 1–5 seeks to avoid this for BLT enquiries.

For all methods discussed it seems to apply that despite initial empirical compatibility, their respective research purposes keep ready integration at bay. Ley (2012: 79) argues: ‘It is necessary to set out clearly the scientific aim of the endeavour and make clear that the categories and criteria involved are inherent in the study rather than the study object.’30 This could be converted to say that however one’s concept of the

30. On this basis, space syntax could be argued to confuse its theoretical social aspirations by studying its own derivative spatial or geometrical abstractions rather than social empirical reality.
city is formulated, one’s research purpose determines how, with which analytical units, the city should be investigated. I have critiqued some of the analytical units employed by the preceding methods. In return, I have provided a rigorous framework and exacting definitions for my primary analytical units in Chapter 5. Ultimately, all put different demands on data treatment and structure. Considering my theoretical framework postdates these methods it is hardly surprising none offers a ready-made appropriate method to work with boundaries.

So, what has been said on methodological integration so far? Larkham (2006) suggests (British) urban morphology has yet to structurally exploit the possibilities offered by GIS (but see Pinho & Oliveira 2009b; Koster 2009), as well as the complementarity between urban morphology and space syntax specifically (also Sima & Zhang 2009). Soon after, his plea for complementarity and integration found wider support (e.g. Kropf 2009; Pinho & Oliveira 2009a; Sima & Zhang 2009; Whitehand 2010a, 2010b). However, for true integration, degrees of compatibility in the way ‘urban form’ (or specifically the urban built environment) is treated must be determined. The uptake of this challenge in terms of real attempts to combine methods is scarce (a notable exception is Griffiths et al. 2010), which is testimony to the great conceptual work that still needs doing (Kropf 2009; Whitehand 2012). With regards to space syntax, a degree of methodological solipsism seems at play too (cf. Ratti 2004b).

Jones et al. (2009) demonstrate the potential, arduousness and inflexible limitations of integrating space syntactic results in GIS-based mappings. The particular visualisations that make space syntax results readily intelligible to the untrained eye are difficult to replicate with the same clarity and interpretive adjustability in a GIS environment. Fortunately the open source release of Depthmap has led to two software remedies. Initially the plug-in Confeego (Gil et al. 2007) brought many space syntax tools to MapInfo Professional and enabled the import of Depthmap results. Since then Gil et al. (2015) also developed the Space Syntax Toolkit as a plugin for QGIS (Space Syntax Network n.d.).

Significantly pioneering work comes in the form of the ‘place syntax’ specification and advancement on space syntax theory. This is an adaptation of space syntax’s accessibility measures combined with geographical density and other attraction locations (e.g. transport hubs, businesses), which is technically operationalised in the Place Syntax Tool (PST) for MapInfo (Ståhle et al. 2005; Ståhle 2012), and also now available for QGIS (Spatial Morphology Group n.d.). Their reports show that place syntax can in certain cases improve the predictions of
pedestrian flows, and that spatial topology can be successfully combined with spatial topography (or configuration with geographical distribution and density, see Fig. 6.6). As Ståhle et al. argue (2005; Ståhle 2012), the marriage of the description of urban elements in urban morphology and accessibility according to configuration in space syntax is fruitful for analysis, combining descriptive and experiential understanding of urban space. It should be noted that BLT Mapping theoretically also integrates both perspectives.

The development of new and integrative methods using GIS technology is great news for urban GIS applications in general. Strictly speaking, however, there is no established practice for computational mapping according to urban morphological principles (cf. Pinho & Oliveira 2009b). Furthermore, Conzenian urban morphology still lacks appropriate comparative concepts (Kropf 2009; Whitehand 2012). Some initial steps towards urban morphological GIS were reported on by Koster (1998). These efforts resemble customary archaeological GIS mapping, early reconstructive mapping, and include comments on the utility of map overlays (sensu Amherst College 2009, 2010).

As discussed, GIS has been aiding the related practice of reconstructing historic town plans (Lilley et al. 2005, 2007; Lilley 2011a, 2012, n.d.; Dean 2012a; Bisschops 2012), while its visualisation abilities

Fig. 6.6 Place Syntax Tool map of Gothenburg.
This PST visualisation shows accessible density (FSI_ Floor Space Index*), which is morphologically relevant, at a 500m radius combined with configurational space syntax integration at 2000m radius. (Image appears courtesy of Gianna Stavroulaki and the Spatial Morphology Group.)
have shown to be of comparative morphological merit (Lilley et al. 2005, 2007). The potential of GIS for developing comparative urban morphological studies is also argued by Koster (2009). Computationally overcoming the laboriousness of converting data representations and technical analyses remains the main obstacle. Because virtually all present-day mapping research takes place in GIS, and thanks to Gil et al.’s (2007, 2015) plugins, effectuating structural computational integration seems right around the corner. Initially, especially space syntactic abstractions seem incommensurable with more realistic topographical representations. Once projected in GIS there is no reason why these data could not be layered in geographical space and associated through geospatial attributes (cf. Koster 2009; Chapter 5).

Chapter 7 will now develop a mapping practice which respects datasets originating from different disciplines. Subsequently, Chapter 8 will discuss the data structure emergent from the mapping practice and provide a rationale for a spectrum of analytical possibilities. An initial sample of these possibilities is examined in Chapter 9. Although BLT Mapping profoundly alters the data structure of conventional topographical maps, BLTs simply trace the outlines of representations of empirical features. Thereby the urban topography is maintained, and integrative efforts are not complicated. Its base plan retains the option to carry out space syntax as well as the option to identify urban morphological elements. By the same token, there is sufficient detail to geo-locate urban historical references to people and events. Naturally, the native ability of GIS for generic quantitative analyses of any geospatial variable remains available. In addition, the database structure of GIS enables all pieces of data (BLTs and analytical derivations) to be invested with additional values and attribute information (e.g. architectural, economic or affective). In this way BLT Mapping merely adds interpretive opportunities.