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MEASURING THE MATERIALITY OF SPACE

Can space syntax provide the tools for an analytical grounding of assemblage theory?

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ABSTRACT

In recent years, relational theories, including assemblage theory, have brought new perspectives to urban studies and challenged the ways through which researchers approach the study of the urban environment in their effort to truly understand the complex processes that define the ways in which the social is reflected in the urban form and vice versa. Although the implications of assemblage theory for urban studies, in particular critical urban theory, have been explored, a closer look on how this theory could be related to space syntax theory and the methods it employs has not yet been taken. A discourse on such a relationship lies at the heart of this paper, which focuses on Manuel DeLanda's idea of cities as assemblages (DeLanda, 2006) and space syntax's concepts and tools which appear to describe urban properties that fit this notion.

The aim of the paper is to address the points made by Netto (2016) about the future of theory and the need to engage with new concepts and interact with ideas other than those from which each researcher starts their journey. In his words new approaches are needed to “escape the dead ends into which the different strands of urban socio-spatial knowledge have been drawn”. The authors believe that an exploration of the linkages between assemblage and space syntax theories is a fundamental step forward in broadening space syntax's focus on a wider range of possible relations, and thus strengthening it as a socio-spatial theory.

The paper starts with a discursive analysis comparing assemblage and space syntax theories. It then offers a detailed text analysis of chapter 5 (Cities and Nations) of DeLanda's *A New Philosophy of Society*. Based on the text analysis, relevant key space syntax concepts and their measuring tools are discussed in terms of their similarity to the definitions of components and processes which characterize cities as assemblages, as well as of their potential as tools for assemblage analysis. The main concepts discussed are connectivity, integration, segregation, centrality and scales of analysis.

The main criticism to assemblage thinking as a potential research approach in urban studies is its genericity and lack of analytical specificity. The theory is seen as suggestive of themes for research and of methodological

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techniques, yet tending to be indeterminate due to the complexity of the theorization of cities as assemblages, the high level of contingency in the interaction between different components and the potentially infinite scales at which transformation processes can occur. This paper's objective is to assess whether assemblage theory can be made analytically relevant and specific to urban studies by deploying space syntax tools when analytically applying assemblage theory. The authors conclude that assemblage thinking could be seen as enhancing the theoretical background of space syntax and that space syntax tools and concepts could be used as practical instruments for assemblage analysis.

KEYWORDS

Assemblage Theory, Space Syntax, Materiality, Relationality

INTRODUCTION

In recent years, relational theories such as Actor-Network Theory (ANT) (Latour, 2005) and assemblage theory as developed by DeLanda (2006) have highlighted the need to integrate different social sciences approaches into our analyses of social entities if we are to truly understand the complex processes which define the ways in which the social is reflected in urban form and vice versa. Although the implications of such theories for the fields of geography and urban studies have been explored (Anderson, Kearnes, McFarlane, & Swanton, 2012; Farias, 2010; Jacobs, 2012; McFarlane, 2011), their relation to space syntax theory and methods has received little attention. A discourse on such a relationship lies at the heart of this paper and it focuses on DeLanda's concept of cities as assemblages. Such a discourse stems from recent discussions about the need to rebalance space syntax's methodological refinement with its theoretical effort and engagement with other social theories (Griffiths & Netto, 2015). This is not because space syntax lacks theoretical grounding and richness – to the contrary – but because the authors believe that opportunities are being missed in presenting space syntax's full range of theoretical spectrum to the wider audiences of sociologists and human geographers. This paper is also a response to Netto's suggestions (2016) that space syntax, in order to mature as a socio-spatial theory, should open up to and embed dimensions of space which account for wider social processes and for the full range of associations between actors, while at the same time retaining the benefits it offers in its relational treatment of space. He further suggests that one way of doing this is to explore new relational ontologies such as ANT in order to develop a fully-fledged concept of space as syntactic, material, as well as semantic (Netto, 2016).

Assemblage theory, concerned with social ontology and with defining social entities as assemblages, “wholes whose properties emerge from the interactions between parts” (DeLanda, 2006, p. 5), poses fundamental questions about the existence and the nature of social entities such as cities. It argues that individual social entities at any given scale have an objective existence and a relative autonomy and are thus legitimate objects of study. It asserts that the properties of a whole are not reducible to its parts and it thus attempts to account for the unique properties of individual social assemblages formed at different scales. The main

tenet of assemblage theory is that the parts of an assemblage do not form a whole, but it is the interactions between such parts that determine the properties of the assemblage, as in the case of cities which are “composed of entire populations of persons, networks and organizations”, as well as a variety of infrastructural components such as “buildings, streets and various conduits for the circulation of matter and energy, defined in part by their spatial relations to one another” (DeLanda, 2006, p. 94).

The ontological question of whether cities are wholes or sets of interconnected parts is addressed by the discourse on the conceptual understanding of place. In this discourse, there are two contrasting views of the nature of the relationships among the components of a city. One view takes the relationship as being analytic, meaning that the city is seen as a collection of parts which are connected by linkages of varying strength and quality. The other view takes the relationship as being synergistic, meaning that the parts of the city and their interconnections do shape the identity of the city and give it its properties, but that in turn the city has properties of its own, which have the ability to influence and shape its parts. Seamon (2015) defines the first view as *analytic relationality*, by which the parts and their linkages, with their strength or weakness, give shape and identity to the place, and the second view as *synergistic relationality*, which sees place as an integrated whole which sustains and is sustained by its parts. These concepts are particularly relevant to the present discourse because synergistic relationality implies a holistic understanding of place which is shared by both assemblage theory and space syntax. This is something which is deemed as a potential important theoretical contribution of space syntax theory, but poorly articulated to favor the analytical application of its methods (Griffiths & Netto, 2015), while it is fully developed within assemblage theory using concepts relevant to space syntax, but missing an indication of analytical pathways.

The paper presents a discursive analysis comparing and relating assemblage and space syntax theory by focusing specifically on the concept of cities as assemblages as discussed in chapter 5 of *A New Philosophy of Society* (DeLanda, 2006). Key shared concepts identified in the discursive analysis are then addressed in more detail, considering their compatibility and therefore the possibility that space syntax measures might function as an analytical tool for assemblage theory. A discussion and conclusions are then provided regarding the strengths and weaknesses of each theory, how they might complement each other and engage in the development of socio-spatial knowledge reconciling views of space by jointly recognizing its relationality and materiality.

ASSEMBLAGE THEORY AND SPACE SYNTAX

Assemblage theory defines cities as social assemblages - wholes whose properties emerge

from the interaction between parts. In assemblage theory, the city is viewed as a single social entity, of which both physical and human factors are component elements, although its properties are not simply reducible to those of its parts. Individual social entities at any given scale have an objective existence and a relative autonomy and are thus legitimate objects of study. This definition of the city as ‘one’ is discussed and supported by Hillier and Vaughan (2007) who suggest not only that the physical and social aspect of cities jointly operate to generate outcomes, but that the social and the physical as separate contingent processes is intuitively unlikely and thus the idea of the city as one thing is somewhat self-evident. They point out that considering the social and the physical as inextricably linked raises issues of determinism; this is perhaps why the intuitive idea of the city as a ‘whole’ or ‘one’ is continuously debated and felt to require empirical proof. While assemblage theory addresses this philosophical issue, in many ways space syntax evolved to empirically assess the relationship between the social and the physical by developing spatial models which are explanatory of the social phenomena inherent to cities.

Essential ontological concepts, in particular the dichotomies of *universals* and *particulars*, and of *determinism* and *indeterminism* play a key role in setting a theoretical and analytical framework to address ‘the problem of the city’. The universals of urban theories are those elements and processes – the invariants – which are identifiable across all cities, the *morphogenetic* rules which are said to give cities their universal characteristics. The particulars, on the other hand, are those processes and features which are only identifiable and visible in one or a number of cities and which give cities their ‘peculiar’ individual nature. One aspect of the deterministic debate in urban studies focuses on whether there are indeed particulars and then asks what are the causal pathways that lead to specific features and unique city forms. The other aspect debates whether and how the elements that constitute a city have an impact on the city as a whole and, in turn, whether the city as a whole has an impact on its constituting elements, in particular its population – a key ontological requirement for an entity to be defined as a ‘whole’.

Assemblage theory views each city as unique, as a valid ontological entity which also has certain universal characteristics. The identity of a city is shaped by successive processes that take place within it. While the geographical and historical context, and the situation of a given city provides it with a range of opportunities and risks, it is the interaction between social and physical entities, which determines their exploitation or avoidance. A variety of scales – not just the macro or the micro – are involved in the emergence of cities, while historical processes play an important role in their formation and transformation.

Assemblages are seen as differently-scaled unique, singular entities (*individual singularities*) associated to a set of *universal singularities* (invariants shared by many different systems). These universal singularities structure the space of possibilities afforded to the assemblage.

Consequently, any assemblage, in addition to the roles and processes of its components, is also characterized by a diagram describing the set of universal singularities associated with it. Space syntax analysis works across scales, from street-level data to whole-city structure and any range in between and beyond, to regional and nation-wide models. Through extensive analysis of a large number of cities across the world, space syntax has been able to identify the invariants (universal singularities) and variations (individual singularities) that shape cities (Hillier, 2002). It has done so by developing, through empirical research, the theoretical tenet that the configuration of the street network of cities affords different spaces of the city with a certain movement potential (Hillier, Penn, Hanson, Grajewsky, & Xu, 1993).

In the framework of space syntax theory, Hillier (2002) defines the city as an object but avoids delving into the wider implications of the analogy. However, he clearly addresses the ontological issue of universals and particulars. Through the identification of invariants and variations across cities he highlights the factors and processes which structure the urban form. Because of the existence of the ontological dichotomy and because the city is invariably, recognizably structured in certain ways, he is necessarily driven to define it as an existent entity (object) with its own properties. This has led to the formulation of the theory of the generic city: a proposition that claims the existence of a universal city with many spatial and functional invariants across cultures. According to this theory (based on an extensive study of hundreds of cities and settlements ancient and modern around the world), all cities are comprised of a very small number of long lines and a very large number of short lines. These constitute a dual system made up of *foreground* and *background* networks with different geometries: the *foreground* network, made up of longer lines and nearly straight connections and the *background* network, made up of shorter lines with more near right-angle connections, and, consequently more localized and with less linear continuity.

Functionally, the *foreground* network, (emerged in such a way so as to maximize grid-induced movement and driven by micro-economic activity) takes a universal form of a deformed wheel making up the public space of the city where the possibility of encounter and exchange is highest (Hillier, 1989) with a network of linked centers at different scales.

The *background* network is largely residential and is configured to restrain and structure movement in the image of a particular culture, and so tends to be culturally idiosyncratic, often expressed through a different geometry, making the city as a whole look spatially different and thus unique. This difference, dictated by socio-cultural factors, is referred to by assemblage theory as the geographical and historical context.

The basic analytical tool of space syntax is the axial map – the set of fewest and longest lines of sight that cover all the accessible open spaces in a system. This map is analyzed as a set of nodes and lines: different measures are calculated through a set of justified graphs connecting

each space in the system to all other spaces. Visually these justified graphs appear as a diagram spatially describing both the universal and individual characteristics of a city. Although this is not necessarily the diagram implied by assemblage theory, it could be considered as one of the many layers which make up cities as assemblages. This becomes even more relevant when considering that the basic measure of space syntax is connectivity (the number of spaces immediately connecting to a space) while assemblage theory states that connectivity (the streets, transportation and other infrastructure) is the component that enables the circulation of people and other entities between locales, seeing any changes in connectivity as affecting in various ways the social activities that occur in a given locale.

Assemblages are defined by the variable roles played by their components (from *material* to *expressive* role) and by the variable synthesizing processes the components are involved in (defined as *territorialization* and *detrterritorialization*). Territorialization acts to stabilize the identity of an assemblage by defining and reinforcing both spatial and non-spatial properties, thus increasing the internal homogeneity of an assemblage. Deterritorialisation acts to change the assemblage through destabilizing processes. Space syntax focuses on the spatial properties which characterize the network of spaces in a city and in its most practical applications is used to assess how changes to these spatial properties affect, alter or reaffirm the characteristics of a city. The key difference between the two theories is that space syntax intentionally rejects addressing the expressive role of components in a city unless these are spatially evident. Furthermore, according to assemblage theory, specific to the city are the processes of *congregation* and *segregation*, which define boundaries and determine homogeneity, while a variety of factors that might range from conflict to increasing mobility, fluctuating land rents or changes in fashion are seen as destabilizing forces. Expressive elements also play a role in defining the identity of a city or its areas with connectivity contributing by determining in various ways the social activities occurring in any given locale.

DeLanda makes the concept of assemblages and the way they function relatively clear. However, it remains an analytically speaking a vague concept which does not provide a strategy for analyzing social assemblages and does not explain the properties of the whole since there is a high level of contingency in the interaction between the parts and a potentially infinite number of scales at which synthetic processes can occur. The remainder of this paper discusses a number of terms describing key concepts common to both assemblage theory and space syntax theory. The specific shade of meaning the term has in each theory may differ, but key tenets of assemblage theory are clearly common with those of space syntax. The authors believe that identifying these key concepts and initiating a discussion on the specific meaning they have in each of the two theories and their overlap is a vital step forward in developing a mature socio-spatial theory. The common tenets are:

1. Cities as social assemblages are influenced by a larger context, but because they clearly display universal features, they can still be considered and analyzed as a distinct entity.
2. Cities as social entities are basically constituted by the connections or associations between different elements. What is fundamental to the development of cities therefore is both *what* they are composed of and *how* these elements are connected, spatially and otherwise.
3. Both physical as well as non-physical entities are either component parts or actors in the constitutions of cities, thus both must be taken into account in analyses.
4. There are processes of stabilization and destabilization in cities. These processes and their spatial nature must be understood in order to understand persistence, continuity and change in cities.
5. Expressive means as produced and articulated by the processes of group formation and stabilization of groups' identities are key in determining how the social is expressed in the physical form; often this expression results in specific spatial distributions of populations or in the spatial form of places where such expression unfolds.
6. Multiple scales are involved in the emergence of cities, while historical processes play out in their formation and transformation; a scalar understanding of the relations between different components and a diachronic understanding of changes in their connectivity can deepen the knowledge of morphogenetic processes.

KEY SHARED CONCEPTS

Despite the fact that assemblage theory is more qualitative while space syntax is more quantitative with a strong focus on space, the two frameworks share a number of key concepts with their meaning overlapping in many ways. In some cases, these concepts are contrasting and, at other times, complementary or comparable since they may offer descriptions of the same processes and relations, despite the fact that the specific terms used may be different.

Connectivity

In assemblage theory the concept of connectivity is broad and comprises any component which enables the circulation of people and other entities between spaces. As in any assemblage the way these components are connected – their relationality or configuration in space syntax terms – determines the social activities occurring in any given place. This is a key overlap between the two theories: the fact that it is the relationships among certain components of the city that mainly affects its social life and the specific ways it unfolds in public space. In space syntax, strictly speaking, connectivity is a measure of the number of spaces immediately connecting to a space of origin. While this is obviously a quantitative measure, it is possibly the most basic and fundamental measure of analysis of settlement layouts and the one which is the basis of many other space syntax measures. Adopting a wider take on its meaning: how spaces are connected to each other in its various relations and associated measures, can be considered as the basis of space syntax theory. The measure of

connectivity, potentially along other measures, may form the basis for the analytical assessment of connectivity as defined by assemblage theory. Furthermore, the practice of space syntax has now evolved to take into account in its models of assessment connections which go beyond purely spatial configuration, thus including, for example, transport links. This embedding of other components within space syntax analysis may be further widened in the future on the basis of further engagement with other relational theories.

Integration, segregation and congregation

Within assemblage theory there are two concepts which relate to the distribution of population groups in a city and to the homogeneity of characteristics of certain areas: the concept of *congregation*, the tendency of populations to come together in a relatively homogeneous composition and the processes that define the boundaries of a given area and determine its internal homogeneity, and the concept of *segregation*, the grouping of similar populations or skills induced by external forces. The processes of territorialization and deterritorialization are seen as playing a central role in shaping congregation and segregation. In particular, increased geographical mobility interacts with the effect of land rents as a process of deterritorialisation which produces changes in the identity of neighborhoods. Authorities also play a role in allocative decisions and hence, depending on their policies, can play either a territorializing or destabilizing role. The processes that stabilize an area's identity relate to the definition of its borders and to the daily routine activities taking place within it and in particular what can be referred to as residential practices. In space syntax theory social integration or segregation are commonly assessed with spatial measures (Vaughan, 2005; Vaughan & Geddes, 2009): integration is a normalized measure of distance from any space of origin to all others in a system, while segregation means spaces are deeper from all other spaces; the former calculates how close the origin space is to all other spaces, while in the latter more segregated spaces have higher mean depth values. These measures are known to correlate with distributions of population groups, social activities taking place within an area, the definition of area borders and residential practices (as discussed above in relation to the background network of cities). Although these measures do not cover all the characteristics of the concepts of congregation and segregation as defined by assemblage theory, for example the grouping of skills or the extent to which these factors are induced by internal group choices or external forces, they can still provide an analytical measure for at least some of the components involved in these processes. However, previous research has shown that the simple space syntax equation or dichotomy of spatial-social, segregation-integration is not sufficient to correctly interpret the socio-spatial structure of cities and, therefore, other theorizations of social segregation and integration must come into play in order to fully understand urban socio-spatial phenomena (Charalambous & Geddes, 2015). Space syntax can provide a practical measure for the spatial homogeneity of areas, while the concept of congregation provided by assemblage theory can theoretically complement the way with

which space syntax articulates the social aspect of segregation.

Centrality

While centrality itself is not a ‘termed’ concept in assemblage theory, DeLanda articulates the issue of changes in the location and number of centers within cities. He states that historically, a multiplication of centers within cities took place in many countries following WWII as increased car use coupled with suburbanization prompted the development of retail activities in outer locations and the variety of land uses in suburban areas multiplied. The historical identity of cities characterized by mono-centricity was affected and the changes in connectivity brought about by suburban growth and new transport means acted as a deterritorializing force (DeLanda, 2006), thus creating many of the characteristics common to contemporary cities described by Levy (1999) as having a poly-nuclear, open and fragmented peri-urban fabric. In space syntax, *centrality as a process* is a theory which proposes that the formation and location of urban centers are the outcome of a long-term historical process. This process entails the configuration of the street network shaping movement flows patterns, which subsequently have an impact on the distribution of land uses, which then result in the formation of the busier and quieter areas of the network. These differentiations have a subsequent influence on land use choices, and the development of the area as an attractor in the settlement layout as a whole. The process of centrality happens because people’s movement in cities has both a global and a local aspect, the one reflecting circulation in and out of the system, the other within the system. As cities grow, so do their centers. Their spatial configuration also changes thus having an impact on people’s movement and the location of land uses (Hillier, 1999). Because of this, centers also tend to shift and diversify (Hillier, 2002).

The causal pathways that lead to the diversification of centers in cities are somewhat different between the two theories, with assemblage theories focusing more on technological changes and space syntax on the configuration of the street network itself. However, both clearly highlight that relationality of space in terms of connectivity is key to this development. Furthermore, this concept is where the relationship between land use and movement, and the historical process of transformation of cities are identified as fundamental by both theories in shaping contemporary cities. Space syntax, with its capability to assess the process of centrality at different stages of a city’s development can be used as a tool to measure the shift from mono-centricity to poli-nuclearity in relation to different historical and technological changes.

Scales of Analysis

The relationships between the whole and its parts are key to understanding cities since these not only emerge from the interaction among the parts, but the whole can affect those parts in both a limiting as well as an enabling way – a key feature of social assemblages. According to

assemblage theory, analysis of urban development should therefore focus not only on the micro-macro mechanisms behind the emergence of the city, but also on the macro-micro mechanisms through which the city provides its components with both constraints and possibilities. However, since the social processes which shape the city occur not only at these two levels, but at a range of different scales, a method of analysis which accounts for these various scales is needed in order to understand how the properties of the whole emerge from the interaction between the parts and how the whole in turn affects the populations, interpersonal networks and organizations which compose it. Space syntax has this ability to analyze the city at different scales and to assess the relationship between different parts of the city and the whole, not just from a spatial point of view, but also from the related social phenomena that occur at different scales. While space syntax analyses often focus on the concepts of global and local scales, it has always taken into account different radii of analysis and the two-way relationship between the global and the local. Furthermore, the analysis of different scales has become more refined in recent years with the introduction of segment analysis and metric radii, as well as research focusing on the impact of intermediary scales on the functioning of different urban areas (Geddes & Vaughan, 2014). This ability of space syntax to evaluate inter-accessibility can aid in the understanding of the complexity of the linkages between components and the scales at which these interact to produce certain outcomes as articulated by assemblage theory.

DISCUSSION AND CONCLUSIONS

Assemblage theory provides an indication of the physical and human components that interact to create the city as a social entity and proposes that integrating a variety of approaches that address different spatio-temporal scales is the course to take in understanding the emergence of cities. However, the fact remains that the theory is highly generic in proposing analytical approaches: exactly what elements, scales and interactions should be taken into account for analysis remains open for debate. This is not necessarily a shortcoming, but something that should perhaps be viewed positively as potentially enabling those with specific information and skills to develop approaches best suited to the study of the urban form and to specific case studies – a view which is shared by the scholars of complexity science (Batty, 2013; Bettencourt, 2013).

The fact that the theory focuses on heterogeneity, transitory conditions and the complexity of interactions between components enables a deeper understanding of the variety of actors involved in the shaping of cities. Assemblage theory provides a theoretical framework for urban morphology and the social processes that are involved in the shaping of the urban form. It sustains the argument that the physical and human aspects of a city are inextricably linked and should therefore be analyzed together as they jointly define the identity of a city. It also makes clear that an analysis that does not take account of historical processes or of the

distribution of variations across a population, cannot fully explain the emergence of cities and the processes behind persistence and change.

It has previously been pointed out that the relevance of space syntax methodology as a potential analytical tool of relational theories has been little explored (Charalambous & Geddes, 2015). In fact, space syntax, which addresses the relationality of space and its association to social phenomena has great potential for making relational theories analytically specific in the context of urban studies. As shown above, certain concepts of assemblage theory are particularly relevant to space syntax methodology and could be viewed as theoretical facets of space syntax measures. Space syntax offers a variety of measures which describe different properties of space. Such measures are based on how locales are connected, how they are positioned in relation to each other, and how social and physical factors are associated. Moreover, the processes that, according to assemblage theory, define the homogeneity and diversity of areas or cities are congregation and segregation. Part of these processes is the grouping of similar populations or the mixing of diverse populations. Space is sometimes 'appropriated' by certain groups and space syntax can give us an analytical measure of this through its ability to assess the relationship between social phenomena and spatial characteristics. The stabilization of a city's identity normally occurs through habitual human practices and routine activities, in particular residential practices. This is something highlighted not just by assemblage theory, but also by previous scholars of urban sociology, including the Chicago School and Lefebvre (1991). The great achievement of space syntax in measuring these daily routine activities through its understanding of movement and social phenomena in relation to urban space, is its strength as both a theory as well as an analytical tool. Purely theoretical approaches fail to address planning and normative issues of how design influences social phenomena.

Space syntax has the ability to highlight the main structure of the city as a whole, while, at the same time, highlighting the structure and the characteristics of its parts or areas, down to the scale of the street segment. It has the ability to analyze the city at different scales, to assess the relationship between different parts of the city and the whole, and to measure connectivity between different areas. Such research tools cannot but be helpful in the framework of assemblage theory, which states that cities emerge from the interaction between their component parts, that a range of different scales should be analyzed, and that connectivity is key to the variety of ways in which social activities are performed in a given locale. This paper is only a first step in initiating an in-depth debate on the linkages between the two theories, on how they can complement each other, and on what points they remain different. It has hopefully shown that developing an engagement between the two theories can enrich space syntax as a socio-spatial theory and allow for a philosophically grounded understanding of the entity such as the one offered by assemblage theory to develop its analytical

component.

REFERENCES

- Anderson, B., Kearnes, M., McFarlane, C., & Swanton, D. (2012). On assemblages and geography. *Dialogues in Human Geography*, 2(2), 171–189. <https://doi.org/10.1177/2043820612449261>
- Batty, M. (2013). *The New Science of Cities*. MIT Press.
- Bettencourt, M. A. (2013). *The Kind of Problem a City Is* (No. 201-03-008). Santa Fe.
- Charalambous, N., & Geddes, I. (2015). Making spatial sense of historical social data. *Journal of Space Syntax*, 6(1).
- DeLanda, M. (2006). *A New Philosophy of Society: Assemblage Theory and Social Complexity*. Bloomsbury Academic.
- Farias, I. (2010). Decentring the object of urban studies. In *Urban Assemblages: How Actor-Network Theory Changes Urban Studies* (pp. 1–24). New York: Routledge.
- Geddes, I., & Vaughan, L. (2014). *Why do people walk in the suburbs? An analysis of how spatial configuration and land use diversity contribute to walkability* (No. 1/2014). London.
- Griffiths, S., & Netto, V. (2015). Open Syntaxes: Towards new engagements with social sciences and humanities. *Journal of Space Syntax*, 6(1), i–v.
- Hillier, B. (1989). The Architecture of the Urban Object. *Ekistics*, 334/335, 5–21.
- Hillier, B. (1999). Centrality as a process: accounting for attraction inequalities in deformed grids. *Urban Des Int*, 4(3–4), 107–127. <https://doi.org/10.1038/udi.1999.19>
- Hillier, B. (2002). A Theory of the City as Object: or how spatial laws mediate the social construction of urban space. *Urban Des Int*, 7(3–4), 153–179.
- Hillier, B., Penn, A., Hanson, J., Grajewsky, T., & Xu, J. (1993). Natural movement: or, configuration and attraction in urban pedestrian movement. *Environment and Planning B: Planning and Design*, 20, 29–66.
- Hillier, B., & Vaughan, L. (2007). The City as One Thing. *Progress in Planning*, 67(3), 205–230. <https://doi.org/10.1016/j.progress.2007.03.001>
- Jacobs, J. M. (2012). Urban geographies I: Still thinking cities relationally. *Progress in Human Geography*, 36(3), 412–422.
- Latour, B. (2005). *Reassembling the Social: An Introduction to Actor-Network-Theory*. OUP Oxford.
- Lefebvre, H. (1991). *The Production of Space*. Wiley.
- Levy, A. (1999). Urban morphology and the problem of the modern urban fabric: some questions for research. *Urban Morphology*, 3(2), 79–85.
- McFarlane, C. (2011). Assemblage and critical urbanism. *City*, 15(2), 204–224. <https://doi.org/10.1080/13604813.2011.568715>
- Netto, M. V. (2016). 'What is space syntax not?' Reflections on space syntax as sociospatial theory. *URBAN DESIGN International*, 21(1), 25–40. <https://doi.org/10.1057/udi.2015.21>
- Seamon, D. (2015). Understanding place holistically: Cities, synergistic relationality, and space syntax. *Journal of Space Syntax*, 6(1), 19–33.
- Vaughan, L. (2005). The relationship between physical segregation and social marginalisation in the urban environment. *World Architecture*, 185(185), 88–96.
- Vaughan, L., & Geddes, I. (2009). Urban form and deprivation: a contemporary proxy for Charles Booth's analysis of poverty. *Radical Statistics*, 99(99), 46–73.