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10th International Space Syntax Symposium

Proceedings of the 10th International Space Syntax Symposium: Book of Abstracts

THE BARTLETT SPACE SYNTAX LABORATORY

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Symposium themes

1. **Housing and homes**
2. **Architecture and complex buildings**
3. **Urban morphology and history**
4. **Urban studies, transport and mobility**
5. **Land use studies and urban economies**
6. **Spatial and social justice**
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Visual layering as a spatial quality in contemporary Cypriot houses

Based on a function break up of a sample of contemporary Cypriot houses the study examines the nature of visual layering present in the proposed designs. A standard visibility graph analysis (VGA) is here complemented with an examination of the basic visual relationships between the main function/spaces in the house. Which spaces are visually connected to which? What shape do such arrangements take? What spaces tend to perform the role of the pivot in these arrangements? Are there any noticeable trends through time? These are some of the questions addressed by the presented piece of research.

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'Dwellings' then and now:
A topological approach for privacy analysis of 'Wada' and modern houses

Every culture influences the way people use spaces, which in turn are manifested in its domestic architecture. The paper examines two distinct residential typologies: one traditionally evolved, without an architect (Wada) and other modern dwelling designed by an architect (bungalow), to analyse the inter-relationship between spatial configuration and privacy. Authors examine ten traditional houses i.e. Wada (a distinct residential typology of central India) and fifty one modern houses. The concepts of privacy are analysed by identifying physical and non-physical domains within traditional houses using space syntax method. Preliminary study of plans of Wadas and modern houses to identify physical change shows considerable reduction of transition-spaces. Historic documents and interview schedule conducted with historian helped to understand activity-space relationship and identify domains within the traditional houses. Three domains namely: social, functional and sacred-domains form the essential attribute of Wada.

Paper attempt to find answers to following research questions. What is the impact of reduction in number and change in character of transition spaces on spatial configuration from traditional to modern houses? In what way the domains identified in traditional houses continue to exist within modern houses? How does blurring of the boundaries between social and functional domains of modern houses influence the privacy within the house? The study is conducted using justified permeability graphs to analyse depth, integration and topology of both sets of houses and also the identified domains.

The paper identifies spatial differences and disconnect that exists between two sets of houses. Finally the paper concludes that rather than studying the individual activities and there correlation with all other activities, it is fruitful to identify the realms existing within the house.

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Physical integration and ethnic housing segregation

The paper explores the correlation between ethnic housing segregation and the physical layout of city streets in Oslo, Norway. First, it describes a number of economic, social, and cultural reasons to why ethnic housing segregation occurs and how it is maintained, and how these factors might be influenced by whether or not the majority and minority populations live in areas with globally well-integrated road networks. It postulates that minority neighbourhoods and their residents are more adept at accumulating social, human and economic capital if they are more likely to attract visitors from other areas with different ethnic composition. This, in turn, can influence the development of housing segregation as ethnic minorities in such a physically integrated area might have more economic options and greater preference for living in areas with a lower proportion of their own group. If so, it is possible that areas with a high percentage of minorities will experience less growth in its minority share if its road network is well integrated, which will reduce ethnic housing segregation in the city.

To find an empirical foundation for this hypothesis, the paper explored the development of the shares of ethnic minorities in Oslo neighbourhoods from 1992 to 2009. This is seen in relationship to the mean global integration values for all road segments within each neighbourhood. Neighbourhoods with a high minority share are found to have a smaller growth in their share during the period if they are physically integrated. However, the findings are not significant when other demographical and economic factors are controlled for. A physically integrated road network appears to be important, but not sufficient, for a neighbourhood with a high share of minorities in 1992 to attract high-income members of the ethnic majority during the study period. This causes several physically integrated neighbourhoods with a high share of minorities in 1992 to have a low or negative growth in their minority shares from 1992 to 2009. As the demographic data collected is only tied to the neighbourhoods, rather than individuals, there is no indication that an integrated road network will influence the minority members living there in a way that will make them less prone to living in an area with high shares of their own minority in the future.

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Following the codes of rationalist architecture through a syntactic analysis of early Turkish examples

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Rationalist architecture is mainly based on a structurally and conceptually functionalist design approach using concrete, glass and steel in rectangular forms without any ornament. Focusing on functional constructs and simple forms, rationalist buildings largely carry international and timeless design qualities. They display strong similarities with each other even if they are built in different periods of time. They generally present a defined life style and hardly accommodate elements reflecting social structures, local cultures and personal taste. On the other hand, with the current research background, it is widely accepted that cultural and socio-economic factors have a profound effect in the shaping of the built environment and user's peculiar preferences and life styles are particularly reflected in the home environment. Within that context, this paper seeks to develop an understanding of the interpretations of the internationally accepted design codes of rationalist architecture on housing practice in different cultures and locales away from where it originates. It focuses on the avant-garde examples of the early 1930s from Turkey and questions to what degree the spatial organisation and the syntactic properties in these early modern Turkish examples display similarities with those of the houses which were designed by the pioneering architects such as Loos and Gropius and largely acknowledged by the international academia as the keystone buildings of rationalist architecture. As rationalist architecture places a particular emphasis on functionalism, space syntax techniques are taken as appropriate means for a comparative analysis of the spatial characteristics of the early modern Turkish examples and the keystone rationalist buildings. In the analysis, UCL depthmapX, Spatial Network Analysis Software is facilitated. With the use of justified graphs and convex map analysis, the order of integration and mean depth values for each functional space are revealed. The findings from the keystone buildings are used as a basis in revealing the syntactic properties of the examples from Turkey, which can be taken to reflect the idealised rationalism of the period. With the findings, it is pointed out that, in spite of a limited number of local traditions displaying a continued line, the syntactic properties of the examples of early modern houses from Turkey present spatial similarities with the keystone buildings of rationalist architecture with their newly developed functional and spatial structures. It is expected that these findings will contribute to the understanding of the interpretations of the internationally accepted design codes of rationalist architecture on housing practice in culturally and socially different environments.

Neruda in construction:
An analysis of his Chilean houses

So, I'm a natural poet of war and cities,
of machines and houses, of love,
of wine, of death and of freedom
Pablo Neruda, 1943

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Isla Negra, Michoacán, La Chascona and La Sebastiana are the names that the Chilean Nobel laureate poet, Pablo Neruda, used to refer to his houses. Neruda build his houses, he named them and wrote poetry to them. The names, as the houses, are full of charm and mystery and seem to evoke many things: a territory, a location or a tribute to a woman. The proposition in this paper is that through their construction Neruda offered us not only a rich collection of original and somewhat eclectic edifices and an insight to his rich life, but also a set of buildings that were carefully thought and built in search of a perfect combination of 'creative individual' and 'collective social' space.

This was done through multiple interventions to his houses that can be best understood through a configurational analysis of the different construction stages. The many studies carried out on Pablo Neruda's houses, have privileged the analysis and description of each space as separate entities, their particular history, their individual meaning, not aiming at a global spatial perspective and the configurational aspects have not been explored.

By contrast, this paper is based in the historiography of Pablo Neruda´s houses, and how he planned and built their expansion. A study of their spatial configuration is put forward. It aims at unveiling the deeper significance of each house from a systemic perspective, and even more of the set of houses understood as a particular Nerudian way of living in space. Although different in terms of volume and form, the houses express a rich spatial language of its own creator. Neruda was not only the owner or occupant, but interfered directly in the design of these spaces. The result is a set of homes that are able to enchant by their idiosyncrasies, by the mix of materials, and especially due to their spatial connections. The paper is part of a post-doctorate research in progress, using the space syntax theory and methodology. The theory is able to reveal a spatial language; the space convex methodology was used and the graphs of permeability, depth and integration measure revealed how the houses have become the Nerudian space. The approach was essential to: i) study each house and its particular process of expansion or alteration; ii) analyse them as a set, comparing the final version of each house with one another.

The result is a spatial concept with a clear intention of establishing multiple connections from the outside, creating a shallower structure in Isla Negra and Michoacán or a deeper structure in La Sebastiana and La Chascona. In all of them, Neruda's private workspace, the space of his creation, can be described as a segregated and isolated tower, while the collective social area occupied shallow spaces, often connected to the exterior. In fact, not surprisingly, Neruda challenged social conventions in his distribution of the private and public functions.

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When luxury is necessary.
Apartment projects in Recife – Brazil

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This article deals with the relationship between domestic space and contemporary ways of living, which is investigate by analysing apartment projects produced by the state market in Recife and the changes made by the new buyers – the elite of Recife, during the first decade of the Twenty First Century. The product released and commercialised still under construction – known as the original project – largely differs from the finished product – the reformed project –, which is a result of a specific ways of living of this class of consumer. Based primarily on the concepts and methods described in the theory of social logic of space, the analysis seeks to understand the extent in which some attributes of the contemporary society (or the society of consumption) redefine certain social behaviour partners of the family, particularly, their ways of living, and how those ways of living could cause impact on the spatial patterns of the apartment. The results from the analysis of the projects confirm that there is a standardisation for the original projects designed by the state market, corroborate with the diversity of social attributes which characterise the contemporary family and their ways of living (expressed in the reformed projects) and, also, point to the power of the media, although limited, in conditioning the elite of Recife to make luxury a necessity.

Configurational and morphological sustainability in social housing:
The case of Cité Ouvrière in Mulhouse

While currently many large-scale residential projects are scheduled for demolition, the worldwide housing deficit is constantly increasing. Solutions for this shortage are at the moment a top priority for national governments; however since the post-war modernist utopias social housing has created a bad name for being vulnerable to vandalism and crime. Thus, the question is how to design housing for low-income population groups that will avoid deprivation in the long term.

This paper explores the role of architecture and urban design in the sustainability of social housing, meaning its capability to endure any changes over time. Unlike other approaches that focus solely on the environmental aspects of sustainability, the study adopts a more comprehensive approach in order to retrieve those configurational and morphological characteristics that can contribute to spatial and social sustainability. It brings together different scales of design, from the city scale to the volumetric articulation of the housing units and different disciplines, architectural morphology, space syntax and socio-economic analysis. It also integrates the notion of time into the analysis in an attempt to develop a diachronic description of housing performance.

In order to do so, an early industrial scheme of the 19th century, Cité Ouvrière is explored in the deindustrialised city of Mulhouse in France. The findings suggest that despite certain statistical indices of deprivation, the original design of Cité Ouvrière carries inherent spatial qualities that have enabled it to survive effectively despite any socio-economic upheavals: the embeddedness of its urban layout, the natural spatial 'area-isation' (term adopted by Hillier) of its intensified urban grid at all scales and the flexibility in the Skin and Structure (terms adopted by Brand) of its housing typologies.

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Searching the genotypes:
Architectural morphology of urban houses in the ancient city of Panam

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The ancient city of Panam was established in late 19th century in a non-urban setting in Dhaka region. Panam was famous for cotton manufacturing and trading during British rule. The cotton traders built a good number of closely located and nicely ornamented buildings with narrow street frontage. According to history these buildings were owned by merchants who were absentee landlords, coming Panam once or twice a year. However, history explained little about their life styles and function of these buildings. The buildings apparently similar from outward had a variety in terms of their spatial organisations which remains unexplained without any evidence of their use pattern. Although researchers attempted to classify those buildings into common residential types available in this region, a large number of buildings of Panam remain unexplained due to their idiosyncrasies and dissimilarities with the available types.

In absence of social and functional data, buildings can be defined abstractly as a certain ordering of categories, to which added a certain system of controls, the two conjointly constructing an interface between the inhabitants of the social knowledge embedded in the categories and the visitors who's relation with them are controlled by the building (Hanson, 1998). Space syntax transforms the buildings into the form of adjacency graphs to represent, quantify and interpret spatial pattern in such a way that their underlying 'social logic' is understood. These syntactic statements explain the 'abstract genotypes'. In search of genotypes, the syntactic data compiled here are compared to find any difference in the spatial organisation among the different type of houses of Panam and to explain the ordering of space in these buildings in relation to the prevailing types in Dhaka region.

Among 52 dilapidated buildings of Panam, 22 buildings are analysed as abstract systems. Apparently the layouts of large houses of Panam, with halls and courtyards, are similar to the urban residential houses of Dhaka region having courtyards with encircling corridors giving access to series of rooms. However, spatial analysis reveals that both the introverted and extroverted houses of Dhaka have a deep uni-linear sequence whereas in the genotypes of Panam that uni-linear sequence is not very common, rather ringiness became the major character. In fact, the houses of Panam have overlapping rings connecting most of the interior spaces along with the exterior suggesting the depth of the buildings of Panam much shallower than the buildings of Dhaka. From graph analysis it is quite clear that the halls were distributed with the exterior in a ring, thus become shallower and easily permeable for the visitors. It can be interpreted as the need of privacy was low indicating that buildings have less residential quality in respect to the socio-cultural background of Dhaka. Interestingly, spatial analysis suggests that the consolidated type buildings with segregated central spaces and integrated frontal rooms are completely different from any prevailing typology of Dhaka. Thus space syntax analysis suggests that perhaps some of the houses of Panam were not residential type; rather they have some other commercial use which is not clear from their history.

Stating the need for an architectural design process: The role of the space syntax method in a case study of Western Australia project homes

Within the existing literature, the Space Syntax approach to the reading and understanding of the built environment has been strongly connected to evaluations of the efficacy of the result of design processes. If we define design as the process of recognising, analysing and expressing possible connections between identified problems and potential tangible solutions, the evaluation of the final product, the building, assumes as much relevance as the definition of the problem itself.

This paper aims to explore the opportunities offered by the use of the Space Syntax investigative approach, in order to both justify the need for a design process to be initiated, and to facilitate the design process itself, by identifying design-related problems. The research focuses on the design of the most successful, affordable housing model currently on the market in Australia, the 'project home'. By describing the implicit structure of the space configuration of the available assortment of project home designs, the Space Syntax methodological approach uncovers their limited typological categories, three identified genotypes.

The analysis of housing designs, using Space Syntax approach, clearly shows the detachment of the analysed housing designs from the housing needs of the society that they should be meeting, highlighting and justifying the need for an alternative design process to be initiated. Moreover, by describing and classifying current housing designs, the Space Syntax analysis provides an opportunity to reflect on how to use its findings to inform and approach future design proposals.

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Spatial hierarchy on vernacular houses in Eastern Black Sea Region, Turkey

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Human beings reflect their attitudes, habits, self-expressions, and their way of perceiving life directly to the houses they occupy. For vernacular housings, as well, one of the major factors that help spatial configuration is culture. The impacts of user specific lifestyles reveal itself throughout the formation of housings. Different spatial organisations and housing schemes are observed depending on cultural differences.

In this context, determining the factors that help shaping vernacular housings and used as paradigms for new designs is essential in terms of physical, social and cultural sustainability.

One of the first steps in designing a house is to determine the degree of its spaces in spatial hierarchy scale from "public" to "private". Spatial hierarchy, which is a crucial criterion for comprehending the interrelation between spaces, also provides the opportunity to have knowledge on cultural identity. In this paper, the significance of the impact of cultural difference on spatial configuration is emphasised and vernacular housings from 3 different cultures (Laz, Hemshin and Georgian) in close proximity in the Eastern Black Sea Region are evaluated using the criteria of spatial hierarchy.

The criteria that help us rank the spaces from public to private are as follows;

1. In order to obtain the accessibility coefficient, the properties of the space; that is, its position within the system, its density and frequency of use

2. In order to obtain the psycho-social coefficient, the roles of space; that is, privacy, security, identity and time are taken into consideration. With the help of these two coefficients, the "Spatial hierarchy coefficient", which enables the ranking of spaces from public to private, is obtained.

Within the scope of the research, 30 housings were studied. The spaces having the functions of kitchen, sitting room, entrance and guest room which were common in all the three cultures, were ranked according to their spatial hierarchy coefficients and the result was evaluated in terms of the user's relationship with their culture. In the study, space syntax, observation and face-to-face interview methods were used to reach the findings.

In this study conducted on the spaces formed and inhabited by 3 different cultures living together in the same region, it was determined that the living culture caused similarities and differences in the spatial configuration of houses.

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Is there a Brazilian home? An overview of domestic space and modes of life

This paper addresses the syntactic nature of domestic space, pointing out at specificities as well as aspects that appear to resist temporal, geographic or social differences, by reviewing case studies in which the researchers have attempted to decode the spatial logic of Brazilian residential buildings from the 19th and 20th century. It is here proposed that two spatial properties – the irrelevance of transition spaces and the importance of the exterior – are the kernel ingredients of a spatial structure that is the closest to something that may be referred to as a "Brazilian home". In recent times, these two properties have become less pervasive. Increasing demands for privacy require articulations by means of transition spaces and the exterior, albeit maintaining a certain degree of importance, is progressively being deprived of links to the house interior and to the public space. Studies (and media police records) indicate that this may contribute to antisocial behaviour in both sides of the walls. Raising awareness – especially amongst training designers in architectural courses – about spatial properties that have moulded domestic life for over a century in Brazil might help to face some of our present day challenges.

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Abstracts
2. Architecture and complex buildings

Teaching network and agent-based models to architecture students

Architectural design is necessarily a situated learning process that continues to be a subject of interest in architectural education. Whether designers should give preference to a functional design product or whether the focus should be centered on creative output are issues that need to be questioned. Given the typically vague descriptions of creativity it is even harder to determine whether design functionality and design creativity should be treated as separate entities. The implications of any preferences made on the methods of assessment are crucial. While teaching is necessarily aligned to design as an experiential learning process, it also requires careful understanding of how knowledge can inform rather than constrain creativity. In evaluating the creativity or even the functionality of a design there are challenges present in accounting for a comprehensive and yet practical framework for assessment. In teaching practices the challenge is to ensure that the assessment process is sufficiently specified without limiting creative explorations. It is argued that through exposing design propositions to internal and external criticism, assessing progress becomes less of a challenge. In this course of development 'creativity' is revealed not as value-neutral but as a product of a social process that is practiced through experiential learning.

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Spatial and social patterns of an urban interior – The architecture of SANAA

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The architecture of the Japanese practice SANAA, led by Kazuyo Sejima and Ryue Nishizawa, seems to be conceived so as to be spatially and programmatically 'uncertain', with configurations that tend to be freed from constrictions and often characterised by multiple layers of transparent materials, establishing a continuous relationship between interior and exterior. The present study seeks to understand whether there is an underlying configurational logic behind SANAA's architecture that is shared across their buildings. The results of this exploration are presented in this paper in two sections. The first section analyses a selection of buildings from diverse functional and formal typologies in order to explore whether in spite differences they share spatial similarities. The analysis takes into account two different properties: permeability, as the spatial network created by accessible spaces, and visibility, as the set of visually interconnected spaces, either directly or through transparent materials, but not necessarily accessible. Drawing on the conclusions of the first part of the analysis, the second section of the study focuses on what can be considered the first in-depth study of SANAA's Rolex Learning Centre looking at both spatial properties and social practices. The particular geometry of the building entails methodological challenges derived from a fluid and continuous undulated interior. Thus, syntax tools are customised to address the floor and ceiling's undulations; a systematic framework for analysing the intricate relations between permeability and visibility in the building is created; finally, the indeterminate condition of space is explored through a comparison between spatial properties and spatial practices in the building.

According to the results of the first section of the study, where a strong foreground structure is identified in the buildings analysed, and after analysing the Rolex Learning Centre by making use of the 'nearly invariant' properties proposed by Hillier to describe organic cities (Hillier, 1996), it is argued that the architecture of SANAA resembles urban systems in its topology, and in certain cases its geometry. Moreover, the spatial arrangement is qualified by the control in the use of transparent and opaque materials, which originates a set of areas in the layout with different levels of privacy. Finally, a closer look to spatial practices in the building reveals that the places likely to be used in a more informal way are those hosting a disjunction between levels of visibility and permeability. This is considered an incisive finding that, added to existing research on permeability and visibility relationships, provides a new way to explore the relationship between architectural complexity and functional uncertainty in buildings.

Slicing the cake: An isovist-based analysis of computerised workplace configuration

This paper addresses the analysis of computerised workplaces, with special regard to configurational aspects such as accessibility, visibility and privacy. The research method is based on isovists, axial maps and visibility graphs, proposing a more detailed analysis making use of isovist sections. The object of study is the layout reformulation of Federal Justice Court in Brazil, where judicial procedures are chiefly performed using computer applications.

The study comprises the analysis of configurational properties of the workplace and of individual workstations, which are evaluated and compared to each other and to organisational hierarchy. The method includes a survey that was responded twice by the workers, both before and after the reconfiguration of the Court. The results from the survey were correlated to the computed values for accessibility, visibility and privacy based on axial maps, visibility graphs and isovist sections.

The results showed that the configurational properties of the analysed workplace have been improved after layout reformulation. The research also presented some evidence on the relation between the attributes of isovist sections and the perception of configurational properties of open-plan offices by workers. Eventually the detailed analysis of isovist sections might widen the scope of space syntax research, while contributing with human factors and ergonomics to expand the body of knowledge regarding computerised workplaces.

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Disciplined informality: Assembling un-programmed spatial practices in three public libraries in Medellín

Medellín's Library-Parks were built with the main purpose of strengthening the sense of community of each library's surrounding neighbourhoods. In addition to 'original' programmes of public libraries, these buildings organise cultural events and meetings for sharing ideas and practices. Great importance is given to the generation of informal interactions in the libraries, and to the networks that are constructed by these interactions. Interactions are programmed (events organised by the libraries) but also un-programmed based on random encounters, which generate emergent social networks. However, despite the intention to support 'community emancipation' through informal networks, the organisational structure of the libraries may control such unprogrammed formations through institutional rules for organisation of behaviours. In fact, even if there are no official intentions for social control, the mere presence of staff means that human activities may be observed and informal networks affected. This leads to an implicit form of control that can be more pervasive than overt control based on predefined behavioural rules.

Understanding the tensions behind the organisational aims built upon the desire to enable informal interactions leading to self-organised social groups and at the same time define institutional rules that discipline society – is the main topic of this paper. In particular, we look at three cases – San Javier, Fernando Botero and Belén libraries – focusing on how observed informal interactions associate with the libraries' organisational control. Rather than looking at these social practices as rates of activity, which is the normal research practice in studies of space and activity using space syntax, we develop a method to address them as socio-spatial network elements. This approach reveals phenomena that would not be made visible otherwise: that is, of the ways in which the Library-Parks structure informal interactions potentially supporting the development of self-organised social groups and at the same time define institutional rules that discipline society.

It is found that the three buildings work in significantly different ways, despite their similar programme. In San Javier, space is used as the instrument of tactics of disciplinary control, particularly through controlling thresholds of communication between different user clusters and through constant surveillance of each cluster. In turn, Fernando Botero becomes a network where clusters of users are linearly linked by 'transition spaces' that work as bridges. Different clusters are separated with sharp programmatic boundaries, excluding unpredicted mixing of activities and making knowledge remain internal to the group. It is argued that empowering space and society to be generative rather than conservative can be achieved less by predicting the use of space and more by providing socio-spatial conditions that allow unpredictability to flourish. In this sense, we propose that environments such as Belén Library-Park support the formation of self-organised social groups. Structured on a core community of clusters of informal interactions, this building can be an exemplar in terms of constructing social awareness that surpasses the limits established by the Library-Parks Programme – both in spatial and transpatial dimensions.

A study on the design methodologies for activating large-scale underground commercial complexes

Underground commercial complexes have caused confusion and inconvenience to the users, and there has been a problem with activation of them (Hoeven and van Nes, 2013; Dursun, 2007). Actually, many of them have struggled or stopped operation. For the success of the large-scale underground commercial space, a gap may need to be bridged between the design process and architectural design disciplines. In designing large-scale underground spaces, architects have difficulty with perceiving the outcome of a design in terms of spatial configuration and cognition, which strongly affect the success of a commercial space. Currently, in most architectural practice, the zoning and layout plan are formulated by considering the function of each individual facility independently. There is a relative lack of consideration of utilising the advantage of mixed-use facilities to achieve mutual synergy (Kim and Kim, 2007). Several studies have suggested that the spatial configuration of a commercial complex strongly influences the activation of the facilities (Kim et al., 2010; Kong and Kim, 2013).

In this context, this study aims to propose design methods to establish a spatial configuration plan by evaluating design alternatives for activation of a large-scale underground commercial complex, and present design guidelines based on case studies. 'Central City Shopping Centre' in Seoul is selected for the case study in which tenants and owners of the shops are constantly changing due to an economic failure over the last 20 years. The research methods are as follows. First, the business models, design process, and spatial configuration of the three cases are analysed utilising space syntax. Second, problems are identified through the analysis of the case with the lowest intelligibility in terms of spatial configuration. Third, the redesign of the case is performed along with analysis of the space syntax for activation of the spatial configuration. Fourth, the results of the improvements are analysed through comparison of the redesign with the current status of the case. Lastly, the design process and guidelines for underground commercial complexes will be proposed, based on the above results for commercial space activation

The results of this study will provide design methods for analysing the spatial configuration of underground spaces and identifying the spatial behaviour of users, and apply them to the design of an underground commercial complex. In practice, they can be used to evaluate and modify designs to enhance the success of a large-scale underground commercial complex. Furthermore, they can be applied to maximise profits through the activation of a commercial complex.

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Towards a methodology to assess adaptability in educational spaces:
An entropy approach to space syntax

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This paper aims to explore the concept of adaptability applied to educational facilities and to propose a comprehensive methodology to identify and assess this concept within educational spaces, in which Space Syntax plays a significant contribution on the adaptability of the individual spaces analysed, as well as on the whole spatial system.

The research recognises the relevance of adaptable educational architecture towards evolving pedagogical, technical and social needs, for a more complete spatial answer and a better building performance over time. Adaptability follows Krüger's (1981) definition as "the ability of the built form to maintain compatibility between activities and spaces, as those vary". The research question resides in "how" and "by what means" can a contemporary school building be considered on its degree of adaptability, recognising the significance of the formal classrooms as content providing places, as well as other informal learning spaces where peer communication bears a recognised relevance towards educational experience and student achievement.

This problematic addresses the approaches on building adaptability carried out since the 1970's, with a critical review based on recent advancements. The originality of the presented methodology resides in a crossing of outcomes from distinct spatial assessment processes, aiming to describe how adaptability is portrayed and what are its key variables to assess it. It is applied to distinctive learner-centred environments, in order to conclude on potential adaptability discrepancies between them. As a combined process, the methodology is composed of three stages, in which the subsequent complements the previous, as follows:

1. Probabilistic and combinatorial models, following Fawcett's studies (1976), focus on maximising entropy, as an "index of adaptability" (Baird, 1972), considering the most adaptable one, to be the most probable macrostate amongst all the microstates (Krüger, 1984). Thus, the use of a mathematical approach to determine the entropy of each space provides a quantitative measure of adaptability.

2. Subsequently, a Space Syntax analysis focused on the parameters of integration, depth and connectivity, based on both the axial lines that cross each convex space analysed in stage one, and on the convex spaces themselves, informs on "how" and "why" a space is being used and whether spaces with analogous entropy levels, allocate different uses. These findings display information on whether spatial morphology bears relevance for the school's occupancy, namely to activity schedules and spatial density of natural movement.

3. The final stage comprehends a systematisation of the results, concluding on whether potential spatial feasibility and effective spatial occupancy coincide, providing an outlook on the relevance of spatial morphology, towards use and adaptability. It also informs on adaptability variations between formal and informal, productive and supportive spaces (Krüger, 1992). Its final outcome potentially provides a comprehensive outlook on spatial analysis and a methodological development on architectural research, to be applied to other design briefs.

Production of spatial complexity in an educational building

No.18 building in the Xiangshan Campus of China Academy of Art is a four-story building designed by the 2012 Pritzker Prize winner Shu Wang. The first part of this paper explored users perception of this building by three data collection methods. By questionnaire, it is found out that majority of its users no matter how familiar or unfamiliar they are with the building, encountered difficulties in way-finding behaviours. By cognitive map sketch, it is found out that 60% of users' metal maps have obvious discrepancy. By way-finding experiment, it found out that more than half of the detour behaviours are related with the design feature of vertical connections. Therefore, it is an unusual case which can enlarge our understanding for indoor navigation in overwhelming spatial complexity conditions.

The second part aims at uncovering the spatial features which made this building distinctive from normal educational buildings. Two sets of analytical methods are used. First, this building is examined by basic architectural analysis, j-graph analysis and, decision point density analysis, then comparing its various measures with an ordinary educational building. Second, several remodelled scenarios is created to compare with the original design. VGA analysis is used to show the effort of straightening the elongated twisted floor plan.

At the end, a comprehensive explanation for the spatial complexity and navigation problems is concluded. Three vertical spatial features and four horizontal features are summarised. In addition, this paper discusses the overwhelming problem of complicated buildings in a contemporary era, and suggests there is a need to refine tools for measure legibility of spatial layout. Four tools applied in this case study have shown their potential and should be tested in further studies. Finally, simple design suggestions are made for designers to utilise the findings from this empirical study.

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Spatial layout and spontaneous behaviour for people with dementia: A study of adult day-care centres

In this study, three adult day-care centres (ADCs) for people with dementia, located in Dresden, Germany, have been analysed using space syntax. From the collected observational data, this study determines a positive correlation between the spatial accessibility of ADCs and the frequencies of three behaviours of people with dementia participating in those daily services. The results of this study are intended to further the application of space syntax methodology in future studies of healthcare facilities, especially the ones for people with dementia.

Investigations of spatial configuration were made using space syntax methodology and Visibility Graph Analysis (VGA). Two parameters, including the level of spatial accessibility and the intelligibility of buildings, were calculated. Observational data of three types of behaviours, consisting of wandering, standing and socialising, were accumulated through behaviour mapping.

Results from statistical analysis show a positive correlation between spatial accessibility and frequencies of those activities. This finding confirms the results of related prior work focusing on other healthcare facilities. Several recommendations on space using and designing for ADCs were derived through the analyses.

Cultural events and their location patterns in the 'Beyoğlu' urban area

The paper addresses the duality of the spatial and transpatial relationships among people related to particular cultural events in the 'Beyoğlu' urban area of Istanbul. With focus on the transpatially structured 'public' that such cultural events have the potential to engage, the paper addresses the spatial structure of these events through an analysis of their particular locations in Beyoğlu. The study analyses the syntactic distribution of 141 cultural events, held between January 2011 and January 2013, and their pattern of proximity along the open space network of Beyoğlu. Throughout this exploration, the paper extracts practical case-specific knowledge on the spatial structuration of the different kinds of cultural events in the Beyoğlu urban area, generating speculative arguments on the spatial and transpatial dimensions of cultural event-mediated encounters and co-existences.

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Analysis of airport configuration and passenger behaviour

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Airports serve a variety of services related to both the preparation of the passengers for their air trip and their free time inside the terminal. Hence, the process of airport planning is complex and strongly case-specific because of the big variety of services that airports might offer. Based on these premises, this paper aims at analysing airport space configuration, considering the Theory of the Social Logic of Space (space syntax). It is assumed that a morphological investigation can shed light on pedestrian movements and choices enabling planners to propose more pedestrian-friendly terminals.

The study explores the positional relationships between the aeronautical (e.g. check-in and security) and non-aeronautical services (e.g. retail services, beverage areas and lounge), taking into consideration the Lisbon Portela international airport case (the departure floor, in the check-in area before the security control zone). Space syntax is applied to analyse and evaluate the building plan and its implications on passenger perceptions and choices. Visibility Graph Analysis is developed and the variables: visual connectivity, visual integration (global and local), intelligibility and synergy of the terminal are compared to assess airport planning and space allocation.

The configurational findings are faced with a survey conducted to collect data on passenger perceptions and choices. The frequency of usage of the non-aeronautical areas is estimated and passenger characteristics related to their personal profile, travel choices and activities inside the building contribute to the assessment of the terminal configuration through the use of Discrete Choice Modelling.

The major conclusion of this paper is that the attempt to include SS indicators in DCM was rewarding since the initial assumption that SS affects passenger choices was proved through the significance of the equivalent variables that were included in the developed model. It was shown that SS can stimulate passenger choices and favour alternatives that are more accessible or well-connected.

In the *Social Logic of Space* it is stated that spatial configuration affects social relations in how it structures patterns of movement, encounter and avoidance. Since then, a lot of space syntax research has investigated these phenomena to provide empirical support and to refine the understanding of mechanisms and relations. However, most of this research focuses on the first half of these patterns – that of how space structures and generates encounters, whereas studies of how space generates patterns of avoidance is less often studied. The outset of this paper is that in order to understand a 'social logic of space', the study of how space generates, allows, or prevents patterns of avoidance is a missing key question that may also further develop discourses of patterns of encounter. Avoidance, as a social action, simply requires a series of socio-spatial, interactive, and shared relations to and through space that necessitates assumptions, presumptions, and speculations of the behaviours of specific or generic others that studies of encounters at times can avoid. In extension, while a development rather than a challenge to studies of encounters, this informs knowledge on the relations between society, activity, and space in general, and on the socio-cultural structuring taking place in everyday spatial performativity.

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Spatial databases: Generating new insights on office design and human behaviours in the workplace

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Space syntax research has shown how human behaviours in the workplace are shaped by spatial configuration; in turn, evidence-based design practices have highlighted ways in which this data can be used to inform tailor-made solutions in office design. Yet, existing research focuses on either single case studies or comparisons of a few cases on a small scale. Also, each study uses its own methods and metrics which makes it difficult to establish wider patterns beyond single datasets. This paper presents a larger than usual data set on workplaces, which has been collected by Spacelab, a design and consultancy practice based in London. This dataset includes spatial and space usage information such as syntactic analysis and desk occupancy on client companies. It resides in a spatial relational database, allowing for systematic combination of the collected data, useful for doing either deeper analysis, or generating benchmarks and baselines. These insights are not only highly relevant to clients but also give rise to opportunities to generate new insights on office design and human behaviours in the workplace from a research perspective. Two main research questions relating to the size of samples are discussed: Firstly, whether large samples are necessary to fully understand phenomena, and secondly, whether behavioural patterns vary across cases. Observation data and syntactic analysis are combined to understand in which areas of an office different activities take place. Observation data is also brought together with the functional allocations of space in order to ask whether activities follow the programme introduced by functions such as meeting rooms, kitchens, workspaces, etc. It is shown that observation data only becomes robust and reliable with longer periods of observations than previously recommended. Three to four full days seems to produce reasonably stable results for desk occupancy, while five full days seemed required for percentages of people walking and interacting. Some surprising findings were revealed regarding the distribution of activities in space, for instance dispelling the myth that interactions happen in corridors and highlighting that interactions tend to occur in rather segregated spaces. While it is argued that predictive power of the analysis varies, first steps towards establishing generic patterns have clearly been taken.

Seeing and being seen inside a museum and a department store. A comparison study in visibility and co-presence patterns

Regardless of their different purposes – one being educational and the other commercial, both museums and department stores show similarities in the structuring of spaces due to their nature of exhibiting material collections. Another overlap is found in their history of development, as they both had a purpose in reforming society. It is evident that inter-visibility among visitors inside these two buildings played a crucial role in this purpose. Therefore how inter-visibility is shaped by their spatial layouts is of interest. In this paper, co-presence, which is a fundamental element in creating interactions, is interpreted as a by-product of seeing and being seen among visitors in buildings. This paper is designed to study the patterns of co-presence within these two building types and to make comparisons across them. The study employs a new methodology, combining Edward Hall's dimension of space and isovists, at room level to measure different degrees of co-presence. With this methodology, two sets of measures have been derived – boundaries and behaviours. Boundaries are based on visitors' personal, social and public dimensions defined by Hall. Measures of behaviours are derived from directed isovists and categorised into three types: spectating, acting and interacting. The paper demonstrates how this methodology can be applied to quantify degrees of co-presence inside a selection of rooms in a museum and a department store in London in relation to their spatial configurations. Results indicate that the phenomenon of being seen is strongly associated with integration of spatial configurations. The relationship between these behaviours and spatial layout suggests that the patterns of co-presence seem to be generically formed by configurations. By introducing methodology to measure degrees of co-presence and comparing the different co-presence patterns generated by the two building types, the paper contributes to understanding of patterns of co-presence inside buildings at micro-scale.

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Experiencing three-dimensional museum environments: An investigation of the Ashmolean Museum and the Museum of Scotland

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The relationship between the spatial organisation of museums and visitors' experience has been widely explored. However, previous studies rarely focused upon the actual use and effect of the atria on how people navigate. To understand this interaction entails answering the following research question: How exploration and movement in museums are affected by two and three-dimensional properties? This question is investigated by the comparative study of the Ashmolean Museum of Art and Archaeology in Oxford, renovated by Rick Mather Architects (2009), and the Museum of Scotland in Edinburgh, designed by Benson and Forsyth (1998). The two museums are selected as relevant cases for their spatial similarities and significant differences closely connected to the organisation of their atria. The intention is to understand whether atria account for similar or different exploration patterns in the ways users navigate in three dimensions. The comparative analysis, stemming from space use observations, space syntax methods and agent simulations, shows that significant differences in real and simulated movement result from the varying spatial positioning and character of the voids. Variability in spatial behaviour derives from the impact of the third dimension, assigning different identities and orientating capacities to the atria and the museums.

Elements of design in workplace environment:
Pre and post studies

The aim of this paper is to investigate the impact of various design elements and spatial configurations on workplace environments using results from pre and post occupancy evaluations from different organisations studied in practice. The research contributes to the existing knowledge and studies in the field of architecture and interior design and proposes an evidence-based framework of design elements to be considered during the design stages of commercial buildings. The paper investigates how communication and collaboration in office environments are influenced by the shape and arrangement of furniture, workplace density, form of the floor plate, number of floors and elements of connection. These elements have a great impact on employees' interaction and behaviour. Different organisations, studied in the past year, are investigated applying evidence-based design methodology. Pre and post occupancy data from direct observations of activities is used to understand behaviours. Spatial analysis using visibility graph analysis (VGA) is applied to analyse the layout configuration. Results illustrate how the selected architectural elements could change behaviours and that different spatial parameters should be tested when designing an office layout.

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Choreographing collaborative academic experiences: The 'quiet building' and the 'airport lounge'

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Like a hidden curriculum, buildings influence learning by engaging, negotiating, and re-aligning users' experiences with and within architectural space. A number of studies have employed space syntax to analyse educational buildings and assess the effects that various designs have on collaboration, creativity, and learning outcomes. In that spirit, this paper presents a new comparative study of two recently-completed university buildings: the William Johnston Building at Florida State University (2011 – Tallahassee, Florida), which I characterise as a 'quiet building'; and the Mandel Center for the Humanities at Brandeis University (2010 – Waltham, Massachusetts), which I characterise as having the attributes of an 'airport lounge'. Through a combination of space syntax analysis and qualitative research methods, I identify within each building the spatial elements and characteristics that enhance unplanned face-to-face encounters and communications, describe how spaces accommodate such encounters, and explore users' perceptions and interpretations of collaborative experiences as a reflection of the potential for collaboration inherent in the morphologies of each building. I begin by distinguishing the three major subjects of my inquiry: the individual, the individual's social milieus, and the educational architectural spaces that contain, shape, and mediate individual and social experiences. The relationship between these components constitute a 'pedagogy of architecture', which, in the words of Elizabeth Ellsworth, 'create a fluid moving pivot place that puts inside and outside, self and other, personal and social into relation'. These subjects converge in my interpretation of learning as a relational process centred upon the individual and shaped by the spaces that individuals navigate and inhabit. My findings emerge from the alignment of two data sets. The spatial analysis of the buildings includes examination of their programs and compositions, illustrated by justified graphs, together with analysis of potential space uses from the perspectives of permeability through axial line maps and convex maps, and visibility through visibility graphs. I juxtapose this technical information with qualitative data gathered through on-site observations and interviews, which reveal not only what collaborations could potentially happen in each of the two buildings, but why actual collaborations do happen. A building's spatial configuration (including visibility and permeability characteristics) can either support or inhibit the formation of social communities and enhance or suppress users' desire to collaborate, especially when combined with discrete non-spatial factors, including institutional culture and extracurricular programming. Overall, the results of this study suggest that educational spaces that most successfully support meaningful social and collaborative experiences are more enclosed, inhibit unproductive movement, and have narrow user profiles. The 'airport lounge' model invites and supports unintentional encounters and is perceived as dynamic, fluid, and responsive to its users. In contrast, the 'quiet building' model suppresses the collaborative instinct and is perceived as institutional and indifferent to individual users' needs. Surprisingly, the morphologies of these two models can be very similar, and I conclude with specific spatial attributes of the William Johnston Building and the Mandel Center that may explain, in part, the stark differences in the ways that these buildings function.

Structural correlations between architecture, music and cinema: Rhythmical description of the Parthenon frieze

Although Architecture is traditionally considered an art of space, it is by nature a time research field because our spatial experience is also temporal. Focusing on the design of temporality in Architecture, we have to go through the fields of both music as the art which eminently handles time -since every piece of music is a temporal experience- and philosophy which explores the perception of time. In Architecture, the investigation of the movement in place (in loco), referring to the design or the inscription and the perception or the reconstruction of the movement, de facto integrates spatial data in a temporal context.

We will disclose at the outset our basic view according to which all phenomena are in principle temporal, and in addition are perceived and expressively constituted as rhythmical, after noting our two references:

a. According to the modern views of music theory, rhythm refers to the composition of perceptual sections which are defined by the relationship of the previous element and the next one.

b. Perceptual sections should not be regarded as positions in space or instants in time, i.e. still sections. Nowadays, we tend to consider them moving sections.

The analysis of the Parthenon Frieze is the subject of our study. Most interpretations of the monument suggest readings through static rational rules. Until even today, rhythm in architecture is often defined according to this building, as a rule, a repetition. However in ancient texts, we find out that the rhythm in music is not defined in this naive way. On the contrary, it presents several similarities with its modern definition. For example, Aristoxenos claims that rhythm refers to time intervals and to the manner that they are perceived by senses, considering that this view is the main principle of the study of rhythms. So we argue that the conception and design of the Ionic frieze of the Parthenon aimed among others at its organisation as a time work (opus).

Driven by the conviction that these notions of rhythm ought to have influenced the design of such a special building, we shall attempt to study the Parthenon Frieze by using modern musical terms and describe a unique example of both architectural and music design including both spatiality and temporality. We shall further continue the analysis, having as tools, the three positions of Bergson on movement, as they are set out in Deleuze's analysis for cinema movement, in his book 'Image – Movement'.

Finally what we claim is that the Parthenon Frieze was not designed as an image which refers to the initiation and progress of the procession of Panathenaea, but as a show that records the very movement in time by using the rhythmology and choreography with a cinematic sense.

Activation of movement of the procession presupposes the physical movement of the walker. Only then the represented event is revealed and lively unfolds, rendering the walker a participant-companion in the Panathenaic procession.

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The gadget building: An overview on contemporary football stadiums

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This paper discusses morphological aspects of contemporary football stadiums. Recent national and international tournaments have presented considerable demands for new and more complex buildings for football. In that context, the type manifests contemporary distinctiveness – in fact, football stadiums become a unique design theme in late 20th century, motivated by the development of norms of security and their relation to mass media and advertisement.

In addition, recent exemplars of the type present a noticeable morphological interest: an evident disjunction between their spatial structures and their external surfaces images. While the former is constituted by rigid international prescriptions that standardise program and spatial characteristics (location of technical rooms, conditions of access or restriction to specific zones, geometrical criteria for the perfect view of the pitch and etc.), the latter becomes more susceptible to the free usage of formal elements detached from the spatial structure – basically directed by non-architectonic self-references, but imagistic, iconic and semiotic ones.

In this study, that phenomenon is evaluated in the context of the 2014 Brazilian World Cup. While configurational analyses of space presents the rigid syntax of the type, analytical representation of formal elements demonstrate how the buildings tend to become recognisable by a well-defined self-determining and almost totemic image associated to local aspects or icons of the visual culture of each host city – like the reference to sand dunes, tropical vegetation or local team's colours.

In other words, appearance prevails over function every time football itself is not enough for socio-cultural validation of the buildings. These characteristics represent a new building type: the gadget building.

Building circulation typology and space syntax predictive measures

Spatial layout planning, especially designing floor plans and circulation systems for efficient navigation and orientation, is one of the most ubiquitous and complex problems in architectural design. In this article, we implement a graph-based method for the systematic modification of the circulation system of an existing, prominent architectural case (the Amsterdam Municipal Orphanage designed by Aldo van Eyck). While preserving the spatial organisation of the existing building, we systematically and fundamentally redesign its circulation pattern into three distinctive, circular circulation archetypes which are highly comparable to an existing building layout in their topological structure, but contain different geometric properties. Axial line analysis and visibility graph analysis are conducted and the resulting graphs are summarised using the property of intelligibility, which provides a measure of (expected) ease of navigation and generates intuitive hypotheses for future studies in these artificially created environments. The article works towards creating a link between different forms of building circulation and potential ease of wayfinding based on spatial analyses and is relevant for human-centred architectural design and building usability research.

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Size and complexity of hospitals matter for quality of care: A spatial classification of NHS buildings

The relationship between quality of care and hospital environments has been established in previous research, which proved that environmental and configurational factors could affect health outcomes. However, the focus of these studies was on single cases and results were not always comparable. To fill this gap in knowledge, the aim of the paper is to classify NHS hospitals according to building properties and to study the relation between the physical environment and healthcare adopting a top-level approach. This was initiated by the recent quality of care inspections of NHS hospitals. The main arising question was to see whether spatial layout could be related to quality of care problems. Such a classification however was not straightforward because of the condition of the NHS estates. Almost each campus consists of a hotchpotch of buildings of different sizes, built in different years and adopting various typologies. Therefore, a classification based on the relation between different spatial elements was proposed and adopted.

Various data sets were used to gather the necessary information for a top-level classification. The Care Quality Commission and the NHS Hospital Estates and Facilities Statistics were the two main data sources. Information regarding quality of care and building metrics was obtained from these data sets. Details about the spatial configuration of the buildings were retrieved manually for a selected set of hospitals and their spatial properties were analysed. The presented results suggest that the quality of care is influenced by the size of the hospital campus and its complexity i.e. the number of distinctive buildings on site. Such a relationship is not surprising because smaller and less complex buildings are occupied by smaller and less separated organisations and thus the dimensions of the building enhance communication and flow of information between different teams. The results could give insights to future planning policies and new building developments on NHS hospital sites.

Space codes in architectural teaching and learning

This paper is focused on studying the role of physical educational space in architectural teaching and learning behaviours and activities beyond formal classroom schedules. It seeks to understand how the architecture school buildings in Portugal, although typologically very distinct, answer similar functions and how their layout and configurative space properties promote and enhance a social and informational interface that is essential to learning activities. Through the case studies, it is argued that space configuration stands as a pedagogical device, which includes a set of rules for the regulation of pedagogical interactions and communications between students revealing hierarchies of social groups.

With this in mind, three case studies were chosen for this research, mainly because they have a similar pedagogical curriculum based on the enduring influence of Oporto school of architecture: the Faculty of Architecture of Porto University (FAUPorto) designed by Álvaro Siza; the Department of Architecture at School of Arts in the Faculty of Sciences and Technologies of Coimbra University (DAUCoimbra); and the School of Architecture in Minho University (SAUMinho), designed by Távora.

Initially the paper presents the case studies and analyses the relationships between their spatial layout and patterns of space usage and appropriation. Additionally, due to the specificity of the educational context, the study makes reference to Basil Bernstein's pedagogical theory (1973), focused in patterns of knowledge transmission and acquisition (Peatross, Peponis, 1984). The collected data informs on how students, teachers and others use academic spaces for socialisation and non-formal learning activities. The conclusions are based on correlations analysis between axial and visual integration with the collected data. The results suggest that spatial layout and distribution of these school buildings moderate patterns of movement, use and the potentials for encounters and subsequently interactions between them.

The study concludes that spatial configuration is a significant factor for the occurrence of both formal and incidental interactions among students, identifying a significant cluster of spaces with better correlation between higher integration values and higher occupancy and interaction rate between students: common spaces located along the major hallways. We recognize on these clusters a hidden pedagogy that establishes a new frame of learning spaces, reordering the hierarchy of the active learning spaces' system and therefore instituting specific Learning Space Codes in Architectural Schools based on Siza's pedagogical influence.

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033

The Apple story: Spatial, functional and cultural parameters in branded architecture

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Numerous scholars from a wide array of disciplines have discussed the way in which flagship stores establish the use of physical space as a marketing device for the embodiment of a branded organisational identity. Apple is a particularly interesting example of the way the consistent and strategic consideration of customers' experiences can be mediated by retail space. Apple is a brand that develops careful, strategic policies to compose unique experiences for its customers and simultaneously achieves constant redefinitions of its retail process in alliance with its marketing intentions. Therefore, this makes for a particularly interesting case study.

Recently, Apple launched a new payment strategy where employees can conduct transactions all over the retail area by using mobile devices. This paper constitutes an attempt to understand the extent to which the new mobile practice has changed the Apple Store's established dynamics and user experiences. The investigation is twofold: First the examination of the Apple Store in Regent Street at two different time periods, in 2009 and in 2014 allows capturing the introduction of a mobile payment strategy and resulting new behavioural dynamics. Second, the comparison of two London based cases, the Apple Stores in Regent Street and Covent Garden, allows identifying commonalities or variations on how the same organisational strategy is embedded in different configurations. The methodology combines analytical tools of space syntax with on-site observations of space usage.

Results suggest that the functional dispersal of the purchase experience has changed the dynamics within Apple's retail interiors with reflections on functional allocation, space usage behaviours and the layout's performance. The analysis highlights that the functional distribution appears to have an impact on the operation of the recently introduced mobile payment method and that the way in which each retail interior incorporates organisational principles in relation to its spatial configuration affects the generated behavioural patterns. Overall, results revealed the complex interplay between spatial appearance, functional distribution, behavioural patterns, operational properties as well as cultural connotations.

This study introduces a consistent way of analysing branded environments and organisational strategies through a multi-layered and temporal methodological approach that combines analytical tools of space syntax with observations of customers and staff behaviours. Overall, the paper offers a starting point for incorporating a framework of analysis that can enhance our current understanding of spatially configured branded experiences.

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The spatial and social organisation of teaching and learning: The case of Hogwarts School of Witchcraft and Wizardry

Existing research on school buildings and how their layout informs the spatial and social organisation of teaching and learning is scarce with an evidence base that has been called incomplete and underdeveloped in a 2005 report commissioned by the UK Design Council. Only a small handful of studies have analysed school buildings in the tradition of Space Syntax. Hence this paper aims to close this gap by systematically reviewing literature and proposing a theoretical framework for the future study of school buildings. Rather than focusing on an empirical case and post-rationalising phenomena found in the field, important concepts of the Space Syntax study of buildings as well as pedagogical theories are brought together upfront in a single conceptual framework. Only then is this framework applied to prove its feasibility and value. As a dataset, a well-known example from popular culture has been chosen to allow the framework to be easily comprehensible and perspicuous: Hogwarts School of Witchcraft and Wizardry, the fictional secondary school of Harry Potter and his friends as featured in the novels by Joanne K Rowling and the associated movie series. Floor plans of Hogwarts are analysed using Visibility Graphs and the movie material has been systematically evaluated in order to distinguish types of learning (individual, peer and taught learning) and map episodes of learning onto functional areas of the floor plan.

Seven important dimensions are identified in the framework: 1) Accommodating different teaching styles; 2) Accommodating different processes of learning; 3) Strong or weak framing of the relationship between teacher and taught; 4) Movement economies; 5) The interfaces a building constructs; 6) The realisation of spatial and transpatial solidarities; and 7) Correspondence and non-correspondence models. The analysis of the Hogwarts narrative highlights the importance of social and public spaces for the accommodation of diverse learning processes: only 10% of learning in the movies occurred in classroom settings and the majority of peer learning took place in common rooms, dormitories and courtyards. It is also shown that peer learning tended to happen in more integrated spaces.

The paper concludes that the framework can be fruitfully applied and delivers interesting insights into the spatial and social organisation of teaching and learning inside school buildings in relation to pedagogy. It proposes to shift the focus of attention away from classroom conditions in the architectural debate and instead embrace the idea that learning is social and occurs in many different settings and places, which puts the idea of the school building as a whole in its interplay between spatial elements and their connections high up on the agenda.

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035

Distribution of shoppers in multi-layered shopping complex: Estimation of shopper density considering escalators, elevators, stairs

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Today, complex commercial facilities are being developed that have many elevators, escalators, and stairs and comprises multi-layered floors; the number of such facilities is increasing in large cities due to the compactification and densification of cities. These commercial facilities are similar to those in a three-dimensional space such as a town. We investigated the relationship between the space configuration of a facility that is complex, similar to a three-dimensional town, and the distribution of shoppers in this space. The target facility is Bay-Quarter, which is adjacent to Yokohama Station in Kanagawa pref. Japan. In Bay-Quarter, circulation paths are outdoor space. Moreover, many vertical paths such as elevators, escalators, and stairs constitute a complicated space that connects those circulation paths up and down. We considered how complicated and multi-layered space configuration influences shopper dispersal by investigating the distribution of shoppers in Bay-Quarter and formulating equations for those distributions. First, we investigated 1) the distribution of walkers in all circulation paths and 2) the number of visitors in all stores to understand the distribution of shoppers in the target facility. The researcher walked through the facility and recorded the distribution of walkers by taking snapshots, and counted the number of visitors in each shop. We divided the target facility into 335 convex spaces and totalled the number of shoppers in each convex space, as well as calculated the population densities in each circulation path and in each shop. Next, we analysed the spatial configuration of the target facility using convex analysis, axial analysis, and visibility graph analysis (VGA) from space syntax theory to understand the spatial character, and calculated the indices of the spatial configuration by space syntax. In the analysis, we distinguished non-vertical movement from vertical movement and adjusted each step number based on the accessibility and visibility of the escalator, elevator, and stairs. We treated convex spaces as units of analysis and analysed the relationship between ten types of space syntax indices, including Isovist and walker density and visitor density in each shop. Through multiple regression analysis that assumed walker density as a dependent variable, we revealed that the integration value of space and the "closeness to the nearest escalator" influence the distribution of walkers in circulation paths. Using a multiple regression analysis with visitor density in shops spaces as a dependent variable, we revealed that the visitor density in some stores is significantly estimated. The "area of the field of vision range from the shop window" and the "length of the shop window" affect the number of visitors in retail stores, whereas no indices of spatial configuration influence the number of visitors in the restaurants and service shops.

Comparing the use of actual space and virtual space: A case study on Beijing's Wangfujing area

Recent development of user assessment website such as Dazhongdianping (a very popular website for choosing and reviewing restaurants in China) has great impact on the way people use urban functions. This paper analyses the relationship between the configuration of actual space, number of customers observed in fieldwork and the visibility of shops on website in Beijing Wangfujing area. The result suggests that the use of informational technology is strengthening the spatial distribution logic of these restaurants instead of weakening the role of actual space. By comparing the customer number of shops inside one of the case shopping mall with the number of reviews posted on web, this study also explores the potential and limitation of web data being used in spatial analysis.

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Spatial concepts in museum theory and practice

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Since the beginning of space syntax, the field of museums has been a recurrent focus of inquiry in the syntactic literature. Over the years a body of studies of museums has been accumulated which use space syntax and its concepts to bring consistency and rigour to the analysis of spatial layout, and through this to relate museum space to different aspects of how they work. Amongst other themes, the studies have explored the relation between the layout of space and the communication of knowledge, museum space as a symbolic system, and the link between spatial layout and movement. Over the same period, there has been an increasing awareness of the spatial dimension in the museum studies literature, so much so that the problem of space is now one of its key themes. This literature addresses such problems as how we can conceptualise museum space through the idea of exhibitions as 'texts' and as 'maps', or the role of space in the 'interactive experience model' and in the learning experience of the visitor, as well as in the capability of the museum to embody theories, construct knowledge and produce meaning. By relating and comparing it with the space syntax literature, the paper brings to the surface common preoccupations and identifies many parallels between the space syntax concepts applied in the studies of museums and museological ideas of space, including the role of space in the collective nature of museum experience, the problem of intelligibility, and the part space can play in different modes of acquiring information. But beyond these two areas of rich spatial ideas about museums, it will be argued that there is a third: current museum practice. With the freeing of museum architecture from stereotypes, and the greater emphasis on 'the visitor's encounter with the museum and its collections', the later part of the twentieth century and the early twenty-first century has seen radical experimentation and innovation in the design of museum space. A number of recent museum projects are analysed and discussed in the paper, selected to illuminate different ways in which spatial design becomes part of the individuality of each museum and the distinctive experience it offers the visitor. It shows, for example, how some cases lead visitors to see intricate linkages between times, places and objects, reflecting the curatorial idea that cultures interact with and influence one another, while in others, it gives them an embodied experience of places and monuments by adding the sense of topography to that of chronology. This examination suggests that these real museum projects embody concepts of space which are in some senses more advanced and complex than found in either of the literatures, and so might be said to be pointing in new directions theoretically. Finding a way to bring together the spatial concepts in all these three areas will be, it is argued, an important next step in the field of museum research.

Use of an online interactive space analysis tool to understand student perceptions of four secondary schools

With the sheer complexity of the built environment, understanding the aspects of the building that directly impact the occupants can be prohibitively difficult. Previous methods have been largely split between low-number, high-detail methods (photo-surveys or interviews), or high-number, low-detail methods (questionnaires). This study presents an alternative to these methods; creating an online tool that represents a navigable building, enabling the occupants to freely identify any aspect of the building that they feel is important. This online tool deliberately works in a manner similar to Google Street View, taking advantage of this familiarity to reduce the learning curve and maximise immersion. Using spherical images captured with a special camera or smartphone, each space in the building is captured and then uploaded into the online tool. Whilst in the online version of their building, the respondent can navigate through the building, make unguided comments about any part of the building.

Using this tool, four recently built secondary schools were imaged and online versions created. In each school, students from three ICT lessons aged between 11 and 14 explored the online version of their school and marked parts of the building that were important to them. The students were asked to follow a typical day in the school, moving from lesson to lesson and to the spaces they use at breaks. The tool collected both the movement data and the comments, allowing analysis of not just the occupant attitudes, but also the route the students take through the building

The movement data for each school was compared to the visual graph analysis of the building, showing that the movement of the students within the tool resembles patterns seen elsewhere; configurational logic with attractors. The rich data that is generated in parallel with the movement data allowed insights into the way in which the students moved through the space and what was important to them.

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Abstracts
3. Urban morphology and history

Spatial configuration of Erbil Citadel:
Its potentials for adaptive re-use

Erbil Citadel joined the UNESCO world heritage list in June 2014, and is one of the world's oldest continuously inhabited human settlements. From the first decades of the 20th century, it has witnessed continuous deterioration due to large number of influencing factors which have left it deteriorated and obsolete. In order to conserve and enhance this unique historic Citadel, a revitalisation project was initiated. The "Conservation and Rehabilitation Master Plan" was proposed as a major decision making tool for the High Commission for Erbil Citadel Revitalization (HCECR). The Master Plan adopts adaptive re-use as the core strategy for a culturally-driven revitalisation.

This research focuses on the issue of new uses allocation as a significant part of the adaptive reuse strategy. It is intended to approach the new uses allocation for Erbil Citadel in terms of a recognised influencing element: the Citadel spatial configuration. The main question is to what extent and how the properties of spatial configuration (syntactical properties) could be considered and invested in the allocation of new uses for Erbil Citadel. Answering this question, which is the main research objective, adds spatial configuration as another influencing factor and provides a more stable ground for assessing and developing the initial draft of the land use plan for new uses allocation to achieve an optimised and more appropriate re-use. It is expected to provide the indicators necessary to deal with a range of new uses competing for the Citadel buildings – most of them are traditional houses of similar typology.

The research method consists of: (1) introducing a theoretical background for the concept of adaptive re-use and the arguments concerned with the spatial configuration as related to the concept of adaptive re-use. (2) Analysing the spatial configuration of Erbil Citadel by measuring its syntactical properties (integration and choice) to specify its potentials. (3) Analysing the allocation of new uses in the initial land use draft for Erbil Citadel by classifying them according to their seeking for natural movement, a proposed variable which links the spatial configuration and the allocation of new uses. (4) Carrying on an analysis of association between the syntactical properties of the axial lines measured in (2) and the types of the new uses overlooking them classified in (3) to specify the extent those properties are considered in the initial draft. (5) An iterated analysis of association between the measured integration and choice, and the type of new uses re-allocated in a modified plan, proposed by this research, to specify how the syntactical properties are invested for more appropriate re-use. In conclusion, the degree of association between the syntactical properties and the new uses allocation are increased, to a considerable extent, in an intentional re-allocation process. This is achieved by investing those properties as criteria to evaluate the initial plans of new uses first, and then they can be used as guidelines to direct the re-allocation process to achieve a more appropriate adaptive re-use.

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Evolving syntactic structures of Baghdad: Introducing 'transect' as a way to study morphological evolution

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Most Middle Eastern cities have evolved in a spontaneous manner with a high degree of complexity. Later, many of them were expanded using modern planning concepts and models. Between the two phases, different patterns of spatial structures have formed. The main purpose of this study is to identify syntactic variations in the urban structures of different morphological phases of a typical Middle Eastern city, Baghdad, using space syntax techniques at different scales, extending from districts to quarters to neighbourhoods. The study is important, because with the exception of a few studies (Hiller, 2008; Karimi, 1997, 1999; Karimi & Motamed, 2003; Rashid & Shateh, 2012), studies on the evolution of Middle Eastern cities using space syntax techniques are still rare.

Baghdad has been selected as a case study not only because it is one of the oldest cities in the region, but also because it has observed phenomenal growth and change during the last one hundred years or so. Syntactic properties of the urban structures of this city are examined both diachronically and synchronically. Diachronically, the evolution of syntactic structures of the historic core, Old Baghdad, is studied for a period that spans over 1500 years. Synchronically, the city is divided into a set of meaningful segments, called 'transects,' in order to make the study more manageable.

For the study, several historical maps are overlaid in GIS using georeferencing based on important landmarks and streets that did not change from one historical phase to another. Along with the shapes of the syntactic cores, two measures of space syntax – integration and choice – are used to describe syntactic properties of the study area within one transect containing Old Baghdad. Changing syntactic structures are examined and compared at the scales of quarters and neighbourhoods.

Findings of the study raise interesting issues regarding syntactic properties and land use patterns at different scales, both synchronically and diachronically, in Baghdad, indicating need for further studies along this line in this and other Middle Eastern cities.

Brasilia – Monitoring and trends of urban growth, spatial densities and territorial conflicts

The urban Federal District (Distrito Federal – DF), like most Brazilian metropolitan spaces has shown similar problems, differentiating in degree and intensity of its spatial processes. One on the most relevant issues happens due to the quick paced and uncontrolled urban growth, a spatial fact that causes environmental, social, economic, institutional, and political damage, and mainly, compromises the territorial planning process. Amongst the main spatial components that stimulate expansion, the differentiated polarising effect of the main locations, the great construction sites of the official process of real estate speculations and the private urban instalment plans´ consolidation are highlighted. The research seeks spatial representation and interpretation of Brasilia's urban aggregate growth process from the 50's of the past century until the first decade of the XXI century, as well as graphically representing the expansion vectors of the urban historiography and tendencies of a close future. The work process shows that the assurance of survival of the preserved spaces is incompatible with territorial usage. These spatial observations, which are processed systematically in other Latin American urban areas, above all, point to the importance of a more effective management of territorial use and dynamics as a fundamental component to decrease territorial incompatibilities and incongruities. This research is one of the products and result of the Projeto Instrumentação Geográfica e Dinâmica Territorial (Geographic Instrumentation and Territorial Dynamics Project), processed in the monitoring program of territorial usage in Central Brazil.

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Morphological aspects of the old centre of Goiânia, Brazil

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This paper examines the spatial configuration of the old centre of Goiânia, the Goiás State capital, a city which is part of the new Brazilian planned capitals designed and founded in the beginning of the 20th century. The research intends to explore the urban dynamics in the case study, by analysing its spatial configuration patterns according to four architectural aspects: functional, economic, topoceptive/legibility and sociological. Form-space features are also considered, including the reading of the street grid connections based on the Theory of the Social Logic of Space (space syntax). The investigation is structure in two research questions: 1) how does urban configuration affect the performance of the old centre?; and 2) is there a relationship between street accessibility and the built heritage conservation/preservation? Findings have demonstrated that the old centre of Goiânia has a form-space that contributes to good levels of accessibility, suggesting that it remains one of the main active centres of the city despite the emergence of new centralities. Integration values found collaborate with these results and are higher than other Brazilian scenarios. Despite the obvious degradation of some places, key aspects for the maintenance of the centres as those linked to urbanity, vitality and the primary function as active centre are still found. However, higher accessibility values contribute to the destruction of the original features of the buildings in the old centres, like the case in Goiânia. These features are seen as out-dated and not suitable to the new economic reality. They are often conserved, but not preserved, which compromises the integrity of the city's remaining heritage.

What can typology explain that configuration cannot?

This paper aims to contribute to a better understanding of the relation between space syntax and the adjacent field of urban morphology. We believe that this can benefit both fields in their further development and more specifically, this paper will show how typical approaches in urban morphology can be helpful in explaining variations in correlations between space syntax measures and pedestrian movement.

That these correlations vary is shown by various scholars and the reoccurring argument is missing data input such as, amongst others, density, land use and public transport. We also see a problem in space syntax analysis in that there seems to be little consistency in exactly how pedestrian movement is best captured, that is, with what measure and at which radius.

Hillier and Iida (2005) show for instance in their study of four London areas that the 'best radius' can be found with a radius of analysis varying from 12 to 102 segments. This is troublesome, especially if we are not able to explain why this is the case. In this paper we propose to use two typo-morphological approaches to explain such variations: the classification system for street morphologies developed by Marshall (2005) and the integrated density approach 'Spacemate' developed by Berghauser Pont and Haupt (2009; 2010). The results presented in this paper show that different neighbourhood types, in terms of density and street morphology, indeed have different patterns driving pedestrian behaviour and following that, ask for tailored spatial analysis. It is shown that in denser and more 'griddy' street patterns, the betweenness centrality measure is able to capture pedestrian behaviour, but in other neighbourhood types pedestrian behaviour is better captured when also closeness centrality and the distribution of attractions is included. Further, it is shown that what may be called the 'scale of operation' of each neighbourhood plays a crucial role which needs to be considered when choosing the radius of analysis.

This paper shows further that a first indication of pedestrian intensity and pedestrian distribution can be arrived at by using two relative simple spatial measures: 'accessible density' and 'attraction betweenness' respectively. Although this study is just a first tentative exploration in combining urban morphology with space syntax, we suggest that we based on these preliminary results can see many advantages in pursuing research in this direction.

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Urban morphology, spatial configuration, typology.

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The spatial character of London's railway terminus neighbourhoods

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The railways constructed during the mid to late 19th century have given London more individual terminals than any other city in the world. As substantial interventions into the city's street network, the construction of stations and their related infrastructure created new spatial relationships with surrounding neighbourhoods. The relationships between the largest stations, the terminals, and their host areas developed over a period of 175 years, from the 19th century, but these stations still dominate their neighbourhoods today.

Previous research into London's railway terminals, and the development of stations around the world, has focused on the direct functions of a station, as connectors and transport hubs. However, the network influence of station buildings and of the railway infrastructure that passes through large areas of the city behind stations has received limited research attention. Station neighbourhoods are frequently discussed only in terms of their redevelopment potential, in relation to railway improvements.

This paper analyses the neighbourhoods of two terminals – Euston and Waterloo – as case studies, representing the two different types of approach structure typical of London, and investigates the spatial relationship they have developed with their neighbourhoods. A combination of spatial analysis techniques is used to assess the configuration of areas around both stations during two time periods – the late 19th century and today. The aim is to assess the spatial character of these sample areas, and investigate the extent to which they have changed over time. This allows the hypotheses to be tested that long-term spatial outcomes arise from the insertion of railway terminals into existing urban fabric, and that these outcomes differ according to the nature of these insertions. It aims to generate more detailed knowledge about the spatial role of the terminus in London, and its influence on urban form, particularly in more overlooked areas behind railway terminals.

The rationale behind growth patterns:
Socio-spatial configuration of Izmir,
Turkey 1700s – 2010

İzmir, which the recent excavations have shown to be an 8000-year-old city, has gone through various stages in its development process. It was an important harbour city located on Turkey's west coast, triggering commerce between east and west. When the inner harbour was revitalised in the 17th century, trade activities increased and the city became an even more popular destination for Levantines. By the 19th century, therefore, İzmir's morphology was defined by its cosmopolitan structure, especially where the historical centre emerged.

The urban pattern changed drastically during the period between the end of the 19th century and the beginning of the 20th century. In each period, intrinsic and extrinsic socio-spatial dynamics including natural and man-made disasters, planning decisions, and the exchange of Greek and Turkish immigrants determined the growth processes of the city.

This study investigates the generative rules of İzmir's urban structure by looking at nine different periods based on intrinsic and extrinsic dynamics. These periods were chosen according to the availability of historical maps and data. We observed morphological changes throughout the 1700s and the years 1836, 1856, 1876, 1885, 1905, 1922, 1941, and 2010. In order to analyse urban transformation and growth processes coupled with underlying indicators, this study uses segment angular analysis. Socio-spatial dynamics are discussed for each period. This paper aims to reveal how intrinsic and extrinsic phenomena shape urban form in cities. By looking at a hybrid city like Izmir incorporating radial, orthogonal and organic patterns, this study tries to understand urban transformation over time using space syntax analysis.

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Thinking spatial networks today:
The 'Vastu Shastra' way

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This paper is based on the conjecture that, often successful, well-functioning cities or urban areas are the outcome of a heuristic approach to design – an accumulation of trial and error of spatial networks over centuries. Such has been the case of traditional Indian cities like Madurai, one of the oldest continuously inhabited cities in the world; and Jaipur, which was built in the beginning of eighteenth century.

A common denominator for the inception of these cities has been the principles of Vastu Shastra, the ancient Indian science of town planning and architecture, aimed at achieving a balance among functionality, bioclimatic design, religious and cultural beliefs (Ananth, 1998). These Vastu principles having survived centuries of socio-economic, political and cultural changes, in the form of these cities, embed within themselves the essential DNA of an efficient and robust structure for settlements. However, instead of learning from such cities, planning practitioners and academics in the discipline have been incurious about the reasons of overwhelming resilience of these cities. Decoding this DNA could potentially give us a deeper understanding to the design of effective and resilient spatial network.

Therefore, taking Jaipur and Madurai as empirical case studies, this paper aims to decipher their DNA, compare and contrast them in form of a framework of principles that have contributed to the resilience of their spatial networks, over centuries. This is done using various syntactic techniques, which allows us to objectively analyse spatial networks. Understanding the commonalities and differences between spatial structures, in comparison to the current best practice, the paper concludes its transferability in current urban context.

From sea to land: A study of two settlements in Eyjafjörður, Iceland

Urban development in Iceland has happened rapidly since the beginning of the 20th century, and as the infrastructure improved after the Second World War, the main connection shifted from sea to land. The fishing industry has for many years been the main source of income and the first settlements were mainly connected by sea. In the 1960s the fish stock fell into decline affecting the main source of income in many villages that were left to shrink.

With the method of space syntax, this paper investigates the changing relation from sea to land in Siglufjörður and Akureyri, Iceland, by looking at changing spatial configurations over time and changes in the location of important industrial, public and cultural building functions. To better understand the impact of the spatial changes over time, interviews with people living in the two settlements before and after the 1960s will be included.

This is done to understand and test the hypothesis that the changing relation to the sea has had implications on the spatial structure and social function of the two settlements. In the past the town centre was drawn back from the harbour, but today the waterfront in both settlements is gradually becoming more important for leisure activities. In the spatial analysis it is shown that there has been a significant change regionally, as Siglufjörður and Akureyri have become better connected by the Héðinsfjörður tunnel. This connection affects the life of people in Siglufjörður significantly by decreasing travel length from 300km to 77km as well as making the journey safer.

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The maps of the modern city: Brasília and the phases of a fragmentary urban configuration

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The article encompasses the cartographical research of three different phases of Brasília's Pilot Plan: conception (proposal sent by urban planner Lucio Costa in 1956 for the public contest), execution (executive project for the construction of the new Brazilian capital, inaugurated in 1960, after a series of adjustments) and metropolis (the current urban settlement – 2013, with its expansions and fringes). It is our intention to identify how the transformations undergone by Brasília, from its original project to the contemporary city, can be decoded using the available cartography as a snapshot of each time under scrutiny. The main question we aim to answer is: How the configurational urban changes over time affected the essence of the modernist conception and discourse applied in the new Brazilian capital, Brasília? As theoretical background, methodology and tools, we have chosen to use the Theory of Social Logic of Space strategies which allowed exploring the relations between urban configurations resulting from different morphological moments of the city, using axial maps and related variables. Moreover, the models produced are contrasted with historical data, which reveals the association between social dynamics and how they are materialised in space.

Understanding the spatial organisation of economic activities in early 19th century Antwerp

This article uses space syntax analysis to explore the relationship between the spatial configuration of the city of Antwerp and the organisation of its trades and occupations in the early 19th century. A cadastral map from 1835 and a commercial almanac for 1838 were used to map the occupations held by the inhabitants of some 10,667 plots. Antwerp maintained a medieval spatial configuration at this time, with a strong 'background network' of distributed streets and continuous public spaces that privileged movement and encounter. However a 'foreground network' of streets was still found to be more accessible to global through movement. The spatial analysis of economic activity found a low level of clustering of different trades and occupations in particular parts of the city. Economic activities were rather broadly distributed throughout the background network of the street system. However, some trades and occupations took advantage of the foreground network of accessible streets more than others, and this was found to be statistically significant. Those occupations with high accessibility at all scales included retailers, wholesalers and artisans. While retailers would have prioritised access to passing trade, the latter two groups may have valued the circulation of goods, products and knowledge as much as the circulation of people.

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Inter and intra buffer variability:
A case study using scale

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Many morphological studies select sample sets to explore neighbourhoods of interest, particularly in terms of their structural street properties, measures of scale or density, and proximity to the metropolitan centre (Cervero & Gorham, 1995; Crane & Crepeau, 1998; French & Scoppa, 2007; Handy et al., 2003; Jacobs, 1993; Peponis et al., 2007; Southworth and Owens, 1993); yet beyond the established and distinctive structures of these neighbourhoods, few have analysed, in depth, the variability in their measures. This study randomly samples 4,321 localities from the 24 largest American metropolitan areas and describes a method using the measures of length and area to evaluate the variability both between and within these localities. Calculated as the standard deviation of mean scale, Inter Buffer Variability is introduced to describe the variation between these localities while Intra Buffer Variability describes the variation, or consistency, within these localities. How varied then are the measures of scale, and are the measures for some MSAs more varied than others? As will be shown, the MSA Inter Buffer Variability for both length and area are broad, which is expected given both the urban and suburban localities captured across each MSA; and yet, the MSA Intra Buffer Variability is also broad suggesting more variation within these localities than originally suggested by the samples illustrated within the literature. Comparatively for each measure of length and area, both Inter and Intra Buffer Variability are graphed one in relation to the other with their associated means used to delineate those trending higher or lower than average. Interestingly, four quadrants emerge distinctively delineating the measures of scale for these MSAs.

This paper deals with morphological and land use patterns in Brasília Metropolitan Area (BMA). Previous studies concentrated on the morphological attributes of the municipality of Brasília. Now we extend the scale to the metropolitan level. Special softwares are used (Depthmap© and ArcGis©), which allow us to reveal important attributes of the phenomenon: the fragmented and dispersed urban structure; low densities; the eccentricity of the metropolitan centre; severe problems of accessibility among places of residence, work and services etc. The results obtained and the comparison with other Brazilian metropolitan regions allow a critical analysis of the governmental proposals contained in the Master Plan for the Territorial Organisation of the Federal District and the Plan for the Preservation of Brasília as a World Cultural Heritage Site. Current trends point to the aggravation of problems, due to the priority granted to urban development in areas far away from the metropolitan core, thus ignoring possibilities for creating new boroughs within the perimeter of the classified area and its immediate surroundings.

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Towards spatial network multiplicity:
A reference to Bangkok

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Intense urban developments in developing countries often lead towards extensive alteration or replacement of historical spatial layouts. In most cases, this results in new spatial system being added-on as another layer in the city. However, in certain cases the development could result in some degree of abandonment of existing historical spatial network itself, though preference remains for the added-on type of network. Considering the way in which multi-layers spatial network superimposed upon each other, i.e., the historical, the existing and the future, this research asks the questions: Could morphological transformation be effectively established in cases where the abandoned historical spatial network is re-integrated into the existing and future system? And, to what extent can the findings of this re-integration offer insightfulness towards the multiplicity of the spatial network analysis?

Bangkok was chosen as the study city for exploration of these two questions. Bangkok was a water-based city, formed through networks of canals that had been abandoned for a preference of road-based city. Extensive toll ways crisscrossing throughout the city were later added to ease increasing congestions. Eventually, with the pressure of urban expansion, increased population, traffic congestions and lack of space for road construction, mass transit systems were introduced. These systems, comprising of elevated and underground rails, have since become the principle strategic urban development tool. Amid all these, almost all the canals have become inactive. Very few are used as alternative thoroughfares to roads, i.e. with operation of some limited commuter boats. This research focuses on the morphological study of Bangkok's spatial network in four systems: the Bangkok road network; the existing Bangkok spatial network; the Bangkok road-and-canal network; and the proposed integrated network for the future. The space syntax computer program was applied as the analytical tool.

This paper places emphasis on two key issues. One is the technique used for modelling the spatial network itself – in what way can a model of multi-layered spatial network be constructed to allow for independent system analysis as well as comparative study across different models. Another is on the findings of each model studied and the comparison of their spatial characteristics. Not only were the patterns of urban transformation found to be finely differentiated when the historic, existing and future spatial networks are integrated as a single studied model, it also indicates the opportunity of multiplicity for spatial network usage. As much as the latter may be unique to Bangkok, it offers an alternative projection into the future of historical city development. It could be said that the findings provide a conscious warning to planning differently in the future.

Historic Persian caravanserais:
Climatic effects and syntactic configuration

Ancient trading routes such as Silk Road necessitate places for short-term accommodation, rest and security for caravans including travellers, traders, merchandise and pack animals. These places, which are strategically located in different regions along the trading routes throughout Asia, are called caravanserais. Caravanserais are basically composed of three different functional sections; among these sections, the common gathering area that is in the form of a courtyard is usually open and located centrally. As the location and shape of this courtyard forms the architectural typology, the other sections are the spaces reserved for guests' accommodation and service areas, which are both surrounding the common courtyard area.

This paper deals with caravanserais built in different regions of Persia (ancient Iran) during the significant period between 17th and 19th centuries. Within this period, during the first half of the 17th century most of caravanserais, bridges, bazaars and roads were built and restored in order to upgrade the Silk Road to improve the commercial prosperity of the Empire. However, since Persian Empire had a vast amount of land expanded from Caspian Sea to Persian Gulf, it was obvious that caravanserais had to be built according to the constraints of four different climatic zones. Therefore, this paper focuses on the syntactic configuration of the above mentioned spaces and the effects of climatic aspects. The hypothesis of this paper suggests that climate affects the design of public, private and service based spaces and these differences lead to the genotypes of Persian caravanserais. Functional zones of the caravanserais strictly separate the accommodation from the service areas such as storage, cooking, bathrooms, administration and security. However, common spaces may serve both for service functions, social gatherings, trading and even shelter for pack animals. The configuration, position, size and enclosure of these spaces differ according to climate. Therefore, syntactical analyses applied to five caravanserais which are located in four different climate zones in Persia from Safavid to Qajar period, present data of depth levels, integration, circularity and compactness within these spaces.

This study is not only a syntactic discussion regarding varieties of caravanserais in different climatic regions in relation to their configuration, but it also explores syntactic components such as design geometry and perceptive qualities. In this research, by focusing on relations between the three main components of caravanserai space and the climatic parameters we determined that technical development in forms of structural composition and the effects of climate change morphology and spatial quality.

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Plotting urban growth: Fishing towns in southern Portugal, 1970-2014

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This paper examines the evolution of eight fishing towns in Algarve, in order to identify the spatial typologies that characterise changes in the urban fabric. The star model (Hillier et al., 2012) and the mean and maximum variables of normalised integration and choice (NAIN and NACH) were employed to compare the spatial configuration's changes in two different periods: 1970 and 2014. The results show an increase in segregation from 1970 to 2014 as well as a more fragmented and less cohesive urban tissue in most of the towns.

Setting up the metropolis:
Unpacking the historical spatial cultures of London and Manhattan

London and Manhattan constitute unique urban configurations which have claimed and conquered the metropolitan vision. This paper travels back in time to look for the foundations of these cities' architectural and urban morphology. The study is focused on the architecture of the everyday, the vernacular buildings which collectively form the character of a city's historical built environment. It discusses how both preconceived frameworks and emergent architectural decisions and societal rules have shaped the two cities throughout their spatial histories. Drawing evidence from historical and empirical data the analysis presented in this paper builds on space syntax research which investigates morphological processes in urban configurations. The paper looks at two contrasting cases of urban grids to contribute to the understanding of the way different spatial arrangements influence city form.

The urban past of London and Manhattan is considered in terms of planning intentions, architecture, urban form and the embodied socio-cultural models and ideals. The approach emphasises the way architectural and urban scales were configured together to produce each city's historical morphological identity and spatial culture. This stems from an effort to form a parallel understanding of both the building unit and the urban realm where this is situated. In this perspective, the discussion provides an overview on the one hand, of the building aggregation rules of the London terraced house and the Manhattan row house schemes; and on the other hand, the structure of the urban grid in each case. The aim is to shed light on the interplay of these two elements, underlining the challenge for any urban design approach: to tackle both buildings and streets along the lines of a unifying and diachronic spatial logic.

The study considers the syntactical and morphological properties of urban space, looking at the building, the block and the city scales. The paper aims to highlight that both for London and Manhattan there exist inherent cross-scale organisational consistencies that hold the spatial cultures of each city together.

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Urbanity in Brasilia's superblocks

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The literature about Brasilia is almost consensual stating that the residential areas (superblocks) are monotonous and deserted. But a closer look can perceive variations in the configuration of its public spaces and patterns of co-presence. The hypothesis of this paper is that these behaviours are linked to certain spatial variations that followed the implementation of the city. The research corroborates studies in urban planning that investigate the relations between architecture and human behaviour. The sociological performance is simultaneously associated to global and local spaces attributes. Various aspects concern this: accessibility relations between public spaces; number of doors that open to them; visual permeability between open spaces, and between public and private space; size of the spaces; number, type and distribution of activities; availability of shaded areas and places to sit. The analysis starts with the comparison between spatial patterns and encounters system of eight superblocks distributed by Pilot Plan of Brasilia. To analyse the spatial patterns, space syntax tools were used and a field work depicting activities and facilities in each superblock was carried out. The analysis of social departed scheduled observations of subjects and activities in public spaces. Data is processed by the statistical tool principal component analysis (PCA) for validation of the relations among spatial and social attributes' variables.

Urban evolution of the Rio De Janeiro Port

Driven by the events that will occur in the city, Rio de Janeiro signals a new economic dynamic. With a historic centre that remains attached to its original financial and commercial functions, the municipality seeks to regenerate the neighbourhoods around it. In that context, located adjacent to the historical centre, a new project was created with the intention to revitalise the Port of Rio de Janeiro and adjacent areas named 'Porto Maravilha'.

This paper presents a case study of the Port of Rio de Janeiro. Since the second half of the last century, the port has been losing its primary function. Composed of large industrial blocks and a fragmented urban grid, its built environment went through a process of deterioration and loss of functions, as part of its activities were gradually relocated and changes of its built environment occurred. By adopting the space syntax framework, this paper examines how the changes in the morphology of the port have affected its integration with the city. This paper also investigates the role that the Porto Maravilha project plays in improving the accessibility of the area.

Considering that part of the changes in accessibility have been defined by the new regeneration project of Porto Maravilha and part by the architects and stakeholders in their own developments, this study also raises the question of to what extent these localised interventions impact on the accessibility of an already highly fragmented area.

The analysis found that the fragmented urban fabric of the port street network affected its urban function, bringing decay to the area once the port was deactivated. The analysis showed that the Porto Maravilha proposal has a small role in increasing the accessibility of the local area. Conversely, architectural projects lead by the private sector were able to further integrate the proposed developments with their immediate urban fabric and at the same time increase the port accessibility to the surrounding areas, assisting with the creation of a new urban centre in this area of Rio de Janeiro.

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Inner city ring roads: A comparative study of Munich and Stuttgart

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The transformation of inner city ring roads is a key challenge for urban planning and design in European cities in the 21st century. To this end, we have to understand the different development conditions of these roads and the role they play in the urban street network. Space syntax research has already been successfully applied to address these questions.

This paper focuses on inner-city ring roads in Munich and Stuttgart, two German cities, which are comparable in size and socio-economic role, but very different in terms of their spatial structure. In order to analyse the spatial properties of the ring road, we develop a spatial model of the two cities in three development periods:

i.   The urban structure of fortified city shows the development conditions for an urban ring road.

ii. The urban structure of expanding city shows how the urban extensions of the 19th century linked into the urban fabric of the core and whether concentric or linear extensions were developed.

iii. The urban structure of the modern city shows the impact of car-oriented urban planning on the cities.

The space syntax analysis of Munich and Stuttgart is carried out in three steps: First, we develop a spatial model of Munich and Stuttgart in each time period, then carry out an angular segment analysis with depthmapX, and finally calculate, visualise and interpret key spatial indicators.

The study finds, that the medieval street network in Munich creates a good development conditions for a circular ring road around the city centre. This was only partly realised in the 19th century, particularly in the south and west. The highway-style completion of the ring road in the north and east in the 1960s created a barrier for pedestrian movement.

In Stuttgart, by contrast, the original street network and the irregular form of the outer fortification create more difficult development conditions. In the 19th century, no plans for a ring road were realised and the urban extensions connect seamlessly with the medieval core. The highway-style ring road of the post war period destroyed sound urban quarters, still separates the city centre form its surroundings and compromises the adjacent cultural institutions.

The paper concludes with a comparison between the spatial structure of the two cities, specific recommendations for transformation schemes in Munich and Stuttgart and key principles how to deal with urban ring roads.

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Oxen in the backstreet: Tracing an old rural route within the modern city

This paper presents a research on the urban transformation process in Suwon, South Korea. We focus on Wooman town to analyse the conflict between the old and new street patterns, by using the segment angular choice analysis. The street pattern of the old village retained its organic shape which appeared through a long period of time, but a city scale intervention pushed the mechanism of this original network to an unexpected direction. In the modern block of Wooman, two spatial structures co-exist. On the outer band are high-rise modern buildings along the linear network and on the inner band are low-rise irregular type of buildings and streets. Thus, the old organic network is completely enclosed by the straight urban grids which appeared at later stages. The conflict between the irregularity and regularity caused malfunction and fracture inside the urban block. The syntactic analysis revealed how an excessive number of roads, caused by superimposing two heterogeneous systems, could weaken the efficiency of land use and pedestrian flow in a new setting. For the comprehensive understanding, we collected data from historical documents to trace the periodic change of the area. Then, we observed the current pattern of pedestrian movement and synthesised it with the segment angular choice analysis. At the end, this research illuminated the consequences of imposing a new urban grid on an old irregular street pattern, and suggested how we could reconcile the conflict to humanise the urban environment for the sustainable growth.

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Migration and lag of centres during city growth

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The paper discusses the relationship between street network and urban shape boundary by means of investigating the relative position among three centres in the city: axial map centre, syntactic core centre, and urban shape centre. Two measures are introduced: Lag measures metric distance between two centres in a given time relativized by urban area. Migration measures metric distance of the translation of a centre during a time period relativized by the amount of change of urban area during the time period. Various configurations of street network and urban shape produce diverse positioning between syntactic and shape centres, often with a considerable lag. The migration of centres during urban expansion is most evident in coastal cities, which exemplify settlements that grow asymmetrically due to the physiographic constraints of coastal areas. The syntactic core shifts over time according to complex processes that involve the configuration of arterial roads between neighbouring settlements; street patterns of accrued urban areas; and urban shape boundary. The coupled effect of street network and urban shape on the lag and migration of three kinds of centres is studied based on the analysis of forty cities in the Adriatic and Ionian coastline according to three historical stages during 1800-2010. The analysis combines the heuristic classification of patterns of centre lag and migration with quantitative methods that test the effect of settlement size and presence of gridiron street patterns. The study contributes representational and analytical techniques for the study of urban form in evolution.

Spatial morphology of rebel cities:
The cases of Madrid, Merida and Istanbul

The year 2011 went down in history as the year in which urban movements spread worldwide. The movements which found root in some countries before 2011 resulted in the revolution in Tunisia which became a bellwether. Following Tunisia, urban movements were then witnessed in Arab world countries such as Egypt, Libya, Syria, Yemen, Morocco and Bahrain, to be referred to as the 'Arab Spring' which was followed by 'Indignados' and 'Occupy', respectively. As for the urban movements in Turkey, the 'Gezi Park' incidents of June 2013 have common points with the movements that spread over the whole world. In this study, the spatial morphology of Rebel Cities, as defined by David Harvey (2013), was analysed. The aim of the study is to reveal the potential relations between urban movements and spatial morphology. For this purpose, the starting process, development and results of urban movements were initially analysed. It is known that governments, the present-day urban perception, viewpoints regarding urban rights and the commodifying of cities are the major causes of these movements. Research demonstrates that the Internet and social media, as communication methods of our age, have played a leading role in urban movements (Castells, 2013). Alternatively, the view that 'place' has an impact on the interaction of city dwellers, their coming together; thus, the emergence of urban movements is a view that is proposed within the scope of this paper. In this paper, it is argued that experiencing face-to-face communication in public space has greater value and effectiveness than coming together on the Internet environment. The movement, which was triggered by gathering on social media, became visible in urban space. It also became greater and more permanent. This could be observed in the cases of Egypt, Spain, the USA, and even Turkey. The urban movements that either start in a low-income neighbourhood of a city or are triggered by incidents in a city centre without making a call for a movement on the Internet indicate the significance of urban spaces that make it possible to come together and interact. The hypothesis of our study is tested within the framework of the analyses and evaluations conducted in three different cities. According to this scope, with the 'Indignados' movement of Madrid, Spain, with 'Resist Gezi Park' in Istanbul, Turkey, and with the city of Merida, Spain, which did not participate in the countrywide movement, their spatial morphology has been analysed. The method used in the study is space syntax analysis which helps to reveal the social logic of space. Space syntax analysis was conducted in places where these movements were visible in urban space and in the main public space of the city where there was no movement. As a result of these analyses, it can be seen that the gathering spaces in cities where urban movements are observed had integrated values at local (micro-R3) and global (macro-Rn) scales, and that the axes connecting these spaces had the highest values. On the graphs, they are coloured in red and orange which represents integration. As for the city where no urban movement was observed, the most integrated spaces were not found to be of the quality and accessibility that would shelter a potential gathering of city dwellers. According to the findings of the study, one of the common points of the cities whose movements were analysed is the presence of public spaces in those cities. The major factor that triggers urban movements is the quality and accessibility of public spaces (squares, streets, parks) where city dwellers may gather. These findings indicated that public spaces were significant as one of the major elements causing urban movements, enabling city dwellers to come together. This study reveals the importance of the potential of urban space to allow social encounters in terms of democracy.

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Abstracts
4. Urban studies, transport and mobility

The effect of spatial configuration on propensity for non-motorised journey to work: Case study of a gridded and a non-gridded American city

The theory of 'natural movement' postulates that configuration of the urban grid is an important generator of aggregate patterns of movement in urban areas (Hillier et al., 1993). Retail and commercial land uses locate themselves at these configurationally hotspot locations to take advantage of the economic opportunities created by movement i.e. passing customers (Hillier, 1996). These retail and commercial areas are also work places for a good number of people and will influence the choice of some residential locations. Since journey-distance and journey-time are two very important factors influencing propensity for walking or cycling (Plaut, 2005; Wardman et al., 2007; Pucher & Dijkstra, 2003; Schwanen & Mokhtarian, 2005) we hypothesise that the sites of retail areas as understood by their configurational index, will first affect the choices of residential locations and hence also influence the use of non-motorised transport (NMT) particularly walking and bicycling.

We test this hypothesis in the cities of Pittsburgh and Lubbock (USA) using data collected from American Community Survey and US census bureau. Topological and angular configuration analyses of CAD drawn axial lines and street centrelines derived from GIS maps were performed for both cities. ArcGIS spatial analysis tools were applied to combine land use, socio-economic & demographic, transportation and space syntax variables to the scale of census block-groups that was selected as the study unit. Statistical analyses including stepwise and best-subset regressions were carried out to select relevant and significant variables explaining the use of NMT. The findings indicate that choice of transportation mode is significantly explained by multiple variables in which configuration features prominently. In the paper, we also describe and test our assumptions, comment on the selection of areas instead of axial lines as units of analysis, and postulate on the applicability of this research on creating sustainable communities.

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The Capibaribe Park: Restructuring the urban fabric of the city of Recife by articulating public spaces

This paper describes the research methodology and interventions proposed for a 30km linear park along the main river system of the city of Recife, Brazil.

This project has been commissioned by the Municipality of Recife to the Federal University of Pernambuco – UFPE and it has been developed in the last two years by a multidisciplinary team coordinated by InCiTi, a group focused on research and innovation for the city.

The aim of the project is to provide a strategic plan that tackles environmental, spatial and social issues. However, the project extrapolates the immediate boundaries that are under the influence of the river system, given the fact that such change in the social – spatial configuration of the city is perceived as a framework or initial structure of support that will ignite the transformation of the city.

Therefore the proposed park seeks elements that are able to promote the reinvention of the city, grounded mainly on expanding the potential and qualities of existing public spaces and the vacant or underused areas along water courses, with the aim of intensifying the use of these spaces for people and improving their connection with the city. Most of the strategies proposed in the project are based on structuring vital and sustainable places and on the priority for public and non-motorised modes of transportation.

One of the main challenges in this research is how to reconnect citizens and river. Recife is a city that is nearly 500 years old where the relation between city and river has drastically changed in time. In the early years and to a certain extent during the expansion of the city, the river was one of the main structures of transport and connection among the initial settlements that formed the city. The advent of the car and other modes of transportation in parallel with the expansion of the city to areas not directly related to the river, reverts the former relation between city – river; spaces along the water are no longer at the centre but at the city´s periphery.

That inversion of the role of the spaces along the river is evident in the analysis of the axial map of Recife. The structure of the river represents a gap in the continuity of the city fabric. Such divide is even more relevant when combining the syntactic analysis with data regarding income, access to public services and public spaces. In the current setting, the river segregates social groups, it is a barrier to fluid circulation in the city, a void in the urban fabric. The Park project aims to bridge this void in the city structure using a network of public spaces, connected mainly by cyclist and pedestrian paths.

The main expected outcome of this project, apart from everything related to the improvement of the environmental conditions, is the use the spatial structure of a park as a framework that can reweave a divided city.

Exploring the impact of road traffic impedance and built environment for vulnerability mapping of evacuation areas: Case study of Hyderabad city

This study identifies spaces vulnerable to a disaster in terms of impedance offered to evacuation. Evacuation for spaces is evidently dependent on combination of several spatial and demographic features. In order to develop an evacuation model or prioritise regions for special attention during calamity, it is necessary to understand interactions and interdependencies of numerous factors. In this study, we address vulnerability issue in terms of potential difficulties in evacuating a region from a spatial perspective. Arrangement of built-up areas and interactions of neighbourhoods are studied based on topological as well as metric distances between them.

We couple building to building (point to point) accessibility considering metric distances & their respective on-ground areas with space syntax based axial analysis on urban streets. The approach creates multi-dimensional feature vector on top of buildings layer. Feature vectors consist of building on-ground areas, their reach, betweenness, and local integration & choice values of segments adjacent to which they are located for a metric radius of 500 meters and topological radius R10. Further, we use bivariate Local Indicators of Spatial Association (LISA) to identify the clusters and conclusively carry out knowledge based denomination of the areas in terms of their vulnerability.

The study reveals that road segments offering highest traffic impedance for planned grid like arrangements are parallel, of equal length and in close vicinity of each other whereas for non – grid wards are rather scattered. The clusters of buildings located on roads with lower accessibility are significantly less in number as well as smaller sized for grid like symmetries compared to non – grid arrangements.

The evaluation of areas from vulnerability perspective carried out in this study can form the basis of a generalised decision support system – framework to identify, rank and prioritise both the current and future space planning and emergency response.

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Movement and the connectivity of streets: A closer look at route distribution and pedestrian density

Correlations between pedestrian movement and connectivity of streets have been frequently found in numerous studies. The configuration of the street network and its relation to observed movement patterns found in space syntax research is, of course, a significant part from them. With an attempt to further investigate the relation between urban form and movement behaviour, this study tests the correlation between configurational measures and a more detailed data on pedestrian movement. Observed in three residential neighbourhoods from Stockholm, the first part of data collected is the number of pedestrian per street segment (on a given moment). This so-called 'snapshot' data of the pedestrian density is tested with the configurational measures of the street network. The preliminary result shows a significant degree of correlation between pedestrian density and configuration. More importantly, another set of data on pedestrian movement is the data of 200 individual trips made in one of the three study areas (with highest average movement density). The detailed data on individual walking trips is obtained through random on-site tracking of pedestrians, and includes the route and the details of the trip character. This data is also tested in its correlation to configuration measures. An interesting result from this is the large difference in the degrees of correlation found for origin/destination segments and route-in-between segments. The result also shows that the degree of correlation also differs according to the character of the walking activity e.g. utilitarian, recreational, etc. Testing with data on movement containing more details of pedestrian behaviour, this study tries to investigate how urban form interacts with pedestrian movement in the aspect of street connectivity.

On the slopes of Vesuvius. Configuration as a thread between hazard and opportunity

This paper focuses on the urban agglomeration that has gone growing up along the centuries on the western side of Vesuvius, a still active and fearsome volcano, few kilometres southeast from Naples. In view of the dimension of the agglomeration and of the spontaneous and unplanned way it has been growing, the purpose is to investigate on the actual role Vesuvius – as an element of both danger and richness – has gone assuming in the urban self-organisation. This paper will analyse the grid configuration of the whole settlement, in order to discuss the way Mount Vesuvius has been interiorised (if it actually has been) in the spatial choices and behaviour of the local communities so as to benefit from its presence and to co-exist with its threat. Three major results are expected from the findings: to examine and verify the actual resilience of the whole agglomeration, so as to evaluate the extent to which the concern and alarm are actually justified; to analyse the configurational state of the system in order to pinpoint possible actions for risk mitigation; more in general, and aside from the case of the Vesuvius area, to evaluate how risk from natural hazard is spontaneously mitigated in self-organised urban spaces; and if self-organised urban structures, when exposed to natural hazards, really work better than we may think or fear.

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Momentum integration:
The syntax of cycling

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Cycling has long been known to have significant physical and mental health benefits for its participants. It has the potential to significantly reduce the carbon footprint of a city, increase personal mobility, improve transportation equality, improve air quality, and reduce congestion. While cycling has seen a major increase over the recent past, it is still a relatively small proportion of overall transportation. One significant factor in inhibiting the growth of cycling in many UK cities has been the lack of sufficient dedicated cycle routes. This deficiency is partly due to the lack of any recognised method of forecasting the practicability of future dedicated cycle lane provision.

Historically, the prediction of movement rates for cyclists, using space syntax methods, has been weaker than that achieved for pedestrian rates. This paper theorises that cyclists' route choice is primarily dominated by the momentum of the cyclist rather than route complexity. In this paper we introduce momentum integration as an alternative mechanism to understand cyclist movement. Momentum integration unifies multiple aspects of movement (specifically angular complexity, elevation change, traffic lights position) into a singular system, which can be computed using traditional syntax methods.

This paper describes the methods of momentum integration and introduces new software known as 'Momentum Mercury', which uses open source, centre-line data to compute momentum integration maps. The paper then continues to produce a movement rate analysis comparison between traditional space syntax methods and momentum integration using a survey of cycle usage in a major UK city. Analysis of this data shows that they are momentum method improves upon previous pedestrian correlation.

Up to where a city ends. A spatiotemporal imprint of commuting patterns for the ten largest Greek cities

This paper deals with the composition and implementation of an analytical methodology for the redefinition of urban areas limits, which utilising both spatiotemporal socioeconomic and geographical data is applied for the ten largest cities in Greece in a Geographical Information Systems (GIS) environment. Critical points throughout the research are the selection of input data and the segmentation of space. As input data, we use parameters that can reflect the urban sprawl dynamics, such as housing, workplace and workplace distance. We examine urban centers as transmitters or receivers of manpower based on their ability to attract and repel people in strong connection with the workplace factor. Based on the central question, "Up to where the city ends?", we attempt to outline the "real" and not institutional boundaries of an urban center, which vary based on the parameter of transportation for work. The principal objective is to leverage methods and techniques in order to identify a methodological framework approach, analysis and evaluation of the spatial position, influence radius and relations arising from the variation of the dynamics of urban centers. The study of these spatial development components will be implemented on the basis of their evolution in time, using the same methodology in the range of the last decade (2001-2011). Thus, through this process, we attempt to deconstruct the existing reality, to record its individual components of the causes of its generation and ultimately to recompose them in an attempted understanding of this reality.

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Spatiotemporal analysis of the e-mobility system in Newcastle-Gateshead area

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The world is witnessing an accelerating expansion of urban areas and intensive urbanisation. The robust relation between transport infrastructure and urban planning is reflected in how integrated and reliable any system is within the urban spatial system. Designing an integrated infrastructure to support full electric vehicle (EV) use is a crucial matter, which concerns planning authorities, policy makers, as well as current and potential users. Reducing range anxiety by facilitating access to public refuelling stations (RSs) is designed to overcome one of the main barriers that stops potential users to utilise EVs. The uncertainty of having a reliable and integrated charging infrastructure presents hurdles to, and slows down, the growing trend of smart ecosystems and sustainable urban communities as whole. Strategically locating non-domestic (public) EV charging points will help to pave the way for a better market penetration of EVs and, in space syntax terms, this involves establishing the spatial configurational correlates to successful charging locations. This paper analyses real information about EV usage of the year 2012, in one of these metropolitan areas. A case study of 38 charging points (CPs) with 120 EV users located in the inner urban core (NE1, NE4, and NE8 postcode districts) of a metropolitan area in the North-East England, the city of Newcastle upon Tyne, incorporating space-time analysis of the EV population, is presented. Information about usage and charging patterns has been collected from the main local service provider in the North East of England, Charge Your Car (CYC) Ltd. The primary methodology employed is a clustering analysis. It is conducted as a dimensional analysis technique for data mining and for significant analysis of quantitative datasets. A spatial (consisting of space syntax measures) and temporal analysis of charging patterns is conducted using SPSS and predictive analytics software. The study outcomes provide recommendations and an explorative design theory for the implementation of non-domestic EV charging infrastructure. This paper presents a methodological approach useful for planning authorities, policy makers and commercial agents in evaluating and measuring the degree of usability of the public electric mobility (e-mobility) system.

Calm after the storm: The configurational approach to manage flood risk in river-cities

Watercourses can play a crucial role in settlement development, both in term of land use and space perception. River presence influences the whole urban pattern and whatever element that modifies spatial configuration – such as areas that can't be reached after a flood event – will globally affect the distribution of configurational indexes within the grid. Even if one could appear just a local grid variation, the whole city's working way will be modified and, in turn, the city recovery rate after a flood event could change too.

Configurational analysis in river cities contexts can be assumed as a decision making support tool: it allows to evaluate how flood recovery can change on varying of spatial configuration, helping in quantitatively assess a sort of spatial urban resilience property. Then, it needs to choose which configurational measures could suitably describe this property.

In technical literature some previous works have analysed urban resilience, attempting to describe it through a configurational approach at urban and architectural scale (Cutini, 2013; Koch & Miranda Carranza, 2013).

Focusing on flood resilience evaluation, space syntax measures have been carried out for the Turin metropolitan area (IT). The chosen case study region is an urban context with more than 500.000 inhabitants, crossed by two of the major Italian rivers. Assuming a flood scenario in the region, the feasibility of applying literature resilience indicators for flood event has been assessed, even if they have not been defined in relation to a flood event. The results have shown that, although useful in describing some grid properties, these indicators can't coherently be assumed to define if a certain urban system is resilient to flood events.

Therefore, as a starting point to achieve appropriate measures of flood resilience (in syntactic terms), it has been considered to pursue the priority objective to correctly estimate flood related changes in configuration layout, from spatial and functional perspectives. A statistical-based approach has been pointed out, obtaining a post-processing methodology. The latter has been applied to Turin case study, providing coherent and meaningful outcomes and allowing to overcome some operational issues in comparing different grids.

Evaluation of flood syntactic effects leads to a first flood resilience characterisation.

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Integrated sub-regional planning informed by weighted spatial network models:
The case of Jeddah sub-regional system

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Existing Space Syntax methodologies provide the tools to measure the impact of proposed spatial changes, but are strongly dependant on the quality and availability of the spatial data. This becomes particularly more complex when major land use changes or development projects are proposed in a large region and there is no or very little spatial layout data available for them. To counter this problem it is suggested that an 'integrated urban model' can be developed by using land use and demographic data to supplement the lack of spatial layout data and create a more realistic model for evaluating planning decisions. This paper explores the use of a 'weighted space syntax' model to contribute to the process of integrated urban planning for a large urban region in a major planning exercise in Jeddah, Saudi Arabia. The study aims at identifying the growth pattern and development potentials of the Jeddah Sub-regional system along with testing planning proposals for its growth over the next twenty years. The method for allocating the weighting to the segments of spatial networks by dividing the city into 'superblocks', identified by the foreground network and morphological similarities or spatial conditions such as existing municipal districts and major development boundaries. The weighting is then applied to the segments per unit length since longer segments have a higher probability of having a higher number of plots. The output is a spatial analysis impacted by the land use distribution, which adds the attraction or repulsion to movement generated by certain land uses to the spatial configuration and provides an accurate depiction of the functioning of the city. With this methodology we are able to estimate the impact of any number of projects of varying scales, at different time periods. This model has been integrated into the planning process through working with the lead planners in Jeddah at different stages of the project in both informative and evaluative modes. The result is an iterative, evidence-based approach and a collaborative framework for the planning and decision making, which could be adopted in future planning for Jeddah or elsewhere.

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Capturing patterns of shrinkage and growth in post-industrial regions: A comparative study of the Ruhr Valley and Leipzig-Halle

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Existing Globalization reinforces transformations within urban societies and leads sometimes to the phenomenon of urban shrinkage. This is not only visible in small areas and cities. Often entire regions are facing similar causes, yet not all areas within them show similar developments. Apparently other factors influence intraregional trajectories. To understand phenomena of urban transformations it is important to consider their inherent complexity. This study addresses urban and regional developments as processes and as complex systems of different inter-dependent multi-scalar networks. The aim is to capture patterns of growth and decline in post-industrial regions. Analysing the urban network of two German post-industrial regions – Leipzig-Halle and the Ruhr Valley – at multiple scales this research explores how their network morphology relates to their present socio-economic situation. By using the theoretical methodological approach of Space Syntax and GIS methods, complexities between those spheres are revealed offering an insight into intra-network relations and their origin. The purpose is to understand to what extent industrialisation and deindustrialisation has affected the spatial structure of these regions influencing their patterns of growth and decline.

The research reveals that in spite of similarities in the ways in which both regions have grown, their overall structures differ significantly. This difference relates to their present condition of regional-shrinkage and partial growth and influences their future potential.

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Evaluating the impacts of an urban design project: Multi-phase analyses of Taksim Square and Gezi Park, Istanbul

Taksim, which is known as the heart of Istanbul, is not only the main centre of entertainment, retail and cultural activities, but it also functions as a connection node between the old and new central business districts of the city. Throughout history, Taksim has played an important role for both the city and the country as it was the 'host' of several major social events, while it sometimes was the direct 'subject' of these events.

Taksim has long been the subject of debates on account of its unresolved pedestrian and vehicular traffic. In September 2011, Istanbul Metropolitan Municipality approved a pedestrianisation project for Taksim. Despite the objections raised by professional organisations and civil protests, the area went under construction in order to build a tunnel system for vehicles, which would leave the surface above as a pedestrian-only platform, and to reconstruct a military barrack, which was once located in the place of Gezi Park but was demolished in the 1940s. The construction phase of the pedestrianisation project for Taksim Square was completed in 2013. However, the reconstruction of the replica barrack was cancelled upon the judgement of the court which was declared as the wave of demonstrations continued throughout the country. Currently, the underground tunnel system is open to traffic, Gezi Park remains as is with slight improvements, and Taksim Square, which is a vast concrete space, awaits for an urban design project.

Considering that there would be a major change in the pedestrian activity in Taksim during the construction and after the implementation of such a significant pedestrianisation project, this three-phase research was designed in order to bring an insight on the relation between the spatial organisation, and the volume and movement flow of pedestrians in the area before the municipality's pedestrianisation project was implemented (phase I), during the construction (phase II), and after the implementation of the pedestrianisation project (phase III). In order to quantify and analyse the volume and the flow of pedestrian movement in the area, gate counts were conducted for all three phases. After the launch of the construction, many of the roads (both pedestrian and vehicular) were blocked, and alternative routes were introduced to users. The changing spatial layouts of these three situations were represented in syntactic maps and were analysed to compare with the movement patterns.

This paper explores the opportunities and challenges in taking a syntactic approach to the spatial analyses of different phases of the pedestrianisation project in the rapidly transforming political centre of Istanbul. The results of this paper, which were derived by using the tools offered by Space Syntax, demonstrate the effects of the changing spatial layout on pedestrian movement levels, and provide insight towards understanding the preferences of pedestrians when their usual choice of route is blocked and they are forced to use alternative paths. The paper also provides input for the urban design project which will be implemented in Taksim Square by the Istanbul Metropolitan Municipality.

How do UK regional commuting flows relate to spatial configuration?

The benefits of living in cities are well documented and can be generalised to include capitalising on agglomeration benefits in triggering productivity gains. However cities cannot be approached as stand-alone places but rather as a system of city regions and national urban hierarchy. Despite the connected nature of city regions, research on spatial configurations beyond cities is limited. The majority of spatial configuration research focuses on the city. This can be attributed to the lack of interdisciplinary research with large geographic model and the technological limitations in computing nation-wide models. The need for research on urban agglomeration benefits from regional infrastructure and the advent of large scale open source data and software, raises an opportunity to examine regional issues such as commuting behaviour from the spatial configuration perspective.

Based on the theoretical propositions, where spatial configuration is a determinant of movement, this research examines to what extent spatial configuration relate to commuting behaviour at the regional and national scale. In order to approach this research question, we first describe and introduce the commuting flow and spatial network dataset used in this study. Next, we describe the association between the commuting flow variables and spatial configuration variables through an exploratory correlation analysis. Third, we define an initial classification of commuting flows based on three specific urban agglomerations. To conclude, we compare how the configuration perspective in using angular distance compares with the geographical perspective in using metric distance to model commuter flows through a gravity model.

This study showed that spatial configuration in the form of integration is able to capture cities as concentrations of people and workplaces and as attractors of commuter flows. Although this attraction of commuters towards cities is obvious, the characteristics of this attraction are complex. City size, spatial density, regional integration, metric and angular proximity seem to affect commuter flows in city regions and can be described using spatial Integration at different radii. The difference between being a commuter city (Wigan), a city that attract commuters from nearby (Oxford) or a city that attracts commuters from afar (Norwich) appears to be influenced by the balance of city size, density and its regional connectivity. Re-interpreting the gravity model from a spatial configuration perspective produces significant result in explaining commuting flows. However a comparison of different commuter models based on metric and angular impedance shows that metric rather than angular proximity associate more strongly to commuter flow between city regions. Whilst, Space Syntax research argues the importance of spatial configuration influences pedestrian behaviour at the local scale, this research argues distance and configuration influences our behaviour in a more complex manner at the regional scale.

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The hidden corruption of American regular grids: Why space syntax doesn't work in the United States, when it looks like it should

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"If you don't play the game, then you're not in the game."

Poor Richard

Space syntax has made remarkable progress in research and practice around the world over the last 40 years. However, this is not the case in the United States. Space syntax remains on the fringe of American planning and development. This is odd since there seems to be several inherent advantages for widespread application of space syntax in an American context, i.e. ongoing large-scale urban growth, an established research programme at one of the country's leading universities, and seemingly 'natural' allies in professional practice. The paper outlines the financial, institutional, and legal hurdles/pitfalls confronting space syntax in the American market, especially in the private sector. Using a series of 'back-of-the-napkin' financial calculations common to the American development process, the paper demonstrates how these challenges can transform into a distinct advantage for advocating the cause of the space syntax in the United States. Given this, the paper concludes by discussing the enormous challenges and opportunities for space syntax in America today.

Shifting centralities in search of identity:
The new 'Heart of Doha'

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A design intervention at the heart of any historical urban core requires a multi-layered sensitivity – first, at a planning level, directed at any historical urban patterns that have shaped what has emerged as a centre; then, at a design level, directed at the evolution of built form, amassing and distribution; last, at a social level, directed at understanding of what people's perception of a city centre is and how they employ its space and landmarks for carrying out social activities. Working within this multi-dimensional framework, the current paper examines an ongoing case of a historical centre revitalisation – the Msheireb development in the downtown area of Doha, arguably the largest of its kind in the Middle East. The interest this paper takes in this development is two-fold – to evaluate the success of the development in re-gaining and re-establishing an urban centrality, lost after the 1950's impetuous demolition of heritage fabric in favour of a sporadic upraise of commercial developments and the rapid propagation of sprawling highway infrastructure; and second, to illustrate the potential of the development in extending its spatial engagement towards landmarks and social places of cultural heritage, which serve as anchors in an emerging pedestrian movement network and also as major attractors for socio-economic activity.

For the aims of these arguments, the theory and methodology of space syntax will be employed to first, explain the urban science of city centres, then to analyse and illustrate the morphological transformation of Doha's historical centre, and last, to assess Msheireb's impact on the city's urban core and its spatial capital. Employing space syntax first as an evidence-based tool, it will be shown that Doha's centre has continuously shifted outward and the historical urban core has lost its configurational potency due to rapid, post-oil city growth which has annihilated the inner finer urban grid in favour of larger network configurations and campus-like developments. Assessing the Msheireb development within this context, it will be shown, that it is in fact successful in re-gravitating a certain locally-defined centrality back to the historical core, through revering and reinforcing a historical, socially-laden urban grain, much necessary for the vibrancy of city centres. However, it will also be shown that, on a more global scale, the development has been largely designed as an urban enclave and the propagation of grid pattern and the spatial engagement of the wider context and nearby landmarks is only partially realised. Motivated by these findings, space syntax will be further employed as an analytical design tool in a design exercise to link the development to its larger downtown context and test its spatial potency to engage urban attractors and public spaces in a more intelligible configuration, thus improving not only the pedestrian movement network, but also the distribution of socio-economic activity.

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Measuring bikeability: Space syntax based methods applied in planning for improved conditions for bicycling in Oslo

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Our study, on the commission of the municipality of Oslo, has consisted in analysing and evaluating existing conditions for bicycling in Oslo and providing input for a revised bicycle strategy that aims at significantly increasing the bicycle share in Oslo by 2025. This paper presents the overall methodology used for evaluating the former strategy and elaborates upon the space syntax based analyses carried out in order to propose an improved bicycle route network.

An important issue in bicycle planning where space syntax based methods are highly applicable is network assessment measures. In the research presented here, route directness, a feature that according to bicycle planning literature is crucial for well-functioning bicycle route networks, has been examined by space syntax analyses applying the measurement normalised angular choice. Such analyses reveal the potential for fastest/easiest routes within a network, other conditions being equal. Comparing results of these analyses of route directness in Oslo with bicycle route facility standards in terms of traffic safety and speed continuity, shows an interesting pattern of low standard along most direct routes. We also see that bicycle route standard and closeness to the city centre correlate negatively; the more central, the lower the standard. Based on the analyses, a strategy for improving the bicycle route network in Oslo is proposed. The study illustrates how space syntax analysis of route directness in combination with GIS-mapping of route facility standards is highly useful in bicycle planning, both for understanding existing conditions for bicycling and for assuming effects of alternative proposals for improvements.

Easiest paths for walking and cycling:
Combining syntactic and geographic analyses in studying walking and cycling mobility

We discuss fundamentals of a new computational approach to configurative analysis and synthesis and present a number of advancements we have made in the direction of computational analysis of walking and cycling mobility. We have scrutinised the notion of distance and addressed it in correspondence with the notion of geodesic or optimum path. We present a new all-inclusive pathfinding algorithm for walking and cycling and show how this pathfinding algorithm can be used as a new basis for a number of conventional network indicators such as closeness and betweenness centrality measures -taking into account the physics of walking/cycling mobility as well as the cognitive aspect of human navigation. To this end, we revisit the meaning of distance and introduce a new notion of geodesic, which we call 'easiest path', i.e. a path that is reasonably short, flat and at the same time cognitively simple. Using this new geodesic, we reconstruct betweenness centrality indicator and introduce two new accessibility measures as 'proximity to any', 'vicinity of all' and a method of zoning as to walking and cycling accessibility. We show how suitability of locations as to their walking/cycling access can be modelled in a way that is immediately understandable for both citizens and urban designers/planners. Models are implemented as a toolkit, available as a freeware application.

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The dialogic city: Towards a synthesis of physical and conceptual artefacts in urban community configurations

This paper addresses a question in urban research relating to definitions of the physical and conceptual artefacts that comprise local urban communities. These artefacts are, we suggest, products of complex relationships between discursive and non-discursive agencies in urban contexts.

We focus on the problems of defining conceptual artefacts by considering how urban communities' social meanings are embedded in their spatial configurations, conceptualisations and practices. Considering the relational nature of the built environment, we describe the interplays of space, society and meaning as being 'dialogic'. By this we mean that the urban environment's discursive and non-discursive agencies inform and transform each other through processes of their complex inter-dependencies. These dialogic processes also occur where professional and community practitioners seek to transform the built environment by exchanging their conceptualisations and definitions.

Towards a refocusing upon conceptual artefacts in the built environment, we review a selection of diverse research from the fields of space syntax, actor-network theory in architecture, and urban sociologies of crime and deprivation. We sample from specific studies of urban spatial effects upon local community behaviours. We observe that processes of conceptualisation are revealed in professionals' definitions of urban environments. Moreover, we draw attention to the lack of community-membership definitions in many urban interventions. We argue that this lack persists because community conceptualisations, based upon 'mental models', tend to be reflected in quotidian or sub-conscious practices, which do not enter the standard professional discourse.

We reflect critically on the urban research studies sampled, considering in particular their treatment of the role of conceptualisations in shaping the urban environment. Building on this critique, we argue that the notion of 'mental models' is overlooked in the urban research literature and warrants further investigation. Working towards a synthesis of physical and conceptual artefacts, we attempt an outline of the significance of inter-dependencies in urban formations. Hence we consider the role played by local conceptualisations in phenomena such as neighbourhood boundaries, community foci, stereotypes of others and place-specific community values. Finally, we outline the requirements for a method to examine these conceptualisations.

Pedestrian risk index for Irbid city, Jordan

Engineers develop pedestrian accident models to reduce the risk of being involved in a traffic accident. Many factors entered to predict accidents incidence. The research results indicate that there is a significant relationship between pedestrian exposure, traffic volume, and accident incidence, which yields r-squared 0.71 at a 5 per cent level of significance. The availability of detailed data about pedestrian exposure (volume) is a major challenge facing pedestrian safety advocates & urban planners. Many techniques could be used to estimate exposure, space syntax methods were used in this paper to analyse streets network and predicts the movements' potentials. Using the space syntax approach in modelling pedestrian movements would allow planners to take more a proactive role in risk assessment when needed tools and resources are not available.

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The arable city: Quantifying the potential for urban agriculture in the 21st century metropolis

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Australia is one of the most urbanised countries in the world, with some 90% of the population living in cities. Only 6.1% of Australia's land mass is considered of arable quality, compared to 17% in the USA. Moreover, the amount of peri-urban land available for food cultivation is diminishing as urban sprawl expands to accommodate a growing population. The advent of 'industrial' agriculture in the 19th and 20th centuries marginalised urban agriculture but the past 20 years have seen a resurgence in public and policy interest and activity in numerous cities and countries. The research and data which should underpin such renewed and increased interest and activity, however, remain ad hoc and largely anecdotal. A more informed approach is now both urgent and essential. The growth of cities generates benefits – notably by creating centres of economic development and innovation – but also detriments, by way of sedentary lifestyles and obesity, stress and mental ill-health, crime and loss of community cohesion. There is international evidence that urban agriculture may help reverse these trends through its positive effects on diet, health and wellbeing and the social fabric. In addition, urban agriculture responds to the challenges of climate change, both through mitigation (reducing 'food miles' and carbon footprint) and adaptation (substituting for those rural areas where agriculture may no longer be viable). This paper reports on the first stage of a broader project which aims to develop an evidence base for policy, planning and design to facilitate urban agriculture in Australian cities. This stage relates to the identification of available space to support quantification of food production potential. While Sydney is the focus, care is taken to ensure that the final methodology used will be transferable. One way to increase the quantity of agricultural land in built-up areas is to cultivate informal green spaces such as vacant lots, street and railway verges, and also the rooftops of existing buildings. Determining the potential for urban food production requires application of a range of methods to ascertain the location, spatial extent, distribution and ease of access to suitable spaces, including such 'leftover' spaces. These methods include remote sensing (LiDAR, satellite and aerial imagery) and field verification, and also space syntax. The main focus of this paper is to explore space syntax techniques in relation to their capacity to quantify the accessibility of potential sites, their interrelationships as elements of an urban agriculture network and their integration with the broader city fabric. The longer term objective is to derive a database of potential urban agriculture sites in inner and outer metropolitan regions, categorised in terms of the ease with which local residents can get to individual sites by walking or cycling, the proportion of city dwellers able to easily reach an urban farm, the potential number of users at the local scale, the inter-accessibility of sites at the city-wide scale and the spatial diversity of prospective sites.

Comparative analyses on factors of the pedestrian numbers in a downtown area using space syntax indicators:
Case comparisons of Sakae-South, Nagoya CBD in Japan between 2005 and 2011

In the Japanese downtown district especially in the age of "Urban Renaissance", the making of turnout has become an important matter. For exploring the solution, the authors are trying a factor analysis of pedestrian numbers in 2011 on each pavement on a holiday in Sakae south district, Nagoya, Japan, where the area of 400m x 800m has many retail shops including several department stores that showed eminent turnout.

In our analysis, we use the indicators by applying space syntax theory as a candidate factor, as well as other candidate factors such as the accessibility from the subway station and the space use intensity. Then, apply mainly a multiple linear regression analysis. Especially, when we make space syntax by using UCL's Depthmap, we had to consider the "high degree of space openness" in the case of Sakae south district, thus we devised a kind of improved the space syntax indicators. Concerning the improvement, we focus on screen and configurations of ground, especially, a vertical drop in the district: A screen needs to be considered: a wall, hedge, fence and an entrance to an elevated road, all of which are 1.5m or more in height. And, the heights above sea level in the district vary between 12.5m at the highest and 7.5m at the lowest; however this difference of elevation is not taken into account in the Depthmap. Outside the district, a contour line of 1.5m or higher is a borderline, and any area beyond this line cannot be seen.

We need a comparison among a wide variety of visibility graph analysis (VGA). This time the authors preferred to deal with a visibility graphs rather than the axial maps for the convenience of time and data. From the local measures of the visibility graph of Sakae south district, the connectivity and the integration value were used in the visibility graph analysis (VGA). Additionally, A GIS data from the planning section of Nagoya city bureau were used.

After applying the analysis, we use the multiple linear regression equation to make a forecast of the pedestrian number. Trial calculations are carried out for the case of a whole roadway section of Otsu Avenue, the main thoroughfare that passes through the case study district from north to south is converted to a pedestrian mall.

In addition, we also analyse the pedestrian numbers in 2005 by the similar method and try to compare the multiple linear regression models in 2005 with the models in 2011. The comparison is considered by strength of standard partial regression coefficient in the candidate factors or multiple correlation coefficients. And, we clarify the change in the influence of the space syntax indicator on the pedestrian numbers, considering the changes in historical background and the space use intensity that happened by some rebuilding during 2005 and 2011. As a result, we find the further usefulness of the indicator made by applying space syntax theory.

The research being in process, the authors would talk about this analysis in detail the conference.

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The spatio-temporal routine of pedestrian movements in large cities: The case of Seoul

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Using one of the largest longitudinal datasets on urban pedestrian volume, this paper applies a series of multilevel models to explain spatio-temporal variations in pedestrian counts. The aim is to answer the following questions: 1) to what extent could pedestrian counts be explained as a routine over time? 2) Controlling for the temporal routine, how are pedestrian counts related to their count locations? 3) How would the relationship between pedestrian counts and count locations vary across different time periods? Further discussions are made regarding how the answers to these questions can be utilised to enhance the explanatory power of spatial predictor variables in conventional regression analysis and also to provide a consistent base for effective pedestrian survey design.

Exploring countrywide spatial systems: Spatio-structural correlates at the regional and national scales

In this paper we take a step towards extending space syntax analysis into the countrywide scale, through the study of three very-large spatial systems in the UK, namely the top-tier road network of the entire country (170,007 nodes), the complete road network (1,208,674 nodes) of three contiguous NUTS1 regions (the East of England, South East of England and Greater London) and the complete road network of UK's mainland (2,031,971 nodes). We compare the results of our analysis with several types of functional and socio-economic data, finding clear statistical associations at the scale of the entire country between network structure, vehicular movement flows and the spatial distribution of several socio-economic variables. We conclude by arguing that space syntax models and analysis hold their value at very-large territorial scales, being highly robust and producing coherent results between datasets of different sources, themes and dimensionalities.

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2014 World Cup: A motivation for accessibility improvement in Porto Alegre, Brazil

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Porto Alegre, Brazil, was one of the cities where the World Soccer Championship took place in 2014. Like in the other ones, authorities listed a number of decisions to be taken in order to better host thousands of tourists that would be in town not only to watch the games but also to enjoy the city and regional attractions. One of the main aspects to be improved was urban mobility. It was intended by authorities that all journeys should be easy for residents and tourists. Solutions towards straighter paths linking hotspots and attractors, like the airport, bus stations, soccer stadium, restaurants and pubs, hotels, parks and historical areas should be searched by urban planners. Thus, the road system conditions should be evaluated regarding to quickness, safeness and comfort for drivers and passengers. A basic aspect on mobility in cities issue is the urban grid accessibility. The purpose of the research was to discuss the situation in Porto Alegre before the sports event and the effects on accessibility and potential movement caused by the modifications and increments on the grid prescribed by planners and authorities for the World Cup. Seven infrastructure projects in different places were selected for the intended evaluation. Potential co-presence among local population and tourists was analysed from the results of an overlay between the main street grid, emerged on the spatial configuration, and the specific roads and streets that were potentially coursed by visitors and tourists, in the sense that they could have increased social and economic opportunities as well as cultural exchange during the days of the event. Space syntax measures like step depth, global integration, and choice, were applied not only to evaluate the accessibility but also to identify the potential main routes chosen by tourists and citizens to move from one attractor to another. On one hand, results allowed the conclusion that those infrastructures didn't affect significantly the grid accessibility of Porto Alegre as a whole, although the integration core incorporated some important spaces as consequence of the modifications on connections. On the other hand, the potential routes of movement among different places of interest match with choice foreground network, what suggests that there was a considerable chance of co-presence between Porto Alegre citizens and strangers during the World Cup.

Identifying city-regional structures in Rio Grande do Sul, Brazil

Presently, the idea that a region can be defined and delimited as part of a territory with similar characteristics which are, in some degree, different from other places, is being reviewed. Literature shows attempts of contemporary territory descriptions as consequence of complex, diffuse and contradictory realities of a globalised society, what suggests the necessity of discussing new concepts of region.

In the 70's, nine metropolitan regions were delimited and institutionalised in Brazil, based mainly on criteria of population, conurbation, commuting and industrial activity. Ever since then, the number of metropolitan regions has increased up to more than forty, which were delimited based in different and subjective criteria, with negative consequences for public urban policy making and governance.

The conurbation criterion is considered a fundamental one for the identification of a metropolitan region. However, is it possible to find relevant global structures in non-conurbated city-regional systems?

An exploratory study is proposed for the Metropolitan Region of Serra Gaúcha, recently institutionalised in the State of Rio Grande do Sul, Brazil, where political reasons overcame technical delimitation criteria. The ongoing research uses geo-referenced data of different land uses, in thirteen municipalities, to be correlated to syntactic measures in order to find out patterns of land use and occupation representative of a contemporary territoriality in the southern part of the country. The present paper is a preliminary approach, restricted to four municipalities, towards the comprehension about spatial relations within agglomerated cities which are not in a conurbation stage.

Space syntax was taken as an appropriate theory and methodology for the investigation because it allowed to disaggregate space, from demographic census sectors (surfaces), into units (axial segments) to which data can be linked, supporting a much more accurate analysis. Municipalities were analysed separately evidencing individual structures, and as a whole, where global accessibility and centrality revealed the city region structure and the degree of autonomy of the parts.

The preliminary results showed interdependences between some land use locations and space properties and attributes in the municipal scale. However, in the regional scale, areas along some important accessible spaces were not intensively occupied yet, suggesting functional independence among cities.

The study case pointed new targets for the ongoing research, towards a new data set and the knowledge of routes adopted by suppliers, customers, partners and the distribution logistics for industrial and commercial enterprises. This way, space properties and characteristics can be better correlated with eventual new and different relations among cities not necessarily conurbated.

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The effects of perceived and objective measures of home-environment on transportation and recreational walking among children

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This study explores the relative association of objective and perceived environmental factors with recreational and transportation walking behaviour. Randomly selected parents of students (ages 12-14) at 10 elementary schools (N=1000) located in Istanbul, Turkey, completed questionnaires about their socio-demographic characteristics, neighbourhood environment, and their children's physical activity.

Home-environments (400 and 800 meter buffers) were evaluated through GIS-based land-use, segment-based street connectivity measures, and street-level topography. In addition, detailed field surveys related to pedestrian quality attributes were conducted within home-environments. Logistic regression was used to investigate the relationships between recreation and transportation-related walking and objective and perceived measures of the built form.

Findings of the study indicate that both types of walking behaviour are associated with different perceived and objective environmental attributes. More importantly, preliminary results suggest street network connectivity measured at the segment-level is significantly associated with walking behaviours. Thus, it can be argued that modifications to the home-environment may help change hence children's walking behaviour.

The local spatial logic: Application of pedestrian model in Criciúma, Brazil

Understanding generative pedestrian movement causes is a key urban planning issue, especially when it comes to verify public policies efficiency towards open public spaces maintenance or improvement and the correlation of such governance actions in strengthening social dynamics. Pedestrian movement is a complex phenomenon which patterns emerge from the interaction among multidimensional variables ranging from cultural behavioural patterns underlying social relations, spatial configuration accessibility patterns to sidewalk attributes. The most effective problem-solving tools applied in order to improve pedestrian movement focus on modelling sidewalk attributes through the relations held amidst their physical variables. In this paper we introduce a modelling method which processes data interactions through artificial neural networks and genetic algorithms. Hybrid data parallel processing allow the comparison between potential and empirically measured pedestrian movement based on space syntax variables and sidewalks service levels. It provides accurate and reliable descriptions for public open spaces social appropriation patterns and its correlations to changes in urban grid morphology and functional centralities. The model proved its efficiency in processing simultaneously large data samples which consider whole urban areas global spatial structure, what enabled the impact analysis of large scale vehicular through movement on local scale movement and depict changes on pedestrian behaviour. The empirical case from which data were collected, the city of Criciúma / Brazil, summarises a pervasive phenomenon to several Brazilian cities located on crossroads– the rupture of a consolidated functional centrality by the convergence between roads and main street sectioning the city core and causing the emergence of dynamic barriers related to heavy traffic through movement which imposes discontinuities to the urban grid, changing natural movement potentials, social appropriation and land use patterns. Modelling data samples altogether for the whole configuration failed to provide significant correlations to measured pedestrian movement. Several modelling tests indicated that axial lines which displayed higher Choice variable values, that is, indicated higher fluxes probability through the urban system were coincident with morphological neighbourhood boundaries. Evidences obtained through the separated modelling of zones bounded by axial lines which displayed higher global Choice values led to the corroboration of the following hypothesis: barriers aroused by high regional and global accessibility road lanes might divide city cores and trigger morphological transformations that induce differentiation among the resulting parts which are coherent to the degree of spatial segregation. The outcome of this complex process at local scale is the socially shared acknowledgment of distinct neighbourhood boundaries defined by drastic changes on the spatial logic underlying the production of urban space depicted by pedestrians through morphological properties changes. It grants legibility to eventual spatial segregation imposed by a through movement route linking the city core to its regional surroundings.

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Combined impacts of configurational and compositional properties of street network on vehicular flow

Space Syntax, which was developed based on Graph Theory, has been proved as one of important research methods regarding urban movement. The conversion from spatial network to J-Graph and the independent analysis of spatial configuration in space syntax makes it possible to quantitatively analyse the spatial network. However, it is undeniable that compositional properties of spatial network are partly discarded in configurational analysis of space syntax. By a study of vehicular movement in five cases of Shanghai, this article re-examined the predicting model of vehicular flow associated with configurational analysis in the irregular street patterns of Shanghai; explored if and how the compositional properties of urban network – street width and direction influence on the vehicular flow; and then further established an integrated and optimised predicting model of vehicular flow.

SSS¹⁰

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Abstracts
5. Land use studies and urban economies

Modelling dependency networks to inform data structures in BIM and smart cities

The pervasive deployment of "smart city" and "smart building" projects in cities world-wide is driving innovation on many fronts including; technology, telematics, engineering and entrepreneurship. This paper focuses on the technical and engineering perspectives of BIM and smart cities, by extending building and urban morphology studies as to respond to the challenges posed by Big Data, and smart infrastructure. The proposed framework incorporates theoretical and modelling descriptions to verify how network-based models can act as the backbone skeletal representation of both building and urban complexity, and yet relate to environmental performance and smart infrastructure. The paper provides some empirical basis to support data information models through building dependency networks as to represent the relationships between different existing and smart infrastructure components. These dependency networks are thought to inform decisions on how to represent building and urban data sets in response to different social and environmental performance requirements, feeding that into void and solid descriptions of data maturity models. It is concluded that network-based models are fundamental to comprehend and represent the complexity of cities and inform urban design and public policy practices, in the design and operation phases of infrastructure projects.

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Distances, accessibilities and attractiveness: Urban form correlates of willingness to pay for dwellings examined by space syntax based measurements in GIS

The population of Oslo increases rapidly and the corresponding demand of housing is an issue of great public, political and professional interest. Today, we can see several interesting discrepancies in the housing market, such as very high prices for dwellings with low technical standards and for dwellings located in "cityscapes" very different from what is planned and built today. There is a great diversity in attractiveness of housing in terms of a households' willingness to pay. What are the patterns of such attractiveness in more detail and what might be the lessons to learn concerning what to build in the future? How can we plan and build housing that responds to the wide range of contemporary demands and that will also be attractive in decennials to come?

Economists and real estate businesses provide statistics on prices of dwellings, but the variables examined are usually too general for the results to be useful for actual planning and design. However, space syntax based research has shown that locations in cities can be measured more specifically and that analyses of these measurements correlate with numerous phenomenon related to activities and attractiveness of cities. By applying space syntax based measurements in GIS, comparing housing prices with presumed relevant variables of buildings and neighbourhoods by means of hedonic regression analysis, it is possible to seize new knowledge about how specific urban form variables of buildings and neighbourhoods correlate with housing prices. By this approach, willingness to pay for dwellings has been examined in two studies in Stockholm and Copenhagen. This paper presents methods and some result of these studies. In brief, we see that continuous urban form measurements in GIS are significant for willingness to pay for dwellings. Some of the significant measurements are distance to city centre and accessibility from dwellings to parks, public transport and waterfronts. Due to the specificity of these measurements achieved by GIS analyses applying the Place Syntax Tool, leaning on methods from space syntax and urban morphology rather than on the less building- and urban form specific measures of the real estate business, the method provides new and more detailed knowledge. This knowledge should be useful for the wide range of actors participating in housing design and development, actors ranging from politicians, local authorities, urban planners and architects to real estate businesses and constructors.

The effects of accessibility factors on land values in the CBD of Izmir

Distance from the city centre is a primary factor for urban land values, especially in residential areas. Due to shifts in the global economy, as well as recent technological and economic developments, city centres have begun to act as central business districts (CBDs) by offering a wealth of business, retail, leisure, finance, accommodation, education, culture, recreation and health facilities. Thus, the distance to these new CBDs has begun to affect and determine land values not only in their immediate surroundings, but also for all the plots within the urban area. At this point, proximity to the CBD is considered a major advantage for land values. In addition, CBD land values are not homogeneous and the land values of each lot differ at the street level. Discussing accessibility factors affecting land values in the CBD is an important parameter to consider when planning new city centres in the future.

This study is intended to assist in the understanding of these heterogeneous CBD land values by calculating and analysing the accessibility factors with reference to Izmir, a coastal city of Turkey. Accessibility factors were calculated by using both distance measures to the facilities and spatial configuration measures of road-centre lines. Statistical analysis was used to understand the relationship between all factors on the basis of land values. Spatial analysis was accomplished using both network analysis and space syntax analysis of the spatial data for the CBD of Izmir. Network analysis was used to calculate distances to elements such as; the port, the sea, educational, health, regional, recreational and cultural facilities, as well as the main pedestrian routes and nodes. A space syntax analysis was used to calculate street configuration measures (integration, choice). Accessibility factors were analysed for 63 streets in the CBD.

According to the results of the analysis, the model is able to explain 59.9% of the variation in tax values ($R^2=0,599$) with the five independent variables: (1) distance to the sea, (2) distance to cultural facilities, (3) distance to recreational facilities, (4) distance to main pedestrian way and (5) Integration n. Results of this study confirm that, space syntax plays significant role in estimating tax values in CBD's in the accessibility context.

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An empirical study on applying community detection methods in defining spatial housing submarkets in London

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Housing submarkets can be defined as a set of dwellings that are reasonably close substitutes with one another, but poor substitutes between other submarkets. This research argues similarities within submarkets are not only captured by its building and location characteristics but also in how each dwelling is inter-connected within its local area and embedded to the rest of the system. This research conjectures that spatial network local-areas as defined by community detection methods can be used to identify spatial housing submarkets. In order to test this conjecture, the hedonic approach will be used as an empirical strategy on the case study of London. The study found spatial network local areas correspond with planned known local area boundaries and that greater house price similarity is found within spatial network local-areas than between. The study also found that spatial network local area as defined by community detection technique can be used to identify spatial housing submarkets to explain house price. The contribution of this research is it represents a proof of concept in the use of community detection techniques in the definition of spatial housing submarket. Importantly it illustrates the significance in how spatial configuration influences housing market not just in terms of accessibility (Law et al. 2013) but also in terms of housing submarket. Further research will be carried out to study the spatial configuration of the spatial network local areas in understanding severances and connectivity between them. By understanding cities through multiple spatial representations will allow more informed policies at the local-area level.

Urban transactions: Investigating the relationship between spatial preference and spatial configuration in the city of Leeds

This paper describes an experimental method that has been developed to investigate the relationship between spatial preference (in relation to commercial real estate occupation) and spatial configuration. Traditionally, the pursuit of real estate economics has been supply driven, reliant on the rational assumptions of neo classical economic analysis. Furthermore, consumer behaviour is typically an implicit assumption rather than explicit variable in traditional economic analysis. This is because it has been difficult to reveal the characteristics of economic demand (the subjective behaviour of real life participants in the urban land transaction process) and its interaction with the urban environment. In response, the method demonstrated in this paper, and its initial findings, reveals how the human interaction with space (its behavioural characteristics and transactional dialogue), can be explicitly analysed, visualised and combined in order to address this deficit. Findings (based on an initial examination in the city of Leeds in the UK) confirm a relationship between urban configuration and spatial preference, and that this is variable dependent on the use class of commercial property under appraisal.

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The architectural adaptation of urban economic life: Location, use and form of the commercial-residential building in Cardiff

Revisiting Jane Jacob's notion of locality knowledge, this paper argues that combining commercial space and dwelling fosters social, economic and architectural processes that come about by factors of local urban economies. The mixing of uses merges the relation of 'what one does' and 'where one lives' in a particular building whereby urban and architectural scale effects come into place. Comparisons of commercial-residential buildings in two local districts of contrasting morphologies in the city of Cardiff are studied in the context of their urban-architectural design scales. From an urban scale analysis, attention is given to the distribution of commercial-residential buildings in relation to spatial centrality; from an architectural perspective, it examines the way residential building adapts commercial additions, defining how different functions associate distinctive adaptable typologies depending on the building's urban location.

By using syntactical and morphological approaches, the paper combines Depth Distance analysis with patterns of use and building form, drawing two reportable findings: The identification of corner shops located within one turn of direction from main high streets within gridiron urban forms, while activities combining retail or local office businesses with residential functions are located in corner blocks along streets within radial urban morphologies. These spatial attributes of location combine the adaptability of local property markets to mixed use with advantages in accessibility to produce an urban building that can flexibly accommodate innovation that is both a reflection of new skills and knowledge contributing to a local diversity.

Social transformations, informal transformations.
A study on configurational changes and their relationship with urban dynamics in Vila Planalto

In current gentrification studies, the emphasis is put upon socioeconomic issues, with a focus on population resettlement or on the conditions of land revenue (real estate appreciation) as a global phenomenon of capital accumulation. The relationships between gentrification and urban configuration at a smaller or local scale have been little explored. From this point of view, space syntax theory creates concepts, methods and tools to explain the relationships between a society and its space, which are useful in the context of urban transformations of a city area. This paper analyses how spatial configuration affects the distribution of land uses – that is, the different activities that can be carried out – in Vila Planalto. This area, which is undergoing strong real estate appreciation, was originally a construction camp used during the building of Brasília. To evaluate the potential effects of spatial accessibility on the location of socio-economic activities, we used measurements of integration, control and choice, which we obtained from the analysis of axial maps, compared with cadastral maps, demographics, and land use data. It was found that the relationships between the road network and the location of activities in the area operate at two different levels or scales. At the first level, the more globally integrated axes concentrate the commercial uses, aimed at a non-resident population, predominantly bars and restaurants. At a second level, one can observe local retail frequented daily by residents, in locations that have a greater potential of pedestrian attraction. These are predominantly corner shops, bakeries, bars and diners.

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The effects of spatial relations in property-led regeneration

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In Turkey, since the entry of the Law on Redevelopment of Areas under Disaster Risk (Law No. 6306) into force in 2012, there has been a significant increase in the number of both property-led and area-based renewals. Property-led regeneration works as an invisible tool of a greater urban regeneration process that creates a broader impact on the city. Although the practice is comprised of singular constructions, as it reflects the renewal of individual buildings, it transforms the general appearance of the urban fabric. This transformation is not as sharp as it is in area-based urban regeneration practices, but still the individually renewed buildings dramatically affect the quality of urban space.

The sole control of local authorities over this renewal process is the construction and utilisation permits they give. In spite of this uncontrolled and unplanned trend, these renewals seem to concentrate in certain areas occasionally, suggesting that there are some determinants. Particularly, the differentiation in areas which have similar building densities and construction permits is remarkable.

This paper presents a part of a more comprehensive research that investigates the triggering factors and consequences of property-led regeneration. The entire central area of Bakirköy, Istanbul that has varying building densities and different settlement layouts has been selected for case study. Within the scope of this paper, the locations of individual renewals are analysed in terms of their spatial relations. This way, it is aimed to understand the role of spatial relations in property-led regenerations.

By defining the factors that affect the locations of these individual constructions, it would be possible to predict the locations that have this tendency. We believe that such an approach would be of significant aid for the local authorities to take necessary precautions to direct this process which considerably affects the quality of urban space.

Understanding the roles of urban configuration on spatial heterogeneity and submarket regionalisation of house price pattern in a mix-scale hedonic model: The case of Shanghai, China

Hedonic model is a powerful tool to investigate the important factors featuring cities' house markets globally; but the development of a local regression approach named as 'Mixed Geographically Weighted Regression' (MGWR) has brought a new insight into urban studies in the field of house price modelling with a proper consideration of spatial heterogeneity, which enables urban planners to know valuable local and global information about elements that factor the property value. In this paper, we proposed a two-step framework to understand the spatial heterogeneity and submarket regionalisation via MGWR in a case study of Shanghai. In the first step, a mixed GWR hedonic model is adopted with the incorporation of globally fixed effect and local factors. In this manner, the influence surface of spatial configuration and land use settings on house price patterns are measured by controlling other elements. Compared with the outputs of ordinary least squares (OLS) analysis and purely local model, the results of specified model in this study are more promising, indicating that the spatial heterogeneity of house price is a complex urban system. In the second stage, a data-driven approach is adopted to detect the spatially homogeneous submarkets based on the coefficients of accessibility indices obtained from MGWR instead of the raw data. Comparison of a regular cluster analysis using housing structural information and the prosed approach is conducted. The results suggest that spatial accessibility and function accessibility are key factors in shaping spatially continuous housing sub-markets on multiple scales with other elements. The findings finally reveal that multi-level modelling procedures provide additional and useful insights into the varying relationships between spatial layouts and the housing price distribution and that urban configuration not only affects house price pattern but also influence shifting housing submarkets.

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An ecology of the suburban hedgerow, or:
How high streets foster diversity over time

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This paper builds on the proposition by Penn and colleagues (2009) that cities provide a structured set of social, cultural and economic relations which help to shape patterns of diversity in urban areas. Far from being a random mixing, it could be said that urban systems are akin to ecological systems where flora and fauna are closely interrelated and in which the richness and evenness of species in a community contributes to the overall resilience of the ecosystem. This study goes further in suggesting how a variety of building types, sizes and street morphologies are more likely to propagate patterns of co-presence over time – providing the minimal but essential everyday 'noise' without which generalised sustainability and liveability agendas are likely to flounder when faced with questions of implementation in particular places. This morphological diversity, it is argued, enables the development of niche markets in smaller centres which can support new forms of socio-economic activity.

Building density of parcels and block-faces from a syntactical, morphological and planning perspective

In a sprawling metropolitan area such as Atlanta, sustainability can be achieved by building upon the potential of a site. Potential can be found in the availability of land that creates opportunities for new buildings, but can also be found in planning guidelines, the morphological conditions of parcels and blocks, and the syntactical accessibility provided by the street network. While buildings and land uses can be changed and do change over time to accommodate new functions, the street network remains fairly stable and unchanged.

While many studies of urban development have focused on the block or street segment, in this paper we focus on the finer scales of the parcel and the block-face. Using City of Atlanta data, this paper seeks to understand the relationships between parcel and block-face building density and planning, morphological, and syntactical variables, taking into account several control variables.

Descriptive and inferential statistics are presented, including model results that describe the effects of planning, morphological, and syntactical variables on building density. Results support the hypothesis that connectivity, centrality, local and global street density, block size, access to diverse land uses, and land value have mixed effects on building density, depending on the scale of analysis and the land uses present. The results have important implications for land use and zoning policy. For example, accessibility and visibility are required at varying levels for different types of land uses, warranting an analysis of reach in assigning land use and zoning overlays to parcels. Additional findings include that different types of land uses require different types of building density and street connectivity, that parcel coverage is highly correlated to high local and global street density, and that street network diversity encourages density.

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A study on spatial structure and functional location choice of the Beijing city in the light of Big Data

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The availability of big data provides a new angle on investigating whether, and if so, how far urban spatial morphology intrinsically interacts with its functions. This article, using a pilot study of the Beijing city, first seeks to explore spatial configuration – the complex relation between any pair of individual spaces regarding other contextual spaces – of urban network collected from Baidu, and the aggregation patterns of Baidu's POI (Point of Interest) regarding functional classification. And then, it focuses the attention on conducting a statistical correlation between the configurational patterns of urban network and the aggregation patterns of functions. Based on these studies, it argues that different functional points, according to their business size, consumer preference, cultural or brand asset, and business operation mode, adopt and adapt the differently structured layouts and meanwhile seek the differently valued locations at different radii.

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10th International Space Syntax Symposium

Spatial and social justice

Ethnic groups and spatial behaviour in Rotterdam's neighbourhoods

Little knowledge exists on the relationship between urban space and the behaviour pattern of various ethnical groups. For this purpose four different neighbourhoods with a high number of various ethnical groups were investigated in different time periods during a weekday. A difference was made between Europeans, Turkish, Moroccans, and Surinamese/Antillean users in the static snapshots. The following spatial parameters were taken into account: Axial and angular analyses with topological and metrical radiuses of the street and road network (Hillier & Ida 2005), and various micro scale tools (van Nes & López 2007) showing the relationship between private and public space.

As it turned out, the more spatially segregated the street net is in a local area, the more the various ethnic groups are separated from others. These areas consist of a labyrinthine broken up street net, dead end and poorly inter-visible streets. A high spatial integration of the street net contributed to great variation of all types of people on streets. These areas consist of a highly inter-connected street net with shops located along it and with entrances directly connected to the street.

The results shed some light on the current urban regeneration and urban design practice in the Netherlands. The spatial structure is hardly taken into account, in which contribute to a further socio-economic segregation of various ethnical groups. Seemingly, spatial segregation contributes to social as well as ethnical segregation among the users while spatial integration support socio-economic integration among various ethnic groups.

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Disconnecting the territory:
A diachronic configurational study about gated communities in Brasília

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The article examines the configurational diachronic process of the Federal District´s urban sprawl (Brasília, Brazil), based on the study of irregular occupation by gated communities and the corresponding public policies related to their emergence and/or developed for legalising them. The paper analyses how these occupations occurred, and indicates the resulting morphological features, evaluating the consequences to segregation/ integration processes in the capital of the country. In order to conduct the study, three research questions were established: (1) Is there a cause-effect relationship between public policies and the occupation of territory by gated communities?; (2) How consistent was the government's role concerning the issue over time?; and (3) How has the Federal District's urban grid diachronically changed due to the occupation by gated communities? In furtherance of analysing the impact of progressive urban growth in the territory, changes in the urban fabric relationships were explored (configuration), allowing us to observe how these settlements affected the urban dynamics in Brasília. The analysis was performed by using space syntax (Hillier, 1996; Hillier and Hanson, 1984; Holanda, 2002), based on the study of the city as a system of relationships.

Results have shown that: (a) there was a gradual process of the occupation of empty spaces , especially near the Pilot Plan and the most important satellite cities; (b) the densification and the filling of voids did not show improvement in the connections of the urban fabric; (c) the gross increase of connecting axes over time versus gated communities did not produce better urban fabric performance; and (d) there was little change in the values of basic syntactic analysis variables (number of axes, connectivity, global integration, local integration, synergy and intelligibility) which shows that the discontinuity and the segregated nature of the street network of the Federal District are not an exclusive consequence of the gated communities, but of the modernist design based on which the city was designed. The findings point to the existence of mutual influence between public policies and the consolidation of the Federal District's configuration by gated communities. Besides that, this research subsidises the identification of clear periods with defined characteristics that mark the progress or stabilisation of these occupations. Furthermore, the interpretation of diachronic changes in the urban grid using space syntax techniques demonstrated the validity of the strategy, whose results show that the segregation process was perpetuated in the territory of Brasília, supported by a modernist motif.

Visibility affecting gender aspects in middle income group apartments in Dhaka

Houses carry cultural information in their material form and space configuration (Hanson, 1998; Oliver, 1987; Lawrence, 1993) and the relationship of gender and its social connotation as a cultural factor has an imprint on the morphology of house form. While emphasising on socio cultural factors as the primary forces in determining house form, Rapoport (1969) finds gender considerations such as position of women and their privacy as key determining factors of house form. The gender issue along with privacy of women in domestic environment has been given importance on the domestic spatial organisation of the urban houses of Dhaka from its genesis period. Visibility of the spaces used by the female members of the family hold a pivotal role in the spatial organisation in the context of Dhaka, the capital of Bangladesh. Dhaka, being the capital city of Bangladesh, has pulled immense population from outside and has undergone through a continual transformation during the last few decades. Due to rapid urbanisation and constraint of space in urban areas in Dhaka and with the advancement of the society, the urban life resulted in a change in the pattern of residential space and in its organisation. The concept of privacy and segregation, as a product of socio-cultural and religious factors, has undergone a process of transformation with the changed spatial pattern of domestic spaces inside contemporary middle income group apartments.

This paper presents the results of visibility analysis conducted on a sample of 50 middle income group apartment plans in Dhaka considering gender related spatial behaviour. Questionnaire interview of the female users of these apartments compliments the visibility analysis of Space Syntax method analysis conducted with Depth map. It focuses on the position of women in the domestic space and investigates how privacy and controllability is perceived by the women user in the recent apartment houses. The interview of the female heads of the studied contemporary apartments indicates that in spite of morphological changes of domestic space organisation from traditional to present day context, the concept of privacy with respect to women users has remained unchanged and been addressed differently by the recent women users in the compact contemporary apartments. Controllability over the adjacent spaces tends to resume its position that was evident in the traditional courtyard type living. Although the role of women has changed in the family, due to their participation in the economic activities, still women prefer to Preserve their visual privacy and occupy spaces that are visibly more integrated and can have a control over the adjacent spaces from their working area in the domestic environment.

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Reading the text as a city: The architectural chronotope in two nineteenth-century novels

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Noting the popular idea associated with the linguistic turn in cultural theory that the city can be read as a text this paper argues that this motif can be usefully inverted such that the text might be 'read as a city' – whether or not it has a specifically urban focus. This proposition is explored in relation to the contrasting plotting strategies of Elizabeth Gaskell in North and South (1848) and George Eliot in Middlemarch (1874). Space syntax theory is brought to Bakhtin's notion of the literary chronotope, a concept denoting the time-space contexts encoded in literary narratives, in order to develop the architectural dimension of what Raymond Williams called the 'knowable' community. An articulation of the 'architectural chronotope' in North and South and Middlemarch reveals clear differences in the images of the knowable community presented by the two texts. These are said to realise contrasting novelistic conceptions of the bourgeois city, both with resonances in space syntax theory.

Gender and urban space:
The case of Sharjah, UAE

The aim of this study is to objectively examine the effects of gender on public space use in historical core of Sharjah, the third largest emirate in the United Arab Emirates, by utilising space syntax techniques. An earlier study, which syntactically analysed the city of Sharjah focusing specifically on the effects of the modern developments on its urban structure, has already declared the dominance of male movement in the heritage area. The current study analysed the visibility properties of the heritage area of the city of Sharjah and correlated them with the observed pedestrian movement patterns to interrogate if there is any property of space itself that correlates with the gender differences of its users. The study also aims to raise some discussions for space syntax research agenda on the topic of gendered public space use.

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Karachi: The transformation and spatial politics of a post-colonial migrant city

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The partition of the Indian Sub-continent in 1947 resulted in the mass movement of people between India and Pakistan with a number of Urdu-speaking, Muslim communities choosing to re-settle in Karachi, Pakistan. These Muhajir or "refugee" communities have now been resident in the city for over 60 years and whilst the term traditionally means "refugee" in Urdu- their mother-tongue- in the context of Karachi today, it refers specifically to the descendants of these first wave (Partition, 1947) Urdu-speaking migrants from India. The community was initially seen as a landless, rootless people but, over time, they have become one of the key actors in the ethno-political landscape of urban Sindh, in Pakistan today. Whilst the political exploits of this community have been extensively reported and documented by anthropologists and journalist as part of Karachi's tumultuous political history, little has been written about the settlements and spatial practices of this amalgam of diverse, primarily North Indian migrant communities and how their arrival, and occupation has impacted and transformed the manner in which the city has developed. Using space syntax analysis and information drawn from master-plans, urban development reports, historical accounts, and political, religious and linguistic identity-markers associated with the Muhajir community, this study analyses how the city of Karachi has grown and developed through the last 65 years of its post-Partition history and tracks the settlement patterns of the Muhajir community into and around the city. The study shows that, whilst Karachi may be considered a Muhajir city, the community established clusters in very specific areas of the city at the time of their first settlement in the early 1950s and, whilst newer areas have been added to the city, these community-based clusters have persisted and densified over time. The manner in which the community has consolidated and marked its spaces in the city and the way their presence has impacted its growth seems to suggest that the community's identity has gone through a process of transformation and concretisation from Muhajirs as disadvantaged refugees to Muhajirs as a formidable ethnic group with considerable political clout that they exercise with regard to decisions that pertain to the growth and development of the city today.

In times of increasing residential segregation in cities the potential for interplay between local inhabitants and non-locals in urban public space becomes increasingly important. By sharing space we gain information and knowledge from our fellow citizens (Granovetter, 1983), and are enabled to participate in processes that negotiate social structures, attitudes, norms and acceptable behaviours (Giddens, 1984; Zukin, 2005). From this point of departure streets as well as local squares and centres appear to have a key role providing an arena for interplay between different social groups and an arena for exchanging information and are seen as crucial for providing access to opportunities and various urban resources (Young, 1996). Many neighbourhoods, however, have proved to fail in this respect and in areas that today face problems related to social exclusion in Sweden the streets are often characterised by co-absence rather than co-presence and there is an evident ruptured interface between locals and non-locals (Legeby, 2013). We argue that patterns of co-presence to a large extent are influenced by urban form and by the morphological properties that also is related to what kind of non-residential activities are likely to emerge locally. This paper aims to highlight the critical role of public space and demonstrate how configurational properties may be analysed and described so that it becomes clear if and where urban design interventions can be used in order to create more favourable conditions and improve access to both various urban resources and to an urban life with a mix of locals and non-locals. In a project conducted in collaboration with the city of Gothenburg seven neighbourhoods are analysed according to the potential for co-presence in public urban space, and according to access to urban resources; two aspects identified as highly relevant from an urban segregation perspective. This paper uses a three-pronged approach that combines configurational analysis, accessibility analysis and observations, and various diagrammatical representations of the results are presented. The findings establish that several of the neighbourhoods prove to hold unfavourable conditions as a result of their spatial configuration. Nevertheless, the study illustrates a way forward whereby public planning can be supported by socio-spatial analysis and more accurately operate by using urban design to reach more equal living conditions and overcome social exclusion.

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Interaction rituals and co-presence – Linking humans to humans in space syntax theory

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There are two fundamental theoretical links necessary to make for a robust foundation of space syntax methodology. The first concerns the link between humans and their environment, where space syntax has contributed to the development of what can be called a cognitive geometry for the analysis of spatial form. The second is the link between humans and humans, that is, the generation of social processes, where space syntax has highlighted the idea of co-presence as critical in such processes. However, these issues are far from exhausted in space syntax theory or even always convincingly argued. It is therefore the aim of this paper to further contribute to the second of these issues and in a parallel paper to contribute to the first.

The ability of spatial configuration to support critical relations between humans and humans is essential to space syntax theory where it already in the early texts of space syntax theory is argued that space, far from simply constituting a background to society is a social material in itself (Hillier & Hanson, 1984). More specifically this is argued with reference to Durkheim's theory about different forms of social solidarity (Durkheim, 1984). Further attempts to link space syntax methodology to sociological theory has been made (e.g. Hanson, 2000; Hillier & Vaughan, 2007). However, these attempts have also been criticised from within sociology, notwithstanding strong recognition of the potential contribution of space syntax (e.g. Liebst, 2014).

This paper aims to contribute to a more robust theory on how spatial configuration supports the link between humans and humans, that is, social phenomena, based on earlier arguments by Liebst, that also can be accepted from within sociology, which, it will be argued, is essential for the further development of the field. First, in supporting a stronger understanding of space syntax itself as not being sociological theory proper, but rather a theory and, not least, a methodology in what Durkheim called social morphology. Second, open for stronger rapport between space syntax with the social sciences in general and sociology in particular by presenting a socio-spatial foundation based on established sociological theory.

This theoretical contribution will be based on the central sociological micro-tradition from Emile Durkheim's later work on rituals (2001), over Ervin Goffman's micro-spatial analysis of interaction rituals (e.g. 1963), to Randall Collins attempts to form a broad general sociology based on the micro-scale study of interaction ritual chains (2004). A similar contribution, however with different emphasises, can be found in Legeby (2013). It will be argued that this tradition presents a most appropriate sociological framework for space syntax claims to sociological relevance that is highly recognised within sociology in itself.

Space and protest:
A tale of two Egyptian squares

Protests and revolts take place in public space. How they can be controlled or how protests develop depend on the physical layout of the built environment. This study reveals the relationship between urban space and protest for two Egyptian squares: Tahrir Square and Rabaa Al-Adawiya in Cairo. For analysis, the research uses space syntax method. The results of this analysis are then compared with descriptions of the protest behaviour.

As it turns out, the spatial properties of Tahrir Square seem more effective for protesters to succeed than Rabaa Al-Adawiya. Protesters seem seek spaces with a high degree of accessibility on a local scale as well as on a city-wide scale and a high degree of symbolic value. Furthermore, the number of alternative routes, access points, shorter block lengths, and increased visibility are spatial factors affecting where and how demonstrations take place.

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Reflections on space syntax as sociospatial theory

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Few approaches have been quite so polemical and have stirred quite so many different responses as space syntax. This article is not an introduction to space syntax; rather it aims to discuss its substantive reach and epistemological status. This aim in mind, I shall propose a series of observations concerning the nature of the theory in order to highlight, on the one hand, its main contributions, such as the emphases on social reproduction, co-presence, and the embodiment of practice; its hybrid epistemology; its relational concept of space; and the reaffirmation of space as a living dimension. On the other hand, it shall discuss the limits of the theory concerning society-space relations: the reduction of social practice to movement, human interaction to social interfaces and encounter, and the actor to bodily presence; the primacy of syntax over semantics; the problem of time in the structuring of space; and the difficulties of theoretical contribution. Finally I look to discuss the theory's place regarding distinctions between urban and sociospatial theories, and dilemmas to be faced in its future development.

The spatial dimension of increased income gaps, polarisation and social exclusion manifested through patterns of segregation has put emphasis on what impact spatial configuration may have on justice in cities (Hanson, 2000; Hillier, 1996; Massey, 2005; Young, 1990). Within sociology, economic and cultural geography and critical urban theory both societal and moral costs of spatially related injustices manifested through segregation (Franzén, 2001; Wacquant, 1999) and uneven distribution of urban resources and rights (Fainstein, 2010; Harvey, 2000) are emphasised. Traditionally research focused upon residential segregation, but since justice in a spatial context implies a great array of urban places, segregation is here investigated in public space (Franzén, 2001; Legeby, 2013). In terms of urban form and urban public space justice is here defined in terms of the opportunities that the spatial configuration offers its citizens when it comes to co-present situations with non-locals. The argument relies in that urban form may influence the formation of social networks that in turn could have an impact on life chances through the opportunities one have; on the labour market (Zenou & Östh, 2006), in achieving information on vacant apartments (Granovetter, 1983), to participate in the negotiation of norms and values in urban culture (Zukin, 1995) – and subsequently the participation in the formation of democratic institutions (Giddens, 1984).

Investigating the spatial dimension of justice accordingly require both a social and a spatial analysis. The spatial analysis aims to describe the spatial conditions for co-presence between locals and non-locals to occur, meanwhile the social analyses highlights the composition and intensity in the actual co-present group. The result of the study indicates a correlation between spatial and social performance, where the spatially more central public spaces also had higher intensity and heterogeneity in the co-present group between locals and non-locals. The current situation in Gothenburg is accordingly argued unjust in relation to the investigated target areas characterised by high unemployment and social exclusion, which are also located in more isolated parts of the urban network. Accordingly the spatial configuration is disfavouring encounters between non-locals, which is argued important to break patterns of exclusion and encourage participation in societal processes. Accordingly the study highlights a lack of understanding of what impact urban design and spatial configuration may have on social outcomes, particularly in contexts where social isolation and spatial segregation coincide.

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'Planned' political capitals: From conceptual ideas to lived constructs. The case of Washington DC, Brasilia, Abuja and Astana

The present paper aims at contributing to the spatial and social understanding of the so-called 'planned cities' by analysing some historic examples. The study focuses specifically on cities where politics constituted a powerful force behind their design, referred to by some as 'political capitals' (Vale, 1992; Hall, 2006), or 'cities of reproduction' by other (Hillier, 1996). In order to consider different historic contexts and urban design ideas, this paper takes a chronological approach and selects Washington DC (USA, 1791), Brasilia (Brazil, 1956), Abuja (Nigeria, 1979) and Astana (Kazakhstan, 1997-2007) as case studies.

The main aim is to understand how urban conceptual ideas have been translated into patterns of experienced space in a context where the 'scenarios' of social complexity have been built overnight. Grounded in Lefebvre's ideas (1974), this paper argues that the study of 'planned' political capitals should be addressed from a holistic approach where perceptual, conceptual and lived realms are closely interconnected. The paper focuses in depth in studying the transition in these cities from conceptual space (i.e. the space of planners and architects), to perceived space (i.e. the space produced through a dialectical interaction between society and space)

Space syntax's configurational theory and methodology are used to unveil the spatial morphology of these cities. Three different syntactic models are analysed (i.e.: the original design, the planned area in its current state and the city as a whole today), to understand how order and structure are combined in these cities. Following Hanson's ideas (1989), order is understood as a series of spatial mechanism such as regularity, repetition, symmetry, etc., and structure as the patterns of movement that we learn over time while exploring the city. The results of this study reveal that, despite initially being regarded as products or fixed constructs, 'planned political capitals' are subject from the very beginning to emergent spatial processes that blur their original strict geometry, making them comparable to the so-called 'organic cities'. The research also shows, however, that the loss of order does not necessarily imply a gain or loss in the structure of the system and that the retention of structure throughout time depends on the pathways that the development of the city follows in respect to its original design.

Configurational characteristics of sociospatial segregation in Brazilian cities

Most studies in urban spatial segregation focus on macro features and are usually directed at large metropolitan areas. The characteristics of segregation in a micro scale and the particularities of medium-size cities in the distribution of different socioeconomic groups throughout the urban tissue are still poorly explored. This paper investigates the relationship between the configurational characteristics of 10 Brazilian cities with population between 200,000 and 350,000 and the distribution of socioeconomic groups over the urban fabric. More specifically, it (a) checks if the main routes of the urban grid pass through the cities' economically disadvantaged areas; b) quantifies the relationships between accessible and segregated areas and the social groups to which they correspond; and (c) checks whether there is a relationship between income inequality and mean integration measures for the cities as a whole. We test the hypothesis that higher income population prefer to locate themselves in areas with higher integration (closer to other areas of the city, thus achieving high accessibility) but medium to lower choice areas (away from main through passages, thus balancing accessibility with lower quantities of strangers passing by, noise and other types of nuisances). The methodology involves visual analysis of segregation maps and the comparison of integration and choice measures for census tracts with higher and lower mean income (10 percent of the census tracts on both extremes). Results showed that, for medium-sized cities, the dominant pattern of segregation is characterised by lower income groups located at the outskirts and higher income groups located in highly integrated and more central areas. However, other spatial strategies are employed to serve the desire of high-income groups to distant themselves from low-income areas, such as grid discontinuities and separation by undeveloped areas and/or main thoroughfares.

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Successional segregation in Gerani, Athens:
Unpacking the spatial structure of an immigrant quarter

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This study examines the role of spatial configuration in shaping patterns of immigrant segregation through the case study of Gerani, Athens.

Previous research has suggested that despite its negative effects, segregation can be positive as a key mode of accommodating urban diversity. In this context, this study asks what is the role of space in shaping immigrant segregation patterns and accommodating difference. Although Greece has accepted major migration waves during the last decades, the Greek state is characterised by the lack of internal policies towards immigrants' integration, leading to social friction. The district of Gerani reflects the current socioeconomic and spatial transformations of the Greek capital and is chosen for this study as a multi-ethnic district and the most distinct commercial immigrant centre of Athens. The existence of a certain degree of informality that characterises both the built environment and the local economic activities reveals the structure of spontaneous socioeconomic patterns. After establishing the spatial properties of the area through space syntax analysis, the immigrant networks are mapped through primary ethnographic research tracking the development of immigrant economic activities. Finally, the above analyses are combined qualitatively and quantitatively, through statistical analysis. The study suggests that Gerani's spatial configuration might be related to its consistent deprivation and, consequently, to the concentration of high immigrant densities. Furthermore, despite the supposed homogeneity of the "ghetto" of Gerani, the various ethnic groups appear clustered in the area in terms of economic activities and use of the public realm, while an internal hierarchical rationale emerges; locations characterised by higher levels of "natural movement" and proximity to attractors have clusters of those immigrants who have achieved greater social integration with Greek society, whilst locations with lowers levels of "natural movement" and adjacent to abandoned enclaves of anomy have concentrations of the more socially disadvantaged groups.

Overall, the issue of immigrant integration and segregation remains mainly a political issue that premises the adoption of long term external and internal policies. Considering, however, the role of spatial design in this process, the current study proposes that specific spatial structures offer immigrants the necessary protection to gradually build their socioeconomic life. These principles should be re-interpreted and assimilated in strategic design proposals and policies that aim at the creation of more socially inclusive solutions.

The spatial dimension of urban socio-economic inequality: A study on five Brazilian cities

The aim of this paper is to present the implications of urban morphology on socio-economic features of five Brazilian Capitals (Goiania, Fortaleza, Belo Horizonte, Brasilia and Curitiba). They are considered the most unequal cities amongst Brazilian State Capitals and are placed among the world's most unequal cities, according to a UN-HABITAT report. Our purpose is to contribute to the understanding of Brazilian cities by analysing the relations between two very distinct socio-economic areas: the ones presenting the lowest and the highest income indexes. Besides their income layers, these areas were compared in terms of their contrasting spatial structures. By correlating opposing income groups and urban configuration, it is possible to perceive how diverse they are regarding angular global and local integration, and choice values. Results point to a very strong relationship between spatial patterns, segregation, income layers, and different capacity of the inhabitants to access urban facilities and services. A poor spatial structure is essential to understand poverty and segregation in Brazil's biggest cities. Such understanding may contribute to the public debate concerning public policies, particularly those related to the architecture of the city.

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Wayfinding to support urban exploration: Combining space syntax analysis with social media data for navigation system design

Current navigation system development has been focused mainly on an efficiency-based approach for generating the shortest paths for pedestrian circulation in the city. In this way, routing application design presupposes that pedestrians engage with the built environment by moving through urban space along the fastest and safest routes. Although this approach is consistent with patterns of pedestrian behaviour in large cities according to space syntax research, it does not take into account alternative routes that can connect urban spaces by means of less accessible streets and offer the chance to explore a city.

This paper examines how urban exploration can be enriched by adding a spatial feature that is absent in current navigation systems. We suggest that by combining space syntax 'choice' values from angular segment analysis with location-based social media data – such as Facebook 'check-ins' – as a measure of urban mobility, it is possible to recommend alternative routes, driving users towards places of high social activity located in streets with low pedestrian flow. Our approach involves the development of a mobile application that integrates Facebook place profiles, space syntax measures, and Dijkstra's algorithm implementation for wayfinding purposes. The aim is to generate the shortest path from a current standpoint to a predefined destination, including well-visited places located in streets with low-choice values. The evaluation includes: 1) analysis of a set of routes generated for different areas of Central London, focusing on comparison of the number of waypoints and 'check-ins' on each of the routes; 2) measurement of length differences between the proposed routes and standard recommendations offered by Google Maps; and 3) qualitative user assessment by 20 individuals in the area of Bloomsbury in Central London to capture users' perceptions regarding these routes' degree of feasibility for everyday routines.

Early results show that streets with low-choice values can contain venues with high social activity and that urban strolling along less accessible streets is perceived positively by participants, who were willing to adopt alternative routes that encourage urban exploration and serendipity despite an increase in distance and time. The validation of this approach underlines the potential of space syntax analysis when combined with geo-located social media data, and the way pedestrians can use this new kind of implementation to expand the scope of alternatives for urban strolling and social interaction. This combination can be used to incorporate the use of space syntax techniques into navigation system design and other related applications.

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Walking to school: The effects of street network configuration and urban design qualities on route selection behaviour of elementary school students

This study examines the association of spatial layout of street networks and urban design qualities of the street environment with path selection by elementary school students. The aim is to better understand the extent to which objectively measured street network configuration and systematically measured urban design qualities are related to pedestrian route choice behaviour. Within this scope, randomly selected 6th, 7th, and 8th grade students (ages 12-14) from 10 elementary schools (30 students per school) in Istanbul, Turkey were asked to draw their routes walking between home and school. The schools were drawn from diverse neighbourhoods that vary substantially in education and walkability (street connectivity patterns).

Street network configuration of the entire region was evaluated by using angular segment analysis (integration and choice) implemented in depthmapX as well as two segment-based connectivity measures (metric and directional reach) implemented in GIS. The decision to include different measures is motivated by the variety of configurational qualities (metric, geometric and topological) captured by each measure. 40 street segments along the selected routes for each school (N=400) were characterised through detailed field surveys in terms of five perceptual urban design qualities that are prevalent in urban design literature: imageability, enclosure, human scale, transparency, and complexity. These are measured in terms of the physical features of the street environment including but not limited to buildings, sidewalks, and street items (i.e. trees). Linear models were developed to investigate the relationships among street network configuration, urban design qualities, and route choice behaviour of school students.

This study contributes to the literature by offering insights into the comparative roles of street network layout and urban design qualities of the street environment in explaining urban navigation behaviour of children. Preliminary findings imply that notwithstanding the significance of safety attributes, such as the presence of pedestrian crossings and traffic signals as well as the number of vehicular lanes along the selected routes, the overall spatial configuration of urban layouts –both at the local and global level– may prove to be a significant variable for the description and modulation of human spatial behaviour in urban environments. Moreover, results indicate that route selection during target-directed walking is sensitive to certain aspects of the street environment that relate to more perceptual urban design qualities.

Investigating the effect of urban form on the environmental appraisal of streetscapes

Urban planning decisions have long-term implications for the appearance and functionality of cities and it is therefore highly important for city planners to understand how urban structure influences the experience of a city's inhabitants. In this study, participants walked through three urban routes (the direction varied between groups) and rated their environmental appraisal both by marking their pleasure continuously on a map, as well as by rating certain checkpoints that revealed different urban scenes along the way on a semantic differential scale. Results are presented for subjective user ratings, as well as in relation to objective, formal measures of spatial qualities via space syntax (e.g. centrality measures integration and choice, as well as isovist properties). A factor analysis of the bipolar adjectives revealed that items were loaded on what we called appeal, activity and spatial experience of the streets. Previous experience in terms of spatial sequence did not appear to influence these evaluations. The combination of global and local spatial properties correlates more strongly with environmental appraisal, or appeal of space, than the use of either one of them. We discuss these results in the light of understanding (and attempting prediction of) to what extent environmental properties relate to users' experience of city streetscapes.

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Urban perception, visuospatial properties, environmental appraisal, predictive model, isovist, centrality measures.

Characterising place by scene depth

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Turner and Penn introduced the notion of integration of isovist fields as a means to understand such fields syntactically — as a set of components with a structural relationship to a global whole (1999). This research was further refined to put forward the concept of visibility graph analysis (VGA) as a tool for architectural analysis (Turner et al., 2001), which has become widely used.

We suggest a complementary method of characterising place that does not make use of integration or a graph yet which allows – as visibility graph analysis does – discrete viewpoints to be dimensioned in relation to a set of such viewpoints. In our method, principal component analysis (PCA), a statistical technique, is employed to infer salient characteristics of a set of views and then to situate these component views within a low dimensional space in order to compare the extent to which each view corresponds to these characteristics. We demonstrate the method by reference to two distinct urban areas with differing spatial characteristics. Because PCA operates on vectors, order of the data has important implications. We consider some of these implications including view orientation and chirality (handedness) and assess the variance of results with regard to these factors.

Isovist analysis is useful tool for understanding how individuals perceive and act in space. It is often used in space syntax research as part of a set of techniques that examine users' visibility of space. Traditionally, isovists represent the optimal viewshed from any given location; when working with real-world spaces, however, there may be obstacles that obscure the optimal isovist. This paper explores the relevance of first-person isovists that are drawn from what is actually (and not only theoretically) visible in the scene. A candidate measure, termed "choice zones", is evaluated. The paper argues that for real-world studies examining the social use of space, it may be desirable to complement traditional viewshed analyses with ones that take an egocentric perspective.

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Raumsynth: An experimental setup for investigating the relationships between urban form and spatial experience based on Fechner's Method of Production

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By extending Fechner's Method of Production, we investigate the relationships between urban form and spatial experience using an experimental Virtual Reality setup that allowed participants (N=102) to create three-dimensional, environmental scenes in real time. Participants could adjust five independent parameters (building height, building width, amount of buildings, space between buildings, and street width) to arrive at a scene that felt pleasant or unpleasant to them. Participants were also asked to estimate certain sizes in the virtual environment. A streetscape and an urban square were used as contextual scenarios for the participants' preference ratings. This article describes an approach for analysing the resulting, highly complex data in three steps: First, the correlations between direct spatial features were calculated. Second, the participants' answers were combined into clusters. Third, these clusters were imported as a data source for investigating more advanced spatial features, such as amount of visible sky, and visible vertical and horizontal surfaces, and linked to the participants' ratings for pleasure and dislike. We found that ratios in both distances and amounts of visible sky, vertical and horizontal surfaces of the streetscape and urban square scene used in this study are clearly distinctive between (what participants rated as) unpleasant and pleasant scenes.

Using space syntax to analyse stress ratings of open public spaces

This article contributes with preliminary data on how selected properties commonly used in space syntax research relate to users' ratings of stress and spatial qualities in open public spaces (OPS). First, by conducting a literature research in the fields of space syntax and environmental psychology, a set of syntactical properties is extracted, which have been associated with health and stress-related measures in previous research. Second, the result of data construction from a sample of 22 OPS in Darmstadt, Germany is presented. Specifically, the sample is described with street network characteristics including global and local integration and connectivity, as well as isovist properties including total area, perimeter, vertices number and density, openness and roundness. In the third step, the constructed data is paired with city dwellers' ratings (n=134) of the sample regarding to stress perception and urban design qualities using a set of bipolar adjectives (e.g. max. stressful / max. relaxing, spacious / narrow). Significant relations have been found between global (r=N) and citywide (r=3000m) integration values and users' ratings of OPS as being stressful, relaxing, safe as well as being exposed to traffic. A weak relation can be found between the vertices density of an OPS's isovist and participants' ratings of safety. Overall, the results indicate that line-based measures such as global and citywide integration may be valid measures to analyse stress perception in outdoor spaces. Selected point-based measures, which had been previously paired with cognitive measures in indoor settings, need to be subjected to further research to analyse the perception of outdoor settings, for which this article contributes with preliminary data.

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Ecological space and cognitive geometry: Linking humans and environment in space syntax theory

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There are two fundamental links necessary to establish for a robust theoretical foundation of space syntax methodology. The first concerns the relation between humans and the environment, where space syntax has contributed to the development of what may be called a cognitive geometry for the analysis of spatial form. The second is the relation between humans and humans in the environment, that is, the role of spatial form for social processes, where space syntax has demonstrated how spatial form is essential for the distribution of human co-presence in space and with sociological support argued the vital importance of such co-presence for social processes. Nevertheless, these issues are far from exhausted in space syntax theory or even always convincingly argued. It is therefore the aim of this paper to further contribute to the first of these issues and in a parallel paper to contribute also to the second.

While James Gibson's theory of affordances often is referred to in this regard, his larger framework of an ecological approach to visual perception is far less addressed in space syntax research. This paper conducts a close reading of Gibson's theory on perception in the aim to demonstrate its close links and high relevance to space syntax theory. Its more recent development by other writers, such as Harry Heft and Anthony Chemero, will also be referred to. More precisely, it will be argued that Gibson's theory forms a most apposite ontological framework for space syntax theory and methodology that supports its novel conceptualisation of the relation between humans and the environment and, not least, presents a firm theoretical foundation for its particular form of geometric representations, such as the axial map. Importantly, Gibson's ecological ontology distinctly contrasts with the typical conception of space, borrowed from physics, found in most spatial analysis and urban modelling.

Exploring children's perceptions and experiences of outdoor spaces

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All people employ their senses in order to locate themselves in their environment; however the perception of space is not common to everyone and differs related to various factors. Considering these differences in perception and the factors affecting it, it should be stated that children's perceptions and experiences of spaces are different from adults'. Unless the places are created by them to play, children perceive and experience environments that are created by adults. Thus, spaces that children experience are generally based on adult's logic of design configuration.

As children are the active participants of their home and school environments, the present study focuses on a pilot study which is conducted at a primary school with the 5th year students. Therefore, the aim is to discover children's landmark recognition and preferences of outdoor spaces in terms of their home- school routes, playing areas and reveal the underlying syntactic structures of the spaces as well.

Considering the main structure of the research which is based on the comparison between children's responses to a questionnaire and syntactic properties of the significant places, the methodology is organised as two phases including the individual interviews with students and syntactic analyses of the spaces identified and preferred by children. The first phase of the methodology is based on the examination of children's perceptions and uses of outdoor spaces with the help of a questionnaire where students answer the questions and draw their route from home to school. In this phase, students are also asked to comment on the photographs taken from the predetermined city landmarks. For the second phase, spaces identified by children are analysed due to the syntactic properties based on various calculations.

The results of the research emphasise that the edges of the city and especially the city walls seem to affect the spatial perceptions of children. Although children mostly prefer to stay in the close vicinity to their home-school environment, they can identify significant city landmarks. The outcomes of the research also indicate that there's a difference between the female and male students considering the preferences of playing areas.

Keywords
Children's spatial perception, historic city, outdoor space, wayfinding.

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Cultural cognitive differences in the spatial design of three-dimensional game environments

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Research into cognition has indicated cultural differences between Western and East Asian subjects in the perception of two-dimensional screen based images. East Asian subjects are able to process complex changes in visual information across a screen space better than Western subjects, who deal best with centralised changes. This paper discusses how these cultural cognitive differences transfer to the design and interpretation of three-dimensional virtual space, as represented on a two-dimensional screen.

Space syntax measures where used to analyse East Asian and Western game environments. Initial results indicate that there are statistically significant differences between the spatial parameters of the two cultural groups of chosen game environments.

The analysis of three-dimensional game space also indicates spatial design differences between original Western game environments and their adapted form for the East Asian games market. These adapted game environments are spatially comparable to game environments from other East Asian games, indicating a considered design approach to the design of three-dimensional environments for a different cultural market.

The question of whether cultural influence on the design of each game space is tacit or explicit is also considered. Local spatial characteristics that a designer may visually manipulate, where correlated with global spatial characteristics a designer cannot visually determine.

The findings indicate cognitive differences in the design of three-dimensional space are present between the groups of Western and East Asian game environments. Results also indicate that these can be discussed in terms of known cultural cognitive differences in the interpretation of two-dimensional imagery.

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How does a child act in a theme park?
Searching for the role of space syntax in a child's cognitive schema

The experience of the world that begins with the perception of the environment by human senses is followed by organised patterns of thoughts. This perceptual information is converted as memories which reach to the storage within a cognitive schema. Beginning from infancy, depending on the age and the stage of cognitive development, every individual continuously builds up a unique cognitive storage.

According to Piaget (1955), children, in the context of this constructive information approach, are not different from adults; they build schemata following their perceptual and cognitional processes. Their cognitive development helps them to cope with environmental stimuli and to behave in a more intellectual manner after the age of seven; which was defined as the last two stages of cognitive development. Because of the fact that cognitive development increases their capability of learning and recalling their environment, especially in the latter stages of their development it is expected from them to reflect more information in their cognitive maps.

Depending on this theoretical background within the scope of environment and behaviour theories, this article investigates how a thematic spatial layout for children influences their spatial cognitive schemata. An indoor theme park that presents temporal experience of a city life in a child scale is selected as the case study environment for this research. The layout of the theme park emphasised by a city centre surrounded by children sized buildings functioned with various job professions, vehicles, landmarks and related equipment, which presents little participants mimicking adult activities like performing jobs, earning money, shopping or entertaining. This thematic world raises some questions such as follows: How much do children remember the components of the environment? Are there any spatial components that are not remembered by any of the children? Does remembrance play role according to the syntactic values of spaces or the functions of spaces? How do children perceive this scaled environment and how much can they transfer it to their schemata?

The methodology is composed of three phases; first one is focused on behavioural data recorded by the parents tracking their children's behaviour through the visit, second one is focused on cognitive maps created by each child as individual drawings, and third one is focused on existing spatial data which is revealed by syntactic analyses of the theme park to reach significant evaluations in terms of integration, isovist perimeter and isovist area values.

Both the behavioural maps and cognitive maps of children are analysed and compared with the given spatial syntactic data to attain some significant results to generate an efficient debate on examining how such an environment can be associated with cognitive maps and behaviour of children. Thus, the research is projected to find out correlations between children's behaviour, memory and syntactic values of a specific physical environment.

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A configurational reading of the urban villages and critical implication for their social nature

This paper sets out to investigate what the key spatial characteristics are in the way the villages' spaces are embedded in the urban context, which is of interest not only for themselves but also for their critical implication for creating different patterns of space use and movement. It is an attempt to explore the morphology of the villages' spaces and looks at the key spatial properties of the layout and their suggestions as a space in which to encounter movement on a multi scale, and whether people from different distances use the village space as part of their journey or not. It examines first the morphology of village space, with the aim of identifying the villages' configuration within a spatial arrangement of the urban system and their way embedded in the surrounding context, then uses the hypothesis derived from this analysis to explore the relation between the villages' spaces and their social nature. The aim is to clarify how absorbed villages layout of space related to the city and does this patterning have social implication? In this paper, we explore villages' spatial layout as an independent variables, and look for its consequences in terms of observable movement pattern of spatial living. In the next, will set the study report a set of field studies, in which observed pattern of cultural movement as an implication for social nature are examined alongside space syntax analyses to try and establish how far systematic relations between the two can be found. By using the outcomes of the first section as guiding hypotheses for the second. It is argued that if certain properties are shown to be critical in urban spatial patterning as dependent variables, then they may also be related to the way in which spatial layout acts as an independent variable. In this respect, the analysis progresses on three levels to illuminate the key spatial characteristics of the way village layouts are implanted in the urban context: First level: an attempt is made to identify the generic properties of the absorbed villages within the urban system by discerning the local system of the villages and the global morphological regularities of the village space at different scales through using the main syntactic measure of normalised integration and choice segments. Second, level is about how these generic property that maintains with high movement at different scale in relation to space use and of people movement. Third, level is about village-global relatedness; each village space constituting an urban system has certain relations to its surrounding area. The analysis identifies a mighty difference between the village configurations at a different scale. The view put forward here of those studies shows that the villages vary in the patterns and the strength of their local and global movement, along with a different generic property. When spaces are routes of this dynamic high choice of movement at multi scale, this implies a space with potential high co-presence of relative inhabitant movement from the village and the surrounding areas; the longer the route graph, the higher the potential of movement from different scales.

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Prophylactic architecture:
Spatial configuration of Leper Colonies

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This research discusses the Leper Colonies as part of the prophylactic policy of compulsory exclusion for all leper patients. The leper was identified as contagious in 1883, which triggered the discussion regarding the isolation of patients as the primary means for prevention of the disease. The discussions about the design of a Model Colony from which other Brazilian colonies could be built started in 1921. This represents the template for the prophylactic policy of leper in Brazil, being adjusted to the various regional circumstances, thus acquiring unique/particular configurations. In 1935, a National Plan to Combat Leprosy was established, resulting in construction of Leper Colonies throughout Brazil. The Mirueira Colony, built in Pernambuco from 1937 to 1940, was a part of that plan. It was conceived as a colony isolated from society, which should meet all the patients' needs by including a hospital unit, as well as residences, leisure equipment and areas for the practice of agriculture and animal breeding. These were small towns where the patients would rebuild their lives ruled by the administrative staff. This episode represents the association between architecture and urbanism and the current medical and sanitary engineering precepts, where the purpose of the colony and its spatial configuration are closely linked. The colony is perceived as a prophylactic instrument, therefore, part of the medical apparatus. Thus, the aspects considered in the prophylaxis of the disease are based on assumptions of classification and inclusion of different social categories in a strict hierarchical system, expressed in the medical instructions and in architecture. Classification is a key to the spatial discourse. The organisation of patients was based on several criteria: income level, gender and age, degree of disease. These classes appear in both discourse of leper prevention as in the spatial configuration of the colonies, defining how the patients were housed in these institutions. The different classes should be arranged in the colony with the meeting between them controlled so as to ensure order. In the case of the Mirueira Colony, there is a clear distinction between inhabitants and visitors. The classes are organised in a nondistributed system, with classes of equivalent status located at the same depth. The superior class – the healthy – appears in the shallower levels, while those related to the patients are located in the deepest levels. For the movement between spaces related to different classes, there is the obligatory passage through the space that has more control. Men and women, although side by side in the plan, meet only in scheduled activities, or on space under constant control. The study of spatial pattern of the leper colony shows that the space restricts and selects the users according to their functions and contributes to the prevention of leprosy, both by the patients' isolation from society, but within the institution to ensure the order and the protection of the staff.

A tale of three beaches: Profiling seaside neighbourhoods in Natal, Brazil

This paper is part of a research in which nexuses between architecture and society are investigated. At this stage we aim to identify architectural variables that may contribute to more urban vitality and/or social diversity in three beaches located in Natal, Brazil by exploring spatial configuration, land use, building height and modes of interface between private and public spaces. Although beaches in Brazilian cities are perceived as key sites of urban vitality and social diversity it is common knowledge that certain groups choose certain beaches or even certain areas within certain beaches. Our case studies have appealing natural attributes, public transport and leisure facilities, but distinct built environments that, we believe, relate to varying social interfaces, deemed crucial for choosing or avoiding them. Redinha is viewed as a remote beach favoured by "common people"; Praia do Meio, as a decaying area frequented by "locals", meaning the poorer residents of the vicinity; Ponta Negra as the beach preferred by the middle-class and the tourists. None of the beaches is sustained by the city's global integration core, and they all have distinct architectural scenarios. Redinha is topologically the most segregated (although being the most intelligible), and has the less developed built ensemble. Praia do Meio is the most segmented area, in terms of spatial configuration and built form. Ponta Negra is highly accessible at intermediate radii and community uses mix with commercial and tourism facilities. In all areas, uses supporting leisure/tourism gather on the waterfront, and local uses cluster on locally accessible roads. In Ponta Negra and Redinha such uses blend, or are continuous, whereas in Praia do Meio they are clearly separated. Findings so far, suggest there are coincidences between effects that the interplay of the studied variables may have, as described in the literature, and general views concerning (and contrasting) each beach. If the architecture of each of these beaches tells a different tale, what is its corresponding social logic? The next research stage focus on society, by bringing the observation of social practices and how they are perceived by the local users into investigation, we seek to verify whether the interplay of the examined architectural variables may contribute to foster instances of more tolerant or even inclusive social interfaces.

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The impact of an urban cable-car transport system on the spatial configuration of an informal settlement. The case of Medellin

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In Latin American, informality is fast becoming a recognised part of cities, increasing awareness of urban poverty and segregated communities. This has led to the rapid rise of urban interventions of which cable-car transport systems is one of the most popular. These address physical causes of segregation such as steep slopes and poor road layouts, whilst offering fast connections into the city. In Latin America these transport systems can be seen in Medellin, Caracas, Rio, Manizales and most recently La Paz. Their appeal is low cost, relatively quick construction, minimum disruption to existing urban fabric and low emission levels, making them very attractive to municipalities. However, many believe they only benefit immediate residents, offer limited socioeconomics gains and are merely political tools. Even their integrational worth is questioned, as the presumption that these alone can integrate the urban poor is queried. So how can we better interpret their impact and does this form of integration alter informal settlements?

Through the case of Medellin, this paper will explore these issues, looking at the role spatial integration (in this case urban cable-cars) plays in the upgrading process and its relationship to other urban conditions that contribute to this transformation. This is done by comparing the spatial configuration of the city and the areas surrounding the cable-cars, 'WITH' and 'WITHOUT' the cable-car connection, through a variety of different metric scales. This is then correlated to a series of onsite observations into pedestrian movement patterns and land-use locations at two sites – San Javier and Santo Domingo. This demonstrates the spatial configuration of each case at city and meso scale, is very important when implementing a new direct spatial connection, especially in terms of its integrational impact. However, this analysis also shows that whilst the cable-car clearly provides better connectivity into the city, local socio-components and possibly topology has a strong influence on the impact and benefits of the intervention at a local scale. Nevertheless, this paper argues, through its analysis and background research that the cable-car still played a pivotal role in the transformation of the informal settlement, especially in Santo Domingo, since without good spatial integration, the upgrading would have remained introvert and localised, whereas the cable-car offered this transformation the opportunity to synergise with the wider city.

The lack of good citywide integration often leads to isolation, encouraging local socio-components to dominant, which is prevalent in informal settlements. This paper demonstrates the role spatial integration can play in these complex environments, so that we can better interpret and predict its impact.

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The interpretation of the spatial distribution of suicides: A comparative study on the social housing and the shanty town in Korea

The studies on the cause of suicide focused on the pathology of individuals for a long time. In 1951, Emil Durkheim claimed that suicide was no longer a personal issue. He argued that suicide had relevance to social integration of society which individuals belong to. After that, suicide has been dealt as a social problem. After his study, the research on social ramifications of suicide has been in progress. According to Jimi Adams et al. (2012) and Gifford (2007), social integration of society correlated with spatial characteristics. Gifford (2007) summarised the existing studies by stating that the social pathology including suicide resulted in the problem of the spatial disconnection. Their researches contain the intimate relations between the space and human behaviour. To support the arguments, Weidemann (1985) shown the criterion in residential environments had an effect on not only the physical aspects, but also social and behavioural aspects. Hillier et al. (1992) proves that the spatial configuration is an important factor of determining people's movement, and the spatial configuration possibly has an effect on the social network (Jo & Kim, 2014). In this context, it is plausible to assume that suicide is closely connected with the spatial configuration and the social networks based on the researches which examined the relationships between the problem of suicide and the social integration and the relationships between the spatial configuration and people's movement. However, there are no studies yet on the suicide that consider the spatial and social aspects at the same time. Korea's Suicide rate has recorded the highest among OECD members for last 10 years. What is worse, suicide rate is much higher in low-income family settlements. The aim of this study is to analyse the suicide from the spatial aspect by examining the spatial configuration and the social networks. This study involves the residences of low-income residential areas – a social housing for the least deprived people and an existing Shantytown – in Korea. To carry out this research; (1) we analyse the existing studies regarding the issues of suicide and of social integration; (2) suicide rate is examined statistically by using SPSS; (3) the spatial characteristics are analysed using space syntax method; (4) social networks are analysed by conducting surveys and interviews; (5) and finally, the spatial configuration of the area which has higher suicide rate and the elements of social networks are examined polysynthetically. Eventually, this paper will try to understand the spatial distribution of suicide, and to analyse the social networks of the areas. The result will demonstrate a new possibility of spatial approach other than the social approach in suicide research. Furthermore, the result of this study may assist in establishing directions of the suicide prevention measures in the aspect of spatial factors.

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Spatial and temporal communication of burglary risk

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At the 5th and 6th International Space Syntax Symposium presentations were made about the results of two joint projects of the Technical University Delft and the Dutch consultancy firm RCM-advies. These presentations provided insight into the relationship between the geographic distribution of residential burglary and the influence of the spatial layout of the built environment. In the now proposed presentation, the findings of yet another project will be discussed. This project focuses on the spatial and temporal communication of burglary risk. The study does not only show that offences like residential burglary are clustered in space and time, but also that because of this clustering we are able to predict when and where crimes are likely to occur and act correspondingly.

The presentation tests the ubiquity of the above mentioned findings by analysing data about residential burglary in two Dutch cities. Is it true that crimes like residential burglary cluster in space and time? And, more importantly, is it prudent to label a burglarised home and its near vicinity as a potential hot spot and allocate crime reduction resources to this area? Research findings from outside the Netherlands suggest that such a (re)allocation of resources could help to prevent around 30% of all burglaries. The reports remain, however, unclear on what actions must be taken and how these must be organised.

Communication of risk

To answer the above mentioned questions, research was conducted in the Dutch cities Gouda and Alkmaar. The results of this study confirm that residential burglaries cluster in space and time. A large portion of the residential burglaries in Gouda and Alkmaar (66% resp. 74% of the total) is committed by burglars that are returning to the area within 1-30 days. Another significant part (15% resp. 10%) is committed by burglars who do not return but continue to burglarise homes in the given area. This last type of offender visits a certain area and commits his crimes wherever he thinks the spatial and physical conditions are favourable. In both cases, it is however likely that the burglaries are committed by the same offender or offender groups.

Spatial characteristics

There are some notable correlations between the different types of near repeats, and the spatial characteristics of the street segments. These correlations suggest that the burglar's decision to commit one or several burglaries is influenced by the segment's accessibility. Near repeats are most likely to occur in street segments that are relatively close to the main routes, well connected to adjacent streets and in dwellings that are relatively close to the street. Offenders that commit a single residential burglary are more inclined to choose less accessible dwellings than offenders that commit near repeat burglaries. They commit their burglaries more often in street segments that are located deep inside the neighbourhood and less well connected to adjacent streets. The dwellings of their choice are often further away from the street and surrounded by gardens, fences, and/or hedges.

This paper is a comparison between two different typologies of informal housing in the Cairo metropolitan area. Ezbet Bekhit is an example of unplanned areas built on state-owned desert land, while Abu Qatada is a different example built on former privately-owned agricultural land.

The paper aims to reveal social divergences through differences in spatial patterns. The challenge is to view settlement community as a spatial system through spatial configuration. Space syntax is used to analyse the spatial configuration of the two areas, in addition to the virtual gate method that is employed to get data on peoples' movement.

The results show that there is a significant positive relationship between pedestrian movement pattern and spatial accessibility implying that opportunities of social interaction, co-presence, and co-awareness of different groups of people can be predicted through spatial design. In Ezbet Bekhit, the association was found at both scales: the settlement, and citywide scales, while in Abu Qatada it was found only on the citywide context. The findings also show that there are differences in gender movements in both informal settlements spaces. Differences in cultural movement pattern – co-presence or co-absence of different categories of people (gender, ethnic groups and others) – are also observed in both areas, where some categories avoid meeting some other in Ezbet Bekhit or local people intermingle with non-local in Abu Qatada. Moreover, adult men affirmed their existence in both alleyways and on boundaries between settlements indicating territorial behaviour in informal areas. This in turn, influences social issues such as locations of conflict and feeling of safety.

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Beyond informality: Traders as space experts in their own informal settlements

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The spatial layout of built environments influences the distribution of commercial activities. As literature has shown, commercial activities can enhance the process of urban consolidation of informal areas (Hillier et al., 2000; Shafiei, 2007). The purpose of this paper is to investigate the correlation between spatial factors and the distribution of internal and edge commercial land use by applying new methodological means, such as a combined space syntax analysis of the street network with inter-visibility (van Nes & López, 2010), and statistical analysis of the economic issues and band analyses. The cases used in this study are three informal areas in Cairo: Ezbet Bekhit, Ezbet Al-Nasr and Abu Qatada. These settlements are selected because they are predominantly self-grown and have not been influenced by city plans or land use regulations.

This research attempts to underpin the following questions: Are the distribution and rate of commercial activities mainly driven by the local spatial composition of the area itself? Or, is it more related to how the settlements are embedded in the overall structure of the city? As it turns out, this research has demonstrated in detail that the distribution of commercial activities takes place on the plots that are located along the spatially most integrated, most distributed and most inter-visible parts of the neighbourhoods in relationship to the whole of the city. The results of this empirical study contribute to further understanding of a theory of an optimal distribution of plots, in which effective land use is defined as an interaction of two core factors: inter-visibility and spatial accessibility. This two-variable approach can be used strategically as a tool to guide the regeneration of informal settlements and transferring economic integration to deprived areas of the city.

Spatial profiles of urban segments:
Assessing place vulnerability to crime

The studies of space as an important component in order to understand why and when crimes occur increased after contributions prompted by the Environmental Criminology theories formulated by Brantingham and Brantingham (1981), and evidences produced by spatial descriptive analysis Hillier and Shu (1999, 2000), Hillier and Sahabaz (2005), Nes and Lopes (2007). Approaches arising from a multidisciplinary vision, argue that space should not only be considered as the scene of the crime, but also an important component in the development of the fact of a crime, with regard to its timing, sequencing and the conditions that led to its being committed. Space syntax analysis of macro and micro spatial relations offer research-based evidence to discuss crime and urban design. Hillier and Sahabaz (2008) warn about the need of precise descriptions and spatial measures but also that "design variables do not act independently, but interact, so that all must be got right together if there is to be a genuine reduction in vulnerability". Thus, we shall present research results on the spatiality of crimes, considering different morphological, typological, and environmental components that are perceived by people, the victims or the offenders, affecting how they move, act, experience and think about the city.

The idea of integrating a series of variables jointly in an analysis led to the proposal of a spatial profile. A profile includes the linking together of a series of traits that are able to characterise an object or phenomenon. Spatial profiles seek to work out the characteristics, sequences and patterns that consistently relate to given types of offenses in a context. It considers the relationship of spatial, social and temporal conditions together to depict a crime situation. This approach makes use of multidimensional statistics, which allows the correlations of complex set of variables such as, accessibility, density, land use, interface, constitutions, visual fields, street lighting and the presence of urban props and deterrents.

In this article, the set of spatial profiles represents qualities of streets or blocks which allow different typologies to be assessed and classified according to a greater or lesser relationship of security, insecurity or the occurrence of different types of crimes. The important output here is to obtain a clear understanding of the socio-spatial elements that together determine such conditions. This article presents results from a data set from a neighborhood in the northeastern city of Recife in Brazil. This neighborhood represents the typical socio-cultural context of a city with significant social inequality between the groups that use the same space, and where the occurrence of crimes reflects different forms of spatial logic in the perceptions of risks, the assessment of opportunities and choices of situations prone to crime.

The study mapped street crimes (muggings in public places from 2010 to 2012) with ARCGIS which helps to identify patterns of concentration and dispersion of street crimes. A set of urban segments with similar morphological properties but different in crime patterns where selected and had their spatial profiles detailed. The whole set of urban profiles were analysed by POSA (Partial Order Scallogram Analysis) allowing the identification of morphological and environment traits associated with different crimes patterns.

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Mapping urban change. The adaptive capacity of coastal fishing villages:
The Algarve (Portugal) and Paraná (Brazil)

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"Sun & beach" tourism is often mentioned as one of the main generators of economic growth for coastal regions. Yet, to what extent is it possible to stimulate the adaptive capacity of the urban territory in order to promote and foster successful "sun & beach" tourism? This paper looks at new approaches to tourism development that are designed to preserve local identity, available natural resources and the socio-cultural heritage while reinvigorating the local economy and stimulating competitiveness. This implies a reconfiguration of urban planning strategies in order to support change, and it is argued here that improving the urban fabric and the tourism performance of coastal settlements requires, per se, a suitable application of space syntax methodologies, as well as an analysis combined with other morphological research methods.

The paper seeks to assess the effects of the industrialisation and massification of leisure activities and the impact of tourism input on four coastal fishing villages along two shorelines of the Atlantic Ocean: the Algarve coast (Portugal) and the Paraná coast (Brazil). Both regions were confronted with an unprecedented interest from the tourist industry, which led to an expansion of the built-up fabric and the road network, changing the relationship between the shoreline and the urban settlement. The lack of planning strategies has resulted in undesired impacts and has disrupted the biophysical and social systems of these habitats, with negative impacts that can be extremely costly for both the environment and society. Different research methods were tested in the study of a sample composed of four coastal fishing settlements, using spatial analysis techniques related to space syntax theory (Carmona, 2014). Selected space syntax tools included axiality techniques, explored on two levels: the global analysis (the pattern of the relationship between the original/vernacular fishing nucleus and the whole settlement), and the local one (the size, scale and shape of the fishing nucleus). In loco surveys (observations and data collection) were also undertaken in order to identify the main physiographical characteristics and occupancy rates and to categorise the coastal front in three sub-sections according to the ecosystem type. The results relating to spatial configuration indicated that: i) the two coasts have different structures as far as their geo-morphological and anthropogenic aspects are concerned: the Algarve coast has a "comb-like" linear structure, while the Paraná coast is organised in a "trident" shape; ii) the proximity between the integration core and the shoreline varies according to the urban network typology: two coastal fishing settlements present an integration core close to the shoreline, while the other ones present an integration core that is inside the urban settlement; iii) from the studied variables, the "shape" presents greater differences in the case of urban development, reinforcing the identity of the coastal fishing settlements.

The conclusions are that the built-up fabric of the coastal fishing settlement is undergoing a process of change, precipitated by both its internal needs and its external pressures, including the demands of "sun & beach" tourism. There is considerable evidence to suggest that there is an explicit relationship between the configurative properties of these settlements and their ability to support change, i.e. their adaptive capacity.

Relationship between some physical spatial variables and four types of street crimes

This paper's objective is the investigation of the relationship between the occurrence of four types of street crimes (pedestrian mugging, robbery of vehicle, vehicle theft, and theft of items inside a vehicle) in four different periods of the day (each period with six hours, starting at 6:00 a.m.) and physical spatial variables (segments attributes) such as: segment length, connectivity, integration, choice, dwelling types (houses or buildings with three or more floors), land use (residential or non-residential), visual and physical connections, physical and visual barriers, nonvisual physical barriers and street lighting in the segments. The investigation is carried out in two residential boroughs in Porto Alegre, Brazil, namely, Menino Deus and Rio Branco. Data regarding the occurrence of the four types of crimes in the streets were collected in the Department of Public Security of the State of Rio Grande do Sul for a five years period, from 2006 to 2010. These data were tabulated in ArcGIS and related to each segment. Some segment attributes were obtained through the analysis in Depthmap of a segment map obtained from the axial map of the two boroughs. Data regarding dwelling type and land use were collected in the Department of City Planning. Data analysis included a linear multiple regression analysis, having the rates of four types of crimes in the streets as dependent variables, in each of the four periods of the day, to be explained by the physical spatial variables as independent variables. Results show, for example, that theft of items inside a vehicle is the type of street crime with the greatest number of occurrences, followed by the number of robbery of vehicle and by the number of vehicle theft, either in Menino Deus or in Rio Branco Borough. In general, the greatest number of theft of items inside a vehicle occurs during the night period. This is also the period where most robbery of vehicles, vehicles theft, and pedestrians mugging occurs. The linear multiple regression analysis carried out revealed that none of the 14 independent variables explain either rates of theft of vehicles or rates of theft of items inside a vehicle during the morning and afternoon periods. Additionally, a clear tendency for variables related to spatial configuration being associated with a reduction in any of the four types of street crime was found. On the other hand, variables characterising the relationship between buildings and the street tend to be associated with an increase in any of the four types of street crime.

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The perceived safety and spatial behaviour in three different neighbourhoods in Rotterdam

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There is a difference between registered safety and perceived safety. An inquiry was done to register how people use space in three different neighbourhoods from different time periods during a weekday. The following spatial parameters were taken into account: Axial and angular analyses with topological and metrical radiuses of the street and road network (Hillier & Ida 2005), and various micro scale tools (van Nes & López 2010) showing the relationship between private and public space. In one of the area interviews were made of the areas users and dwellers for identifying which streets and public spaces are perceived to be unsafe and safe.

As it turned out, high spatial integration of the street net contribute to a great variation of all types of people in streets. These areas consist of a highly inter-connected street net with shops located along it and with entrances directly connected to the street. These areas are conceived to be the safest to stay and move through by the interviewed users. Conversely, neighbourhoods with a labyrinthine street structure and lack of entrances and windows on the ground floor level contribute to few people in street and to a feeling of un-safety in the spaces between buildings. The degrees of spatial integration on various scale levels are low in these kinds of housing areas.

Therefore, the structure of the street network and the public-private relationship between buildings and streets plays a role for setting the physical framework to encourage street life and perceived safety.

Perceptions of liveability in the urban realm: Between the physical attributes of the built environment and the anti-social behaviour of its users

This paper investigates the perceptions of Liveability by city-centre dwellers as an emergent important component affecting the performance of towns and cities, and their sustainability. The study links residents' perceptions of the built environment's condition and aspects of anti-social behaviour present in the area of study with its physical and spatial attributes. It utilises a survey distributed to residents in twenty housing areas in Clerkenwell, London. The dual aims of this paper are to capture residents' perceptions about the Liveability of their locality through an assessment of twenty-four criteria relating to the built environment, including the condition of the urban fabric, the effects of traffic, and the prevalence of antisocial behaviour, and link these to its physical and spatial attributes.

The paper highlights the issues most negatively affecting the Liveability standard in the area, differentiates between the area-wide issues and those that are more location-specific, and accentuates the complexity and overlap between the number of problems concurring at these locations. The most prevalent problems reported by the residents were of an anti-social behaviour nature, whether these were intimidating gatherings of young people, drunken behaviour or drug dealing activities or those that had a direct impact on the upkeep and management of the built environment and its open spaces, like vandalism and litter and rubbish. The paper then maps each troubled location as pinpointed by the respondents, and carries out an in-depth analysis of the built forms surrounding it and of the urban space in which abuse occurred, thus capturing the dynamics of inter-visibility and movement between the users and abusers of the space, the residents in the area and the passers-by. By layering the various elements of the built environment, it became evident that the selection process of any such location depended very much on the combination of problems occurring in it and the physical attributes of the locality in which it was embedded. The paper concludes by assessing the suitability of the various analytical tools to addressing the research question.

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This paper tests the dictum that 3D isovists are easy to generate but hard to represent. In the first section of the paper, we review eleven past attempts to represent 3D isovists, ranging from 1996 to 2014. We attempted to select the widest range in terms of approach, novelty and significance to the field of spatial analysis. In the next section of the paper we introduce three new 3D isovist representations, termed the 'Contour Isovist', the 'Tri-planar Isovist' and the 'Circumvoluted Isovist'. In the final section we evaluate these new 3D isovist representations using an online questionnaire, aiming to compare the representations and to determine their clarity, information-content and simplicity. We invited an expert set of participants (resultant n=20), all of whom were familiar with the use of 2D isovists for research purposes, to take part in the questionnaire. The result of the evaluation was that two of the isovists, the 'Contour Isovist', the 'Tri-planar Isovist', we deemed to be relatively successful and hence have potential for future development. The contribution to this paper is twofold. First, the two successful 3D isovist representations are a contribution to the field and, second, the method of evaluation. We conclude that insufficient research has been conducted into the efficacy of space syntax representations.

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Visual protection surface method:
Cityscape values in context of tall buildings

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The paper introduces a method of computational analysis of the city landscape called Visual Protection Surface (VPS). The method allows exploring geometrical relations between the scope of visual protection of the city and the maximum heights of new buildings. In contemporary town planning protection of urban landscape is a significant issue, especially for historically composed cities in Europe. Specific panoramic views exposing significant landmarks can be an important element of cultural heritage. On the other hand there are aspirations to modernise the image of a city and highlighting its economic potential. The trend to build tall buildings in Europe is growing and the majority of such facilities were built this century. Strategies for developing a city usually take into consideration the need to protect the historical landscape. Main assumptions of many strategies include selection of so called strategic views foreseen for complete or partial protection (e.g. in London 27 views, in Koln 9 views). The question is: how the city can develop without losing existing valuable views? How to create its contemporary identity in accordance with tradition? How the actual computational techniques can support planning? The VPS method uses the virtual city models as basis for calculations. Input data include: coordinates for a number of strategic views and a 3D city model. Results achieved: the surface above the city defines the maximum height of buildings in such a way that no new facility can be seen in any of the strategic views. On the one hand the VPS method can be used for verification of the potential location of tall building in the city. On the other it can be a verification tool of actual protection strategies, which could be too restrictive. The paper presents the background of VPS, the methodology and sample application: using the computer program developed by authors (dedicated for CityGML data processing) and using other GIS software.

This paper is essentially a technical guide to laser scanning for real-world, two-dimensional isovist creation. The paper covers what is laser scanning, good scanning practice and then describes how to use the resultant data to recreate an isovist directly from noisy, real-world scan data. We will demonstrate how two different isovists can be created: the traditional 2D isovist, and a weighted isovist generated from the surface of a sign, display or shop frontage. This second isovist is weighted by the viewing angle of someone looking at the sign or display. Future areas of research identified from this paper include: work on 3D isovist representations and methods to efficiently process the point cloud data (produced by the scanner) in order to calculate a volumetric isovist; using the colour data, also captured by the scanner, in order to generate potential, colour-based, isovist representations; future work on the placement of signs and displays for optimal efficacy.

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Three dimensional isovists for the study of public displays

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During this paper, we suggest that the 3D isovists centred on a display have an impact on the 'noticeability' of the information presented on it. We compared the use of 2D and 3D isovists as methods of assessing display 'noticeability' applied to an environment in which a network of public digital displays has been installed, namely a university campus. We tested 2D and 3D isovists against observations, and experimental methods are employed in order to compare the observed recognition of display-content against the spatial attributes of the display. This paper introduces new software, 'Nebula', which analyses real world scan isovists' point clouds using a number of different 3D, volumetric approximations. For the university campus we studied, we found that 3D isovist volume improves the correlation between the recall of display content (when normalised for the number of viewers), over 2D isovist area or other measures. On the basis of this research, we recommend the use of both 3D and 2D scanned isovists as a new analytical tool for the study of architectural environments.

Introducing random walk measures to space syntax

We introduce Random Walk Closeness (RWC) to the space syntax computational paradigm. Random walks are stochastic processes in which an unbiased walker traverses a network purely based on his current location. Random walks have been used by space syntax in an agent-based scenario, where results are simulation based. Here, the results are mathematical based, i.e. RWC is derived from access times, which are the average number of steps it takes to walk between locations. Results suggest an improvement in correlating pedestrian movement over Integration, RA and network Closeness.

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A unified graph model for line and segment maps

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This paper presents a bridge between line and segment maps, a unified graph model. By using simple justified graphs, it shows that topological steps on axial and continuity maps are equivalent to changes of direction on segment maps in a directional distance model. In other words, line maps are 'compressed versions' of segment maps. Line maps store part of the computations in the representation itself while segment maps rely mostly on the measures. A brief discussion about size-relativisation is also provided. The paper ends with a discussion about potential developments for the ideas presented, which may lead to faster models that preserve data integrity and contribute to a renewed theoretical foundation for street network analysis.

Examining 'edge effects':
Sensitivity of spatial network centrality analysis to boundary conditions

With the growth of interest in the use of spatial network analysis to study the urban and regional environment, it is important to understand the sensitivity of the centrality analysis results to the so-called "edge effect". Most spatial network models have artificial boundaries, and there are some principles that can be applied to minimise or eliminate this effect. However, the extent of its impact has not been systematically studied and remains little understood. In this article we present an empirical study on the impact of different network model boundaries on the results of closeness and betweenness centrality analysis of a road network. The results demonstrate that the centrality measures are affected differently by the "edge effect", and that the same centrality measure is affected differently depending on the type of distance used. These results highlight the importance, in any study using spatial networks, of correctly defining the network's boundary in a form that is relevant to the research question, and selecting appropriate analysis parameters and statistics.

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The space syntax toolkit:
Integrating depthmapX and exploratory spatial analysis workflows in QGIS

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The "Space Syntax Toolkit" is a QGIS plug-in for spatial network and statistical analysis. It provides a front-end for the depthmapX software within QGIS, offering user-friendly space syntax analysis workflows in a GIS environment. It is primarily aimed at supporting the space syntax methodology, and enhancing it with GIS data, analysis and visualisation features. Nevertheless, its functionality is of general benefit to QGIS users by introducing tools for exploratory spatial data analysis. In this article we present the "Space Syntax Toolkit", describing its principles and implementation, the features of its two initial modules – "Graph Analysis" and "Attribute Explorer" – and give indication of future developments.

This paper presents a comparative analysis of three areas within London based on measurable attributes of each city block, to assess the degree to which characteristic differences between the neighbourhoods are evident and quantifiable. Both morphological measures of buildings and space syntax measures of streets are used. Results indicate that neighbourhoods are clearly distinguishable, however, the types of measures which best capture that distinction vary depending on the distinction being made. In the cases studied, building morphology alone distinguishes the residential neighbourhoods from mixed use, but the distinction between two residential neighbourhoods requires a combination of building and street measures.

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Analysis of asymmetric spatial configuration

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Architectural spaces have "visual asymmetry" and "access asymmetry." Visual asymmetry is the relation in which we can observe one space, but cannot be observed from there. Observing an interrogation room through a one-way mirror is an extreme example with which we are familiar through films. Such an asymmetry also occurs in the relation between a balcony and the ground. We can observe a street or a plaza from a balcony, but if we are on the ground, we cannot observe everything in a balcony. This asymmetry is caused by a complex relation between accessibility and visibility. Taniguchi and Kishimoto (2012) proposed a method for analysing this complex relation. Access asymmetry, in contrast, is the relation wherein we can access one space, but cannot be accessed from there. Such an asymmetry occurs at turnstiles that are in an amusement park or a theatre, on a moving walkway, and on an escalator. Movement through these spaces limits a direction, and thus we have a choice of only one direction. It seems that these spaces determine some directions for our activities.

This study systematically describes spatial models, including visual asymmetry and access asymmetry. It also describes depth based on four types of ideas for asymmetric visibility and accessibility, including view depth and viewed depth as proposed by Taniguchi and Kishimoto.

This study presents some examples wherein we analysed architectural spaces that have a simple structure. Specifically, one case is a space with an atrium (it has asymmetry caused by a combination of visibility and accessibility), and another is a space with an escalator (it has access asymmetry). For comparison, we also analysed a space that does not have an atrium, or a space that has stairs instead of an escalator. We show four types of justified maps based on visibility depth, accessibility depth, view depth, and viewed depth, and demonstrate the difference in the character of the depths. In addition, we calculate the integration value for each depth. We compare a justified map and the integration value between an asymmetrical space and a symmetrical space. Thus, this study quantitatively discusses the spatial character caused by a spatial structure's having visual asymmetry and access asymmetry.

Parallel planning – An experimental study in spectral graph matching

A lot of attempts have been made in recent years to generate geometrically correct floor plans, spatial configurations and urban layouts in connection with functional relations and defined spatial properties (Elezkurtaj & Franck, 1999; Duarte, 2001; Donath et al., 2012; Nourian et al., 2013). Different heuristics (force based drawing etc.) / optimisations methods (metaheuristic solvers such as genetic algorithms, simulated annealing etc.) have been applied to search for the "best" trade of between a set of constraint/properties. Most of these techniques are based on an iterative and time-consuming process finding a good solution for one, two, maybe three different constraints/properties. But architecture is related to a multitude of different constraints/properties, which strongly depend on the given task and its context.

In image processing spectral graph matching has shown to solve different tasks such as graph drawing, image matching and image segmentation. A direct translation to architecture seems obvious as an image similar to a plan represents a particular spatial embedding of elements (pixels, rooms…) in two-dimensional space. As these problems are described through graphs, which represent the relation of elements rather than a particular spatial embedding, these approaches are applicable not only to a two-dimensional space but also in higher dimensions.

With such tools at hand, a prototype of a spatial configuration defined by a graph (functional or through properties such as e.g. integration, choice) can be applied to an existing configuration (e.g. the refurbishment of existing buildings), to a spatial configuration which is generated by other properties than the prototype (e.g. structural, solar gain etc.) or to the most generic: A grid, resulting in a possible spatial embedding of the prototype. This allows to unlink functional / configurational constraint with other properties (an existing configuration, other configurational constraints/properties such as structural, solar etc.). Through unlinking, each constraint can be looked at on its own, developed on its own to a wanted solution and then relinked again. Further the process of matching two graphs, based on spectral graph theory, is not based on an iterative process but on one with a fixed computational time. Here the bottleneck is the calculation of the eigenvectors which can be preformed at least in $O(n^3)$.

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Visibility, accessibility and beyond:
Next generation visibility graph analysis

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Visibility graph analysis (Turner et al., 2001) is widely used for the analysis of architectural space and is linked to pedestrian movement distribution or agent based modelling through a number of studies. However, until now spatial relations associated with a visibility graph were simple, very limited and in most cases sub-sampling the affordances of spatial models in question. In this study we use a newly developed analysis methodology, which we call augmented visibility graph analysis or AVGA, and is based on mixed-directionality graph structures, in order to study a number of hypothetical architectural designs where visibility, accessibility and permeability challenge the existing tools and methodologies.

The paper presents the computational problem of analysing spaces that include 'augmented visibilities', areas with 'inaccessible but visible' locations, and through the case studies it demonstrates how the exclusion of some affordances, of the architectural morphology, from the graph representation can dramatically affect the analysis results. AVGA overcomes the limitations of current visibility graph analysis methodologies and allows the analysis of architectural and urban space that includes visuo-spatial and hybrid configurations past the simple 'wall or opening' restriction. The results show how visuo-morphological relations beyond accessibility can be encoded programmatically and how they can shape our understanding of space through computational models.

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Abstracts
10. Posters

Between pagan beliefs and Christian imaginaries. Two 19th century cemeteries in Vilnius

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The historian of death must not be afraid to embrace the centuries until they run into a millennium. (Ariès 1981, p.xvi). This paper approaches burial ground in Lithuania as a place still pregnant with pagan culture mixed with recent Christian attitudes and worries.

European burial grounds suffered a great shift in the 19th century: hygienist strategies of city development brought them outside of the city cores and new burial modes were applied. Cemetery design followed garden evolution that has been gaining edenic shapes since the 15th century.

Lithuania was the very last European country to accept Christianity; it was christianised only by the end of the 14th and the beginning of the 15th century. Nowadays it is a Catholic country surrounded by Protestant and Orthodox cultures. This context effected the development of a cemetery genotype, resulting in a mixed character of architectural styles and the burial ground spatial dynamics.

This paper was first triggered by the aim to identify elements of pagan beliefs in spatial solutions of Lithuanian cemeteries. For decoding a morphogenetic identity of Lithuanian burial grounds, two 19th-century cemeteries in Vilnius, Lithuania, were approached from a syntactic point of view taking into account the mythological references of Christianity and Baltic paganism. The spatial texture of two cemeteries – Bernardines and Rasos – is analysed and compared, by interpreting it as a system of accessibility axes. Configurative relations are used to inform morphological analysis by identifying their architectural character and cultural identity as well as relating them to certain image of paradise, that results from the mixture of variety of Christian imaginaries with previous pagan beliefs.

For understanding the spatial reality of the cemeteries, the observations of the movement have been carried out, helping to construct simple graphs of cemeteries' plans, significant for genotype definition.

Through the configurative relations it was possible to confirm a premise that the two burial grounds studied in the paper are symbolically-organic spaces, that could have evolved in the sequence of the pagan custom to bury in the forests – places associated with abode of gods and the dwelling places of dead.

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Media architectural interfaces:
Exploring socio-spatial effects of interactive media facades onto urban spaces

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Large programmable electronic displays such as urban screens became an indispensable part of the built environment. Increasingly attached onto existing building surfaces, a large number of these displays turn buildings into 3-dimensional media facades. Whereas public digital displays placed on street level are by now expected to be interactive and interactions with them are well researched, large scale media facades are mostly showing active visual content. Interactive systems that allow citizens to engage with media facades are still rare.

For a long time a facade was considered as a social interface that connects the bourgeoisie (private space) with the surrounding city (public space). The challenge here is that when designing interactive media facades there is a need to a holistic architectural approach considering the inside program of a building as well as the surrounding space equally.

But how does one go about designing for an interaction with such a large public screen? Part of the challenge is that there are currently only a few of these kinds of large displays in existence and so there is much to learn from each attempt to deploy an interactive installation.

This paper aims to explore how we might approach interactive media facades to 1) design interactions that let the general public take part in content creation, and 2) to what extend these facades might influence the socio-spatial configurations of movement flows, occupation and encounters in the closer as well as wider urban surrounding.

We will introduce an exemplary system of a media architectural interface (MAIs), which describes the design space of citizens engaging with dynamic content on media façades through shared and tangible artifacts on street level. We apply research through design methods and report on the technical set up of two field studies, in which we deployed a novel tangible user interface (TUI), called the Smart Citizen Sentiment Dashboard (SCSD) during two media art festival in Sao Paulo and Linz in very different socio-spatial settings.

Early findings suggest that MAIs have an impact on the socio-spatial configuration of urban space. However they are strongly dependent on the spatial context. We contribute to the notion of the contemporary city by helping to understand how design and deployment of novel interfaces may disrupt urban flows and stimulates social interactions towards livable future cities.

The blog + the territory:
Exploring the relationship between hyperlocal media and local space

Hyperlocal media are broadly defined as online platforms for news and other informational content relevant to a specific geographic locality: a whole city, an administrative area like a borough, an informally-defined neighbourhood or even an individual street or estate. Brockley Central, "the home for all things Brockley (SE4), Deptford, Ladywell, Lewisham and New Cross" is one of the longest-running and best known hyperlocal blogs, focused on the neighbourhood of Brockley and its high street and but also reaching into surrounding areas. This poster presents one part of a broader research project that through various complementary methodologies attempts to describe the relationship between the blog, Brockley Central, and the urban territory to which it pertains. Here, we map Brockley Central's Twitter followers both in network terms and geographically. Brockley Central's Twitter network is defined as a graph of all its followers and the following relationships between them. Analysis reveals concentrations of following relationships that in network terms are defined as communities, and shows the degree of connectivity of each user. Profiles that can be pinpointed geographically, belonging to local businesses for example, are highlighted on a map. Network communities turn out to be markedly geographical groupings, and centrality within Brockley linked to greater connection within Brockley Central's Twitter network. Bricks-and-mortar businesses visible within Brockley and its surrounding areas also appear to be key parts of the network, helping distribute local news. Although a single case, this is a preliminary step showing the potential for further research linking mediated social networks and their manifestation in urban space.

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Digital manifestations

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We present the comparative analysis into locations of events in the city of London and the locations of tweets posted that relate to those events. Twitter, a social media site, allows users to post sentences publically (up to 140 characters) which can be seen by any other Twitter user and the location of the tweet can be identified. This poster compares the events of the first week of the London Olympics 2012 with its corresponding tweets. In relation to this, two questions are posed: are the tweeters' location correlative to the corresponding event they are talking about and how does the movement of twitter users manifest over time. By filtering users and keywords, and mapping the tweets, results show that there is a strong positive correlation to where the event is happening physically and where people are tweeting about it. By tracking user movements, trends are also identified concerning how people move around the city with four main patterns.

Two questions are asked and two hypotheses are suggested to initiate the analysis:

1) Are events in the city geographically correlative to its associated digital manifestation? The hypothesis to this question is the suggestion that people do not necessarily tweet where the physical event is happening.

2) How does the movement of the digital users correlate to the constituent event? Users that are using social media do not move within the city in accordance to the beginning and end of the event. The choice of medium for the research is twitter and the choice of city events is the London Olympic Games 2012 as the most recent, most internationally popular event within London.

This research is still in progress and deals with the relationship between works of art and the buildings that exhibit them. It has a particular interest in galleries that were designed to house specific collections. The core of the investigation is to understand the relationship between content and continent through the prism of space configuration and spatial navigation.

Three galleries, part of the Inhotim Centre for Contemporary Art, located in Brumadinho, Brazil, are taken as case studies: a) Adriana Varejão Gallery (2008), designed by Tacoa architects; b) Miguel Rio Branco Gallery (2010), designed by Arquitetos Associados; c) Psicoativa Tunga Gallery (2012), designed by Rizoma. The buildings were scrutinised according to their spatial properties, notably with regards to their convex and visual dimensions, and the location of the exhibited works of art.

The buildings reveal distinct art gallery concepts with regards to built form, space navigation and work of art positioning. Of major relevance is the identification of a gallery type, called here building-specific, which is characterised by the indissociability between content and continent.

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Can space syntax interpret artistic expression?

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Representation is a fundamental aspect in arts and design. Believing that the purpose of art, was not merely to depict reality but to enhance, transcend, or even distort it, by the mid of the 19th century various movements in arts and especially in painting led a divergence from figurative art to a then more sophisticated approach through abstraction. At the beginning of the 20th century, aesthetic theory adopted by modern movement and Bauhaus school, was the doctrine that art was a significant form. As the use of rectilinear Euclidean geometry regained importance, basic approach of Bauhaus school based on the perception of Gestalt psychology. In the Bauhaus school, art and design works were considered as consequences of conceptual and perceptual formal language, which had structure, rationale, and syntax of its own. Wassily Kandinsky was among the pioneers of the Bauhaus school and especially abstract painting. Significance of his form selection and particularly emphasis on colours are among the distinctive characteristics of Kandinsky's work. Although the colour theory he introduced constitutes the basis of colour theory and colour psychology of today, Kandinsky considered the geometrical elements as the core aspects of abstract art. Their effects on the observer were more important than their objective characteristics such as shape and colour. In order to examine the logic that lies behind the composition of figures in abstract paintings and to test if the syntactic logic applies to a non-spatial two dimensional organisation, nine abstract works of Wassily Kandinsky during his early Bauhaus period are analysed and interpreted in a twofold analyses. The first stage bases on the design principles of the era such as the significant morphology of his canvas selection, the centre of gravity and balance in the designed canvas, emphasis on colours and formal organisation. The second stage compares these findings with syntactic aspects such as mean depth, occlusivity and compactness of the non-figurative spaces on the canvases. Basing on Kandinsky's ideas, we can relate the abstract painting and its configuration to an architectural space in which the human movement is excluded and where experiences solely rely on perceptual interpretations of the formal composition. Colour on the other hand, may act as a background or may be used as the indicator of emphasis and centre of gravity on the designed canvas, relating it to the function of an architectural space. In the context of Kandinsky's paintings, occlusivity value shows the surprise factor within the canvas, denoting the most detailed figuration close to the frame of the canvas. Compactness value shows the intentional empty spaces on canvas, whereas mean depth shows the position of the smaller sized figures and the orientation of diagonal axis and lines dividing the canvas. This research shows that syntactic theory is not only compatible with pure geometry of architectural or urban space, but also with basic design principles derived from Gestalt psychology.

Museum space narrative as a result of visibility and permeability interplay: The case of Mukhtar Museum and Arts Palace Museum, Cairo

The way visitors encounter museums space configuration through their exploratory movement makes museums a form of spatial environmental art, where the encounter happens through an ongoing process of visibility and permeability interplay which then creates a narrative of sequenced or interconnected spatial vistas and experiences. The success of this narrative is not measured by the number of encountered displays by the viewer nor the time spent in the museum visit, but by how the viewer can relate cognitively to the museum space configuration and structure his own experience. Through the domain of museum projects in Egypt, the paper focuses the study on two Cairo located museums: The Sculptor Mahmoud Mukhtar Monograph Museum opened in 1952. And the nearby Arts Palace Contemporary Art Museum renovated and re-opened in 1998. Both are art museums that exhibit its displays through a spatial themed narrative. While the first is an example of the old type galleried space museum, with a clear directed and deterministic visit loop sequence. The second is an example of the atria space museum type, with an open choice probabilistic visit path. The museum spatial narrative is examined in terms of visibility and permeability, where visibility is analysed through visibility graphs using Depthmap software, while permeability is analysed through the same software analysis taking into account movement barriers. Camera snapshots and three dimensional diagrams are used as a complementary analytical method to elaborate more about the resulted spatial scenario. The results prove that different space configuration produce different patterns of visibility and permeability interplay. In Mukhtar Museum visibility graph was congruent with the museum permeability graph creating an experience based on clear sequential vistas pattern the same way a city urban fabric is experienced. Yet in Arts Palace Museum permeability graph integration pattern were interconnected and interchangeable with visibility graph integration pattern creating a more dynamic cognitive experience structured through experiencing the museum atriums that played crucial role into experiencing the museum spaces visually and spatially from different perspectives. Therefore concluding discussion suggests that it may be early to seek commonalities for museums as spatial types, and it is better to analyse each museum unique narrative separately taking into account other experiential aspects that support and enrich the spatial narrative. This opens the door for further research to correlate a space configuration visibility and permeability interplay patterns with other experiential aspects such as lighting pattern and spatial visual complexity.

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Power laws in the worldwide airplane network and its association with house price

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Variables in nature whose probability distribution often follows the normal distribution where 95% of the data is within two standard deviations of the mean. In contrast variables in space whose probability distribution often follows a skewed distribution where the majority of the elements have low values and few elements have high values. These distributions can be approximated by a power law distribution. The normal distribution is characterised by random evolution over long periods of time. The skewed distribution is often shaped by direct competition and preferential attachment. Example includes population in cities, skyscraper height, income or the transportation network. (Batty, 2013) This research will first explore the extent this tendency holds at the inter-country level using the worldwide airplane network and secondly to explore the extent inter-city connectivity is associated with inter-city house price variations.

This research makes use of open data from openflights.org. The dataset contains an origin and destination matrix from all cities airport to all cities airport of the world differentiated by different airlines. We first group all the city's airport into one city. For example all the flights going to Narita and Haneda would be grouped into Tokyo. Second, we construct a worldwide airplane network. Third, we calculate degree centrality for each of the city. Fourth, we plot the rank size distribution for this network. Fifth, we visualise the degree centrality of the network. Sixth, we produced a log-log plot between house price and the worldwide airplane network degree centrality.

This research finds that the worldwide airplane network degree centrality rank-size distribution exhibits a power law with the alpha parameter equal to 0.774. (Figure 1&2) This is consistent when disaggregated to different continents and network communities. This research also finds a positive association between house price and the degree centrality of the airplane network. (Figure 3) This association can be

attributed to greater levels of airplane connectivity leading to greater access to capital and investors where cities no longer only satisfies local demands but also as assets for foreign investors. Further research is needed to validate this association and to examine the growth of the airplane network in relation to house price.

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We will present the results of an exercise intended to capture architects' intuitive insights about the effects of formal design moves on user perception, particularly when user perception is also significantly influenced by spatial organisation. The results are presented in form of a matrix that matches specific elements with architects' expectations of user response. This matrix was developed as a part of a larger project to test effects of spatial form on user perception, and the aim of developing this matrix was to generate specific hypotheses about user response that could be tested through further empirical work.

This work is a continuation of a previous study "Perceptual tuning of a Simple box" presented in Space Syntax Symposium Chile 2012 by Sonit Bafna, Anna Losonczi, John Peponis. That study aimed to capture the experience of a visitor walking along a rectangular gallery in Tadao Ando's Pulitzer Foundation in St. Louis. We tested whether the visitor's attention would be significantly different, if his or her path took slightly different paths through the same space, that is, if he or she traversed the gallery through a different set of e-spaces. Our findings did support the broad hypothesis, but also led to further questions about the relationship between design and user expectation and about how much of this was intended by the designer. The framework presented here is the result of an effort to systematise this through an empirical procedure, working with architects.

We developed the matrix that is a description of mental processes evoked by a space as designers assume. The matrix rows show the role of different vantage points and approaching routes in the process. The matrix columns refer to the role of some elements and also shows the cognitive process divided to specific psychological concepts. The matrix was created by having four experienced architects go through a systematic procedure of generating insights about user experience. Each was asked to imagine him or herself walking along pre-established paths defined by a set of photographs and to note in words judged expectations of user response to perceived design conditions. The content analysis of the 16 texts showed that there was notable inter-subjective agreement among the subjects. They all identified a set of elements [walls and ceiling]; [floor]; [window]; [parapet]; [upper opening]; [down opening], as key causal factors in user response. There was also an agreement about the type of potential psychological reactions assumed by the designers; these could all be classified into the following categories: {categorisation}; {localisation}; {motivation}; {attention}; {self space} and {emotion}. The final version of matrix lists only those included in the matrix that were 1) noted by all four subjects and 2) could generate testable hypotheses.

The matrix, thus, can be seen to describe designers' insights into user response related to specific elements that can be manipulated in design. Thus it can be used to generate and empirically test specific hypotheses about user response.

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Urban configuration and its relation to open space use in the Wanchai District of Hong Kong

Open space plays an important role in modern urban life, especially in high-density cities such as Hong Kong. Hong Kong is suffering from a limited supply of land for its main urban areas; some open spaces however are frequently criticised as inconvenient for users and consequently not be well used. How to improve the performance of open spaces is, therefore, a critical issue faced by the city planners and designers. As the conventional accessibility model, which is described mainly with respect to maximum walking distance or service radius, is inadequate to give an account of the issue, a new theoretical model is demanded for both research and operational purpose. The study, accordingly, indicates an alternative approach and seeks an explanation from the urban configuration and the way it conditions pedestrian movement patterns. Through investigating the relationship between urban configuration, pedestrian movement, and the accessibility and use of open spaces based on the Wanchai District of Hong Kong, which particularly epitomises various urban grids that may have different consequences on the access and use of open space, the study attempts to examine whether there is a consistent relationship existing in different grids.

 The study first models the pedestrian network of Wanchai into a system of linear spaces by applying the techniques of space syntax. The interrelationships of these linear spaces are subsequently described by configurational variables called integration to capture their "relative accessibility" within the overall layout. The implication for pedestrian movement is also analysed by correlating the configurational variables with the observed encounter rates. And then, the mapping of the pedestrian network is superimposed on a mapping of the distribution of a sample of recreational open spaces to indicate their location in the complex larger system and their association with surrounding pedestrian networks. Finally, the analyses are compared with the observed level of use inside the spaces to identify the describable relationship between spatial configuration, pedestrian movement pattern and the level of use of open spaces. It is hope that the findings can be used to help improve the performance of open spaces in the urban areas of Hong Kong.

Analysis of moving behaviour in exhibition space

It is necessary to design exhibition space so that many people can see as many exhibitions as possible. Exhibition space tends to have areas with many people and areas with few people, which leads to differences in the density of visitors depending on the area. Thus, we must consider the configuration of an exhibition space and layout of an exhibition. This study suggests ways of improving exhibition space. Therefore, we analysed the distribution of people, the moving behaviour of the visitors, and the configuration of the exhibition space.

We measured pedestrian movement in an exhibition (Keio Techno Mall) that displayed the results of university research. We set nine video cameras and photographed the movement of the person from the exhibition space. From the video movies that we monitored, we counted the movement direction of the person and the number of people at every crossing. We divided the exhibition space into convex spaces and counted the pedestrian traffic volume in each space.

We also calculated the space syntax indices (SS indices) of the exhibition space. We conducted visibility graph analysis (VGA), axial analysis, convex analysis, and isovist analysis, and investigated the SS indices of the exhibition space. We analysed the correlation between the SS indices and pedestrian traffic volume, and made a route selection model using the Logit model for discrete choices. The results indicated that the coefficient of correlation was high in the order of choice, integration value, and node count. According to the analysis, many people use the shortest paths, and they choose paths of high integration value. We classified the routes of movement into three types. The first is the route along the periphery of the exhibition space, the second is the route going around the paths of high integration value, and the third is the route from the centre to the perimeter. We analysed the data we obtained to clarify the routing probability using a Logit model. The results indicated that the perimeter paths were chosen the most frequently, and the paths of high node count, the paths of the large Isovist areas, and the paths with few displays are likely to be chosen. We were able to obtain SS indices and a meaningful correlation of the pedestrian traffic volume in this study. We classified the movement into three types and confirmed the relations with configuration of the exhibition space and the movement behaviour of the visitors.

When a person chooses a course in the exhibition space, the person chooses a more perimeter passage. In the exhibition space, the peripheral paths had many people, whereas the centre had fewer people. Therefore, we suggest that the width of the circumferential passage should be narrowed and that we should let people move to the centre by widening the passage toward the centre. Alternatively, we suggest that we should have people move toward the inside by creating partitions that block the perimeter passage. We think that the exhibition space may then become fair and work effectively.

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The 'schoolness' of architecture schools in Portugal

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This poster is focused on how space is used in Schools of Architecture in Portugal and how it is transformed over time, as a result of the need to adjust different programs.

This research seeks to understand how the architecture school buildings in Portugal, although typologically very distinct, answer to the same function, questioning the dual relationship between function and typology.

The case studies of this research are three faculties of architecture in Portugal: Oporto architecture school, by Siza Vieira (1986, 1996); Architecture School in Coimbra University (XVI – XX century); and Minho Architecture School, by Fernando and Bernardo Távora (2000).

Initially the poster presents the three case studies, focusing on changes of building's role as result of the need to adjust to different programs along its life span, which is particularly the case of Coimbra's Department of Architecture, that was originally built to serve as an arts college (corresponding to a humanistic curriculum), later as an hospital, and currently as an university building for studying architecture. Then, a synthesis is presented focused on the study of the relationships between spatial configuration (regarding convex, axial and visual control measures) of three schools of architecture in Portugal.

The aim of this work is to identify a sense of 'schoolness' coming from architecture schools in Portugal; a 'schoolness' as a result of teaching curriculum and to how space configuration plays the role of an invisible pedagogy influencing the socialisation of learning activities.

Results that are presented come from correlations between axial and visual measures.

Urban transformations in left over spaces: A case study of Dilli Haat

Urban transformation is a fairly complex, large and a continuous phenomenon. However, transforming left over spaces within contemporary urban environments into better, safer and valuable public spaces remains a continuous challenge (Bentley, 2004). This paper presents the case of Dilli Haat, as a unique example of urban transformation of a left over space in New Delhi, the capital city of India. Evolved from an open left over space with storm water drain, garbage dump and a line of some vegetation, Dilli Haat has emerged as an active and engaging public space with an over growing demand and high footfalls. Its urban precinct and spatial configuration further become the defining criteria of how it works and how people use it. This paper employs space syntax tools to analyse the spatial framework of Dilli Haat along with in situ observations.

It further correlates the findings based on discussions conducted with the project architects, on site observations and Space syntax tools. It brings out generic conclusions about the spatial typology of Dilli Haat as a learning for urban transformations with positive social impact in Indian context.

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Application of 3D isovists in visual impact simulations of tall buildings

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The poster examines possibilities of using virtual models of cities to provide advanced urban analyses based on application of 3d isovists, focused on impact simulations of tall buildings on landscapes of a city. The paper introduces a method of computational analysis called Visual Impact Size (VIS). The planned height of buildings is subject of discussions, conflicts and controversies, especially for historically composed cities in Europe. This trend is growing worldwide. Most of tall buildings in Europe were built in this century. In many instances, negative consequences of an inappropriate location of a tall building result from inability to foresee its spatial impact. However, proper delimitation of all possible locations for visibility of tall buildings has key importance for urban planning. How is the impact of building changing with increasing height? How the landscape is affecting visibility of building in space? How is the impact changing dependently on urban composition and urban structure of city etc.? Important outcome of the presented subject is an interpretation of basic relationship between tall buildings and the city itself. The visual impact size (VIS) method uses the virtual city models as basis for calculations. It allows: a) to identify all locations in the city from which the planned tall building can be seen; b) to show not only real visual impact range but also imaging of the impact power (visual impact size) of the building. The method was applied in author's professional praxis to verify locations and parameters of tall buildings. The paper presents the background of VIS method, it's idea and sample application: using the computer program developed by authors. The program is dedicated for CityGML data processing (the common standard), and use the data semantics for optimisation of applied algorithms.

As part of his PhD-thesis combining Space Syntax Analysis with archaeological methods, the author revealed that during developing Early Bronze Age, the small lakeside settlement of Zurich-Mozartstrasse transformed within two generations from one with loosely clustered houses and distributed j-graphs into one with very regular arranged buildings and indications of access control. Looking for causes or influences, Concise-sous-Colachoz, a lakeside settlement with very regular layout at Lake Neuchâtel in western Switzerland, offers itself for comparison. Inhabitants of Concise-sous-Colachoz successfully reproduced the particular spatial configuration of their village for almost ten generations, while Zurich failed after only a few. As a basis for further research, the poster restricts itself to looking into the approaches to Concise-sous Colachoz from its two carriers: from landside and Lake Neuchâtel. It slips into the role of a stranger approaching the village and looks at how the settlement's spatial configuration may have influenced inhabitant-stranger interaction. The author thinks that in this interaction lays the key to survival of a settlement within its environment. The poster reveals that for about eight generations, the spatial arrangement of two concentric palisade rings encircling Concise-sous-Colachoz remained unchanged. Moreover, the ability of its inhabitants to successfully reproduce this spatial configuration and even extend their village leads to the assumption of a stable agent environment around Lake Neuchâtel. However, after a fire destroyed the middle phase of Concise-sous-Colachoz, the village was rebuilt on a final, much smaller scale. Although some basic ideas of its spatial layout still remained, important aspects were corrupted. The reconstruction took place at the brink of Middle Bronze Age and the failure of the inhabitants to reproduce the spatial configuration of previous phases may be another indication of a society undergoing transformation.

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A data mining approach: Exploring urban theories on crime using mobile phone data

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Architectural theories and urban design research has attempted to describe the relationship between the built environment and crime. More recent works show that there is a strong relationship between the built environment and location of crime. However, the urban environment constitutes a composition of places, which is not only defined by its physical aspects, but also by the inhabitants and their properties, its people dynamics.

This poster presents one part of a broader research project that attempts, through various complementary methodologies, to describe the relationship between crime and urban environments through exploring urban people dynamics, including diversity of age, gender and residency status, through the use of pervasive mobile technology data.

Here, we present a first step showing the potential for further research linking urban theories, such as Space Syntax, with time based digital data harvested from the ubiquitous mobile phone data.

We propose a new method whereby we mine telecommunication data, which provide us with time based data from which we can infer information related to urban people dynamics and open crime data to quantitatively observe urban crime theories. More precisely, we analyse footfall counts as recorded by time based telecommunication data, and extract metrics that act as proxies of urban theories for crime, such as Diversity of Age, Ratios of Visitors, Residents and Workers, and Ratios of Male and Female Population for urban areas. Using correlation analysis between such proxies and crime activity derived from open crime data records, we can reveal to what extent different theories of urban crime hold, and where. We apply this approach to the metropolitan area of London, UK and find significant correlations between crime and metrics derived from theories by Jacobs (e.g., population diversity) and by Felson (e.g., ratio of young people).

Building on the research outcome (Traunmueller et al., 2014), and as the next steps in this research, it is possible to conclude that combining Space Syntax approach that is Space Syntax graph-based analytical techniques, applied in axial and segment maps, in investigating the relation between the properties of the built environment and the location of crime with information driven from time based telecomm data will help generate a better understanding of the nature of the relationship between people dynamics and the built environment in order to tackle a range of urban challenges, such as crime.

Computational spatial analyses using generative algorithms

Computational design has been influencing design disciplines in the last decade in a significant way, with more impact on certain disciplines than others. Architecture and Urbanism have been deeply influenced by the evolving domain of computational, algorithmic and generative design which has become a part of the design process today. While there is a significant impact of computation on design, there is also a rise of its use in pre-design stages. New methodologies of analysis have been developing using state-of-the-art (and emerging) design tools such as Grasshopper, Python, etc. to create analysis methodologies for architectural & spatial design. The research posters aim to exhibit the use of computational design and generative algorithms to define analysis methodologies that can be used in urban and architectural design for an enhanced understanding of space and form. Space, conventionally perceived and analysed visually, can now be analysed using advanced syntactic tools. These tools are deeply embedded with a mathematical and algorithmic framework and can provide information / data which are not conventionally perceived through vision or other sensory methods. Since mathematics is involved in the process, emerging data-control tools such as Grasshopper3D can be used to comprehend & manipulate data in a controlled way, allowing added dimensional understanding of space. By combining multiple toolkits within and outside of grasshopper3d framework, a number of analysis approaches are being developed and tested through on-going projects. Tools such as visibility analysis, proximity analysis, urban catchment analysis, water flow analysis and slope analysis have been developed and used for a number of complex projects to understand space at concept design stage, which are demonstrated though visuals and codes used for those projects. The visuals aim to unveil the complex processes of space planning that these projects underwent in order to improve the spatial quality and network topologies at local and global scales.

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Japanese detached houses from Edo Period to present

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This study analyses Japanese historical detached houses and clarifies their changing characteristics from Edo period to the present day.

Japanese houses before Taisho Period has the colour of feudalism, emphasising the place of ceremony and welcoming guest, so that the place of patriarch had been placed at the centre of house. After the housing renovation campaign which took place in Taisho Period, the traditional Japanese houses changed to the modern ones where family living space and the space for household tasks were emphasised and located at centre. From houses with open atmosphere with fewer walls, Japanese houses changed to those with segregated rooms whose function was strictly restricted (not flexible). These new houses were promoted with the slogans advocating division of the space for eating and sleeping, or working and sleeping. Furthermore, from the houses closely contacted to the ground with garden, Japanese houses changed to those with less contact to the ground in a minimum lot, like packet "Mini-detached house" in less than 60 square meter lot.

This poster clarifies these changes of the plan of Japanese houses quantitatively using Space Syntax. The changes have been explained with observation, but not quantitatively. With the quantitative analysis, some changes in plan can be more clearly understood and some unnoticed changes become clear.

More specifically, in this study, total dozens of popular or typical Japanese houses from Edo period to the present time were collected and their plans were analysed through convex analysis. Rooms were categorised and separated to exterior space, spaces for gathering and communicating among family, eating, cooking, receiving the guests, sleeping, moving to another space, bathroom and toilet, others, and using the functional integration ratio of each kind of group, factor analysis and correspondence analysis were conducted. As a result of factor analysis, three kinds of factor were derived; a factor concerning the connection with exterior space, a factor concerning centeredness of family space, a factor concerning centeredness of space for moving to another space. By the value of factor scores of historical houses, the main components of Japanese houses were quantitatively explained.

Impression of artworks in museum:
The influence of fixed route and spatial layout

Spatial layouts for an art exhibition are classified into two types: a fixed route and an unfixed route. For example, a fixed route is used for retrospective exhibition. Works are set along a time axis from artist's early works. This layout decides the story of exhibition. This layout shows the story of an exhibition and plays an important role to impress the visitors.

The main purpose of this paper is to suggest the way to impress the visitor by the fixed route instead of works themselves. For the reason, this paper analyses effect on visitors in a layout with a fixed route. The investigation in museums is consisted.

The travelling exhibitions set same art works in two different museums are investigated. People who visited this exhibition are asked what works are impressive afterwards and spatial layout are analysed with space syntax.

In this paper, through the experiment in the investigation in the museums, how visitors are impressed with works by different layouts and which factor effect visitor's action is discussed. Consequently, a fixed route makes some places unimpressive and other places impressive. Isovist area considering a fixed route and the direction influenced the impression of works.

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Urban transformation and gentrification

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The paper investigates the way social relationships of two different groups of people are reflected in architectural and urban form of buildings. The case study analyses Holesovice, a quarter of Prague, Czech Republic, which is undergoing the process of gentrification. Our research compares spatial characteristics of the new development and original constructions and identifies key differences. The methodology framework is based on the Space Syntax theory and Urban Morphology, supplemented by interviews with inhabitants, developers and city officials.

Holesovice is a former industrial suburb of Prague with a large railway station and docks, built mainly in the 19th century. The original construction was formed by large regular blocks with private courtyards in the centre. The blocks were composed of a number of residential houses or the whole block was occupied by a single industry such as a mill, bakery or dairy. During the second half of the 20th century the housing stock of 19th century quarters including Holesovice was poorly maintained and therefor deteriorated. After 1990, when the new economic model entered the Central Europe, many industries were transferred to countries with lower taxes and fewer regulations. Most of the factories and docks were abandoned and therefore offered cheap development sites in exclusive locations, close to the historical city centre and next to the river.

The change of economic model together with the "Back-to-city movement" made the areas such as Holesovice attractive for new middle class people, socially strong, often working in international companies, law firms, IT services or in media. The very character of their work, their engagement in international communities and their strong social position assumes the preference for transpatial relationships over the spatial ones.

In the paper we will show how the new developments exhibit different architectural and urban characteristics compared to the original construction. New developments are typically formed by clusters of individual buildings creating an open space. Even though the open space is accessible, its integration value is very low and it is scarcely used by people living outside the new development. The new construction and the original construction also differ by the boundary between public space and the houses. We will argue that the new urban typology and architectural expression reflect the social relations of the gentrified inhabitants. The analysis of the city structure and information provided by interviewing the developers and city officials allow us to understand the change of lifestyle in gentrified quarters and formulate factors leading to these spatial changes.

3D-negatives of public spaces:
Detection, analysis and tall buildings relations

City is a constantly dynamic viable environment composed of its urban structure, space in-between and its users, inhabitants. The urban environment is a type of "positive – negative" game between voids and volumes with implication of users determining all the dynamics occurring in urban development. The volumes are apparent in form of buildings, structures, superstructures and natural elements, while the voids are the invisible world geometrically defined by surrounding volumes – namely the open spaces in-between. The specific types of urban volumes are tall buildings apparent in most contemporary European cities. The paper uses case of 3 different cities of different scale and characteristics. The main focus is on authors' proposal for process of parametric representation and analysis of urban environment, particularly public spaces (3D voids), using 3D city models. The article presents process from definition of such 3D voids (public spaces) in 3D cityGML models, through parameterisation, finally to proposal of multi-level approach to analysis of urban parameters and perception. Analytic part refers to selected geometric aspects of the voids between buildings. The presented sample application contains: 1) proposal for generating 3D geometry of public spaces (in areas around tall buildings – using 3D cityGML models, 2) sample of analytic interpretation of 3D voids generated in virtual city models with selected urban parameters. Finally, the paper delivers overview of presented proposal for specific parametric computer analysis of geometry of space between buildings – here, specific areas close to tall buildings. The poster is a part of the research project 2TaLL: Application of 3D Virtual City Models in Urban Analyses of Tall Buildings under Polish-Norway Grants scheme.

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