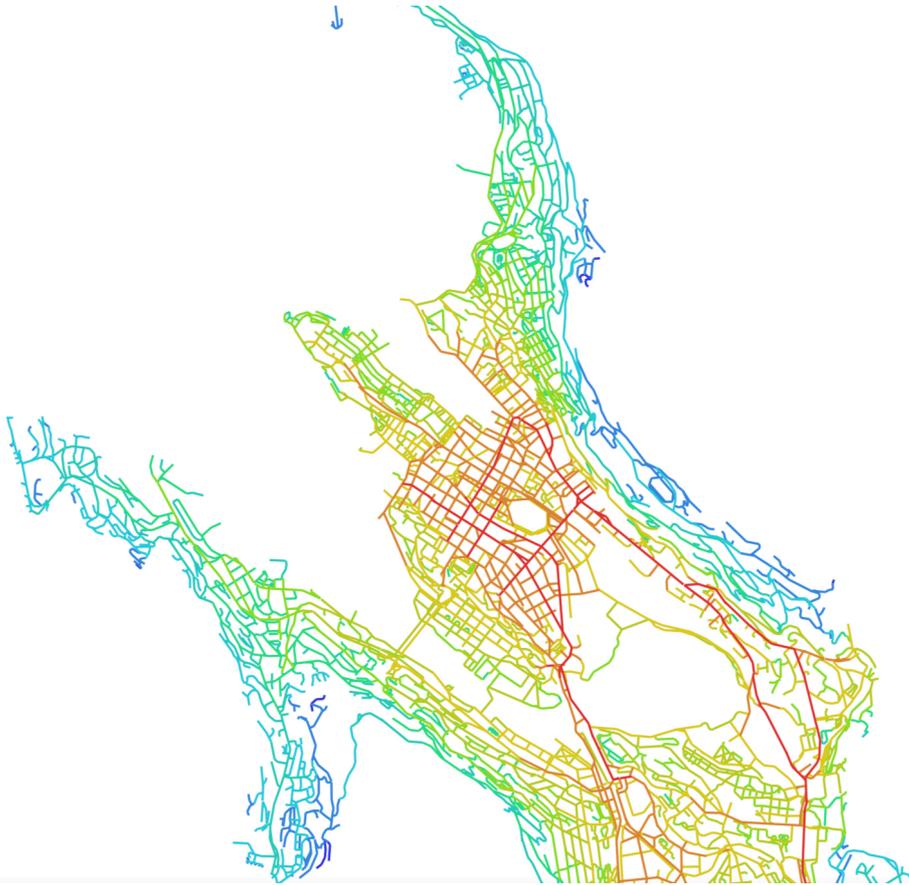


# The 1st international online space syntax PhD conference Book of abstracts



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## First international online Space Syntax PhD conference

Welcome to this special edition of the Space Syntax PhD conference, hosted by Western Norway University of Applied Sciences (HVL). This event is held entirely online due to the current pandemic forcing us to postpone the traditional biannual conference. Currently, the Norwegian borders are closed, and international travel has not yet wholly restarted. However, we hope to welcome you to Bergen, Norway, for the 13<sup>th</sup> International Space Syntax Symposium (13SSS) from 20th to 24th June 2022. Our community needs to be connected, especially in these trying times. Hence the decision to host an online PhD conference on what would have been the first day of the planned conference in hopes of facilitating the members of our community who might find three years between symposia as too long a time to wait for feedback during their PhD research.

The Space Syntax community is growing from strength to strength and is used widely all over the world. Being able to host the conference in Norway (both online and in-person) warms my heart as I was the first 'lone wolf' from Norway who used Space Syntax in my PhD around the start of the millennium. My first symposium was the 3SSS in Atlanta in 2001. I have consistently attended every symposium since then as I cherish this community of thinkers and innovators. I had the opportunity to arrange the fifth symposium in Delft, The Netherlands, where I developed a parallel PhD workshop based on my own experiences of craving learning and exchanging ideas with the community. That year, we hosted two parallel sessions with Professor Julienne Hanson and Professor Kayvan Karimi steering the discussions.

How could Space Syntax be explained to an audience outside our community? A short answer is that Space Syntax is a method for calculating spatial interrelationships in the built environments at various levels of scale, ranging from the building interiors up to regional agglomerations. Space Syntax was founded in the 1970s by Professor Bill Hillier at the University College of London. The leaps in computer and software developments have made it possible to refine the calculations and apply them to complex systems. As Space Syntax evolves, more disciplines ranging from architecture, sociology, philosophy, perception psychology, transport engineering, criminology, urban geography, real estate development etc. have started to show interest in our methods and research community.

I am happy to say that technology has developed quite rapidly since then. Now we are afforded more opportunities to meet up and collaborate without worrying about travel budgets or carbon emissions. For this conference, we have received a total of 50 abstracts from all corners of the world. Many of our contributors are similar 'lone wolves' in their universities or even in their countries. This underscores the importance of our symposia and PhD conferences as spaces for exchanging ideas and inspiration. I am grateful that this online PhD conference can be arranged with zero budget and fueled by voluntary efforts. My thanks to Laura Vaughan and Meta Berghauser Pont for bringing up this idea when the 13SSS had to be pushed back to 2022. Together, we have managed to make a framework for

the event and announce a call for abstracts quickly. I would like to show my appreciation to our reviewers, moderators and chairpersons for this event: Wendy Tan, Chiara Garau, Claudia Yamu, Sharifah S.S. Mahdzar, Kimon Krenz, and Jane (Evgeniya) Bobkova.

The conference is only possible due to Arve Leiknes, Wendy Tan and Linn Jeanette Fylkesnes and their organizational and technical support. Last but not least, many thanks to all the PhD candidates who have prepared and shared their abstracts and presentations. The quality of the online conference is only as good as the quality of its contributions. You are the greatest contributors in making this unique online event possible.

I look forward to a lively and impactful online conference and hope to welcome you to sunny Bergen in 2022.

Akkelies van Nes

*Western Norway University of Applied Sciences (HVL)  
Bergen 21. June 2021*



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**Technical and organizational support from HVL:**

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# Parallel session 1



# How do building-street interface properties relate to spatial configuration and pedestrian movement?

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**Keywords:** choice, integration, microscale, building-street interface, pedestrian movement

Where normative research on urban space and mobility falls short for a lack of explanatory power, precision and context-dependence, the empirical, context-independent, precise approach of Space Syntax methodology has yielded strong descriptive theories on the relationship between spatial configuration and movement patterns in urban space with high post-dict potential and explanatory power (van Nes, 2016, 2017, 2018; van Nes and Yamu, 2020). Whereas the theories of the natural movement economic process (Hillier *et al.*, 1993) and the natural urban transformation process (van Nes *et al.*, 2012; Ye and van Nes, 2014) describe how spatial configuration influences movement patterns, economic activity, building density and land use mix, the author is currently seeking to explain how spatial configurations can facilitate sustainable mobility patterns. Whilst one part of the study focuses on general accessibility for walkable neighbourhoods (Hillier, 2009, p. 3), the other part looks into the effect of the building-street interface on pedestrian movement patterns.

These microscale conditions (van Nes and López, 2007, 2010) are expressed through the quantitative metrics constitutedness, intervisibility and topological depth as indicators for potential interaction (Gehl, 2011), natural surveillance (Jacobs, 2000), crime and perceived safety (Hidayati *et al.*, 2020). A building is defined to constitute the street when it is “both adjacent and directly permeable to that space” (Hillier and Hanson, 1984, p. 101-102). Intervisibility quantifies the percentage of ground floor windows facing the street. Topological depth is the metric representing the amount of intermediate semi-public and semi-private spaces between private and public space.

It is hypothesised that high spatial integration on a local level, a high number of building entrances and windows facing the street, and low topological depth between public and private space make up a complex set of necessary conditions which facilitate walking as a sustainable mobility means.

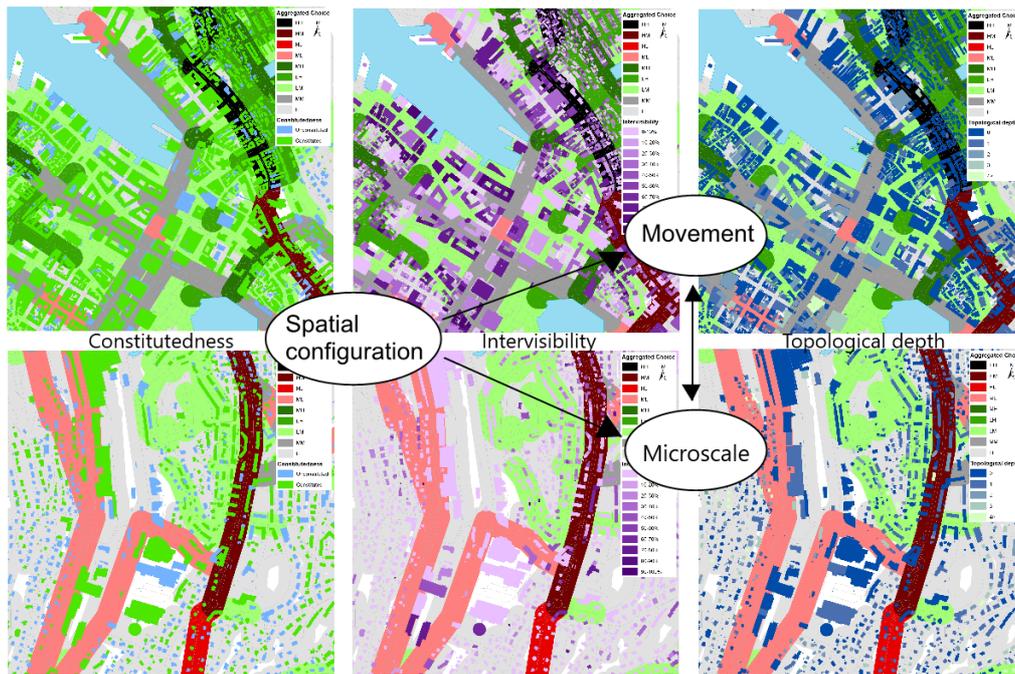


Figure 1: Diagrammatic representation of the working hypothesis; Microscale conditions mapped on aggregated and buffered angular choice

Initial results from the study case Bergen, Norway, indicate that a correlation exists between spatial configuration and microscale conditions. Through-movement (choice) and to-movement (integration) were compared with constitutedness, intervisibility and topological depth and a statistically significant correlation was found. Streets with high to-and-through-movement potentials on the local scale ( $R = 500\text{ m}$ ) have higher average microscale values than streets with low potential. In other words, along segregated streets, buildings tend to turn away from the street. Conversely, buildings along integrated streets tend to have a higher potential for interaction by having doors and windows directly facing the street. This increases the potential for interaction, natural surveillance and a sense of safety.

This research is aimed at investigating whether, in addition to spatial configuration, microscale conditions have an influence on pedestrian movement patterns. To that end, registrations of pedestrian movement will need to be collected. Subsequently, the data will be compared with microscale conditions to determine whether a significant correlation is present. If the data corroborates the hypothesis, it would be a first step towards a theory of sustainable natural movement that links both spatial configuration and microscale conditions to pedestrian movement patterns.

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## **The Global Spatial Properties of Neighbourhood Parks and Boulevards in the Tel-Aviv Metropolitan Area**

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Neighbourhood parks and boulevards offer many health and environmental benefits, and serve social functions like mobility, meeting diverse populations, leisure activities, and contact with nature. Use of open spaces is influenced by our perceptions of their quality (Ewing & Handy, 2009; Rofè, Zarchin, & Feierstein, 2012). The perceived quality of parks is related to their location within the urban network as well as their spatial configuration,

which can be classified respectively as their Global and Local Spatial Properties (Franz & Wiener, 2008; Knöll, Li, Neuheuser, & Rudolph-Cleff, 2015).

My study seeks to examine the impact of global and local spatial properties on the social functioning and personal benefits of neighbourhood parks and boulevards, to identify the particular influences of each, their potential influences upon one another, and how people's perception of park quality is related to these characteristics. To this end, I began by identifying all the parks in the study area and defining the size parameters of what a 'neighbourhood park' is. This preliminary definition produced a sample of 1015 parks, which I then categorized, using angular segment integration in various metric radii, according to their global properties. In the next phase of my project, I intend to select a more limited, representative sample of parks from this larger set, upon which to conduct a more detailed analysis of local spatial properties (based on Visual graph analysis (VGA) and isovists parameters) and examine their potential influence and its relationship to the global parameters.

In the first stage of my study, I mapped all the urban parks in the core area of the Tel-Aviv Metropolitan Area in Israel (TAMA). Using a division of all the parks into head/tail categories (Jiang, 2013), I ultimately selected parks ranging from 100 sq. m. to 4.1 hectares.

To determine the parks' global spatial categories, I used place syntax tools (PST) (Stähle et al., 2018) to analyse the urban network in a variety of radii, based on angular segment analyses of the road centre-line network, and performed a PCA analysis to determine which radii were most influential (Serra & Pinho, 2013). Open spaces can be integrated both on a smaller, local scale and within a larger urban system (Hillier, 1996), so it is important to examine integration at different scales (Krenz, 2017; Legeby & Marcus, 2011).

My analysis revealed two dominant or 'natural' scales, one smaller - at a radius of 250 m, and one larger - at a radius of 3000 m. Comparisons of each park's integration at these two radii produced four multidimensional categories (see Fig.1 A-B). I found that 37% of the parks are in low centrality at both the larger and smaller radius and 28% are in high centrality at both radii, while 35% are on segments with integration values that vary between radii.

An investigation of reachable parks using PST-Attraction Reach (Stähle et al., 2018) revealed that there are places in the TAMA where parks from multiple categories are reachable within an 800 m walking distance, and others where certain categories are inaccessible (see Fig.1 C). This raised questions related to social functions in these areas that will be examined further in the study.

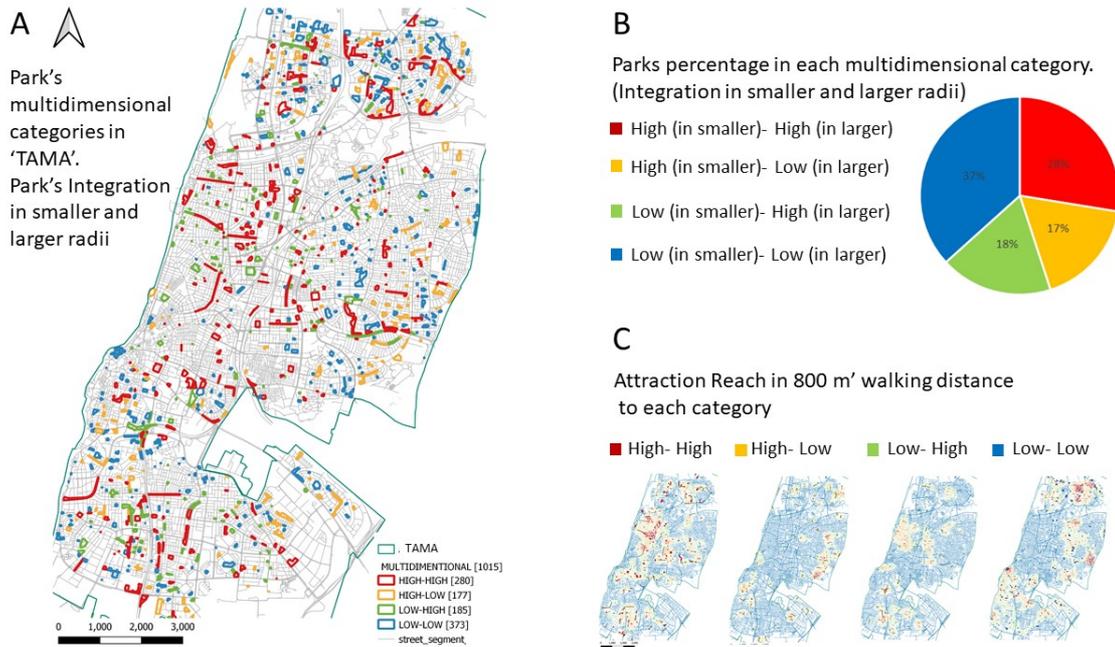


Fig.1- (A) Parks spatial patterns- divided to 4 multidimensional categories (high-low in smaller and larger radii). From these categories a sample will be selected for further research. (B) percentage of parks in each category and (C) Spatial pattern of Attraction reach from each segment to spatial parks category (high-high, low-high, high-low and low-low) in 800 m' walking distance.

## Impact of the Degree of Enclosure on the Use of the In-Between Spaces: Space Syntax Study from Béjaia City-Algeria

Salima Medjkoune

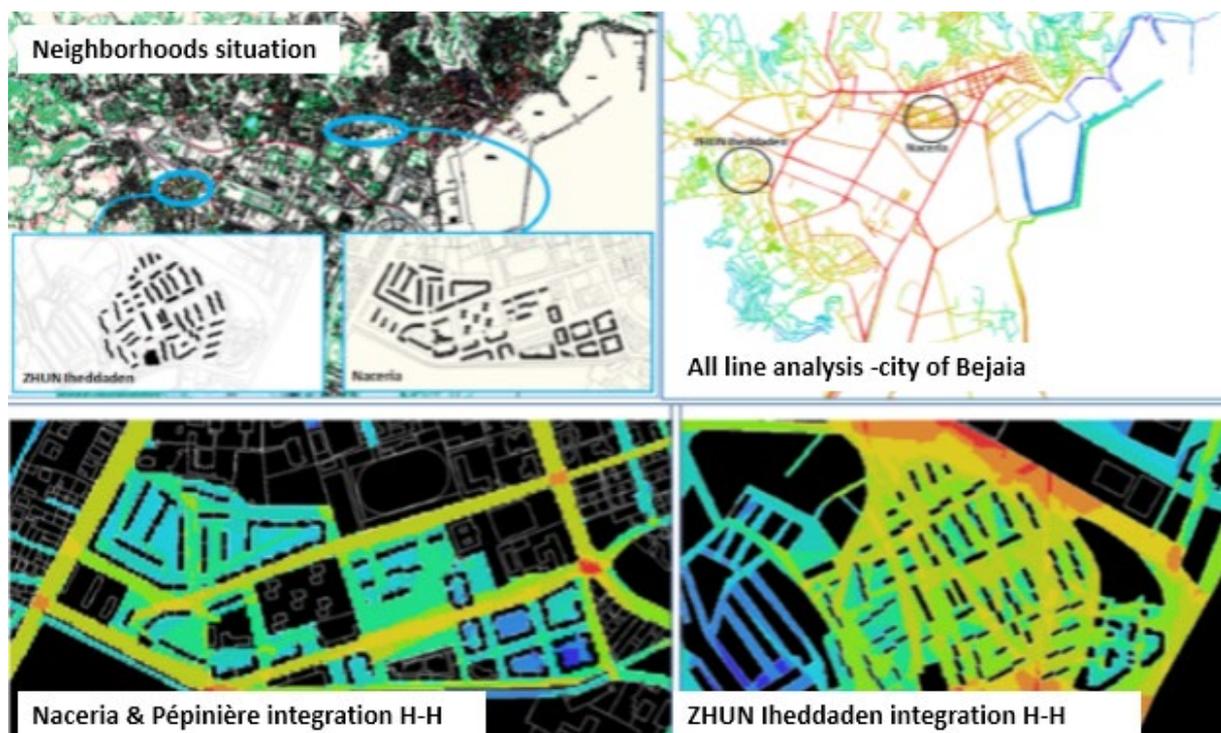
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Urban space is the void between and surround buildings designed for public, semi-public and private use. It consists of many categories of defined open spaces (parks, streets), though, between this latter and buildings arise an 'undefined' categories of spaces that are; *in-between spaces*. This work explores the idea that people's behavior, movement in and *use of spaces between buildings* are related to the visual field created by the *spatial configuration* in general and to the *degree of opening and enclosure* in particular. Past studies on *spatial enclosure* have shown that above all, *culture* influences the way people *perceive* and use an *open* or a *closed space*, and that people tend to prefer more open spaces to enclosed ones. Using *space syntax*, *in-situ observation* and a *questionnaire* as mixed methodology, this study makes use the *in-between spaces* of three different urban *neighborhoods* as cases study from Béjaia city to develop a better understanding of *enclosure degree* and *people use*. It focusses on the questions of how the *physical and the*

*perceived enclosure degree* impacts on *space use* and *social life* in the in-between spaces under consideration. The recent in-between spaces designed in the city of Béjaia, where the cases study are located, are ‘*undefined*’ categories of spaces between streets and buildings. Their *unequal use* contributes to making them as leftover and disconnected spaces within urban environment, instead of being spaces for social interactions that promote social sustainability.

Given that the aim of this work is to investigate the impact of the physical and the perceived enclosure’s degree, a multi-method approach was adopted. A spatial analysis software, Depthmap (*isovist & Visual Graph Analysis*), was used alongside a *snapshot observation* and a *questionnaire survey*. The data from the latter (questionnaire survey) was analyzed by means of a factorial analysis using SPSS. The data obtained from each part is compared and discussed.

The results show that the enclosure degree depends on many factors. The consideration of both physical and perceived enclosure degree present the real degree of enclosure of the in-between spaces. Based on the results certain degrees of enclosure promote a sense of ownership and control, while openness increases the frequency of use.



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## **Land-use network and social integration of older people: The socio-spatial 'embeddedness' of community-based elderly care facilities**

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**Keywords:** land-use network, social integration, elderly people, community-based elderly care facility

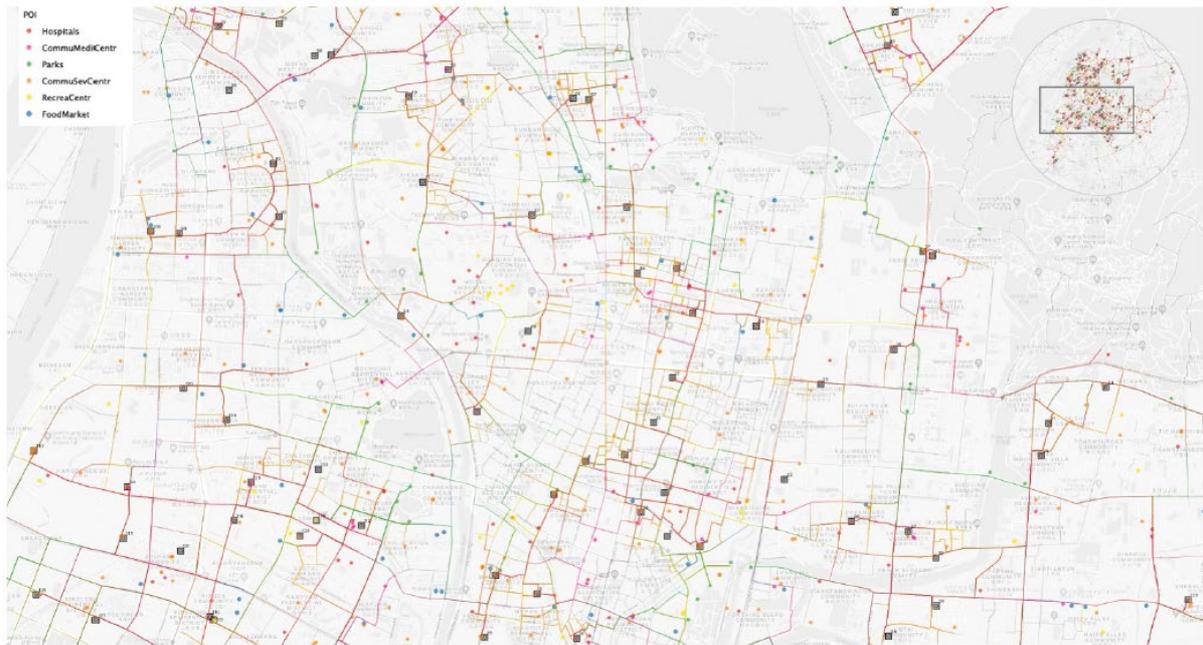
Community-based elderly care facility, conceptualised as a social model of care, is a worldwide prevailing model to tackle the problem of loneliness and social isolation brought by tradition medical model of care for the elderly (Menec, 2017). By spatially embedded into local communities, it aims to provide elderly people with not only necessary and

accessible medical care service, but also social support, which is helping maintain connections with their familiar local environment and social networks.

Compared to younger generations, older people's social life are more attributed to opportunities offered by their accessible physical environment (Lawton and Simon, 1968). It is well acknowledged that an important component made up of older people's sense of familiar local environment is the so called 'third places', such as retail stores, coffee shops, parks, community centres and etc (Cutchin et al., 2003). Local land-uses play a pivotal role in affording elderly people places for encounter and social interactions, which is the rationale underlying the idea of community-based elderly care (Corden et al., 1993, Reed et al., 1998).

However, most existing research on those care facilities focus only on building interior, little attention has been paid to evaluate the way how and the degree to which facilities connect with local land-uses, as well as their implication on older people's social integration. In practice, the complexity of community settings, and the spatial relationship between facilities and land-uses at a meso-scale are largely neglected by local authorities when distributing care facilities, which results in contradictory findings with respect to the social outcomes of implementing policy of community-based care (De Syllas, 1999, Wright, 1995). China is actively prompting community-based care to tackle the severe challenge of population ageing and improve older people's quality of life. During the past few years, over six million nursing beds were provided. Taking over 140 care facilities in the Chinese city of Nanjing as cases, as well as over 55000 land use points of different categories, this study develops a network-based model to quantitatively identify the patterns how and the degree to which care facilities are connected with or isolated from land-uses, thus considering the land-use network as an opportunity structure and indicator of facilities' community 'embeddedness'.

The rationale of the analytic framework in this study is built upon older people's health status and social interaction patterns. Both physical (meters) and cognitive (turns) distance are employed to formulate the spatial impedance indices between facilities and land-uses (Shen and Karimi, 2016, Turner, 2007), which corresponds to older people's physical and cognitive vulnerability of navigating. Land-uses points are categorised into two broad types, general commercial spots and preferred destinations, which corresponds to social interaction patterns of bring-visitors-in (on-site interaction) and attract-inhabitants-out (off-site interaction). Results of this study will demonstrate the overall distribution pattern of care facilities in terms of their spatial relationship with land-uses, and indicate that located within urban communities does not necessarily mean inhabitants of care facilities have close access to their familiar local environments and social networks. The analysis will also quantitatively illustrate how certain facilities might benefit older people with certain health status. The study contributes to a network-based analytical framework revealing the social potential of care facilities brought by urban land-uses. It makes the conceptual model of community-based care evaluable and sets the methodological foundation for further empirical studies.



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## Accessibility analysis of Green Network of Dhaka city: a syntactic approach

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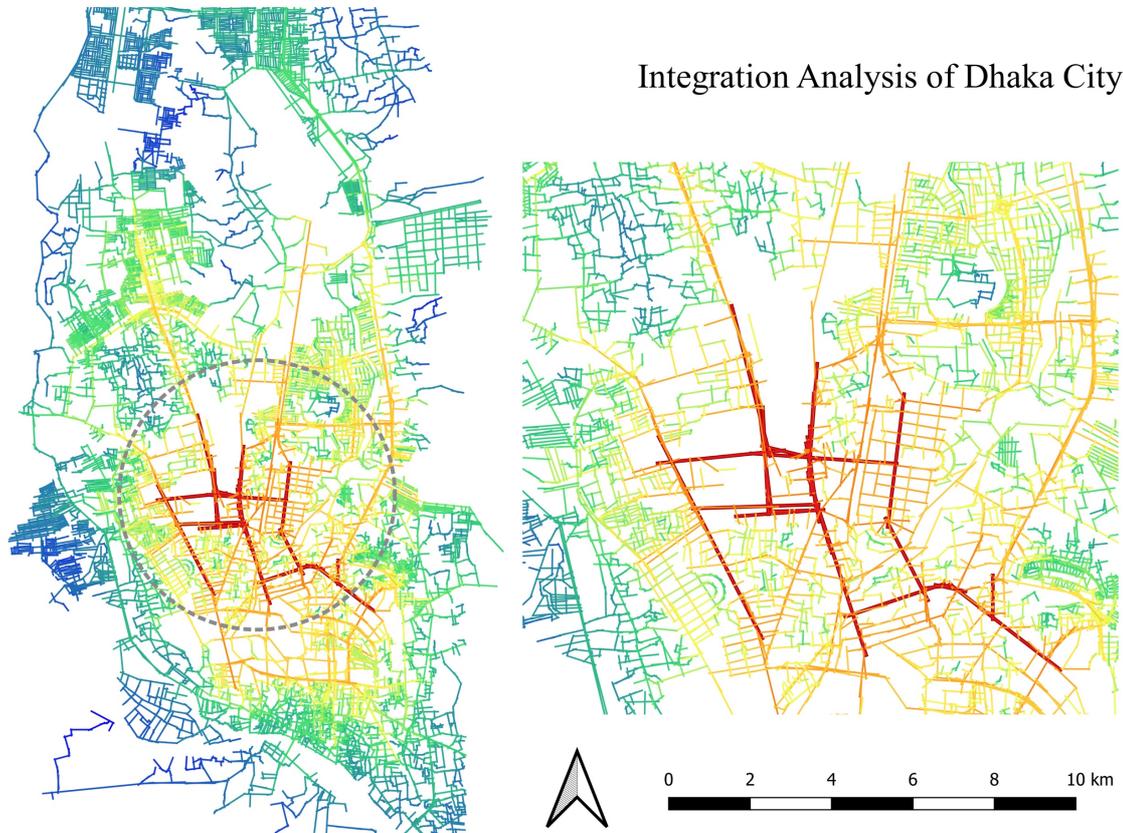
**Keywords:** Green network, Relative accessibility, Integration, Dhaka city and Space syntax

Introduction of a Green network in Dhaka city has potential to create a connected network of its existing green spaces and greenways for pedestrian use. Over and above an environmental enrichment, this seems essential to improve the city's liveability by enhancing public functions, recreational activities and social interactions of the urban dwellers. In rapidly urbanizing cities like Dhaka, it is high time to analyse how to create a well-connected layout with which all public green open spaces will be connected ensuring pedestrian accessibility and should be highly integrated within the whole city grid. Accessibility is one of the key criteria to ensure the successful utilization of a multifunctional green network for a city. It is important at two scales - the city as a whole and to its immediate surroundings. The relative ability of all the existing links need to connect the spaces both to the city as a whole and to the surroundings to achieve an appropriate balance between permeability at the city wide and local scales.

Most previous researches assess the green open space as an isolated entity without connection to surrounding spatial morphologies. For green network planning, the attractiveness of the open space alone is insufficient to account for its access and use, it should be determined by their permeability and visibility quality within the urban fabric. The conventional walking distance notion cannot mirror the relationship. There needs a precise description of how open spaces are spatially embedded in the overall urban layout, or how their location and connection with pedestrian networks creates different conditions for the people to access and use the space. Therefore, a question can be raised is how accessibility of green network can be appropriately defined so that it can become a practical criterion in both research and practice. Under this situation, the study suggests that the theory and methods offered by Space Syntax (Hillier & Hanson, 1984; Hillier, 1996) may provide an appropriate theoretical framework and analytical means for accessibility. It states that movement patterns in cities arise naturally from the way the street network organizes the simplest routes to and from all locations involving the fewest changes of direction (Hillier et al., 1993; Penn et al., 1998).

To formulate an accessibility framework, this study synthesizes the findings of previous studies on relevant subjects; and the accessibility is described here mainly in terms of its permeable and visual links with overall urban layout. The study then models the pedestrian network of Dhaka 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 and the distribution of a selected spaces to indicate their location in the complex larger system and their association with surrounding pedestrian networks. The main result of this study emphasizes the role of integration as a key factor of Green network accessibility. The findings are expected to not only shape a new approach to investigating accessibility-related issues in urban design fields, but also reveal various data

that can be used to improve the efficiency of open spaces in Dhaka and other similar urban environments.



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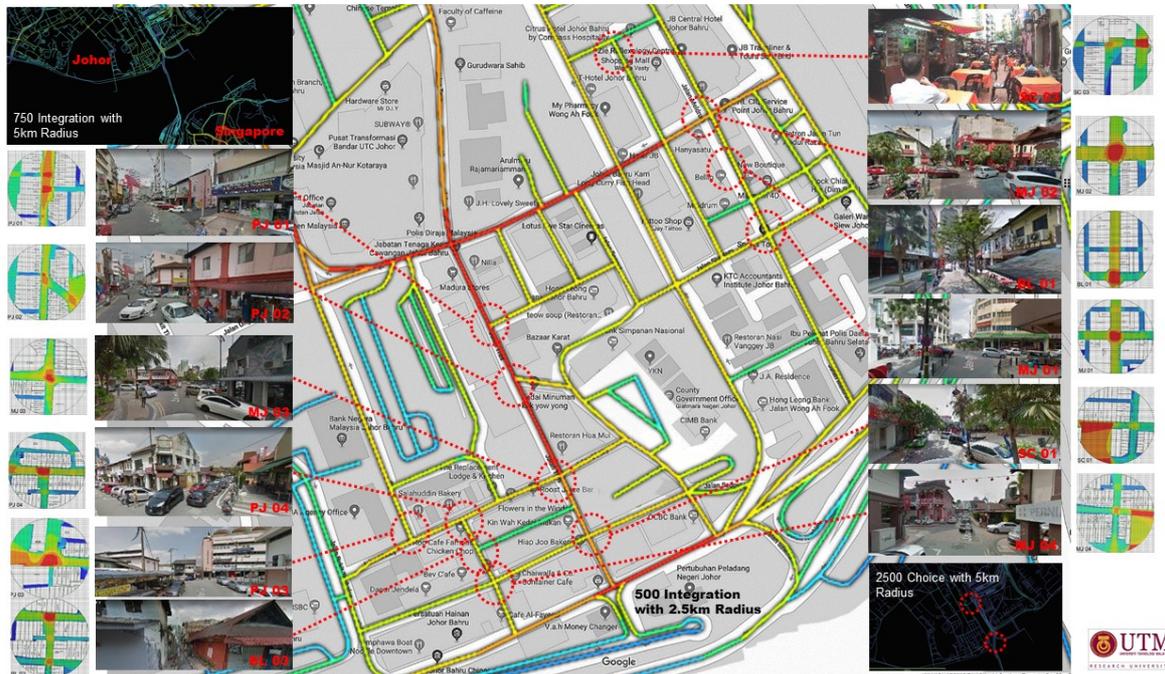
## Pattern of Stationary Activities in the Spatial Networks of Johor Bahru Heritage District, Malaysia

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**Keywords:** Spatial Networks, Static Activities, Visual Connectivity, Space Syntax, Street, Malaysia



Street livability has been highlighted as one of the most important keys for the sustainable development of the city. However, several developing countries struggled to understand the concept of liveable city as the process of reclaiming back the streets for pedestrians, especially at the heritage district, is still a never-ending process.

This study aims to understand the distribution pattern of static activities by the evaluation of spatial network analysis with consideration of explanatory syntactical diagrams. Johor Bahru is one of the fast-growing cities of Malaysia and could be regarded as the dual city of Singapore like Shenzhen of Hong Kong. Since independence, Johor Bahru has currently undergone a socio-spatial transformation and resulted in the decline of the old centre and suburban sprawl. Therefore, the study chose Johor Bahru city as a case to understand the genesis of life between buildings with regards to street nodes.

From literature review, the concept of liveable street nodes through understanding of spatial networks was proposed.

- 1) This study produces the relationship among the agglomeration of stationary activities with the hierarchy of spatial networks and the visual connectivity values.
- 2) This study examines the overall spatial network values with the occupied visual connectivity spot and socio-physical element of street nodes.
- 3) This study synthesizes the adaptable street livability framework through street node spatial configuration.

Space-syntax methodology utilizes a mathematical representation of streets and open spaces to quantify its hierarchical position within a street network. Despite some continuous debate in its methodology, space syntax has gained a considerable amount of

scholarly recognition, backed by empirical evidence that supports its use as a reliable tool for describing static activity patterns. In this study, the location for 2389 total static activities were mapped out from 12 street nodes in Johor Bahru city. The regression models were created to explain the distribution of static activities was compared with the spatial street integration values. Each location of static activity was carefully measured and distributed exploratively according to the street node visual connectivity and socio-physical elements. The relationship framework was created among the distribution values of visual connectivity in street nodes (Visual Graph Analysis) and spatial networks of streets (Segment Analysis).

It was found that the stationary pattern of people was affected by the spatial network of street and the visual connection amongst the pedestrians in street nodes. The previous street liveability depended on environmental conditions, type of business and element of landuse. The results show several significant relationships among the socio-physical element, the presence of static activities of people between buildings with the spatial configuration of the street node itself. Finally, the spatial configuration of the street and the environmental condition has several connections with the numbers of static activities and the previous intention of the city planner.

Street designers, city planners and the authority could significantly be able to develop better liveable streets by learning the creation of spatial livable framework based on the knowledge of spatial networks.

## **NOWY SĄCZ: STORY OF A CHANGING CITY – a space syntax historical analysis of a network of public spaces**

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Situated in southern Poland, Nowy Sącz has 80,000 residents. It was founded in the Middle Ages, but did not develop very dynamically until the late 19th century. A railway line from Tarnów to Budapest, completed in 1876, was an important driver of its growth. Stephen Báthory Avenue is an impressive landmark in the city. It is a monumental artery (for a town of this size), connecting the historical center with the railway station. The Nowy Sącz rail junction's growth paved the way for a modern railway neighborhood, resembling in many ways a garden city. It was developed until the First World War in 1914. Fundamental guidelines for urban planning and architecture were set in an 1870 resolution of the City Council. It divided the urban space into three zones: the central zone, which generally overlaps the Medieval town; the ring of historical suburbs; and the outer zone, which included rural areas and an informal rural layout and modern streets. The next stage of its

growth involved incorporating adjacent municipalities after the Second World War and constructing large, multi-family developments.

A space syntax analysis of historical maps will help understand the urban space's growth and development structure. Characteristics of urban streets yielded by the analyses may be employed to propose and test hypotheses for past urban movement, convergence points, and socioeconomic activity patterns. It can, in turn, help interpret other historical source materials to build a comprehensive picture of urban spatial culture.

Axial maps of street networks will be developed using current and historical city plans (1770, 1845, 1917, 1930, 1955, 1990, and 2020). Space syntax methodology will be employed to measure Integration (HH), Connectivity, and Choice for each stage of the city's spatial development.

The results indicating areas of the highest integration value will be verified against historical studies. A strong correlation will be demonstrated between the foci of urban life of super-local reach and their places in a growing city's structural network.

The innovative space syntax toolbox – with its interdisciplinary approach to research on the urban development history of Nowy Sącz during the 19th and 20th centuries – emphasizes several essential issues: directions of the city's development, city typology, patterns of movement, and foci of urban life. Clear space syntax visualizations make it easier to present and explain the mechanisms and processes taking place in the three spatial dimensions, as well as a fourth: time.

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## **Acquisition of road networks for ancient cities as a significant factor influencing the results of Space Syntax analyses**

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The theory of Space Syntax is based on the configuration of space and the relationships that exist between its components. Its assumptions have been proven to be useful not only for modern, but also for ancient cities which have long ceased to exist and the knowledge of them is often hypothetical.

This paper addresses issues that have appeared at the beginning of the research project “MA-P Maloutena and Agora in the layout of Paphos: modelling the cityscape of the Hellenistic and Roman capital of Cyprus<sup>1</sup>” implemented by the Jagiellonian University, Warsaw University and Warsaw University of Technology. The main goal of the presented research is to investigate the impact of the network model adopted on analysis results. The research has been carried out on several ancient cities i.a.: Olynthus, Priene, which are characterised by a regular streets grid, following the Hippodamian layout.

The first step of the street network modelling in Space Syntax is to generate an axial map that represents the study area (Yang, 2019). Based on the published city plans (Cahill, 2013; Dietrich, 2016), the urban network structures of ancient cities (such as Olynthus and Priene) were translated into vector axial maps in the ArcGIS Pro software. The process of drawing axial lines was performed manually and a few principles described in the papers (Dettlaff, 2014; Yang, 2019) were applied during the vectorisation.

Despite the fact that similar analyses with the use of Space Syntax tools were performed for ancient cities such as the Roman town of Falerii Novi in Italy (Battistin, 2021) or the Hellenistic city of Priene (Al-Sabbagh and Gorgees, 2019), the impact of the network modelling on the results was not studied in the context of ancient cities.

Different types of Space Syntax analysis (axial and segment analysis) have been applied to a set of selected ancient cities (Figure 1). The analysis of the parameters such as: connectivity, integration or choice allowed to formulate the conclusion that the input data form are of great importance and that the step of constructing axial maps is an important component in the whole process of spatial analyses. This is especially important, when results of the application of Space Syntax methods should allow the identification of spatial patterns and the assessment of the probability of hypotheses for the assumptions of urban structures, for

instance what type of urban structures could function in different parts of the city, or what is the most beneficial location of key structures or features of ancient cities.

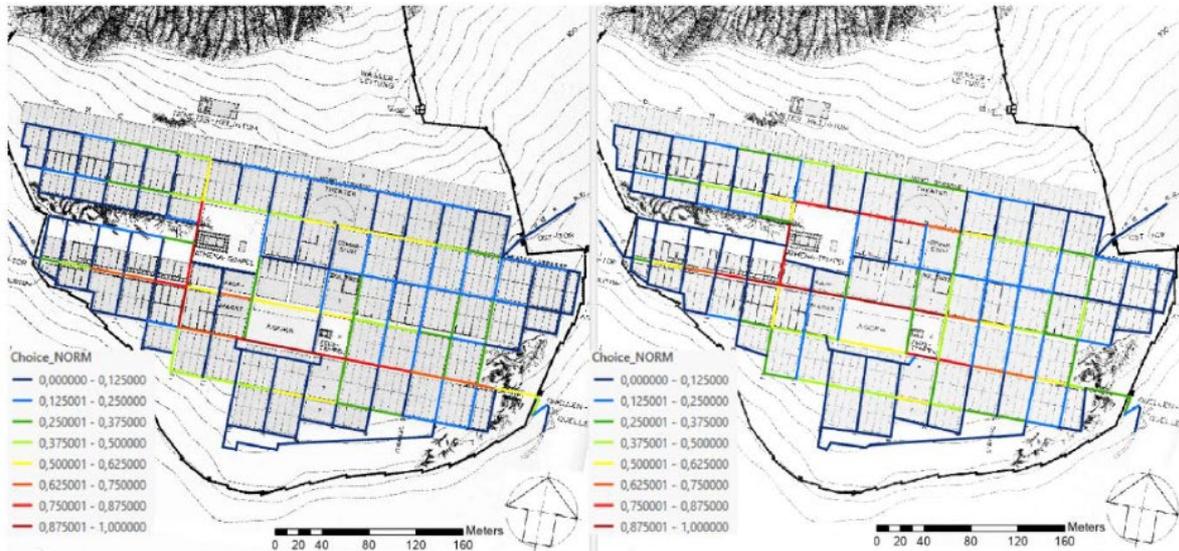


Figure 1 The result of Space Syntax Analysis (Segment Map)– normalised values for the CHOICE factor of Priene City. Both maps are the result of the axial map (drawn manually – left image and automatically generated – right image) conversion to the segment map. The analyses were performed using Depthmap software.

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## Variations of school yards over time in relation to urban principles

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**Keywords:** School yard, school, urban principles, urban morphology, configurative measurements

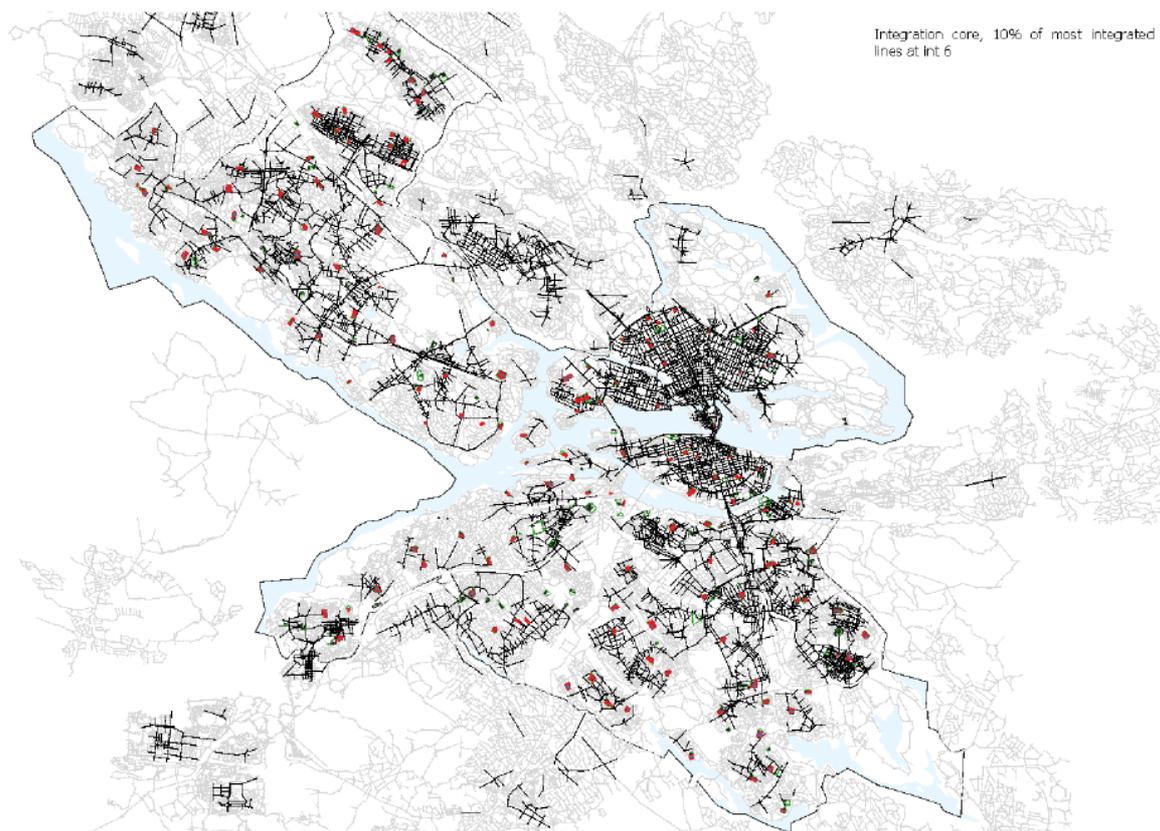
Lately school yards and specifically the size of school yards has become a highly debated topic in Sweden, with reports on the size of school premises shrinking from year to year (2018, Statistiska Centralbyrån), or schools even being built without outdoor yards, not reaching national recommendations.

The children benefit from school yards in health, concentration and physical activity. School yards may also have positive effects from an environmental perspective when they are designed with greenery and permeable surfaces. As the school yards become smaller they become less functional both from a use and from an environmental perspective.

The paper "Schools at front row" by Legeby et al serves as a starting point for a study of elementary schools in Stockholm municipality. The aim of this paper is to further study the questions raised in that paper "...to what extent and how are schools visible? What urban logic follows their location and the implications this may have for everyday life and social processes" (Legeby et al 2019, p 2). Adding to these questions concerns regarding the school yard. To what extent do school yards meet the recommendations? How has the position of the school in the neighbourhood changed over time? How has this influenced the character of the school building and the size and quality of the school yard?

My study includes 160 elementary schools in the municipality of Stockholm, primary with examples from the urban expansion in early 1900 and forward. With an axial map of Stockholm and data from Stockholm municipality and Statistics Sweden the analysis will be done. The size of the school yard and the size of the yard in relation to the size of the school building will be analyzed. In addition, it will be highlighted when the school was built, what urban design principles were present at the time as well as configurative properties in order to capture the location of the school in relation to its neighborhood surroundings. The configurative measures used will be integration core and intelligibility (Hillier et al 1983, Peponis 2017). Integration core may tell about the location and visibility of the school and intelligibility will show how easy the schools are found in the urban network. From this, answers may be drawn about how the position of the school in the city has changed over time and if the size of the building and yard is influenced (Bacharel et al, 2017). Based on these analysis together with the identification of changes in urban morphology, a selection of representative schoolyards will be studied more closely, regarding their placement and relation to the urban fabric.

The study will result in a long time perspective showcasing how changing urban principles locates schools in the city. The historic perspective will also bring forward the varying qualities, amongst others yard size and greenery, which are still found at schools today. These findings can inform contemporary school design and shed light on the debate about shrinking school premises.



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## **Swinging between the “medieval” and “western” characteristics. What can Space Syntax tell on how we construct our suburbs. The case of Prague’s hinterlands.**

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**Key words:** Suburbs; post-socialist; Prague; new versus old; Space Syntax

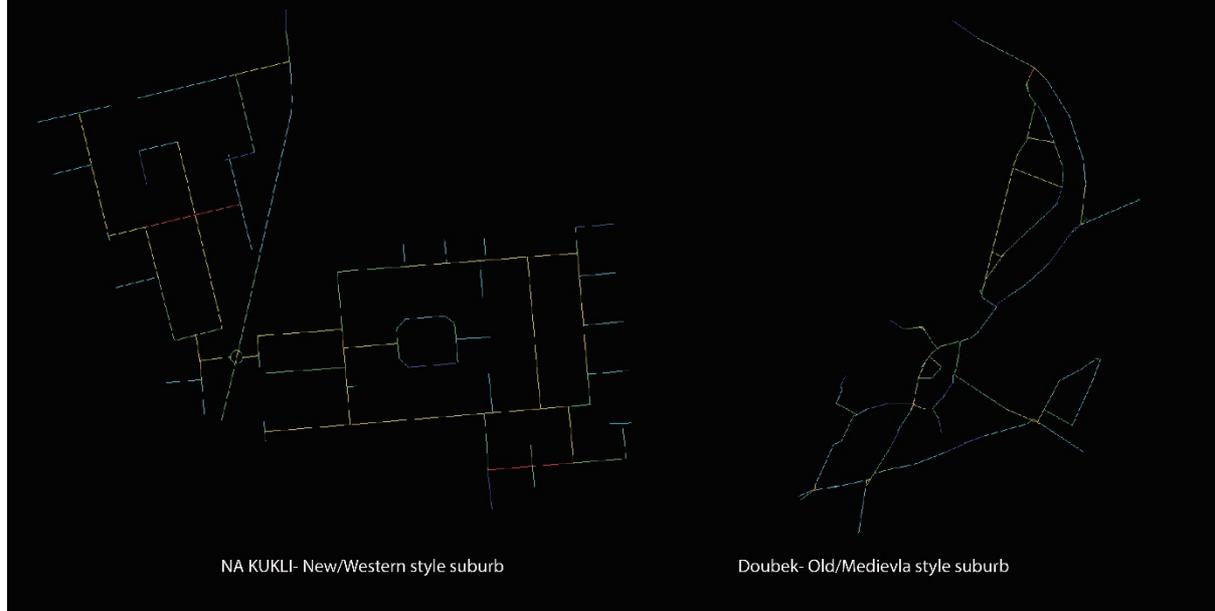
Residential areas constitute the environment in which society is born and developed, where the first social ties beyond the familiar ones are made and the initial centre from where the world is seen. An example is the suburbs, which are becoming not only a key residential area but also a main transformation process of the landscape (Špačková and Ouředníček, 2012). Especially in post-socialist countries (Ouředníček, 2007; Sýkora and Ouředníček, 2007; Leetmaa and Tammaru, 2007) including Czechia (Sýkora 2002; Ouředníček, 2006; Špačková et al., 2016), causing changes in the social and physical aspects (Ouředníček, 2003). This context makes the study of their environment (social and physical) important for understanding social and territory development. Nonetheless, suburbs are lacking in conceptualizing comprehensive research of both environments. This has to do with the critical perception of the suburban physical environment, especially in terms of their urbanistic features (Hnilička, 2005; Temelová, 2008). However, a calling for a change regarding the way suburbs are seen in urban theories has started on the global scale (Keil, 2017) and needs to be reflected in the Czech research too.

The Czech medieval settlement network which accommodated suburban waves in the beginning is changing. New forms of suburbs are appearing, compromising the network and landscape development. There is concern regarding their negative impact on social, agricultural and connectivity aspects. Creating a negative perception of the areas in a moment where they have become the trend location for young families and commuters to Prague (Špačková and Ouředníček, 2012).

Suburban physical environment especially is being “crucified” as unencouraging towards social development and spatial mismatches. The concerns mainly regard their physical form, connectivity and facilitation of movement and socialisation. We believe that spatial configuration can influence the physical and social life of its residents and daily users (Vaughan and Penn, 2006). Therefore, we use Space Syntax methods and tools to understand human behaviour through the suburban spatial structure.

Through this contribution, we will present our work results on the differences between the “new/western” and “old/medieval” style suburbs in Prague’s hinterlands. We ask: What are the differences between the “new” suburbs and the “old” ones when it comes to connectivity and accessibility? Is there any difference in people’s behaviour and movement? What influence has spatial configuration on the social aspects of life (in terms of conditioning and facilitating socialization, quality of life, etc.)? As part of a bigger project, these analyses will help in understanding the relationship between the physical and social environment in suburban areas (Penn and Turner, 2001).

Comparison analysis of Connectivity between the two types of suburbs in Prague's hinterlands



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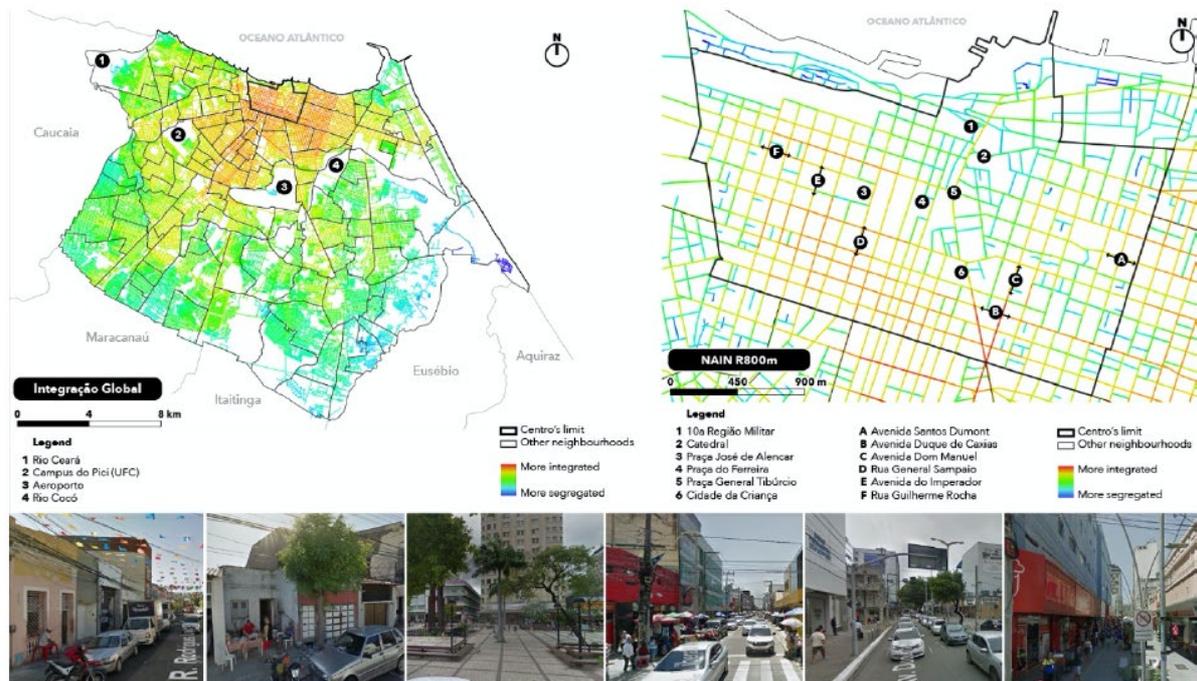
## **The pursuit of urbanity in traditional town centres: the case of Fortaleza**

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This research addresses urbanity in traditional town centres by articulating spatial variables, land use and density to identify how their combination may affect the appropriation of public spaces. In this study urbanity means a quality of the urban space marked by activities of movement and permanence; by diversity of use, buildings and people; by relations of copresence and co-awareness; and by smooth barriers between public and private spaces (Jacobs, 2009 [1961]; Hillier, 2007 [1996]; Holanda, 2013). Urbanity does not simply refer to people agglomeration in public spaces. It is associated to environmental qualities that allow cordial relation among residents and visitors in daily activities, enriched by the possibility of encounter, socialisation and leisure as people meet people at random. Furthermore, the sense of safety in urban space is an important aspect to this experience. Since urbanity is affected by a group of variables present in space, as a phenomenon, it doesn't manifest in a continuous and homogeneous way, but as a spectrum, with different intensities and combination of elements. In this context, a set of variables will be analysed: spatial properties of the urban grid, land uses, density, blocks and plots' shapes and building interfaces' types. The study stems from the idea that conditions of urbanity are affected by centrality and movement through the spatial configuration (Hillier, 2007). The research is based on the case of Centro, a consolidated central neighbourhood in Fortaleza, Brazil. It is a dense area, predominantly marked by an orthogonal urban grid, and one of the most highly accessible parts of town. This spatial configuration reinforced its centrality over the years, which, in turn, acted on the real estate dynamics, changed the land use by attracting commercial activities to its central core, pushing other uses towards the neighbourhood's limits. Urban animation can be observed in spaces marked by diversity of uses and located in highly accessible areas. However, this doesn't necessarily mean an experience of urbanity. For this reason, this research intends to differ the concepts of urbanity and urban animation. The study involved the development of georeferenced land use maps, based on data collected at the field, which were related to axial and segment measures of accessibility as well as to data about the interfaces connecting building interiors and open collective spaces. By analysing these variables and their combination it is expected to understand how urbanity can be manifested and sustained to contribute with directives for urban interventions in traditional town centres.



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## **The syntax of streets and retail business transformation: A case of downtown Eugene, Oregon**

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This study examines the relationship between retail business structure and street configuration in downtown Eugene's (a city in Oregon, USA) retail core. The study area is termed the "Retail Center/Core facilitated by the Pedestrian Mall" (RCPM). It was a part of the City's federal urban renewal program implemented in the late-1960s, called the Central Eugene Project or CEP.<sup>1</sup> Although the CEP successfully achieved several of the original goals

by the early-1980s, the pedestrian mall strategy to revitalize the downtown core “failed,” and the mall was taken out. On this note, the investigation period is between 1978 (one of the successful years) and 1985 (start of decline).

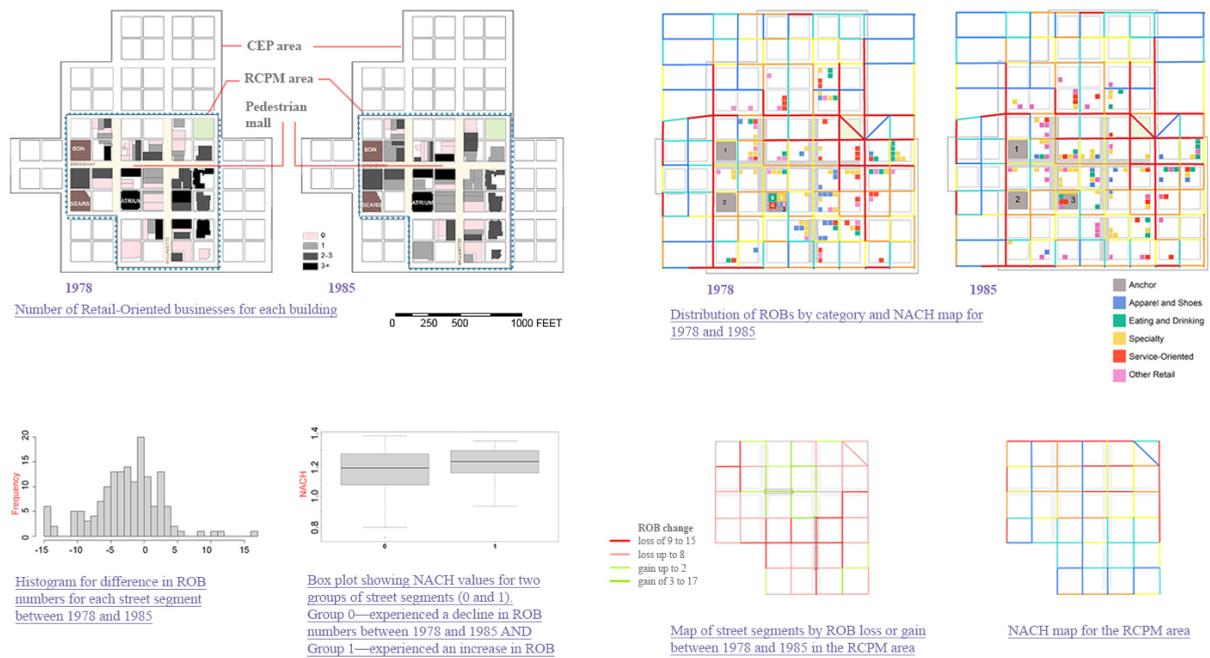
The primary question addressed in this study is, “is there a significant difference in space syntax measure for the two sets of street segments that experienced a loss or gain of retail business numbers?” This research is based on one of space syntax’s central contentions—also known as “movement economies”—that the structure of the urban grid, land/economic distribution, and densities in historically evolved cities are always related to each other, all governed by humans’ natural movement, which in turn is influenced by the urban grid or the street system.<sup>2</sup> This structuring of land use then generates a multiplier effect, which in turn affects the movement, and this cyclical process is key to the way cities are structured.

This investigation uses the Welch Two Sample t-test analysis. The explanatory variable was NACH (normalized choice) measure for the street segment for 1978, while the dependent variables were related to the number of Retail-Oriented Businesses (ROBs) along those segments. The two groups which defined the two sets of street segments (dependent variables) are-

1. Group 0—street segments with a decline in ROB numbers between 1978 and 1985
2. Group 1—street segments with no change or increase in ROB numbers between 1978 and 1985

Of the 77 street segments within the RCPM area, twenty had gained businesses; six did not experience change; and fifty-five lost businesses. Thus, twenty-six were in Group 0, and fifty-one were in Group 1.<sup>3</sup> According to the t-test results, NACH vs. ROB differences had a p-value of 0.038 (i.e.,  $< 0.05$ ), signifying a significant difference in the mean values between the two groups.<sup>4</sup> Additionally, the mean value for NACH for Group 0 was 1.2497, whereas Group 1 was 1.287.

The results suggest that for street segments that lost or gained ROB between 1978 and 1985, the choice measures were significantly different. Additionally, street segments that experienced a decline in ROB numbers between 1978 and 1985 had significantly lower mean values for NACH than the street segments that experienced gain. Furthermore, this points to the phenomenon that ROB numbers generally declined along segments with lower potential to support through-movement or short trips through the system, whereas ROB numbers generally did not change or increased along segments with higher potential for through movement.



1. In addition to the pedestrian mall, other components of the CEP were Auditorium, Hotel, Conference Center, A Commercial Center, and Parking Garages. The pedestrian mall component aimed to make the downtown core more inviting and revitalize the retail core. One important consequence of the urban renewal was the destruction of a large portion of the existing fabric and therefore a major transformation of the area's morphology (building and retail business structure).
2. Bill Hillier, "Cities as Movement Economies," *Urban Design International*, 1996.
3. A total of nine segments that were outliers in terms of NACH values were taken out. NACH, because only that syntax measure showed a near to significant p-value.
4. Other values were—t-statistic = -2.122, df = 66.416; 95 percent confidence interval: -0.074312546 to -0.002271164

## Analyzing the relation between drug crime spots and street connectivity and accessibility

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**Key words:** drug crime, street network, axial map, control, connectivity, integration

What is the preferences of criminals for committing an offense in a particular location? Criminologists, urban designers, and architects are constantly trying to predict those locations. Criminologists associate crime with socio-demographic factors such as income, racial composition, youth concentration and level of education. A considerable body of research has examined the relationship between the occurrence of criminal events and spatial configuration as measured by space syntax methodology. Research findings have shown that crime, in particular property crime, tends to cluster in segregated areas.

Architects and planners on the other hand, relate crime to environmental design factors such as lighting, target hardening, or orientation of entrances, just to name a few. Recently, some work using space syntax has demonstrated statistical relationships between properties of spatial layouts and the occurrence of certain types of crimes. In this study, Space Syntax measures of accessibility are used to examine road geographical patterns of one types of crime: illegal drug crime. Crime data, at an address level with the exact date and time, is based on a 2 months period for the city of Dhaka, in a particular location i.e. Chawk Bazar Police Station including its bit map area. After mapping crime locations using GIS, an axial map was prepared. Syntax measures of street accessibility and visibility characteristics were examined in relationship to instances of crime area. This paper reports on initial findings from research investigating the spatial distribution of illegal drug crime in these area. The physical location of more than 100 incidents of drug dealing were pointed out in the whole bit area. The main focus was on testing the hypothesis that drug dealing is likely to happen close to facilities that inherently and routinely generate a large flow of people. To do this, the space syntax methodology of predicting movement flows in the urban environment was employed. Basic tool used in this paper is Space Syntax methodology. Integration (HH), control and weighted optimal local choice levels of streets at reported locations are considered while using the space syntax methodology. Aim of the paper is to identify the spatial attribute of drug crime locations for helping urban planners, designers and crime control authorities to identify crime zones easily for acting proactively rather than reactive. The results showed that factors such as integration, control and connectivity doesn't have any significant in the most frequent area where the crime occurred. Further analysis on socio-economic and demographic analysis is needed to realize the actual cause.

## **From dissident to deviant... A genealogy of 'terrorism' in Northern Ireland, 1969-1981.**

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My PhD employs space syntax tools to assess the British Government's mid-1970s 'criminalisation' policy in Northern Ireland. 'Criminalisation' was part of a group of measures adopted by the British Government, in an effort to regain control over the direction of the Northern Ireland 'Troubles'. Under this policy, the violence of Troubles paramilitarism was described as 'criminality' and 'terrorism' – rather than 'political' violence. The distinction between criminality/terrorism and political violence was a discursive distinction: intended to deprive paramilitary groups of legitimacy, and (thus) expedite their exclusion from the conflict.

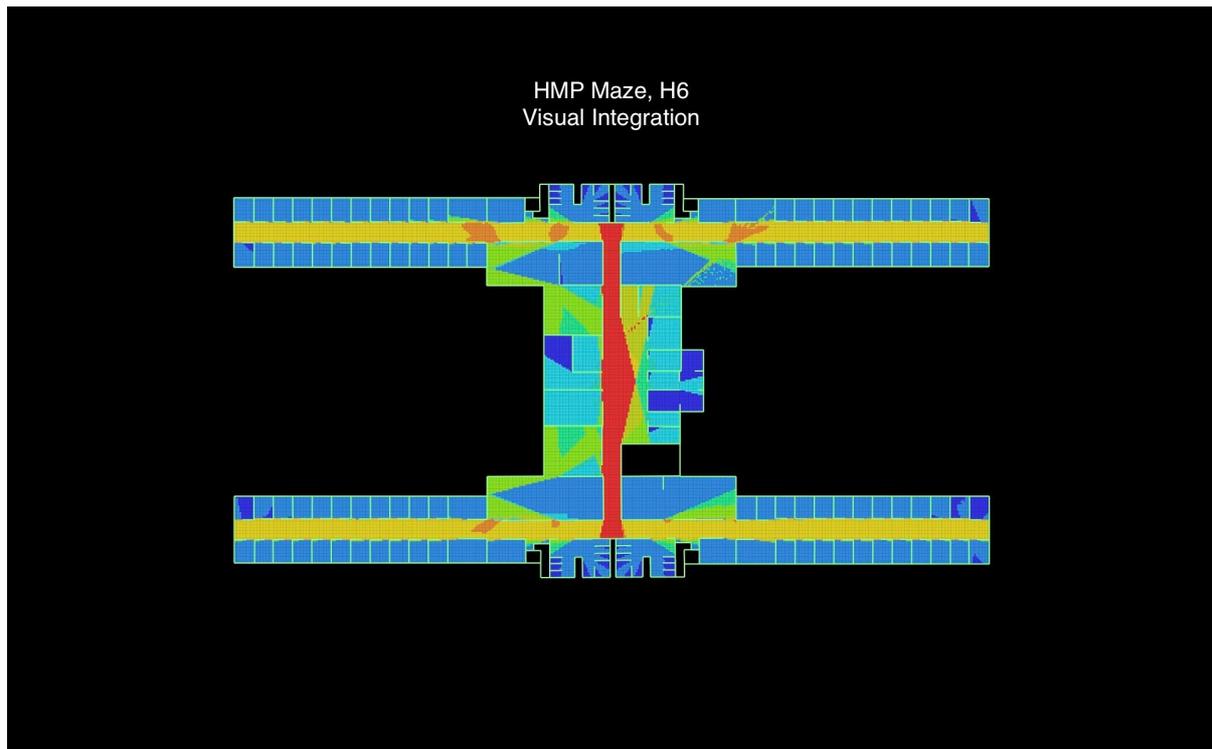
I am conducting a discourse analysis of 'criminalisation', informed by the conceptual insights of Foucauldian 'genealogy'. Part of this discourse analysis involves an assessment of

criminalisation's *spatial realisation*. As Fontana-Giusti argues, Michel Foucault's understanding of discourse is always 'spatially articulated' (Fontana-Giusti 2013, 36). Indeed, Foucault encourages us to think of space as 'an element of support' for discourse: manifesting 'a certain allocation of people in space, a *canalisation* of their circulation, as well as the coding of their reciprocal relations' (Foucault 2010, 253).

This is certainly true of the criminalisation policy in Northern Ireland. Criminalisation's principles were expressed through spatial innovations in Northern Ireland's prisons infrastructure, and in its urban environment.

Firstly, criminalisation involved the construction of new prisons for male and female paramilitary inmates: HMP The Maze, and HMP Maghaberry. These prisons differed from Northern Ireland's Victorian-era prisons, and its more recent Troubles-era internment/POW-style 'camps'. Firstly, in their spatial design; and, secondly, in their location within the landscape. In my research, I use space syntax methods to explore this divergence between old/new prison forms. My aim is to explore measures of integration/segregation (at the level of *internal* architectural plan, and *external* place in the environment) to understand criminalisation's discursive rules: including the disempowerment of paramilitary inmates' control over prison space, and their isolation from the wider body politic.

Secondly, criminalisation involved the securitisation of the urban landscape in Northern Irish cities. Most particularly, the disruption of the city network through roadblocks and 'peace walls', which separated nationalist and unionist communities within the cities of Belfast and Derry. Around 14 Berlin Wall-style barriers were erected in Belfast during the 1970s (Community Relations Council 2008, 12–20). These barriers separated predominantly 'Catholic' areas from predominantly 'Protestant' areas. In so doing, they materialised a key element of criminalisation's conceptual rationale: that Northern Ireland suffered a 'communities' problem. The notion of Northern Ireland as divided between two communities is a long-standing one – and one that perpetuates the likelihood of conflict (Vaughan-Williams 2006, 521). Again, I will use space syntax tools (and measures of integration/segregation) to explore the progressive 'slicing-up' of Belfast's urban network. I hypothesise that peace wall installations incrementally entrenched the idea of Northern Ireland as a 'troubled' society within the urban landscape: segregating pre-theorised Catholic/Protestant communities; and, thus, fulfilling (Oedipus-style) one of the central conceptual frames for understanding Northern Ireland's violence.



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## Case study of Limassol city in Cyprus

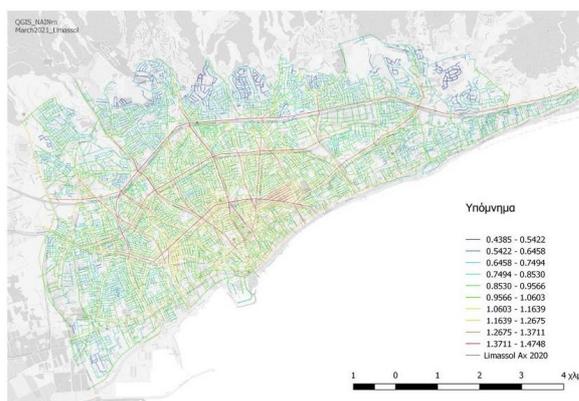
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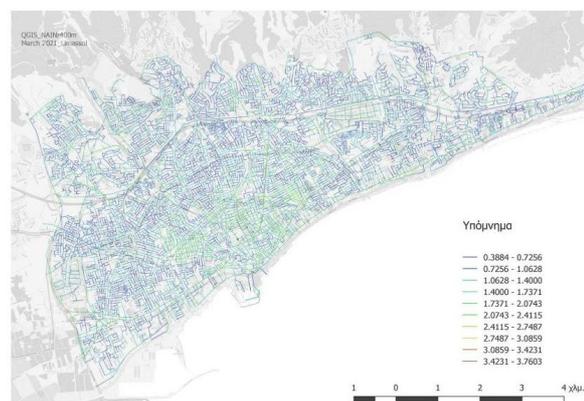
**Keywords:** space syntax, spatial integration, spatial accessibility, urban segregation

My research focuses on the phenomenon of ethnic diversity in contemporary cities which is often discussed in relation to the phenomenon of urban segregation<sup>1</sup>, especially in public spaces of a city, where the social life of different and diverse groups unfolds<sup>2</sup>. Urban segregation is admittedly a multidimensional and complex issue<sup>3</sup>, since it has social, political, economics and spatial dimensions.<sup>4</sup> The research aims to address spatial and temporal dimensions of urban socio-spatial inequalities, in order to understand the ways in which urban form influences social phenomena, such as urban segregation, and vice versa.

As Massey D. (2005) said, the space is always under construction, is a process that never ends and never close. The spatial dimension of a city is a product of relations – between, relations which are necessarily embedded material practices which have to be carried out, it is always in the process of being made.<sup>5</sup>The space syntax theory (Hillier B. & Hanson J. 1984),<sup>6</sup> is a combination of theories and procedures that analyses the spatial configuration of a city in different scales. It is a very important analytical and theoretical tool to find out the most segregated or most integrated parts of the city. The space syntax analysis includes the spatial layout of a city in a relation with social, political, economic and environmental issues of a city. The functions of a city usually include patterns of movements, awareness and different interactions of social life, density, land uses and land values, urban growth and societal differentiation (Hillier& Hanson,1984). The space syntax theory is an analytical and methodological tool, that can help the research to find out the representations of space, the spatial relations and can produce interpretive model by spatial and socio-economic phenomena, and also theories about all the socio-spatial relations that evolving in a city. By using space syntax analysis and analytical requirements of axial lines map and segment maps<sup>7</sup> on the street network of a city, you can find out the degree of spatial accessibility and permeability of a specific area in a relation with the whole city.<sup>8</sup>



Normalised Integration Analysis  $r=n$  \_ global integration (whole city)



Normalised Integration Analysis  $r=400m$  \_ local integration

Space syntax analysis \_ Case study of Limassol city in Cyprus \_ March 2021  
 Normalized Spatial Integration analysis \_ Global ( $r=n$ ) & Local ( $r=400m$ ) spatial integration\_  
 Differentiation of scale\_

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## The impact of visibility properties on the itinerary choice between men and women in the city of Biskra

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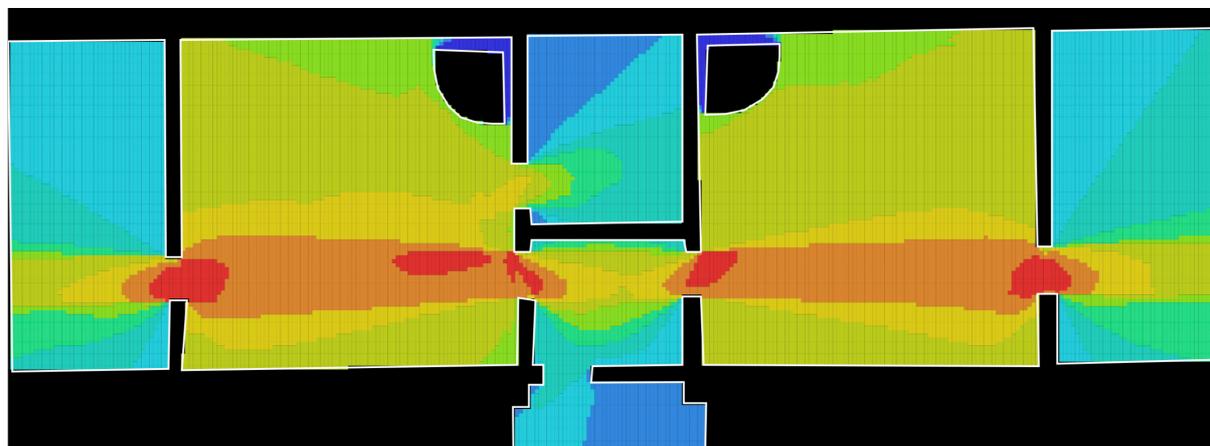
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**Keywords:** Gender, Space Syntax, Urban Space, Movement, Spatial Configuration.

Urban planning plays a major role not only in shaping the movement of people in space, but also to grant choices to the places they prefer to use and fulfil their needs, several studies have related the use of urban space to comfort aspects that is related to ambience characteristics, perception, and even environment's visual field. However, if not well adapted, urban planning could be a reason for the emergence of several problems such as crime, thievery and social segregation. Space syntax theory has addressed the issue of social relations, where the spatial configuration could reflect on how movement is generated through space, which could definitely lead to more or less potential social encounter, this has been demonstrated in the theory of natural movement where syntactic attributes could be an enough predictor for the movement pattern in space. In this context this study seeks to identify the causes that underlie the phenomenon of gender segregation between men and women in the city centre of Biskra, where one part is majorly used by men (colonial quarter) and another one (Zgag Beramdane and El Boukheri) that is mostly used by women, this segregation is not only in the use of space but it has also resulted in distinct locations for commercial activities and services offered to each gender, which took any reason for women to wander in certain streets that do not concern them or provide their needs. This investigation is structured into three parts, the first part consists on the observing of moving pedestrians (men and women) by using the gate count method, the second part is the syntactic analysis which has been conducted by using Depthmap software to study the the spatial configuration of the studied area by focusing on both integration (to-movement) and choice (through-movement) parameters. The final part is in which both approaches are correlated together in order to reach for an explanation and to see whether the pattern of movement is affected by the spatial configuration. The findings showed that there wasn't

neither a positive nor a negative correlation between the two variables, however, even with a slight correlation rate, men seemed to be more guided by the spatial configuration than women as they appeared to dominate streets in most periods of the day. This study suggests that the pattern of movement in the city centre of Biskra is more related to attraction factors rather than the spatial configuration and the visibility properties.

# Parallel session 2



# Triangulating space syntax with behavioural analysis methods for interpreting socio-spatial functions in school settings

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**Aim:** The rapid 21<sup>st</sup>-century innovations in architecture, curricula, pedagogy, and technology put disciplinary school regimes and physical environments under the pressures of change and adaptation. Issues such as control, surveillance, and discipline are expected in school environments but become more crucial in traditional school systems. This research employs spatial analysis methods to generate meanings about the extent of alignment between design intentions and existing functions in three public primary schools in Riyadh. The schools were transitioning towards implementing progressive curricula in spaces designed for traditional passive teaching.

**Methodology:** Space syntax (Hillier, 1996; Hillier & Hanson, 1984) is used in triangulation with other observational methods to collectively generate meanings of socio-spatial practices (see Figure 1). This approach adopts the argument that space syntax can be combined with other qualitative methods to understand human-environment relations and analyse space's social use (Al-Sayed, 2018; Zeisel, 2006). Space syntax is utilised to facilitate the discussion about schools as power regimes with "disciplinary technology" (Foucault, 1977). The methodology interprets social relations among students who use school spaces (subjects), teachers, staff, and CCTVs who control the spaces (agents). The methods included behavioural mapping, movement patterns, floor plan annotation, interviews with teachers and principals, photography, and space syntax (visibility analysis and isovist). "Visibility Graph Analysis" (VGA) (Al-Sayed, 2018) was generated using *depthmapx* software to represent the visual exposure of spaces in the schools' layouts. The fields of vision (isovist maps) were generated from the observed and recorded locations of teachers, staff, and CCTVs at schoolyards.

**Findings:** When triangulated with observational techniques, space syntax offered a rich visual communication output through the analysis of visibility in the schools. The relevance of the produced maps aligns with Sailer's (2015) argument that a spatial analysis of the pedagogical functions should expand beyond classrooms. Nevertheless, there is a potential for greater development of the technology to consider buildings as real three-dimensional objects rather than flat horizontal plans. Moreover, the isovist tool has the limitation of not considering the distance and height of physical barriers in the analysis—distant areas will not be as clearly visible as closer areas.

**Practical implication:** Producing the VGA and isovist maps offered a piece of evidence and a window of meanings on how school spaces are designed, perceived, and used. Therefore, space syntax is considered an effective tool for fostering evidence-based design. The data it provides offers a platform for architects, clients, and policymakers to facilitate their

discussion and decision-making. Focusing on the produced maps as the data on their own can be the primary benefit of space syntax analysis. Definite numerical data can be less factual (Pafka et al., 2018), given that social behaviour cannot be decidedly predictable.

Originality and value: With the limited number of studies in educational settings that employed space syntax with other qualitative and behavioural analysis methods, this research endorses such a triangulated approach.

Fig. 1: Combining the Two Maps of Behavioural Analysis and Visibility Analysis at a Schoolyard.



*Note. The illustration is for this abstract only. The actual two maps are separated and there is an isovist map for each schoolyard.*

## Assessing educational environments: A temporal socio-spatial approach to lower secondary school buildings in Cyprus

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This research is concerned with the interplay between the school environment and school practices. At its core, it seeks to understand and define school environments and at the same time to identify the role of spatial layout and agency in socio-educational practices. Having architecture as the departed discipline, this research's focal point is on relational and configurational consideration of space, where space operates as an intangible asset that

shapes to a certain extent how collective behaviours emerge. However, this does not automatically imply that school space is merely considered as stable and fixed in time. Instead, by enriching space syntax theory with relational concepts such as Assemblage theory by Deleuze and Guattari (1987), school is approached as a temporal relational concept with the main research questions being:

How do the spatial layout and agency in lower secondary school buildings built in Cyprus after 2000 impact the socio-educational school life? and to what extent lower secondary school buildings built in Cyprus after 2000 illustrate spatial, functional, and morphological consistencies?

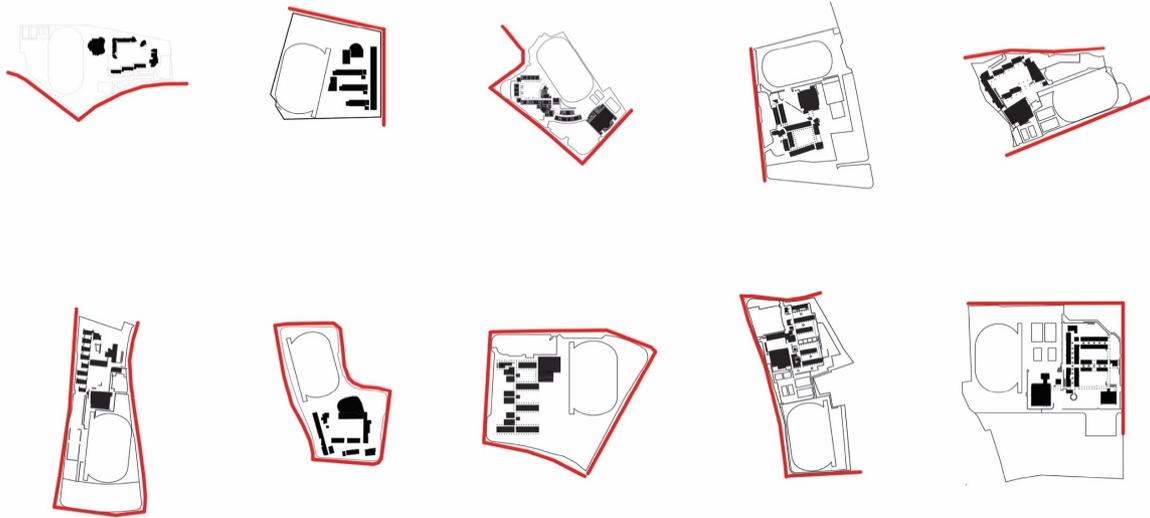
This thesis aim stems from the fact that existing research on how school layout is related with socio-educational practices is rather sparse with an evidence base that has been characterised as incomplete and remarkably underdeveloped (UK Design Council report, 2005). Additionally, only a small bunch of studies were conducted in the tradition of Space Syntax and systematically evaluated the spatial layout of schools in relation to various socio-educational practices, while there was no attempt to address open-air schools. Lastly, very few studies collected empirical data from space usage in secondary schools.

Hence this study aims to close this gap by systematically reviewing school environments and school practices through an innovative methodological framework. Specifically, this study adopts a top-down and bottom-up approach that combines spatial, functional, morphological and organisational data with empirical data from space usage and social agency. In that sense, it contributes to the current lack of empirical evidence (Woolner et. Al. 2007) while enabling case-independent conclusions due to the crosswalk between bottom-up and top-down approach. It also offers an explanatory base for understanding spatial relationality in school buildings, while it also enhances space syntax methodological toolset.

The ten(10) most recent lower secondary schools built in Cyprus after 2000 were selected as case studies. While all 10 case studies were examined through a top-down comparative approach, only two of them were used for the bottom-up methodological investigation. The selection criteria for the case studies vary, with the most important being:

- Date of construction: 2000 marked a critical period in Cyprus education.
- Level of education: Lower secondary education are remarkably underinvestigated.

Thus, this research's innovative aspect is that both theoretically and methodological combines different approaches through a holistic framework. It also addresses school environments' complexity by articulating a crosswalk between depths of research and types of data. In the particular context of space syntax enriches the research studies about schools, since only a small handful of studies examined school buildings so far, while there are currently no research studies on open-air schools such as the schools in Cyprus. Lastly, in Cyprus specific context, it is one of the very few studies that try to provide a critical evaluation of the authorities' existing principles for the design of secondary school buildings based on data.



## **Inevitability of quantitative urban research and the limiting paradox of available datasets; an example from Space Syntax**

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Advances in evidence based urban research and analytics has put the discipline at the forefront of various applied research fields. The success of applied urban research in explaining many real-world problems from pandemic diseases and climate change to institutionalized inequality has proved that the correlation between the living environment and the issues that we deal with is a practical approach towards understanding the complexity of the built environment and addressing them through mid to long-term policies and programmes. However, the dependency of quantitative urban research on available datasets brings limitations to the outcome of the research and applicability of verified results to wider contexts.

Facing growing popularity in academia and across disciplines, the methods developed to understand the spatial dimensions of everyday phenomena have excelled due to advances in new technologies. Still, a considerable part of the research that is being implemented through these methods depend on gathering information and available datasets. In this regard space syntax analysis could be considered unique for its analysis is implemented through intrinsic characteristics of the built environment and has the least dependency on formal data from reliable sources. On the other hand, within the current practices the space syntax analysis is used as an auxiliary set of tools that could facilitate our understanding of

how the built environment functions. This paper looks at these limitations in urban analysis and uses space syntax as an example of this limiting paradox in quantitative urban analysis. This paper briefly explains the process of producing a space syntax model for large scale regional analysis and uses it as an example to show the limitations of research in academia using space syntax. Through this paper it will be explained how in spite of openly available tools and datasets for producing these models, there are limitations in incorporating space syntax into large scale analysis. It will also be discussed how the inconsistency in other datasets may limit the utility of space syntax models in explaining urban phenomena



## **Spatial configuration and human movement at complex buildings**

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Wayfinding at complex buildings may be affected by the spatial configuration of the building, also the perceptual characteristics of each individual. This research investigates complex buildings' spatial configuration for more sufficient crowd management and developing solutions for the obstacles that block the legibility.

The general aim of this part of the research is to point out the main dependents of wayfinding at complex buildings, also establishing statistically positive correlations for more legible indoor environment. The human movement at complex building indoors are related with some main distinct characteristics: such as: path making decisions by gathering the information from the spatial configuration, the individual's perception and cognitive factors and external stimulus. The human movement pattern at a complex building will be investigated through; Syntax measurements: from integration, connectivity and vga analysis, Sketch mapping, Human behavior observations, to understand the path choices of the people during a directed movement. [by individuals which are familiar to the building and which are not]

The user choices and path sequences will be inserted as nominal and interval data for interpreting the movement which will be compared to agent simulated movements to see if there's actual correlation between simulation and real individuals at a complex building. The critical areas and points will be developed which blocks the human movement with unwanted trespassing, repetitive turns, and diverges from the actual paths. The isovist measurements at problematic areas and critical path choice changes will be investigated for regression analysis with statistical tools to understand the human movement pattern in relation to the perception.

A strong relation between human and perception, navigates the human movement through complex buildings, will be researched on the dissertation with syntax tools to conceive the human wayfinding behavior by topological aspects of the complex buildings. Yet, some of the human path choices are influenced by not only the spatial characteristics, also by the vision of the human eye. The second part of the dissertation will be pointing out the isovist parameters [as compactness, isovist area, circularity and occlusivity] and their correlation with movement and choice making of the human beings.

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Note: The thesis proposal has been developed for studying Hospital/ Airports, according to Covid-19 the complex building will be specified later according to the accessibility of these spaces during pandemic. This abstract is developed from one-year study.

## **Perception of Occluded Space; Examining from User's Cognition and Morphology of Space**

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**Keywords:** occluded space, occlusivity, mystery, exploration, semantic and syntactic value

How do we collect information from our surroundings when we move around, especially in building scale related semi open, closed, or open spaces? What does “occluded” mean in the experience of space? What kind of contribution provides to spatial perception? The thesis study bases on these questions...

Visual perception begins with sensations, especially when we see something and how we get into contact with the space is crucial. The layout of the space includes unprojected (hidden) surfaces at a point of observation and projected surfaces, but the configuration that is observed is not just the projected surfaces. The information must be available for the whole layout, not just for its facades (Gibson, 1979).

Occluded space is not fully visible in the whole surrounding, but partially visible. There is a limited capacity to see and move. The word occluded is an adjective, derives from the word occlusion. Gibson (1979) defines the term occlusion as the cutting off visual solid angle. When a view is cut off, the isovist will have two types of boundaries: solid and occluding (Davis & Benedict, 1979; Stamps, 2005). Occlusivity is defined as the length of the open (occluding) edges of the isovist (Benedict, 1979). Occlusivity is not defined from the boundaries of space, it contains ambiguity, uncertainty, an ill-defined part of the visual experience of a space. Also, occlusivity is a measure of mystery (Dosen & Oswald, 2016). Mystery can be related to both lack of environmental information and lack of intelligibility of this information (Yu et al, 2016). Therefore, a sense of mystery evokes exploration and excitement.

In this context, the occluded part of the space contains strong potentials within the study. According to the hypothesis of the study, the occluded part of the space is as much important as the space that we perceive at first sight without any barriers. So, the meaning and geometry of occluded space will be examined semantically and syntactically in this PhD research.

In previous studies of visibility, local and global properties (Turner et al, 2001), the three-dimensional structure of the environment (Fisher-Gewirtzman et al, 2003), permeability (Stamps, 2005), occlusion map (Christenson, 2010), transparency, and mystery (Yu et al, 2016) are scrutinized. This study aimed to examine the occluded space in a complex building with virtual user rotas, user preference, and meaning of space. The primary methods are space syntax and survey of virtual spatial experience data that contains frequency and preference of occluded space. The case study can be a virtual environment of an actual building. It will be discussed how the occluded spaces affected both geometry and semantic meaning with user perception and cognition.

The possible result of the study is occluded space is an attractor and evoking curiosity. If exploration is an active component for occluded space, there is a level of exploration according to the geometry of space. In conclusion, this paper will present a semantic and syntactic approach to examining the potential of occluded places in a complex visual environment.

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## **The effects of visual and acoustical privacy on work-process interactions in open-plan offices**

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Work environments have changed over the years with the introduction of information technologies (IT) and collaboration into working life. In addition, cost-effective workspaces have become vitally important in the 21st century in order to decrease rental costs. All these transformations have affected the design of physical work environments. Thus open-plan offices where workspaces are divided by furniture or partitions instead of walls were introduced into workplace design (Pile, 1978). More integrated workspaces of open-plan offices enable employees to interact and collaborate with their colleagues (Pierette et al., 2015). In addition, interconnected workspaces reduce land costs in open-plan offices where employees occupy less square meters with the elimination of interior walls (Brennan et al., 2002). On the other hand, integrated workspaces in open-plan offices cause the lack of acoustical and visual privacy that even overshadow the main advantage of open-plan offices which is interaction (Hernes et al., 2006). The possible impacts of privacy on work-process interactions is still an uncertain topic and this study is designed to fill this gap through a computational approach. Therefore, this research aims to find out which analyses (generic visibility, targeted visibility, and acoustical analysis) are positively correlated with workprocess interaction patterns in open-plan offices. Mixed methods research techniques through space syntax methodology are used to examine these relationships. Therefore, the study begins with the qualitative data collection to detect work-process interaction patterns in an open-plan office through observation and an online survey. Following the qualitative data collection, visibility graph analysis and acoustical analysis are performed for

quantitative data collection. In order to analyze generic visibility, DepthMapX software is used as an instrument (Figure 1). Then, targeted visibility is analyzed after the development of a new script for DepthMapX software, and written codes in Python are used as an instrument. The last part of the quantitative data collection is acoustical analysis through ODEON room acoustics simulation and measuring software. After data collection, outputs of observation and online survey — field notes and interaction diagram — are analyzed qualitatively. On the other hand, outputs of generic visibility, targeted visibility and acoustical analysis — maps of color spectrum, tables and scatter plot diagrams — are analyzed quantitatively. Results of qualitative and quantitative analyses are compared in order to realize how generic visibility, targeted visibility, and room acoustics affect work-process interactions in open-plan offices.



Figure 1. General visibility analysis (visual integration tool) of the open-plan office by DepthMap (Source: Author, 2018)

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# **Patient control mechanisms in the 19th century asylums of England: A comparative space syntax analysis of asylums based on patient holding capacity.**

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Using the justified-graph techniques of space syntax, this study aims to understand if patient control mechanisms changed when the patient holding capacity increased in the 19thc asylums of England. The processes of producing social relationships with the help of spatial configuration are unconscious and complex. Different concepts of space syntax describes these complex, unconscious processes (Rashid, 2019). For example, Hillier and Hanson (Hillier et al., 1984) used the concept of strong and weak program buildings and reversed building types to explain the processes of generating control over users. Markus (Markus, 1993) further explored the concept of generating control over a group of users in institutional buildings. This research uses some of these previous concepts for its purpose.

For this research, nine asylums (19thc, England) were selected from a British journal 'The Builder'. Case studies were divided into two groups based on patient holding capacity (Bigger-asylums (BA): Asylums containing more than 1000-patients & Smaller-asylums (SA): Asylums containing less than 1000-patients). Both groups were analyzed using the justified-graph method of space syntax. Various mechanisms for controlling patients' movement, surveillance, and interface were compared to find out if the controlling mechanisms changed when patient holding capacity increased in the asylums.

**Control of patients' movements:** In both categories, patients' movements were controlled within and beyond the boundary of these asylums. Accessibility was controlled using security-gates or using administrative buildings as gatehouses. Inside the asylums, restricted zones based on patient classes, walled gardens, labyrinthine plans, and deep spatial structures were used for controlling patients' movements. In the BAs, female patients occupied deeper spaces than male patients, whereas in the SAs both patient-groups occupied spaces of same depths. Circulation routes used by caretakers were more ringy in the BAs compared to the SAs.

**Surveillance and Supervision:** In both categories, the administrative blocks occupied the central position between male and female patient-zones to facilitate supervision. In the SAs, the administrative blocks were nearer to the patient-zones providing quick provision for supervision. Since, the buildings of the BAs were distributed over larger areas, supervision was difficult. In these BAs, a pre-decided up-hill location of the administrative blocks and the downhill location of patient areas supported constant surveillance from the up-hill.

Interface: The depth-structure of all the asylums followed the convention of institutional buildings as described by Markus (Markus, 1993, p.13). The caretakers (inhabitants) occupied shallow spaces and controlled access towards the deep patient (visitors) zones.

Nevertheless, in the BAs, patient zones generally had deeper locations when compared to patient zones in the SAs. All the asylums provided shortcuts using gated corridors, which were used and controlled by caretakers. Therefore, caretakers could control the interface between different visitors (male and female patients) and the interface between the inhabitant (caretakers) and the visitor (patients).

When asylums grew and patient number increased, the spatial configurations were changed significantly for controlling patients. In the BAs, circulation became ringy to provide better accessibility to the caretakers. Asylum design adopted natural surveillance system to supervise the larger patient number in BAs. However, in both BAs and SAs, the conventions of institutional buildings were maintained for the interface between visitors and inhabitants.

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## **At first, these houses were all alike ... Were they? How about now? Addressing conversions in housing estate units in the light of sociocultural changes.**

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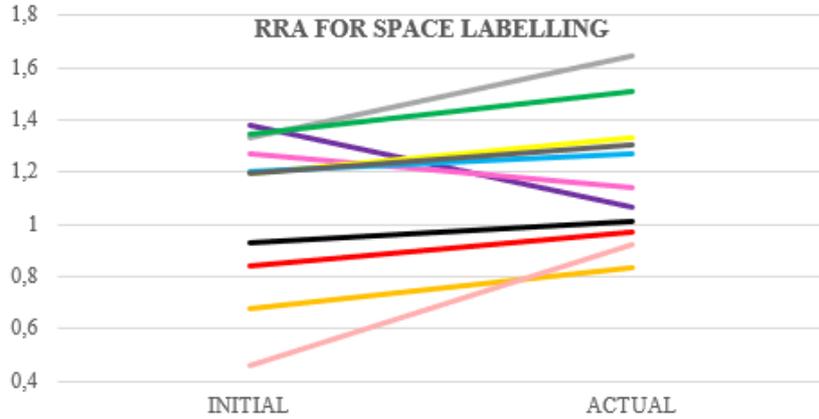
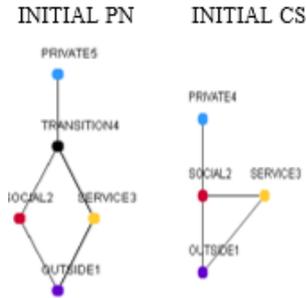
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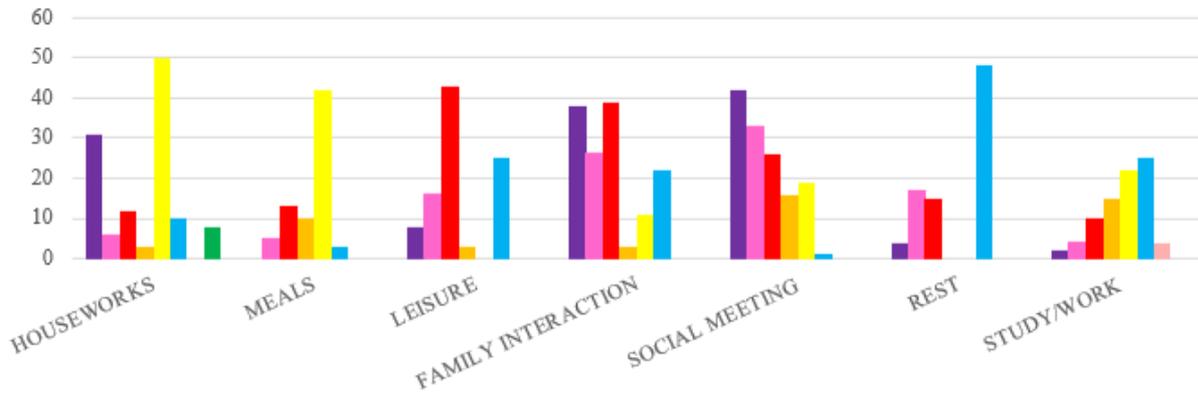
This paper is part of an ongoing thesis, which addresses transformation patterns in the space configuration of housing estate units that may relate to sociocultural change in dwelling modes. In the 1980s, nearly half the population of Natal, Brazil, lived in housing estates [1]. The original standardised plans were designed to respond to what was minimal requirements for middle class nuclear families. Three decades on, over 85% of those houses have been converted [2]. Patterns of change and continuity in space labelling and design

function [3], their respective areas and spatial properties, have been investigated in synchronic and diachronic perspectives, by tracing the successive alterations, as acknowledged by residents, and by applying Space Syntax analysis [4], [5] to gauge how they have affected spatial hierarchy within the domestic milieu. Forty-nine units were examined in two of the largest and oldest estates in town: Cidade Satélite and Ponta Negra. Preliminary analysis showed that the various spatial layouts originally offered delineated two genotypes: one centred in a transition space that renders the three sectors – social, service, and private – as independent spheres; the other, centred in the social sector to which the service and the private sectors are directly linked. Transition-centred plans are larger than social room-centred ones, syntactically more integrated and distributed. However, converted houses tend to equalise, on average values, in overall area, number of rooms, area proportion in each sector, and mean syntactic measures concerning spatial properties. Households have changed from the originally predominant young nuclear families with children to include a considerable number of single parents and multi-generation families. Interviewed residents declared that houses were enlarged with extra bedrooms and bath/shower/wc facilities to offer more comfort and privacy. In some cases, after their grown-up children left home, parents availed themselves of spare rooms to secure separate bedrooms. In others, children returned bringing their offsprings and companions along. Such built expansions were common to both the investigated cases although tending to configure different structures in each one. In Cidade Satélite, where units were social space-centred and smaller, on average, extensions to accommodate returned children mostly occupy newly built outbuildings, which also multiplied in Ponta Negra, but being mainly used to accommodate servants' rooms, service and storage facilities, an arrangement that evokes that for lodging slaves in colonial Brazilian homes [6]. Referred changes in routine domestic practices reveals that the exterior grounds within the plots have become less used than in previous times, although becoming more integrated with the successive expansions. Such findings corroborate studies of contemporary Brazilian dwellings that show a progressive loss of importance concerning the exterior – a historically pivotal space that could restructure the domestic topological hierarchy by being connected to various interior or semi-open areas [7]. They also ratify the tendency to underuse formal social rooms, especially dining rooms, pretermitted by kitchens and terraces as leisure and family gathering spot, and suggest that, at least in one of the estates, families continue to depend on (or to consider the possibility of) domestic service.

### JUSTIFIED ACCESS GRAPH



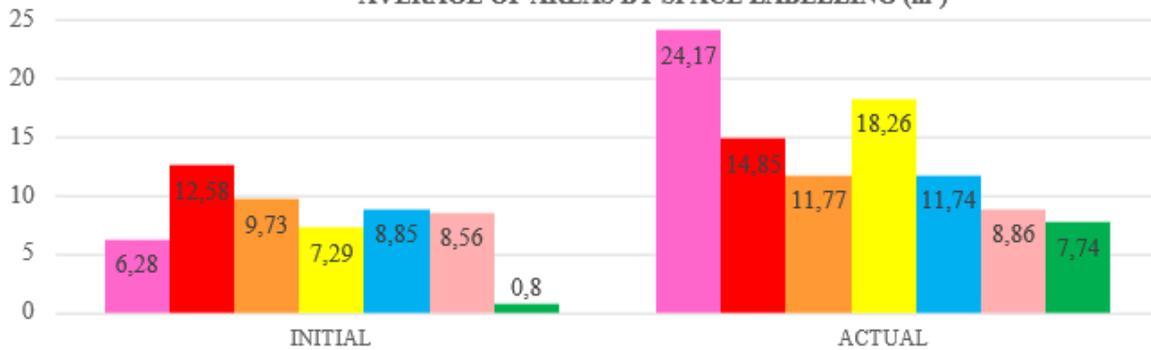
### INITIAL SPACE LABELLING AND USES



### ACTUAL SPACE LABELLING AND USES



### AVERAGE OF AREAS BY SPACE LABELLING (m²)



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## Steven Holl's *Kiasma* Museum and the Fluidity of Space in Movement

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This paper will examine ways in which Space Syntax approach might contribute to the research of role the role of bodily experience in the visitor's engagement with the objects and spaces in the Kiasma Museum of Contemporary Art Steven Holl. The proposal will focus primarily on Holl's Parallax theory and the role of movement in the perception of architectural space. In Kiasma, Holl composed a circulatory system that embodied his *Parallax* concept, highlighting the role of movement in the Perception of architectural spaces<sup>1</sup>. As per his description, "when we move through space with a twist and turn of the head, mysteries of gradually unfolding fields of overlapping perspectives are charged with a range of light from steep shadows of bright sun to the translucence of dusk out of these multiplicities of interactions and effects, certain recognizable patterns will emerge. These patterns, however, are in a constant process of evolving, constantly redefining, and creating themselves."<sup>2</sup> Parallax is a design approach that Holl developed after his encounter with Maurice Merleau-Ponty's body philosophy. Merleau-Ponty considered the lived, active, and

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<sup>1</sup> Steven Holl, *PARALLAX*, Fifth (New York: Princeton Architectural Press, 2000).

<sup>2</sup> Steven Holl, *Intertwining*, First Edition (New York: Princeton Architectural Press, 1996).

moving body to be fundamental to our experience and understanding of the world. The novelty of his approach comes from the idea of *'bodily intentionality'*, the notion that our initial awareness of a new situation is a bodily one, based on an intuitive sense of the movements required to cope with it. This bodily grasp of space allows our behavior to flow along with an ongoing experience without the need to invoke intellectual analysis. This proposal also evaluates the growing body of works in embodied cognition, concentrating predominantly on the concept of Enactivism and Alva Noe's theory on the relationship between action and perception.

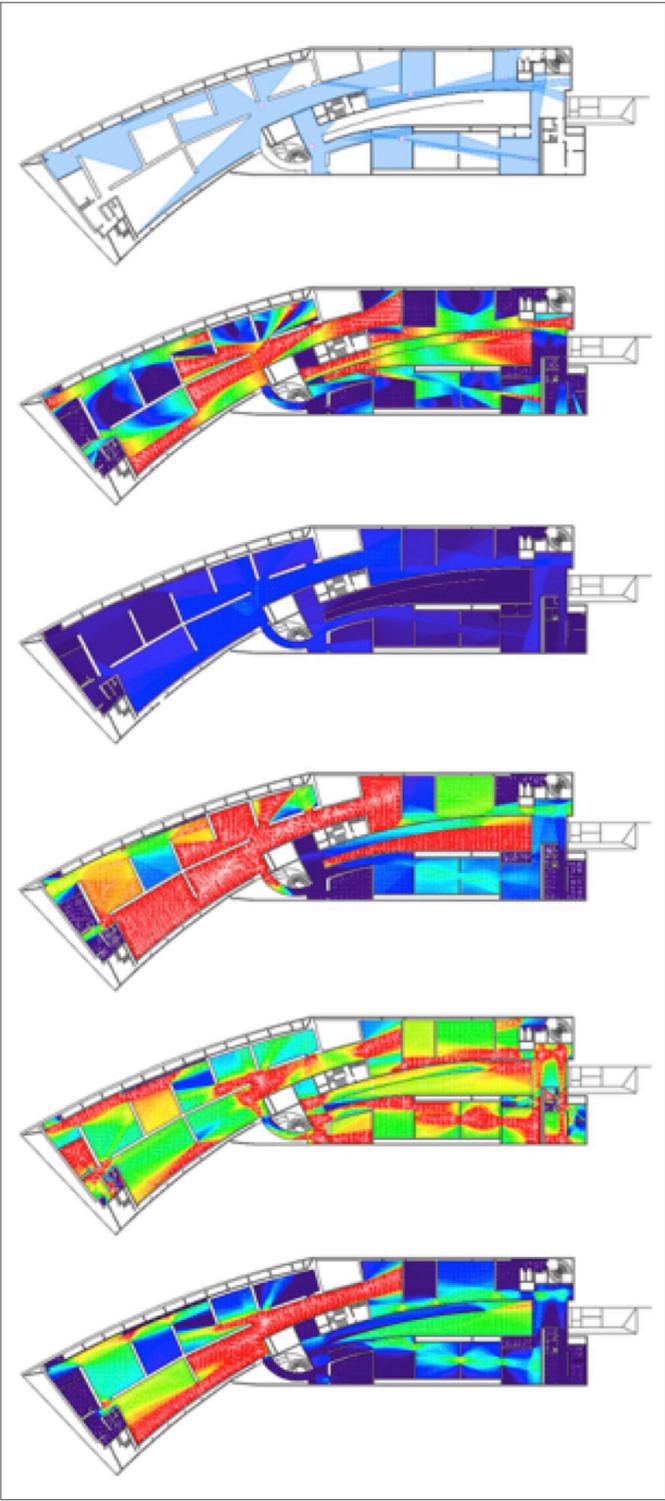
Using space syntax as an analytical tool, this interdisciplinary premise will elucidate how the intricate intertwining of perception and action could provide the basis for the so-called "higher" acts of cognition and communication in pursuit of the concept of grasping in architecture. However, architecture today inherited a general culture that detached our bodies from architectural experience. Those are, first, the domination of ocularcentrism or retinal architecture that emphasizes visual images over a holistic experience.<sup>3</sup> Secondly, the positivist design approach that concurred with the modern movement<sup>4</sup> reduced architecture to merely objective qualities that favored the conceptual over the perceptual. These problems create a gap between humans and the world, resulting in dividing them into two separate components. Therefore, the central questions of this research ask:

Considering Holl's Parallax theory and Space Syntax, what is the role of 'Bodily Intentionality' in achieving higher acts of Cognition and Grasping in Steven Holl's Kiasma Museum?

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<sup>3</sup> Juhani Pallasmaa, *The Eyes of the Skin*, 3rd Edition (John Wiley & Sons Ltd, 2012).

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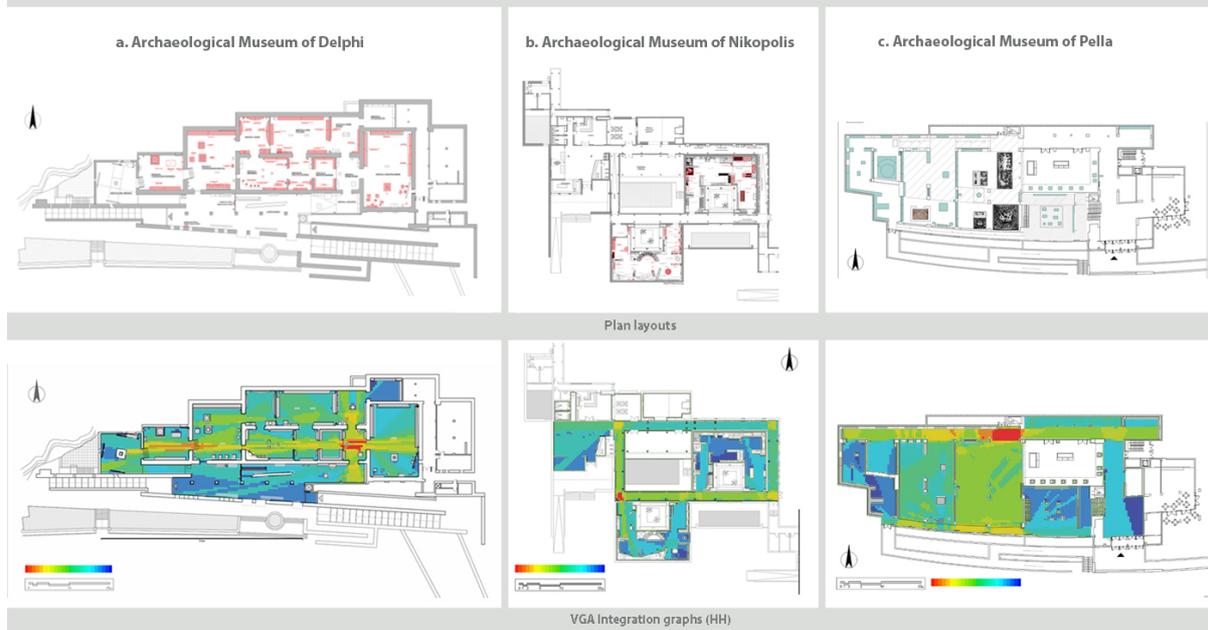
# Understanding spatial experience in museums of archaeological spaces

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The paper focuses on museums of archaeological sites and presents the first part of ongoing research that aims to investigate a key issue in their design: how to relate the space that accommodates the collection of antiquities with the site where they come from with emphasis on the former, the museum. Taking as starting point the idea that, in the case of site museums we have to do with two spatial configurations of space that are closely related to each other, the paper explores how museum space can contribute to understanding the display and by application the archaeological site. To explore this question the paper takes three archaeological museums in Greece that provide variety in terms of spatial layout (from sequence to open plan) and are based around archaeological site, ranging from an ancient Greek sanctuary, recognized as a world heritage site to an Hellenistic and a Roman city. The research draws on the museum archaeology literature (*e.g. Swain, 2007; Marshall, 2012; Siapkis and Sjogren, 2013;*) which sees the spatial context as the key factor in how archaeological objects are perceived. It is also theoretically informed by earlier syntactic studies of museums (*Hiller and Tzortzi, 2006; Peponis and Zamani, 2010; Psarra, 2009, Tzortzi, 2014, 2015*) and archaeological sites (*Paliou et.al, 2014; Stoger, 2015*) and uses space syntax concepts and measures (such as the concept of depth, VGA and the analysis of space types) to bring consistency and rigor in the analysis of the spatial layout and the object display of the three museums from a spatial point of view. This is combined with research into the spatial behavior and experience of visitors through observations and questionnaire. The paper shows how, in one case, movement and space serve the chronological narrative, while the visual links, that are more of aesthetic rather than information character, enrich the visual experience of the visitor; the property of depth is systematically used to place more emphasis on certain objects. In contrast to another case, movement is dissociated from the representation of time and the display space is visually enclosed and aims to compress both time (from the Hellenistic to Byzantine period) and space (archaeological space of 13.550 acres). In the most recent case, the museum route acquires a symbolic function; the spatial and visual configurations are designed to intensify the sense of topography and recreate for the visitors the sense of moving in the archaeological site. Taken together the three cases allow us to illuminate a shift in the architectural and spatial design of museums of archaeological sites. It might suggest that the emphasis on movement and vision, as means of embodied understanding, opens up new possibilities on the way visitors explore and "read" the exhibition content in terms of the archaeological site.



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# Study on the Social Logic of Spatial Transformations in Social Housing. Case Study: Batna Prefecture, Algeria

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**Keywords:** Spatial configuration, Adaptability, Appropriation of space, Social housing, Traditional houses, Space syntax.

This study aims to understand the intrinsic social logic of the spatial transformations carried out on social housing in Batna prefecture, using space syntax theory. The study is based on a representative sample of 14 social housing units and three traditional housing. The first sample was performed by using two variants of each plan, that is to say: (A) the initial state of the plan as designed by the architect, and (B) the state of the plan after spatial transformations, so that the inhabitant could adapt with this type of housing. Traditional samples are located in the vernacular agglomeration of Bouzina in Batna prefecture. This sample was analyzed to understand the logic behind the spatial transformations conducted on social housing units. Indeed, occupants can adapt by creating new spatial configurations that resemble their traditional configurations.

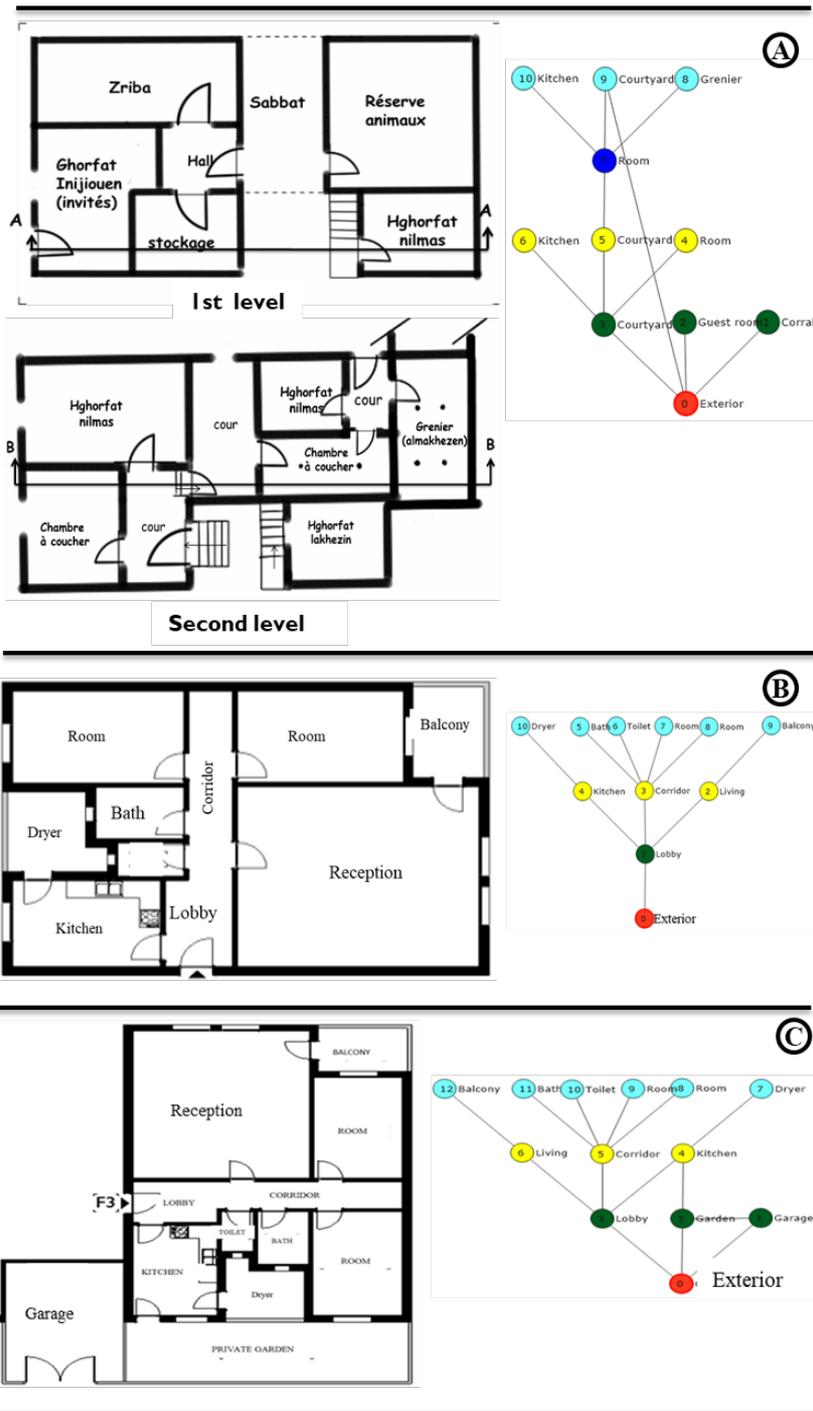
Using syntactic and visual analyses, the study covered two levels, namely: (A) At the level of domestic spaces and (B) At the level of human establishment. The first level translates the architectural plan into a justified graph using the A-graph program. The second level measures the indicators Point Depth Entropy and Clustering Coefficient using Depthmap program.

The results showed at the level of domestic spaces that 100% of the spatial configuration of traditional houses represents ring structures. This configuration has multiple entrances and the guest room often separated from the intimate space so that the movement of guests is hidden, the visitor is always kept away from the family space for privacy considerations. While the spatial configuration of the initial state of the social housing plans represents a 100% semi-deep tree shape. The analysis of the plan state after spatial transformations reveals three types of justified graphs: (A) 44.44% semi-deep tree justified graph, (B) 33.33% outer annular justified graph, and (C) 22.22% complex annular graph. In terms of adaptability, the annular justified graph, especially the complex annular one, has a high degree of flexibility in the use of space, allowing the user easily to modify the diagrams to adapt to different spatial situations.

At the level of human establishment, the depth entropy point graph for the traditional houses showed that the visual relationships are organized around the courtyard and the terrace with multidirectional fields of view. While they are organized around the corridor and the lobby for the initial state of the social housing units, and around the corridor, the

lobby, and especially around the kitchen after spatial transformations. The clustering coefficient graph indicates that all sociological features are located in the courtyard and terrace in the case of traditional houses. Whereas, they are located in the lobby in the case of the initial state of social housing units and in the lobby and the kitchen for social housing units after spatial transformations.

This study had clearly shown that the spatial configuration of social housing changes over time so that the inhabitants adapt to different scenarios and that the concept of adaptability in Algeria is based on socio-cultural factors.



A:  
houses.  
B: The  
of the  
housing  
C: The plan  
spatial

Traditional  
initial state  
social  
plan.  
state after

transformations.

**Figure 01:** Examples of traditional and social housing configurations and their justified graphics (Authors, 2021)

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## **Hybrid Buildings: Complexity and Genericity in Exhibitions Spaces – The case of the Bienal de São Paulo Pavilion**

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This investigation proposes the notion of hybrid, as networks of people and things that combines aspects of natural and social realms (Latour, 1993), to characterize spatial settlements whose possibilities of movement and occupation are configured by the overlapping of sociospatial logics of both generic and complex buildings (Hillier et al., 1976; Hillier, 1996; Hillier & Hanson, 1984; Sailer et al., 2013). Genericity can be described as a condition observed in spaces little informed by social rules, with few restrictions on movement and occupation and, therefore, with a greater tendency towards randomness

through the generation of diverse or less predictable patterns of movement and occupation. Whereas complexity is characterized by the opposite elements (highly socially informed spaces, with many barriers of movement and occupation and with more predictable or less diverse and random occupations and movements) (Choi, 1999; Hillier, 1996; Hillier & Penn, 1991; Psarra, 2009). Generic and complex conditions, to a certain extent, can be observed in all building types, since these concepts operate as limits in the definition of a range of configurational possibilities for classifications of buildings in terms of movement and occupation. However, aware that a completely generic or totally complex spatial configuration would be the exception, most buildings are located in situations intermediate to these limits. Therefore, it is argued that in exhibition spaces these two logics overlap in a very particular and evident way, in the sociospatial definition of occupation of its sectors (Amorim, 1999) and the way they provide the conditions for a spatially guided movement (Peponis et al., 2004, 2003).

At a theoretical level, exhibition spaces were defined as those designed for the exchange (whether cultural, monetary or symbolic) between people through the arrangement of things in space, whether temporary (exhibition layout) or permanent (building layout) (Bobkova et al., 2017; Bourdieu, 1986; Bourdieu et al., 1991; Koch, 2004, 2007, 2015; Marcus, 2010, 2017; Markus, 1993), notions and references that theoretically frame this investigation. Empirically, the discussion is supported by the evidence extracted from the Bienal de São Paulo, an expression that designates both a set of exhibitions (with 33 editions until nowadays) and a building (officially named as Ciccillo Matarazzo Pavilion, a 35.000 square meter rectangular pavilion designed by Oscar Niemeyer and his team, built in 1954 and which houses the event since its 4th edition, in 1957) (Alambert & Canhête, 2004; Farias, 2001; Fraga, 2006; Herbst, 2011; Matos, 2009; Mindlin, 1956; Villela, 2019).

At this stage, analytical studies of the different layouts of the building (its original design, the built project and its different versions over more than 60 years) using space syntax theoretical and methodological procedures are developed in order to demonstrate to which extent these notions constitute its spatial configurations. In a next step, it is expected to compare these findings with the layouts of the exhibitions. Therefore, the investigation seeks to provide contributions at two levels: broadly, in the field of morphological studies of building, whether of a cultural or commercial use (Koch, 2007, 2015; J. Peponis & Hedin, 1982); and specifically, in the field of study of the history of exhibitions (Altshuler, 2008, 2013; Braden, 2018; Braden & Teekens, 2020, 2019; Cypriano & Oliveira, 2017; Vogel, 2014).

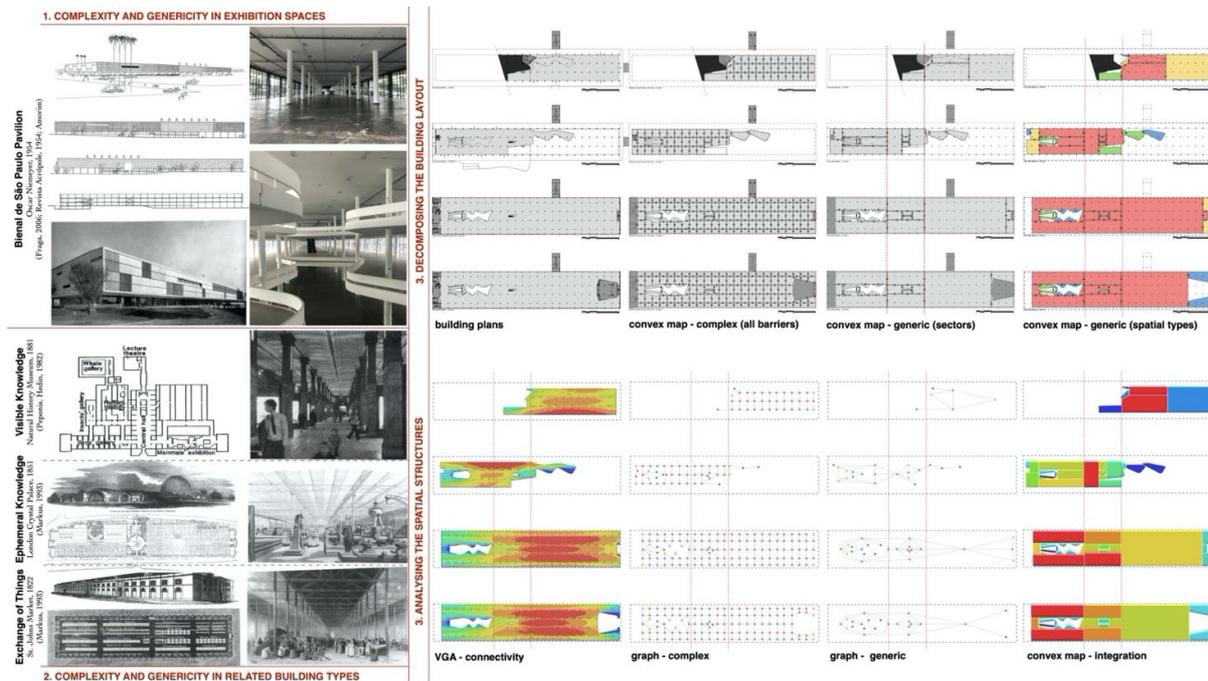


Figure 1. Complexity and genericity in exhibition spaces and in the related building types and spatial analysis of the Bienal de São Paulo Pavilion.

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## **Urban forms of the inner periphery: spatial configuration and habitability conditions**

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**Keywords:** Housing Estates; Space Syntax; Urban Morphology; Integration.

Peripheries, due to their greater flexibility and suggestion, have traditionally been the site of the experimentation of urban forms and types. The production of the first peripheries of large Spanish cities has been characterized in part by the development of housing estates – unitary operations based on functionalist urbanism– and ordinary peripheries or suburbanization –more or less planned forms of gradual growth that adopt traditional systems, based on streets and blocks. The housing estates built between the 1950s and 1970s have been the subject of numerous studies in recent years. Faced with more specific studies that delve into their original character of enclaves without taking into account their current urban context, this work proposes a comparative analysis of these two urban forms, which occurred in parallel and which today make up that first urban periphery. The intense transformation processes that these large cities have undergone during the last half century of urbanization, have also caused changes in their configurational properties and their housing conditions.

The objective consists in showing and comparing configurational and housing properties of different urban forms: housing estates and urban fragments of the inner periphery, which can help to the design of strategies in integrated urban regeneration policies. The case study focuses on the first periphery of Zaragoza, one of the urban areas in Spain with the highest rates of housing density today.

The current level of development of the urban functions of the instances of the study is obtained from the construction, evaluation and representation of the concepts Node Value (NV) and Place Value (PV) of each instance. The first is based on the configurational properties of the urban network of each instance. This property has to do with the degree of centrality and attraction based on the urban form for the natural movement of

pedestrians and vehicles. This analysis also affects one of the most critical aspects of housing estates, their low accessibility and their enclave nature, which recent studies show that it has changed and that current conditions may vary from one case to another. The Place Value is based on the habitability conditions of each of the instances, based on the density of the resident population and the level of accessibility to urban uses and services. To do this, the following steps are taken: (i) preparation of the segment map; (ii) identification of the study instances; (iii) multiscale configurational analysis using syntactic centrality and attraction metrics; (iv) analysis of proximity to urban uses and services; (v) obtaining the NV and PV for each instance. Subsequently, results are discussed, emphasizing differences in the morphological conditions of the different environments at the different scales of analysis.

Results will show configurational and housing differences between the two urban forms, but also between instances of the same group. There is a direct relationship between the enclave status of some housing estates and their level of accessibility, as well as the proximity or distance to basic goods and services, which influences the urban quality of these residential peripheries.



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## **COLIVING + CO-PRESENCE: A STUDY OF SPATIAL ORGANISATION AND CO-PRESENCE IN COLIVING COMMUNITIES**

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The aim of this paper is to employ space syntax and Wi-Fi/Bluetooth beacon technology to interrogate coliving provider assertions that coliving spaces encourage and promote a sense of community amongst residents. In recent times, coliving has raised the demand for housing with shared facilities in major cities across the world. As a new urban shared living typology, it targets Millennials who are reported by Ipsos MORI to be markedly lonely and far less trusting of other people than previous generations. To date, there are only a limited number of academic studies exploring this new building typology; none of which focus on the spatial organisation or social integration within its communities. Furthermore, there is a general lack of quantitative, as opposed to qualitative, research in any existing research.

The pursuit of social integration is a concept that has often driven architectural and urban design; for example, in 2020, New London Architecture initiated 'community' and 'wellbeing' programmes promoting research and best practice in the design of flourishing community spaces. This sense of community both emerges from, and facilitates, social integration which can be defined as belonging to a group whose members exhibit shared values and engage in acts of social support. It is through the routine activities of everyday life that individuals encounter each other in the situated contexts that are central to forming social organisations.

A fundamental precondition for in-person communication is the need for at least two people to be simultaneously present in the same convex space. This least taxing – and most distinguishable – form of social interactions has been defined by Goffman as 'co-presence' whereby individuals become "accessible, available, and subject to one another" (1963, p. 22). Although spaces do not determine the nature of interactions, a social organisation's potential – through instances of co-presence - is largely influenced by its spatial configuration. Therefore, we ask to what extent does the spatial organisation of coliving communities influence instances of co-presence between residents. With research showing that social isolation indicators are closely associated with loneliness, we do this to help enable coliving providers, architects, and academics to better understand how interpersonal relationships form in shared living communities.

In this research paper, space syntax will be used to determine levels of 'integration/segregation' in the spatial organisation of various coliving buildings before selecting the project(s) with highest levels for a co-presence study. The latter study will utilise Wi-Fi and Bluetooth beacon technology to document where and how often residents interact with each other and with space.



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## ***My house, my life but What Urban Life?***

**Effects of Minha Casa Minha Vida (my house, my life) housing program on the everyday life of its residents.**

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This work is part of a thesis that investigates alterations in the urban life of individuals who moved to buildings financed by the *Minha Casa Minha Vida* (MCMV) (*My house, my life*) housing programme in the functional metropolitan area of Natal, Rio Grande do Norte, in the northeast of Brazil. The MCMV was a Federal Government Programme created in 2009 to remedy the housing deficit in Brazil. During its existence, the MCMV, which ended in 2020, subsidized almost 5 million houses and/or flats nationwide for people of different incomes. These facilities stimulated the acquisition of homeownership and created / consolidated new territories in Brazilian cities, hence creating new relations between people who acquire the MCMV housing units to such new locations, generating new urban life. In this regard, several research questions arise: did access to essential daily activities change if compared to their former houses? If so, how have such changes affected their urban life? Could this be deepening socio-spatial segregation processes? We hypothesize that when individuals move into MCMV housing estates, they lose accessibility on both micro and macro scale when compared to their former locations. This loss is worse for low-income families as it accentuates the socio-spatial segregation process, which could generate social and economic damages. To test this hypothesis, we propose a spatiotemporal comparative analysis of the accessibility to essential daily activities (schools, supermarkets, hospitals, leisure places, etc.), before and after moving to MCMV housing estates. The research is divided into 03 major axes: (i) analysis of urban morphology; (ii) analysis of mobility;

(iii) and interviews to understand individual restrictions. The morphological analysis takes into account local-based measures that explain accessibility levels of MCMV housing units to opportunities in the city. Place Syntax methodology supported by Place Syntax Tool (STAHLE et al., 2005; STAHLE, 2008), GIS (Geographic Information System) techniques, and Python data analysis are being used to calculate and explore the morphology of the city. Preliminary results show that the MCMV's housing is more segregated than former houses from the micro to macro scale. Segregation, attested by the loss of accessibility to all types of opportunities, is more severe for lower-income individuals that acquired a MCMV housing unit. This result responds partially to the hypothesis and reinforces other research (FERREIRA, 2012; AMORE; SHIMBO; RUFINO, 2015; NETTO et al., 2017) that upholds the segregating character of the MCMV housing program.

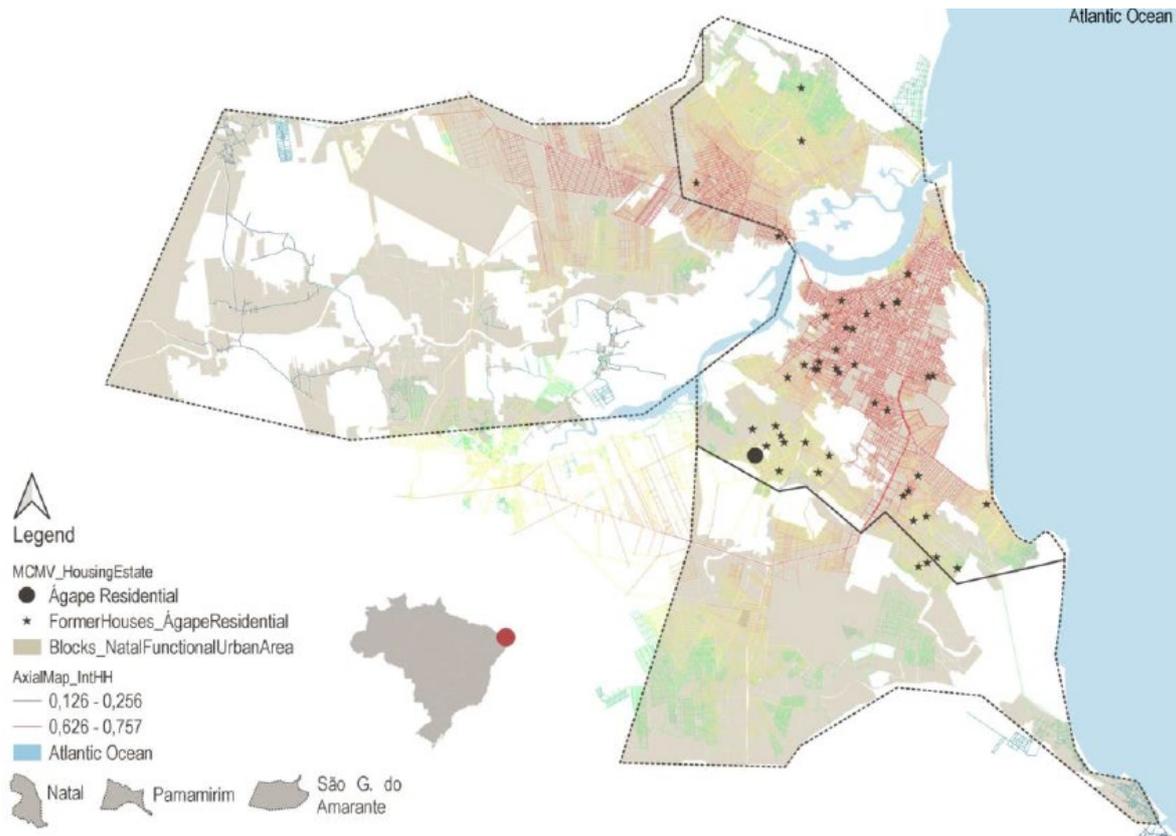


Image 01: example – location of an MCMV housing estate and the former houses of its residents.

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## From gated to vibrant community: comparing spatial vitality between gated and non-gated housing areas in Wuhan, China

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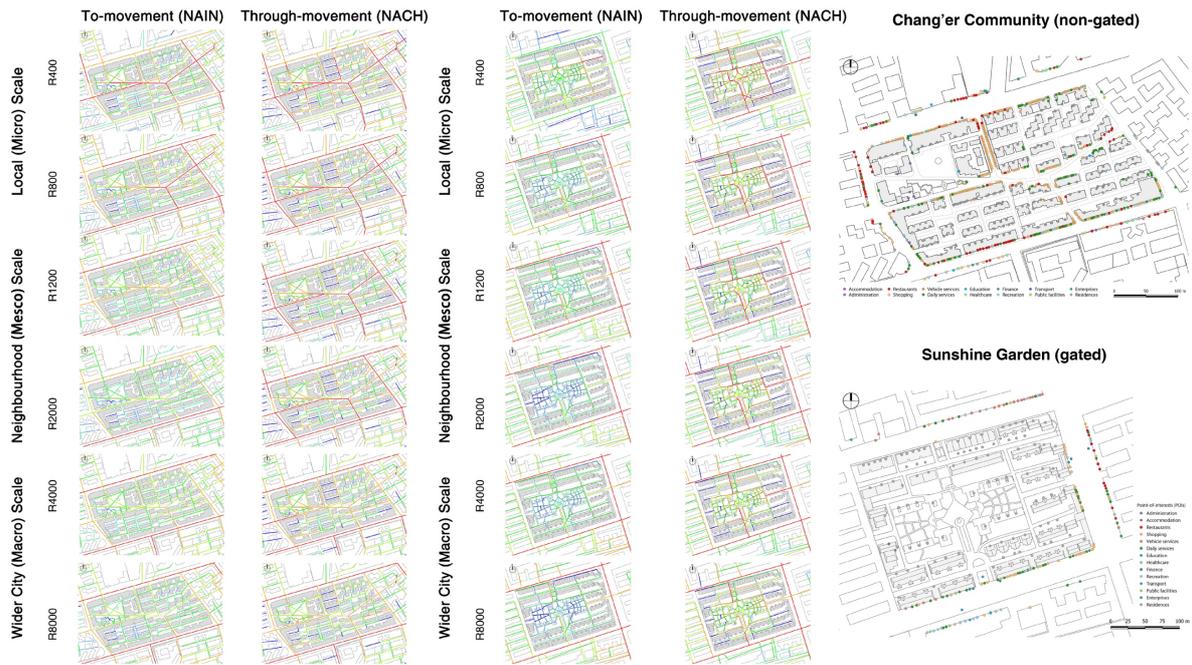
Aiming to achieve more sustainable cities, China's government issued a new directive in 2016 announcing an upcoming housing reform regarding halting the construction of new gated housing areas and gradually opening the built-up ones to the public (Renming, 2016). Since then, research has been focusing on the policy, management, and benefits of ungating. However, little is known beyond physical boundaries regarding how gated and non-gated housing forms would affect the vitality of China's housing area.

In this presentation, I will focus on one of the crucial proxies of spatial vitality – pedestrian movement, which is one of the analytical chapters from my doctoral thesis. Due to the time frame limit, only one pair of cases will be presented as an example to illustrate the applied analytical methods and preliminary findings. Chang'er Community is a non-gated, street-based housing area, while Sunshine Garden is a gated, landscaped compound. Both study cases share similar construction year, housing price, size, and proximity indicating good comparability.

The first objective of the analysis is to compare how gated and non-gated compounds are spatially organised and embedded in their neighbourhoods. To achieve it, extensive spatial analyses were conducted. Firstly, normalised angular segment analyses (Hillier et al., 2012) were computed at six radii to compare multi-scale street centrality. Furthermore, the analysis went deeper by comparing the means and maxima of peripheral and internal streets for each estate at different scales to reveal how the internal interacts with the external world. Subsequently, the multi-scalar 'spatial core' (Peponis et al., 1989) of two cases was extracted by reading the estates both on their own and from their larger neighbourhood. Meanwhile, the correlation between NAIN and NACH at the same radius was computed to measure the 'movement interface' (Vaughan et al., 2010). Lastly, a functional-uses pattern analysis was also carried out on the junction segment level to compare the housing estates' functional density and diversity.

The second objective was to compare the pedestrian movement patterns. Similarly, a comparison was also made between peripheral and internal pedestrian volumes. Moreover, the number of people entering and leaving the estate at each observed entrance was registered for further examination; arguably, a higher proportion of people leaving indicates the estate was losing its vitality. Finally, correlation and multiple regression analyses were computed to test if and how housing form affects pedestrian movement distribution.

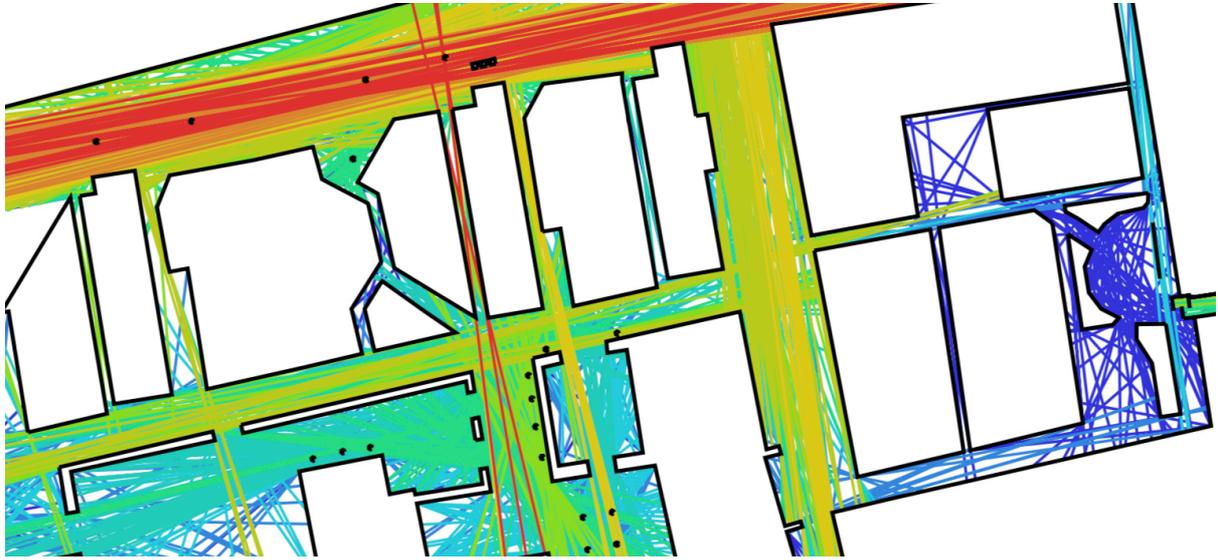
The finding of this study indicates that compared to the gated estate, the non-gated one demonstrated a higher overall street centrality, a more balanced internal and peripheral centrality, a stronger movement interface, and denser as well as more diverse functional uses. These characteristics collectively lead to a more vibrant housing area, where the pedestrian volume remains steadily reasonable throughout the day, both weekday and weekend. The gated compound, on the other hand, displayed a typical spatial usage pattern of a monofunctional zone, where the majority of people leaving the estate for work/study in the morning and coming back during mealtime but leave the area nearly empty for the rest of the day.



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# Parallel session 3



# Developing a conceptual and methodological framework for defining a pattern language of urban form and automatically identifying the urban types of network centrality, build density and land-use. Investigation for the European urban space

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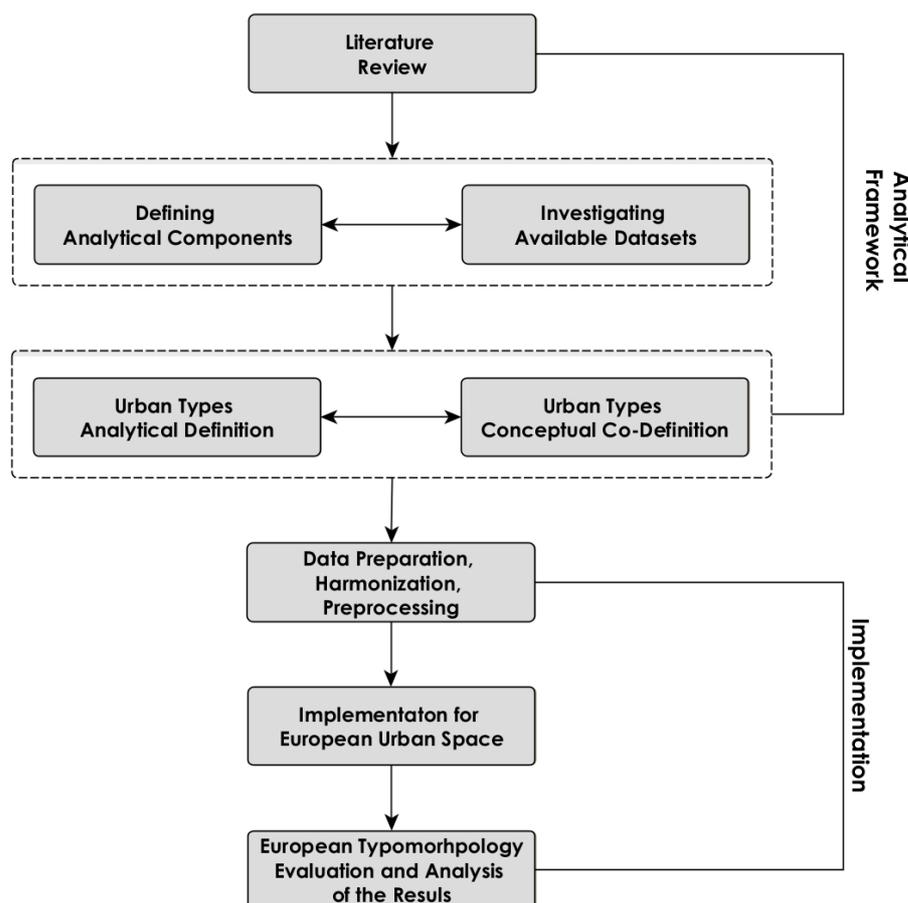
The concept of pattern and typology is considered central for reading urban space, discussing complex urban issues and even producing urban space (e.g. [1]) and as such has been used by many scholars researching urban space (e.g. [2]; [3]; [4]; [5]). In my PhD research, a mixed method approach is proposed for developing a *pattern language* of urban form, using participatory research methods to acquire local knowledge, and a GIS-based methodology for (automatically) identifying urban types, using data clustering and advanced methods of quantitative spatial analysis, towards geodesing [6]; [7]; [8] and human-oriented planning [9]; [10]; [11]. The proposed approach aims to explore the patterns of European urban form, and specifically the urban types of streets, buildings, and land-use, as understood by the citizens and as quantitatively discovered by the spatial signatures of network centrality, build density and human activity. A key element of the proposed research is to provide an integrated framework for investigating these three fundamental aspects of urban form, while providing a standardized, reproducible methodology suitable for the European urban space, and therefore only open and available datasets are utilized. After, solely focused on network centrality and space syntax in the early-stage of my research (e.g. [12]; [13]; [14]; [15]; [16]), we decided to explore the patterns of urban form as an important conceptual tool for reading, discussing and designing the city [1]; [2]; [3], and to also include building and land-use as key elements of urban space [17]; [18]; [19], influenced by the work of Van Nes, Ye, Gil, Berghauser Pont (e.g. [20]; [21]; [22]; [23]; [24]; [25]; [26]; [27]). In this context the research objectives have been evolved to:

- Utilizing advanced spatial analysis for exploring the patterns of European urban form (types of network centrality, build density, land-use) towards evidence-based planning, geodesing and human-oriented planning.
- Utilizing participatory methods to develop a spatial language for reading, understanding and discussing the typomorphological characteristics of European urban form. Legible for “non-experts” (citizens) and useful for “experts” (researchers, practitioners and authorities)
- Investigating the impact of such typomorphological approaches to participatory and bottom-up planning processes
- Exploring the differences among the patterns of European Urban form, across various cities

The research approach implemented in my PhD research is described by the following steps:

- Literature review
- Definition of the analytical components for quantitatively describing the patterns of network centrality, build density and activity
- Investigation of relevant accessible datasets available for the European urban space
- Data preparation, harmonization (standardization) and preprocessing
- Analytical and quantitative definition of urban types
- Conceptual co-definition of urban types (validated and supplemented by local knowledge)
- European Urban Form: Discovering the types of network centrality, build density and land-use for European urban space (provisional Areas of Interest: European Capitals)
- Evaluation of the results and Analysis of the geography of patterns

In the Space Syntax PhD Conference, the first iteration of the research methodology shall be presented, as implemented for Athens. Athens is selected since it is a diverse urban area, and therefore is considered ideal for testing the methodology. Specifically, this first iteration describes the development of an integrated methodological framework for identifying types of buildings, streets and activities via multivariate clustering, by exclusively utilizing open data.



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## Multilevel Multimodal Network Modelling in Space Syntax

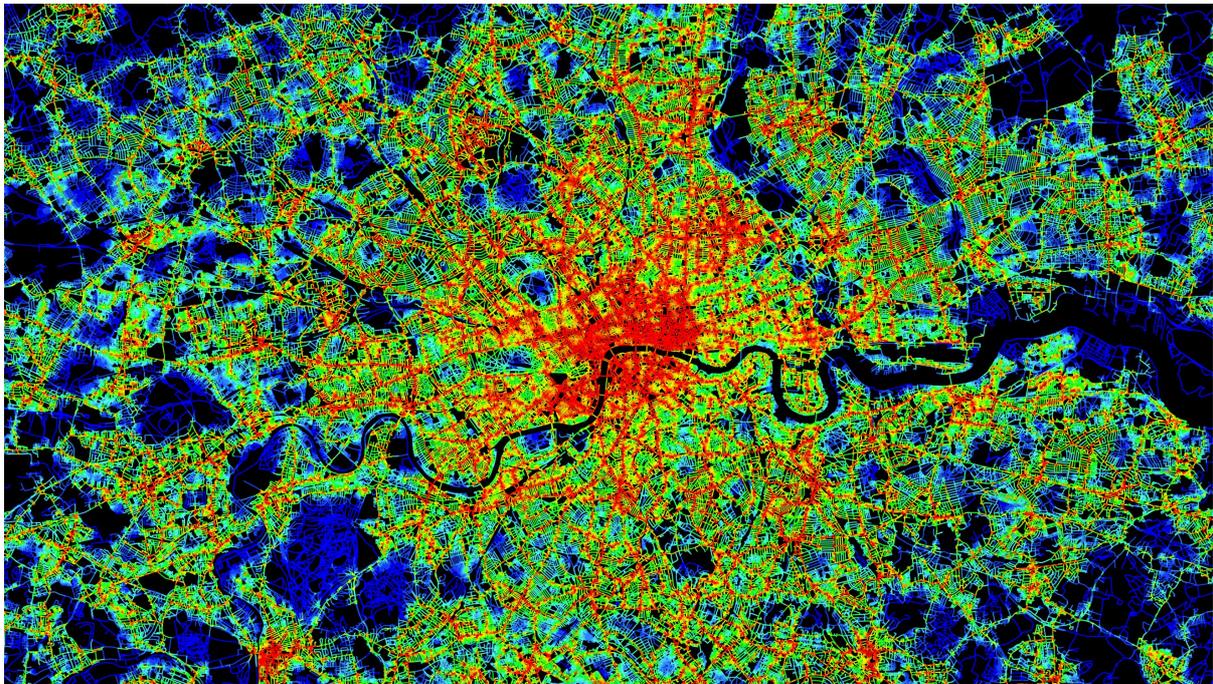
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In recent years, local authorities across the countries have engaged in reducing traffic-related pollution, congestion and accidents and enhancing urban mobility in a cleaner and more sustainable manner. It is essential for the transport and urban planner to provide better conditions for all the transport modes, including walking, cycling, vehicle and public transport and efficient transport services. Therefore, a methodology that could assess the multimodal and multilevel network for the solution and evaluation of urban design and planning is needed.

The aim of this study is to develop a synthetic methodology to examine the multilevel multimodal network that combines all transport network into one model, including rail-based public transport and street network. Space syntax methodology has been proved to successfully examine the configurational urban form and the related effects on the pedestrian and vehicular flow in the streets. This is studied through the simplified street segments with the constant time spent and equal weight between all space to all other space without concerning the non-street transport network between places. The space syntax result could only partially capture the potential movement of people by the geometric composition of the street network and somehow lose the sense of the public transport network, which plays a central role in supporting the daily commute in cities. In order to provide a better understanding of the network accessibility in the cities, this study first developed an Integrated Urban Model (IUM) by adopting the GIS-based multimodal network for the processing of space syntax analysis, then explored various measurements in Depthmap by applying time-cost distance for multimodal travelling. The results presented that the multilevel network model could provide a new vision of the centrality of space and transport network connectivity from the space syntax analysis. The study also demonstrated the concept of time-cost distance, alongside metric distance and angular cost could be significant for measuring the accessibility of the multilevel network in the cities.



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## Modal split prediction in emerging housing estates using space syntax variables

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**Key words:** Modal split, space syntax, housing estate, housing developer

In this paper, our research team focuses on unfolding potentials of an innovative approach to mode choice prediction using variables of space syntax. A technique that uses graph theory to describe and analyse spatial configurations. The goal is to test the research question, whether there is a relationship between modal split of residents and a chosen set of variables for newly emerging housing estates during morning rush hours. Research is supported by the biggest housing developer in Prague, who provided valuable data.

Over 12 thousand people are newly accommodated in Prague every year thanks to housing development [1, 2]. Therefore, it is important for urban planners and public transport providers to predict these new traffic volumes and modal split to prepare for the higher demand. But current methods for forecasting generated traffic of new residential projects in Czechia are rather underdeveloped and provide only rough estimates [3].

Researchers in the field of mode choice prediction currently use household surveys as the main source of variables [4, 5]. Problem with survey data is that we do not have a complete sample to work with and variables used to predict travel mode (income, age, gender, education, car ownership, region of residence, etc.) can only be obtained from surveys.

Another shortcoming of the current approaches is location variable describing position of the examined area within the city. It is either not considered [3, 6] or evaluated generally as a district [4]. Here lies the biggest potential, since in statistical terms 50–70 % of human movement can be predicted or explained purely from a topological point of view [7]. This is where space syntax, known for its ability to model mobility in cities [8], comes into play. In our approach, we focus on variables that minimize the need for knowledge of socio-economic background of future residents. Variables selected for this project are known already in the early project phase of future apartment buildings. The variables provided in the following list are discussed in more detail further in the paper.

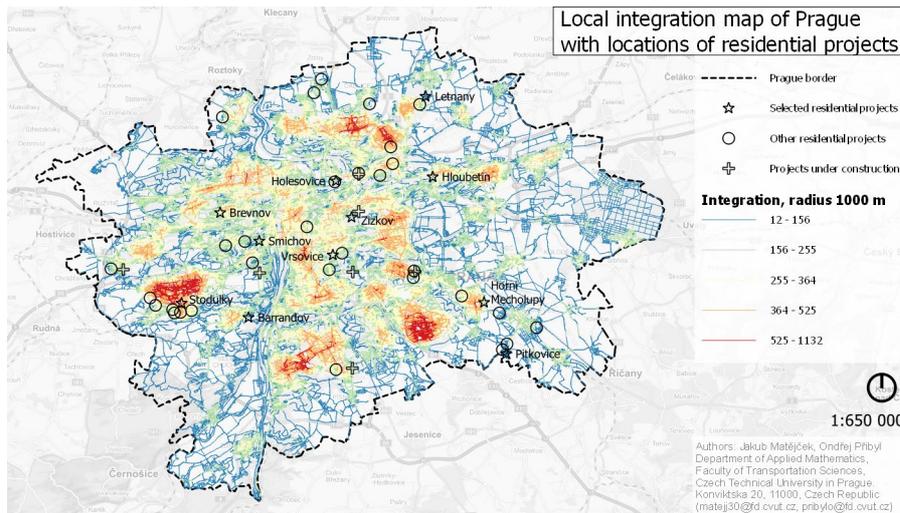
Proposed independent variables:

- Space syntax integration for radius n (axial map for vehicle connections)
- Space syntax integration for radius 1000 m (axial map for pedestrian connections)
- Public transport accessibility (methodology used in [3])
- Number of dwellings (provided by developer)
- Average occupancy of a dwelling [2]
- Average occupancy of a car [9]

Dependent variables:

- Vehicle and pedestrian volumes during morning rush hours (7 - 9 am)
- Modal split (vehicles : pedestrians)

50 projects of our cooperating housing developer were found suitable for this type of analysis. In the first stage, 11 projects were selected to test hypothesis that there is a relationship between dependent and independent variables. Given the sample size, multinomial regression was selected as a suitable method for this type of analysis. In the second stage, the sample size will be extended by other projects and will be divided into training and testing dataset. Afterwards modal share will be predicted for projects currently being built (ready to move into 2021 - 2023).



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## Diagnosis of a morphological and social cut. Case of a Mediterranean city.

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**Keywords:** urban morphology, spatial syntax, planning policies, urban structure, spatial configuration.

Cities are resulting of several urban stratifications across time and space. Made up of several layers whose interrelationship often remains ambiguous. These strata remain in eternal dualities, and whether they are relational, functional, sociological, morphological or other, they arouse the interest of many specialists. However, the approaches used to study the spatial dimensions of urban manifestations often have strong limitations, mainly caused by the lack of suitable methods for experimenting with this subject (MAZOUZ, 2018).

In this essay, which is part of an ongoing doctoral research, studying the correlation between urban morphologies and user behaviors, we will try to answer a recurring questioning which is: "what is the capacity of development policies to create urban continuity?" "To do so, we will study the case of Bejaïa, a three-thousand-year-old city located in northeastern Algeria and whose urban development is generating major dysfunctions. Between a historical core marked by the establishment of several civilizations (from the Phoenician to the French period), followed by an unequalled expansion in the postindependence period dominated by the perpetuation of the model of modernist functionalism. These generate cuts that these policies try to absorb as best they can.

First, we'll treat the morphogenetic evolution of the different layers of the city. It consists of a diachronic reading that tends to dissect the morphogenesis of the city. It will be accompanied by a critical reading of the planning policies that have led to the current configuration.

Second, in order to understand the urban fact of Bejaïa and the different interrelationships between the strata that make up its fabric, we opt for space syntax as a tool of space's modeling. This method makes it possible to detect the components of the spatial structure and the relationships between its different entities. Such an operation supposes studying the configuration of the urban space with a view to highlighting its constituents and its framework, and to identify the existing reciprocal relationships.

The theory of spatial syntax defines cities as sets of blocks and networks of spaces located between them. These networks link a set of street spaces thus forming the structural framework that supports and ensures the maintenance and overall uniqueness of the space studied. The spatial syntax stipulates that each system assimilated to an urban space has its

own architecture and therefore has its own topology (AL\_SAYED & al, 2014), which this method allows to analyze and quantify.

This study based on axial map analysis by the DepthMapX © simulation software will analyse the spatial structure of the urban fabric of Bejaïa. The interpretation of the various analytical values of connectivity and integration of the system, calculated by the software, will make it possible to highlight the degree of continuity / interruptions of the urban network. That such a morphological decortication of urban systems will lead us to better understand the interactions that take place there and will help us to highlight emerging dysfunctions. This way, we could even identify the spatiotemporal origins of these dysfunctions in order to better resolve them.



Figure 1: Connectivity axial map of Bejaia (Author, 2020)

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## **Spatial configuration and bicycle planning in Campina Grande, Brazil**

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This study aims to point out congruences and incongruities between morphological properties of the spatial configuration and mobility by bicycle in the city of Campina Grande, Brazil, aiming to help public managers in the decision making of plans and policies for cyclomobility. In 2015, the Municipality of Campina Grande, Brazil, instituted the Master Plan for Urban Mobility, establishing guidelines and policies for urban mobility plans in the city. Between 2014 and 2019, the city's bicycle infrastructure increased by 455% as a result of this urban mobility policy. Based on this context, the following questions arise: to what extent does the spatial configuration shape the flows and displacements by bicycle in Campina Grande? What configurational and morphological aspects are most recurrent when making route decisions for cyclists in the city of Campina Grande? Is the cycling infrastructure being implemented in topologically accessible spaces, where there is a larger demand for cyclist flow? Which places should be contemplated with bicycle infrastructure, taking into account the spatial configuration?

Therefore, the hypothesis is that the spatial configuration shapes, to a large extent, the flows and displacements by bicycle in the city of Campina Grande, with the linearity / continuity of the road network being the main configurational aspect that influences the decision making of cyclist routes. Although the bicycle infrastructure has been implemented in spaces that are in line with bicycle traffic recorded in certain areas of the city, better articulation between the supply of infrastructure and the demand for use is still required. To carry out this study, the following methodological procedures were followed: (i) collection

of secondary data on the flow of cyclists, road and cycle infrastructure in Campina Grande (Prefeitura de Campina Grande, 2014); (ii) segment map modelling of Campina Grande's continuous urban area, of which measures of connectivity, length, NAIN, NACH, INCH and node count were calculated in Space Syntax Toolkit (Gil *et al.*, 2015) and correlated to other variables; (iii) modelling of the urban topography using Topodata data (Valeriano and Rossetii, 2012), and land use (City of New York, 2019) in key areas; (iv) spatial and statistical analysis, employing thematic maps, distribution of data by percentiles and by correlation and determination coefficients. The partial results indicate that the INCH measure, related both to the potential for integrating and crossing the road network, road segment density at the local scale (1200 meters) and NACHr2400m were the configurational aspects that best related to the movement by bicycle, allowing to explain up to 39% of the variation in the flow of cyclists in the analysis points. These findings reinforce others research (Paiva *et al.*, 2012; Dufaux *et al.*, 2013; Liu *et al.*, 2016). Slope level terrain was inversely related to this movement. Approximately 75% of the retail, mixed and institutional use, are located on the 20% most accessible roads in the city (in relation to INCHr2400m measure). Wider lanes have a greater flow of bicycles than narrow ones, which is contrary to the recommendations of technical guidelines on cycle planning (WRI, 2015).

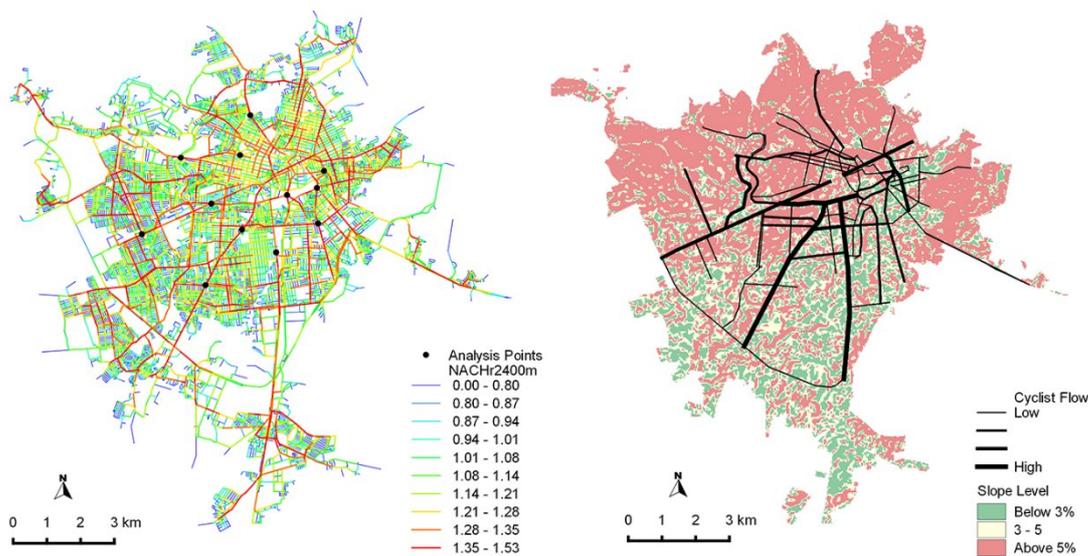


Figure 1: Map of Campina Grande, showing NACHr2400m measure, slope level and cyclist flow.

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## **The loiterer on the way: peri-urban centrality on the outskirts of coastal touristic villages**

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This work is part of a doctoral thesis now in progress, dealing with the relationship between road network and centrality in coastal peri-urban areas. It aims to apply the theory *of the city as movement economies* extending its reasoning beyond the city scale, to span coastal regions that include at least one international tourism pole as well as towns, villages and settlements.

The target location of the study is Praia da Pipa, a village that stands out amongst other similar tourism destinations on the Brazilian littoral: it is located in Tibau do Sul, the only municipality along the country's coastline where the number of foreign visitors would normally exceed that of domestic visitors in pre-pandemic times; the number of lodging establishments in the municipality is second only to Natal, capital (170) of the state of Rio Grande do Norte (94), and higher than that of João Pessoa, capital of the neighbouring state, Paraíba (79) (MTUR, 2019) also located in the Northeast region. Surrounding villages became part of the Praia da Pipa tourism destination, even though being located outside the municipality of Tibau do Sul (BARROS, 2005).

Although the beach is an attraction factor stimulating a concentration and diversity of activities, the village requires permanent interchange with other villages and towns concerning goods and services of various natures. The question is, therefore, whether even in the peri-urban environment characterized by low built occupation, highly accessible road segments would enhance movement that could trigger the emergence of certain uses (i.e. micro-economic activities) and to what extent the concentration of more accessible road segments is influenced by the extension of the road network.

The hypothesis is that the recurrence of favourable accessibility, related to different extensions (reach) of the road network reveals, or predicts, the location of land intended for

real estate speculation (“land fattening” manoeuvres) and future development, for which low building occupancy is a necessary part of the business. In contrast, high accessibility in coastal peri-urban areas still active in rural production, affordable housing or embryos of new settlements are rare to find.

Thus, the aim of the thesis is to understand whether certain patterns of use-plus-[low]occupation related areas tend to coincide with patterns of reach-accessibility values.

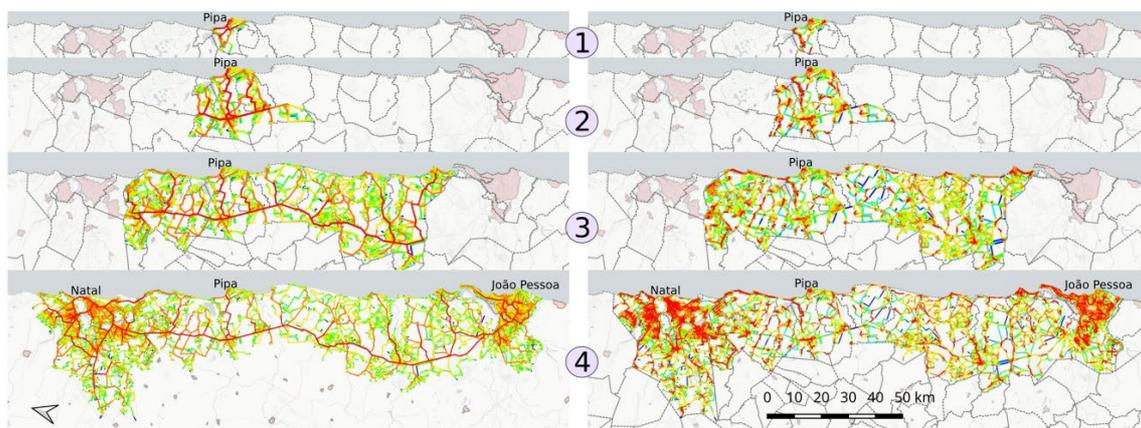
Accessibility is here to be understood as a measurement of cost-benefit through-movement in the road network (HILLIER, YANG. TURNER, 2012) and its extension towards the scale of a town network, depends on the growth and maturation of the regional morphology, as proposed by KRENZ (2018)

Details of the examined road network are shown in four maps, depicting Tibau do Sul (smallest one) and 24 municipalities stretching from Natal through to Joao Pessoa (largest one). The collected location samples were based on general aspects concerning the coastal occupation in Brazil (ARAÚJO, 2011) and other countries (PEARCE, 2003), which will underpin the selection of locations for prospection.

The identification of global and local centralities is being refined by means of multiple metric radii (SERRA, PINHO, 2013)) and the recognition of background and foreground road structures (HILLIER,2016).

The hypothesis may be demonstrated if results reveal a recurrent presence of real estate tourism developments interspersed by unoccupied properties (‘land fattening’ grounds) in areas that are highly accessible due to the extension of the road network at certain reach radii.

### Accessibility on the outskirts of Praia da Pipa to larger cities (2020)



NACH r=n:      Accessibility: high ■ ■ ■ ■ ■ ■ ■ low      NACH r=3200m:

1. municipality (Tibau do Sul)
2. municipality + neighbours
3. between larger cities
4. including larger cities (Natal & João Pessoa)

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## The Geometric Properties of Indonesian Cities:

### A study of the Provincial Capitals of Indonesia in relation to regional variations.

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**Keywords:** Geometry, urban pattern, OpenStreetMap, Space syntax, regional variations

**Background** –The technology and techniques of urban analysis of city has evolved drastically. The advances of Big Data and web 2.0., where the data generated from crowd sourcing, continuously corrected, and improved for its accuracy can greatly benefit urban studies. Yet the use of this method in developing countries are still scarce due to limited information and knowledge on this technique.

**Problem** – A lack of comparative studies amongst cities, especially those in developing countries such as Indonesia and Southeast Asia, is still a significant issue in Urban Design

and urban development for that region. There has not been a consistent and straightforward method to carry out comparative studies to learn about the geometry and street networks of these cities and how it could be classified and how they affect society. The problem of conducting research in this scale can be attributed to the traditional data collection challenges i.e., limitation in data samples, geographies sources, technical knowledge, and availability of time (Ford, 1993; McGee, 1967). This research will use the capital cities from 34 Indonesian provinces for case studies as an attempt to identify a “model geometry” for Indonesian cities that might serve as reference for future growth of Indonesian capital city.

**Methodology** – The primary objective of the study is developing the framework of describing the patterns of urbanization in Indonesian cities, defined by street grids, urban blocks, plot patterns and societal geometrical patterns. The database acquired for this research will include maps from VGI / volunteered geographic information such as OpenStreetMap (Arsanjani et al., 2015; Bennett, 2010; Haklay, 2010) that are processed using OSMnx, a software built on top of Python’s Networkx, matplotlib and geopandas libraries that provides a rich network analytical visualization application (Boeing, 2017, 2019). The street centerline maps that stores geospatial and topological information of the cities are extracted, which then, exported into various file extensions for GIS multi-platform such as ArcGIS, Axwoman (B. Jiang, 2015; Bin Jiang, 2013, 2019), and qGIS applications to run spatial and geometrical analysis. Methods from space syntax and street network analysis is used to measure and analyze the geometrical and topological value such as Global Integration, Foreground and Background network, and Connectivity (Batty, 2004; Hillier, 2007, 2012) that will determine any significance in the findings.

**Results** – The study shows that there is correlation between spatial pattern of Indonesian Cities with the value of Global Integration. This correlation can be classified as regional variations in Indonesian cities that shows there are underlying syntactical structures showing some degree of character between cities in Indonesia.

**Significance** – The study will contribute to the field of urban design study in Indonesia by providing robust methods for describing the complex urban geometry and street networks that could classify the regional variations of cities in Indonesian archipelago. This study is also essential for the emerging future Indonesian cities especially at this time where Indonesia is planning to relocate its Capital city.

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## **An attempt to visualize some observable coastal urban dualities in Nabeul**

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Many studies have shown that coastal urbanization has a powerful and direct influence on the emergence of socio-spatial distancing (Dachary-Bernard et al., 2011). It is clear that the coast, through its multifunctional attraction (Bal & Podolska, 2020), leads to a seaside territorialization that is sometimes not integrated with the urban centrality (Laborie & Rejeb, 2012).

Nabeul is a good example of the duality of the city. Its coastline is currently facing significant changes with very diverse pressures related to population growth, the development of cities but also to tourist areas that characterize these spaces (Gastly, 2013, Said, 2016). All of these anthropic pressures require a logic of differential and sustainable management that considers socio-spatial dynamics and realities (Daligaux, 2003). Such facts can lead to new practices and uses of spaces which are reflected as socio-spatial heterogeneity, generating a fragmentation of the urban configuration (Gomez, 2014). In this case, this work examines the duel socio-spatial organization induced by a process of uncontrolled littoralization. Thus, the fragmentation of the city center and the socio-spatial reconfiguration require the study of these urban phenomena as proposed by (Philifert, 2016) which raises a debate on the correlation between the phenomenon of littoralization of the spatial system and the fragmentation of urban fabrics (Carsjens & van Lier, 2002).

For this research, we propose to set up a multi-scale reading grid to identify certain sets of scales and sets of actors and their socio-spatial interrelationships responsible for the characterization of the main typologies of urban landscapes in the city of Nabeul. In this process, markers of the reconfiguration and fragmentation of the city center can be captured through two themes characteristic of the centrality of a place, the concentration of urban functions (i), and their dispersal in the study area (ii). These urban determinants are reflected by generic concentration/dispersion index of morpho-functional spatial distributions (number of structural facilities and proximity services). Another approach will be associated with this analysis, which refers to spatial practices in relation to the degree of connectivity and continuity of some of the compartments of the city (Laouar, et al., 2019). The use of geomatic sciences, more precisely spatial syntax, leads us to propose an experimental approach to urban systems (Jiang et al., 2000), using different measures and syntactic values such as connectivity (Domingo et al., 2019), integration and Choice (Rejeb Bouzgarrou, 2019). The confrontation of measures of distributions and spatial integration, reveal a spatio-temporal opposition in the organization and frequentation of central and coastal spaces.

These facts allow us to better explain the current urban findings and to suggest prospective scenarios for a better territorial reorganization (Donadieu & Rejeb, 2009). Finally, this experimentation aims to open investigations related to the processes of manufacturing new urban polarities in order to propose a logic of integrated management of coastal cities.

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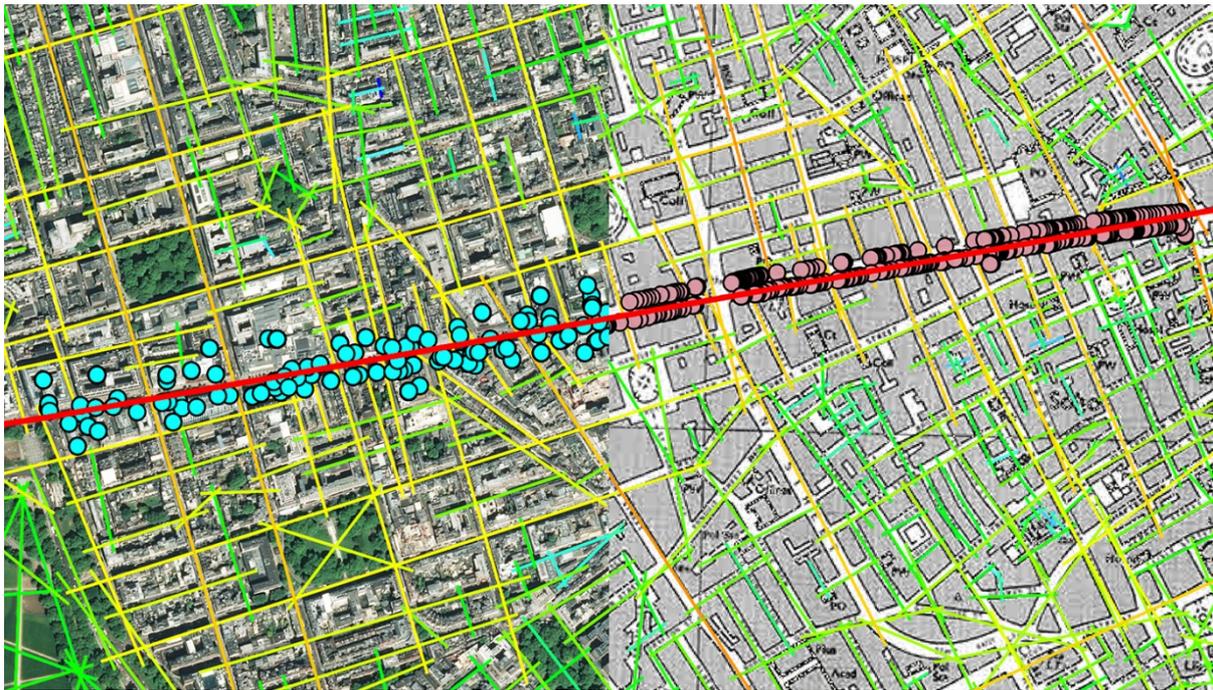
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## **A line with a history: using land-use data to plot change and continuity in Oxford Street between 1970 and 2019.**

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One of the indications of social change in a city is the shift in the character of its central shopping street, particularly the dominant pattern of land-use. This paper focuses on the shifts in the character of Oxford Street, during the historical transition of London from a late-twentieth-century 'modern' city, to a twenty-first-century 'digital' city, in order to better understand the broader socio-economic and media contexts of this change. The research presented contrasts the mapped land-use profiles of Oxford Street in 1970 and 2019 at the building scale to identify shifts in the socio-economic and cultural image of this street. The research employs space syntax methodology to understand the changing land-use pattern of Oxford Street through its embedding in the urban fabric of London during a period when its configurational description has remained largely consistent. It also examines the land-use data of the street in three levels: 1) Group level (nine types), 2) Category level (52 types), 3) Class level (over 600 detailed types) to understand precisely the distribution of activities throughout the street in these two times. Syntactical analyses of Oxford Street, as

well as statistical exploration of these three levels of the land-use data, make it possible to highlight in details how Oxford Street functioned as a centre of retail and arbiter of cultural taste in these two eras, balancing change and continuity. It acknowledges the special status of Oxford Street in space syntax theory as the most integrated line in Hillier's pioneering model of central London (Hillier 1996). It builds on this work to show how land-use data can improve our understanding of Oxford Street as a key to London's movement economy. This approach informs our understanding of the spatial materialisation of changes in the broader cultural and media environments, particularly those associated with the rise of social media since the 2010s. This shift, it is argued, affects how Oxford Street space is perceived by citizens as a social space. In seeking to understand it, we can reflect on how the past of Oxford Street can help us to understand its future.



*Figure 1. Global Axial Analysis of Oxford Street & Distribution of Oxford Street Activities in 1970 and 2020*

## **Space syntax analysis and global cultural heritage attractors A comparative approach between Rome, Jerusalem and Barcelona**

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Historic city centres are important components for cities' sustainable urban development all around the world. They form multi-cultural, multi-functional attraction sites. Understanding the spatial dimension of the socio-cultural systems of historic city centres can provide an important tool for urban designers and policymakers. The aim of this project is to explore the relation between global heritage attractors and the spatial configuration of the cities' street network to understand culture-led pedestrian movement. The methodology proposed here is based on the concepts of attraction for predicting pedestrian urban movement and spatial configuration (Hillier et al., 1993), linking well known approaches of Space Syntax analysis with point attractors. A comparative approach is suggested between similar urban areas – the historic urban areas of the metropolitan cities of Rome, Jerusalem and Barcelona to explore whether the cultural attractors act as multipliers of the established pattern determined by the configurational analysis or whether these attractors are generators of pedestrian movement which perform independent of street configuration. For the scope of this work and following Camiz's classification (Camiz, 2017) we focus only on cultural point attractors (landmarks ranging from monuments, buildings to larger historic areas) and not on linear ones (streets, bridges). We define cultural point attractors as the highest ranked attractions in the studied area provided by the online travel platform Tripadvisor, based on user-generated input (<https://www.tripadvisor.com/>, last accessed 01.04.21). As these point attractors are historic elements, they mostly form part of the urban environment since centuries which also add a diachronic parameter in the analysis (Camiz, 2017).

The specific methodological steps of the presented case study (the UNESCO area of the historic center of Rome) were developed as follows; first, we downloaded the Open Street Map (OSM) road network as a graph (using the Python library osmnx). The graph was simplified by selecting the road central line (RCL) (Kolovou et al., 2017) and subsequently the invalid, overlapping and duplicate geometries (through Road Network Cleaner) were removed. The choice to follow the road central line simplification principles was based both on the fact that we are dealing with large urban systems and the availability of comparable data for the three cities. Finally, through the QGIS Space Syntax Toolkit plugin (based on the DepthmapX software) a high metric radius normalized angular integration was carried out (NAIN) to reveal the to-movement potentials of the (Yamu et al., 2021).

Following the first step, the 10 most popular attractors were mapped based on open data from Tripadvisor and visualized according to attractiveness, depending on the number of reviews. The choice to use data obtained from this online platform was made based on following two criteria; on one hand, to use an open data source, common for all case studies and on the other, the fact that Tripadvisor operates with an international audience, the study could provide us with indicators for mass tourism movement in historic areas of metropolitan cities.

During the last step, the normalized angular integration map (NAIN) of the historic center of Rome is combined with the attractors including a 5-minute service area for each attractor. The results of this correlation are shown in the Figure below.

The comparative study of the three cities along with a data elaboration on each street segment will eventually contribute to a better understanding whether and how the places of cultural significance are being affected by the spatial network per se. This may provide us with insights on pedestrian movement & walkability in regards to culture-led itineraries, a concept that even though has received attention within the planning & design disciplines, methods and tools to measure and eventually predict pedestrian activity especially in historic areas compose a field that allows for further exploration (Sevtsuk, 2021).

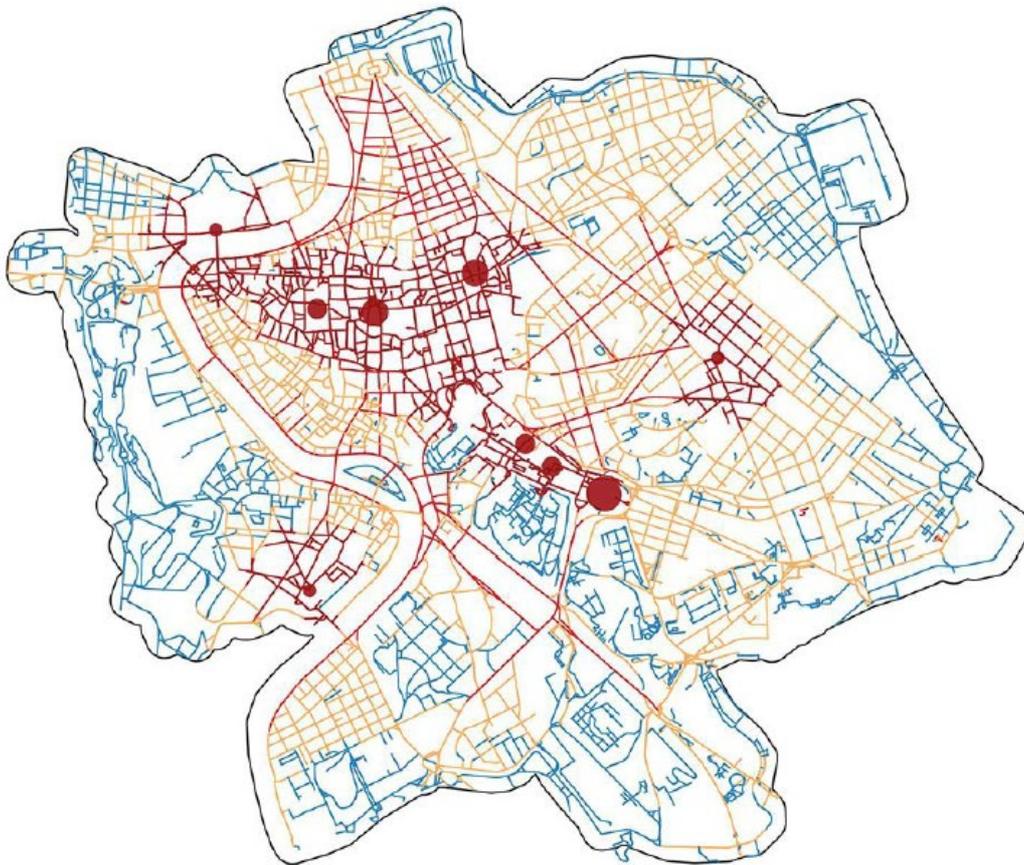


Figure 1 – UNESCO, historic area of Rome. The top 10 ranked attraction points (5 minutes service area) correlated with the NAIN segment map

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