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UNDERSTANDING COHERENCE BETWEEN FUNCTIONAL AND COMPOSITIONAL STRUCTURES OF THE CITY: a case study of local centres in Vilnius

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Abstract

One of the key goals of the design process is to arrange the main elements of compositional structure. Space syntax as an effective method when dealing with the already defined spatial configuration is widely applied to different urban design projects. The problem addressed in this paper is the "separate" (i.e. "non-combined") approach to functional and compositional aspects of the formation of urban structure. Functional issues are likely to dominate in both the analysis and design of the physical form of the city. The aim of the paper is to discuss the findings of the case study as a preliminary attempt to develop the understanding of the main features that determine coherence between functional and compositional structures. The study is a part of a broader research effort aimed at determining the basic shape for analysing the interdependence of functional and compositional structures of the city. The scope of the study is to reveal some inconsistencies in the spatial patterns where the distribution of pre-determined functions and urban composition are in a non-corresponding relation. Three local centres in the north-western part of Vilnius are taken as an example to demonstrate a tentative inconsistency map where the structure of urban space is represented both axially and convexly. Using the spatial accessibility model of Vilnius city, the study focuses on spatial structure at the level of urban blocks, which constitute local centres. The linear elements of the model are overlaid on a ground plan where convex spaces are highlighted considering their artistic and visual potential. Choice (betweenness, a measure of centrality) as a critical measure for analysing local centres is used to identify movement related structural patterns. A specific question requiring further investigation is how to measure both movement and artistic potentials taking into account their interrelationship and dependence on visual properties of urban space.

INTRODUCTION

From a physical point of view, cities are stocks of buildings linked by space (Hillier 2007). Urban space is inseparable from the notion where cities are seen as systems of social activity linked by interaction.

The term 'composition' can be referred to as an urban layout which is a part of urban design that deals with the arrangement of buildings as well as convex spaces and/or the elements of the urban grid. Compositional structure is the conception of the arrangement of the aforementioned elements and the whole of the relations between these elements.

The term 'functional structure' is used in an attempt to tackle questions related to social, economic, cultural and environmental processes within the city. Movement is considered to be a dominant form of space use. Occupation means the use of a building for commercial, domestic and other activities. Accordingly, functional structure refers to both the pattern of movement in space and the distribution of land uses. A street network can be represented as the least set of the longest lines passing through each convex space (Hillier and Hanson 1984). This paper considers that space syntax brings to light functional structure when particular spatial accessibility values are assigned to linear elements.

Functional and compositional structures are closely linked and dependent on each other. Spatiality and axiality are assumed as fundamental concerns for research aimed at a better understanding of the interdependence of functional and compositional structures. In self-organized cities, compositional structure is usually constructed on the basis of functional structure. Differently, creating compositional structure first is a sign of the time and subject of the paper. In this case, functional structure emerges after new compositional axes are connected to the existing street network. This is evident when dealing with districts in the analysed part of the city (in our case Vilnius, Lithuania) having predominant residential land use developed in a large area at one time.

The "separate" (i.e. "non-combined") approach to functional and compositional aspects of the formation of urban structure had a negative impact on those districts and their centres; it ignored the historic function of the street: the integration of movement and social interaction. The focus is on local centres because of their capability to bear on sustainability primarily through the collection of various functions defined as a concentration and mix of land uses and activities in a prominent location (Hillier 1999).

The scope of the study is to reveal some inconsistencies in the spatial patterns of three local centres in the north-western part of Vilnius where the distribution of the pre-determined functions and urban composition are in non-corresponding relation. When dealing with analysed interdependence, the following extremes should be pointed out: the first one is a well-designed but under-used public space because of its inappropriate location; the other extreme could be defined as an important street built within the period of prevalent car-oriented planning decisions having an insufficient number of entrances to buildings, more specifically, unrealized artistic and visual potential.

A new point in the combined approach discussed in the paper is the introduction of the concept of dominance referring to a building as the most visually dominant feature in its urban context. The analysed problem of coherence between functional and compositional structures is also seen through the prism of dominant patterns embedded in urban space. Hence, this paper considers two types of dominance: the dominant elements of built-up structure (referred to below as "dominant buildings") and those of space structure (referred to below as a "dominant pattern"). There are two types of dominance (relationship) reflected in our case. First, the buildings characterised by the properties of height and volume (those

contributing to visual impact in terms of scale and massing) in relation to land use should be pointed out. Second, investigation focuses on the close-up of a spatial accessibility (local and global) map and a convex map where spaces are highlighted according to their artistic and visual potential. As mentioned before, it is considered that space syntax brings to light the dominant pattern of the urban grid when particular spatial accessibility values are assigned to linear elements.

OUTLINE OF THE METHODOLOGICAL APPROACH

The selected examples of three local centres in the north-western part of Vilnius are treated as problematic areas where further interventions are needed. Two of those centres have problems concerned with their location. However, the points identified in the case study could be related to the incomplete/ineffective plan of each analysed local centre.

Districts and their centres in the analysed part of the city have predominant residential land use and were formed within the period of industrial construction dated from 1977 to 1991; before, the territory was mainly used for agricultural purposes. The new elements of the urban grid caused all three districts to have a distinctive character, but when looking at their local centres in the context of the whole city, the lack of connectivity is evident, i.e. not all potential connections were considered enough in order to link local centres to each other and to the global routes throughout the city. Therefore, Ukmergės Street remained the main functional and compositional axis leading to the historic city centre. The major problem is that this street was designed as a transport corridor diminishing the possibilities of social interaction.

The main selection criteria for a district centre were the catchment area and population density. The arrangement of commercial buildings/complexes usually was determined in a large part by artistic decisions. Because of the need to distribute daily amenities within walking distance, the decisions were strongly dependent on catchment radius (as the crow flies) measurement, and permeability issues as well as connectivity between local centres and their urban context were not fully acknowledged.

The surrounding street network plays a key role in determining the potential of the area. However, it seems that separate groups of architects and planners involved in the process of forming new residential districts treated the given site independently, thus not trying hard enough to make the right connections between neighbouring local centres. This disregard can be partly explained by taking into account the notion that each district was planned making every endeavour to achieve an individual character (Miškinis 1991). The usage of mass-produced building components, standardization and unification had a negative impact on architectural possibilities. Therefore, in order to achieve the aforementioned goal, efforts were concentrated on the “innovative” arrangement of the urban layout.

Most of the failures concerning the spatial layout were programmed in the conceptual schemes of districts consisting of large residential buildings and separate commercial buildings/complexes set back from the street. There could be identified two main problems evident in the analysed part of the city: (1) the interwoven structure of public and private/semi-private convex spaces leading to the condition of over-permeability; (2) wide streets surrounded by the under-used areas of the lawn, surface car parking or indifferent and monotonous frontages. The first problem can be tackled by revealing cases where the same convex element can be considered both public and private. The second one is used for investigation by looking at the distribution of land uses and providing opportunities to transform/add the elements of built-up structure. Both problems that emerged as a result of planning decisions, made in order to separate

pedestrian and vehicle flows, have to be approached by analysing the accessibility and degree to which spaces are constituted by building entrances.

The methods used in this article correspond to the basic principles of compositional analysis and were laid down in the paper by Jurkštas (1975). Related to the modernist notions of urbanism, some failures identified in our case are analogous to those of the new towns in the United Kingdom (Karimi *el al.* 2009). Using the spatial accessibility model of Vilnius city (Bučys 2010), the study focuses on spatial structure at the level of urban blocks which constitute local centres. The linear elements of the model are overlaid on a ground plan where convex spaces are highlighted considering their artistic and visual potential. Choice (betweenness, a measure of centrality) as a critical measure for analysing local centres is used for identifying movement related structural patterns.

When looking into urban composition, the following criteria are selected as the main determinants of the artistic and visual potential of urban space: the transparency of facades, the character of frontages and other bounding elements and the visibility of a dominant building. The objective evidence is gathered through field observation and by studying the ground plan. In fact, these procedures are not sufficient to capture the full potential because this research does not include the aspects of urban composition (such as importance, expression, contrast, attractiveness etc.) studied in a subjective/artistic way. This can be a topic of a separate paper.

By summing up all compositional aspects, the convex spaces of the analysed local centres are subsumed into three categories.

- The first and the highest category of convex spaces includes those having complete composition and a distinct character determined by the presence of a dominant element (this means that a dominant building is visible from any point inside convex space and has a dominating visual impact upon the street scene) and openings of windows and doors as predominant elements of the facades.
- Convex spaces characterised by indifferent and monotonous elements of built-up structure and urban space fall into the second category.
- The third category of convex spaces includes the ones edged with undeveloped plots and having predominantly unformed bounds, blank frontages and blank fences.

SOME INCONSISTENCIES: A CASE STUDY OF VILNIUS

a) Šeškinė

The first analysed local centre in terms of construction time and distance from Vilnius Old Town is situated in Šeškinė district, ***Figure 1***. The strength of this centre is global accessibility. It is located on both sides of the main route to the historic city centre and can be easily found and accessed by a large number of individuals, including passers-by. The other two centres (discussed further below) located on less significant routes and hidden within the local urban grid are visited mostly by the locals.

The problem is that Šeškinės Street – a crescent-like element in the radiating street pattern – consists mostly of indifferent and monotonous elements of built-up structure and urban space. Large spaces are dominated by surface car parking and set-back areas along the street with no functions. Economic and social activities

are concentrated inside the quarter along pedestrian streets. During the last two decades, the distribution of active land uses has changed slightly from the pre-determined plan. The flower market was expanded and new office buildings were built (some parts of the urban landscape of the street has been improved). Naturally, there emerged several new non-residential functions along the street showing that the current situation as opposite to the strict separation of land uses and pedestrian/vehicle movement leading to some inconsistencies in the spatial patterns is a response to the constant pressure of change.

Designed mainly for vehicle movement, Ukmergės Street, consisting of a number of non-constituted convex spaces, divides the centre into two parts. The major constraint of the eastern part is the direction of the main axis of the pedestrian street. A failure in its original objectives is reflected by the insufficient number and mix of active land uses. In that case, only few office and residential buildings emerged, though comparing to the western part, the lack of land uses sensitive to movement is evident. This inconsistency can be identified by studying the ground plan. The aforementioned linear element parallel to Ukmergės Street neither performs as a line of global movement, nor is the presence of dominant buildings sufficient to dominate the surrounding area.

b) Fabijoniškės

The local centre of Fabijoniškės consists of two parts (see ***Figure 2***). One of them (the so-called pre-determined part) is a pedestrian area with a complex of non-residential buildings (retail, public office, services, catering etc.) which adjoin it to the east proposed in the conceptual scheme of the district. A large space to the west of the pedestrian area under-used by everyday activity is the result of an incomplete plan and unsuccessful implementation of the intended design. The other part was gradually formed on both sides of the parallel street during the last two decades. This shift can be ascertained by analysing the degree of the coincidence of local and global properties and verified by comparing the processed results to the findings of the study of local centres in London (Hillier 2009).

The urban layout of Fabijoniškės district can be characterised as a combination of grid and cul-de-sac. This prevents natural movement through the pre-determined part the accessibility to which by car or public transport is inconvenient. A newly formed part located on S. Stanevičiaus Street has significantly higher global accessibility. However, despite its disadvantages that are more dispersed active land uses as well as the under-used areas of the lawn and surface car parking surrounding the street, this part has more potential to be developed into a spatially successful local centre. The location is very convenient for public transport users and further improvements in terms of complete composition and a distinct character sustained by the constitutedness of urban space are needed to offer more advantages for pedestrians.

c) Pašilaičiai

A similar and in a sense even more complicated situation can be identified in the local centre of Pašilaičiai, ***Figure 3***. The surrounding street network is actually more confusing. When looking at the conceptual scheme of the district, it can be noticed that the focus was concentrated on “innovative” arrangement and an attempt to combine the circular and regular grid-like network of streets. The need to make effective connections with the surrounding urban grid was somehow disregarded. Connections with Laisvės Avenue, particularly segments having the highest global accessibility in the context of the whole district, can be taken

as an example. The main axis is reserved for pedestrian use only; moreover, no openings of entrances to residential buildings along this linear element (entrances are located in semi-private yards) could be found. Except for the fact that the complex of buildings reserved for commercial purposes can be considered as a dominant element surrounded by the under-used areas of the lawn, the other observed features (the openness of facades, the character of frontages and other bounding elements etc.) do not indicate that composition is complete and convex spaces constituting the local centre could not fall into the highest category.

CONCLUSIONS

Potential locations for concentration and a mix of land uses and activities are the places where the degree of the coincidence of local and global properties is high as shown by Hillier (2009) in his case study on London local centres. Moreover, an attempt to assess coherence between functional and compositional structures presented in this paper contributes to expanding knowledge of the features determining a spatially successful local centre. In particular, research findings can be significant for examining design solutions because of the developed methods for spatial analysis that were not available when the conceptual schemes reminiscent of those used in the designs of the large scale housing estates (in the United Kingdom, as well as of those spread in other countries) were developed.

Using the combined approach, the paper attempts to unfold the notion of coherence in a way of understanding the character and potential of a particular set of interrelated elements that could evolve as a method for examining the indentified inconsistencies in the spatial patterns of the analysed city. A dominant pattern of the urban grid overlaid on the ground plan where convex spaces are highlighted according to their artistic and visual potential can be an effective basis for assessing local centres. It would be worth mentioning that a set of features used here to characterise artistic and visual potential is not complete and there is a need to search for the most appropriate evaluative criteria and develop representation tools. Actually, graphical representation as intended for urban design practice is essential to perceive the effectiveness of analysis, especially for those who are not familiar with space syntax techniques. To better understand coherence between functional and compositional structures of the city, the means of representation and the measures of both movement and artistic potentials are a subject for a further study. An interesting line for further investigation would be examination on whether a higher visual dominance of urban space in relation with the dominant pattern of the urban grid correlates with higher perceived dominance leading to a successful urbanism, i.e. actual pedestrian/vehicle movement flows and informal space use in relation with the disposition of land uses sensitive to movement.

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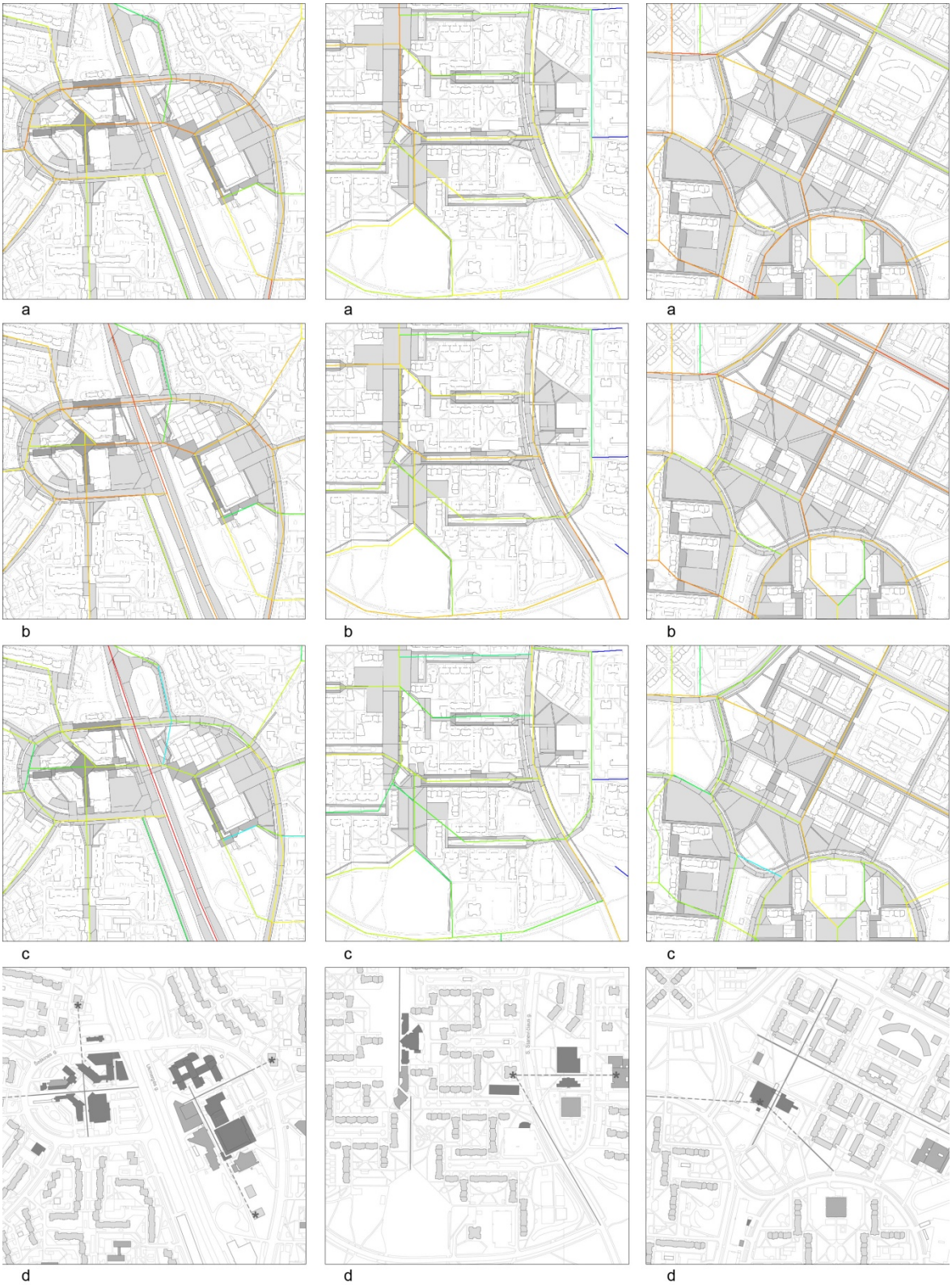
Figures 1–3. Three local centres in Vilnius: Šeškinė (1), Fabijoniškės (2), and Pašilaičiai (3). The combined map. Segment angular choice: Radius 800m (a); Radius 2000m (b); Radius n (c). The land use map (d)



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