Challenges of Portuguese urban planning instruments and practice

Demonstrating a DSS integrating space syntax

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Introduction

The basic idea behind urban planning is to produce some kind of explicit rationality driven by collective purposes, capable of regulating the multitude of individual decisions that build the city over time. How this rationality is constructed, that is, which are the underlying criteria and analytical interpretations, remains one of the most critical questions in urban planning. In fact, in order to be effective, a plan should be informed by a stringent diagnosis of the reality it aims to conduct and regulate, and it must also be able to prognosticate, at least to a certain extent and with a reasonable degree of confidence, the expected outcomes of the proposed planning strategies. On both these stages of the planning process – diagnosis and prognosis - objective analytical methods and predictive models are key. However, in what concerns the physical and morphological dimensions of urban planning, this kind of methods and models remain largely speculative, if not simply absent from the regular practice.
In this paper we propose a Decision Support System (DSS) to address these specific challenges of urban planning practice, with a strong focus on the Portuguese planning instruments. The proposed system, combining GIS spatial analysis technology with space syntax techniques, is able to provide rigorous quantitative descriptions of urban spatial layouts which are, in turn, capable of informing urban spatial strategies from a new and more assertive point of view. Its relevance and operability are demonstrated through the assessment of an actual planning exercise, a Portuguese municipal master plan (Plano Director Municipal - PDM).

Urban planning in Portugal: instruments and practice.

The current Portuguese System of Territorial Management (Sistema Nacional de Gestão Territorial – SNGT) is hierarchically organized and based in the concept of 'cascade of plans', in which the lower order instruments are supposed to detail the options made by the upper order ones. These instruments are classified by their scope of action (national, regional or municipal) and by their function (strategical, regulatory, sectoral or specific). All instruments are binding to public agencies, but only those of specific and regulatory nature are binding to private initiative, thus having a direct and evident spatial impact. In the latter we find the municipal plans (PMOTs), the last tier of the hierarchical scale, but also the only one which contains instruments of mandatory elaboration (namely, the municipal master plan - PDM). These are the instruments that will concern us here, for they are also those who deal directly with the urban scale.

The municipal tier of the SNGT is divided into three planning instruments with different scopes: the PDM, covering the whole municipal territory, urban and non-urban (i.e. natural and rural); the PU (urbanization plan), restricted to urban areas or those to be urbanized; and the PP (detail plan), restricted to small and specific areas of the municipal territory, urban or non-urban. These instruments have also different functions. The PDM is supposed to be a normative plan (defining land uses), but also a strategical one (locating those uses and defining the general municipal spatial development strategy). The PU is the urban form defining instrument par excellence; it is also the most appropriated for current urban management, defining the criteria for development and transformation of the urban environment. The PP has an explicit design role, defining precisely the spatial organization of the areas in which it applies. Its role is primarily of implementation and operationalization of options and strategies set upstream by PDMs and PUs [1].

Albeit straightforward, the use of these planning instruments has been hampered by diverse factors, namely the misunderstanding of their functions and competences and its frequent overlapping. The PDM, that ought to be used for the establishment of a municipal general spatial strategy, is frequently a mere zoning exercise. The PU, with great potential for defining the general structure of urban space, is seldom used. And the PP, which should only be used in localized situations with very low uncertainty of development, tends to overlap and to occupy the function of the PU [1]. Thus, between the very generic character of the PDM and the specificity of the PP, remains a void of integrative strategic vision for the urban structure, which is reinforced by the absence of tools to support and link the various scales of development.

Proposed DSS: integration of space syntax and geographic information systems

The space syntax theories and techniques [2] offer a model for describing urban form and structure that is analytical and non-normative (i.e., it does not speak about how things ought to be, but analyzes them to learn why they are so) and formally defined (i.e., not based in discursive concepts but in mathematical formalisms). It proposes several methods for representing space and spatial systems that are internally consistent and directly translatable into graphs, making possible the analysis of very large spatial networks, like those of cities or even city-regions.

Space syntax can be coupled with GIS platforms to create a DSS [3,4]. Thus, the space syntax modelling approach is extended and gains compatibility with GIS practice in support of urban design [5]. Specific characteristics of this system are:

- Granular, with highly disaggregate data at the level of street segment, useful for detail urban design;
- Predictive, with the results integrated in a multi-variate statistical model;
- Relational across scales – the same model works for local and global analysis;
- Relational across themes – the same model describes urban morphology, centrality, hierarchy or structure;

Demonstration

We demonstrate the characteristics of the proposed DSS with its application to a municipal PDM. For lack of space, in this abstract we simply enumerate and briefly describe a series of analyses performed on the case study, which complement, inform and evaluate the work carried out by the project team.

- Diagnosis – the centrality analysis of the existing municipal spatial structure identifies the actual hierarchy of town centres, as well as the fragmentation and dislocation of these centralities in relation to where the municipality has placed investment over the past decade.
- Prognosis – the different proposed development phases have been analysed in sequence to assess their individual impact and also the overall impact once the plan is completed, testing the extent to which the objectives of the plan are achieved (Figure 1).
- Across themes – the analysis studies both the urban morphology and the mobility systems of the municipality, addressing issues of density, centrality, attraction and movement flows.
- Across scales – the road network hierarchy is identified for various ranges of movement, from local activity to the municipal and regional scales, revealing a finer set of hierarchical levels than it is given by the official classification.
- Predictive – we developed a movement flow forecast model based on traffic counts from the official national roads survey. This model provides objective quantitative estimates of traffic volumes (Figure 1) that can support decisions on road upgrading, downgrading or capacity change.
- Granular – taking the street segment as smallest planning unit, we were able to test the effect of small localised interventions, either affecting the mobility system's hierarchy or the intelligibility of the urban fabric of the different town centres.

Figure 1: Two maps of the proposed plan showing the impact of the proposal. On the left the line intensity indicates an increase in global movement flow relative to the existing condition, with the dashed lines signalling new proposed roads. On the right are the forecasted traffic volumes of the proposal, with line intensity indicating higher numbers.

Conclusions

Given the evident spatial nature and strong impact of the municipal plans (PMOTs), and in order to comply effectively with their purposes, we need to be able to construct spatial strategies that are based on explicit rationalities; otherwise we will just be making educated guesses. The integrated spatial analysis and impact assessment of the proposed DSS can handle degrees of complexity and a multiplicity of dimensions that gives the planner a unified understanding of the problem in support of the diagnosis and prognosis stages.

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