

#184

A SQUARE FOR PEOPLE

A visually communicative, configuration informed and social-oriented redevelopment project for Largo da Graça, Lisbon

VALERIO CUTINI

University of Pisa

valerio.cutini@ing.unipi.it

ALEXANDRA PAIO

ISCTE-University Institute of Lisbon

alexandra.paio@iscte.pt

CAMILLA PEZZICA

University of Pisa

camilla.pezzica@gmail.com

ABSTRACT

This paper describes an experimental project in which the urban designer uses Space Syntax and other analysis techniques coming from Public Life Studies and Building Thermal Physics, to inform the Design Decision-Making for the redevelopment of a public square. Largo da Graça in the historic centre of Lisbon was selected as a case study, suitable for testing many possible and different design changes when space syntax is embedded in the design decisions. The experiment generated a digital workflow with all the steps undertaken in solving design problems, a 'design journal' that includes efficiency targets (centrality, connectivity, enclosure, thermal comfort, social security, equality, and interaction) and a comparative test of the design proposals. The adopted design strategy, as well as the examples extracted from the workflow, could be used to illustrate a link between research and design, adequate for supporting and orientating the project and design of urban spaces.

KEYWORDS

Space Syntax, Urban Design, Design Research, Multidimensional Analysis, Data Visualization

1. INTRODUCTION

Space Syntax methodology can be a valuable support tool to design successful public spaces (Karimi, 2012). In fact, it has provided a valuable contribution in the design of many key public spaces, such as Trafalgar Square and Nottingham Old Market Square. The aim of this research is to provide simple examples about how Space Syntax together with Public Life and Environmental Studies can be successfully integrated within the design process so as to valuably support the creation of efficient and social-oriented public spaces. To such purpose, a Multidimensional Analysis method to inform design decision-making is implemented in a relevant case study. The workflow is presented by giving some examples of the parameters, indices and multimodal ways of representing public open spaces, which have helped the design process, as well as examples on the possibilities of undertaking design changes when space syntax is part of decision-making. Specifically, it is discussed the example of the redevelopment project for a Portuguese historic square. Squares, in fact, offer rich possibilities of observing space appropriation processes, besides offering many sparks for architectural design.

2. THEORETICAL BACKGROUND

Within the system of the urban voids, historic squares maintain a privileged configuration and an exceptional character, concentrating both aspects of functional and representative order. Given their importance, many authors of urban morphology (Sitte, 1889, Lavedan, 1966, Krier, 1981) have sought to classify squares. Even the Space Syntax community, focusing on the syntactic quantifiable measures that expose the rules of the perceptive-cognitive apprehension of spaces, has gone providing a significant contribution to the study (Heitor et al., 1999; Can et al., 2013; Koohsari et al., 2014; Kubat et al., 2015). In particular, some authors have tried to identify the configurational conditions for squares to work as meeting and interaction spaces (e.g. Cutini, 2003; Guerreiro et al., 2014). Specifically, while retrieving a new index able to disclose the hierarchy of squares in cities (interaction index), Cutini refers to the studies of Sitte (1889), whereas Guerreiro studies the pedestrian network together with public life patterns, referring to the work of White (2001) and Ghel (2011). Their research results show that it should be possible to build new responsive, integrated and discursive knowledge on squares, as well as composite models of design evaluation, starting from the study of their spatial configuration. Additionally, urban design requires new effective responses and bottom-up approaches. Therefore, it seems a good strategy to adopt a multidimensional and interdisciplinary 'learning by doing' methodology of performance-oriented iterative analysis and design. In fact, this could help architects learn about the design problem, explore ideas and understand the possible effects of their proposals (Dursun, 2007).

3. METHOD

Architects learn about design problems through the conception and the critical evaluation of solutions, rather than through intentional and separate study of the problem itself (Lawson, 2003). Therefore, we can extract strategies by analysing sequences of design decisions and the different approaches:

- Approach to analysis: provides a description of strategies used to interpret public square's space. They are concepts, attributes and scientific procedures;
- Approach to design: it provides a description of strategies used to undertake design actions, i.e. the various assumptions behind each decision illustrating how analyses are used as part of setting and assessing design aims.

3.1 APPROACH TO ANALYSIS

The distinctive features of a square are heterogeneous, and their origin twofold: global properties, referred to its relationships with the whole urban grid, and local properties, depending on the intrinsic morphologic features of its space. Therefore, a comprehensive analysis of a square requires a multidimensional and multi-scale approach (Lopes et al, 2015, Paio et al., 2016). It is consequently important to understand the global accessibility level of the square through segment analysis and derive radius n integration and choice maps (Hillier et Iida, 2005). Then, the analysis should be repeated at a local level, e.g. within a metric radius of 800 metres from the square, which corresponds to the distance a pedestrian travels in ten minutes, so as to finally provide a map of the local and global access points (Hillier, 2009). Furthermore, a 1 m2 resolution VGA (Turner et al., 2001) highlights the local variations of attributes that influence interaction in squares, which are integration, connectivity and clustering, corresponding to the levels of centrality, capacity and enclosure of each spot in the square (Cutini, 2003). Finally, in order to generate aggregate models of agents' movement in space, an agent analysis is processed (Penn et al., 2001). However, since building a reliable analysis model can be hardly straightforward, with risks of influencing the results, early empirical testing might be suitable for validating the analyses models and outputs (Asriana et al., 2016). Here, it may help counting, mapping and tracking pedestrian activity and using time-lapse photography, which are highly valuable techniques to add details to the analyses results as well. Furthermore, environmental and thermal comfort analyses may help to explain some observed anomalies and seasonal phenomena (Pezzica et al., 2016).

3.2 APPROACH TO DESIGN: THE CASE STUDY

The approach to design is implemented in the case study of Largo da Graça (Fig.1), a square located at the top of the slope where the homonym Convent lies, in the core of Graça neighbourhood, in Lisbon historic centre. Largo da Graça has a complex character, reflected by its roughly defined and highly fragmented boundary, its diversified topography and the presence of some impactful elements such as retaining walls, a big fountain and central green areas. Nonetheless, this place shows a latent potential for liveliness, that the redevelopment project aims at strengthening and increasing. The design is developed in three stages:

- The set up, which defines the starting point of the design problem based on the premises of problem framing and the general design concept;
- The iterative development, in which main design actions are undertaken, evaluated and acted upon with the help of the analyses and refined with the help of cross-comparisons of design alternatives;
- The performance test, in which the design proposal is tested against other successful examples, assessing the quality of the project.

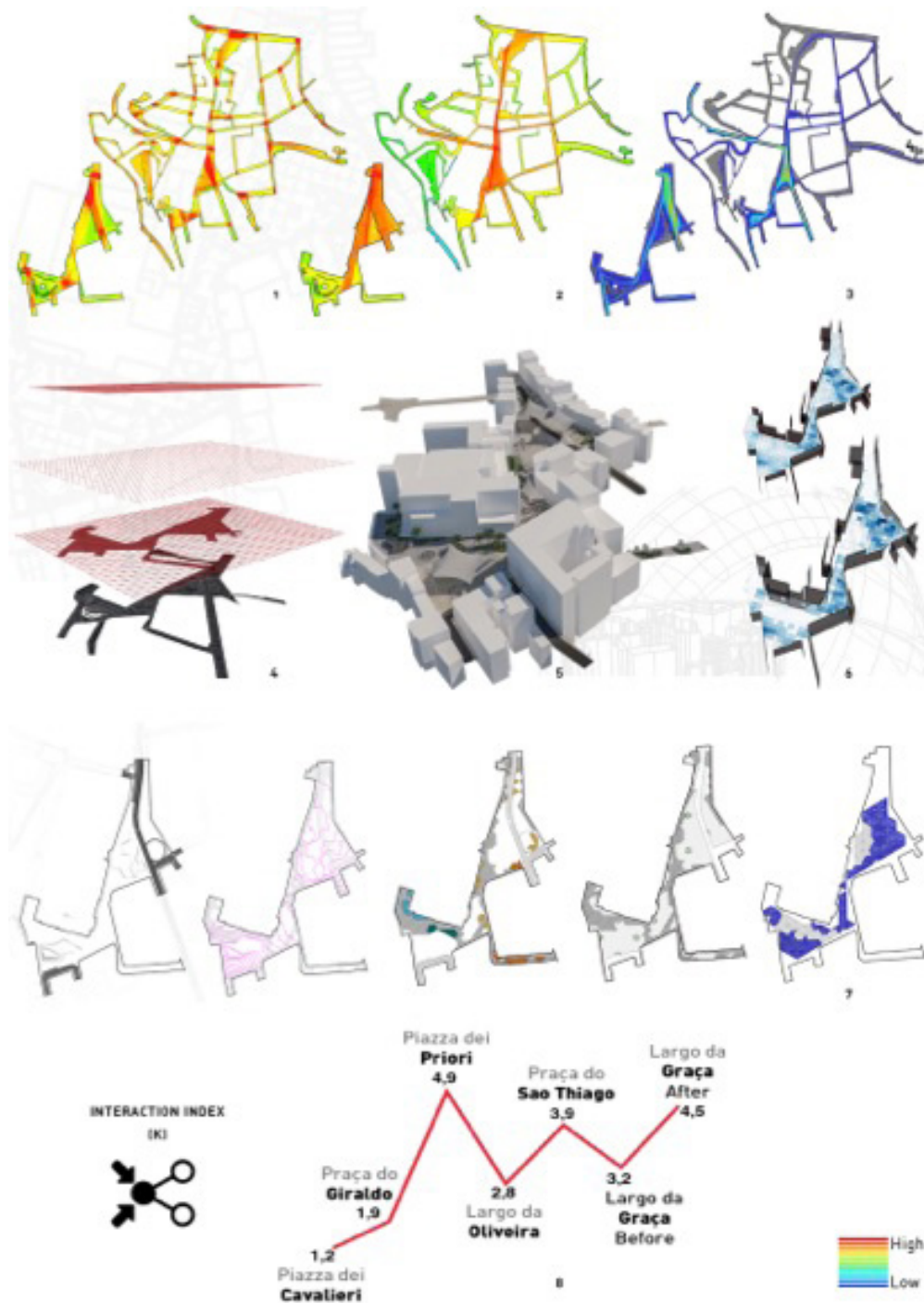


Figure 1 - Square design and multidimensional analysis: 1. VGA control before and after (B/A); 2. VGA integration B/A; 3. Agent analysis B/A; 4. Grid and pattern superimposition; 5. Proposed project 3D view; 6. Thermal analysis and covered surface optimization; 7. Significant layers of the project (from left to right): streets, orography, greenery distribution, areas to walk and areas to stay, lightweight canopy covered area; 8. Interaction Index comparative analysis: famous Portuguese and Italian examples.

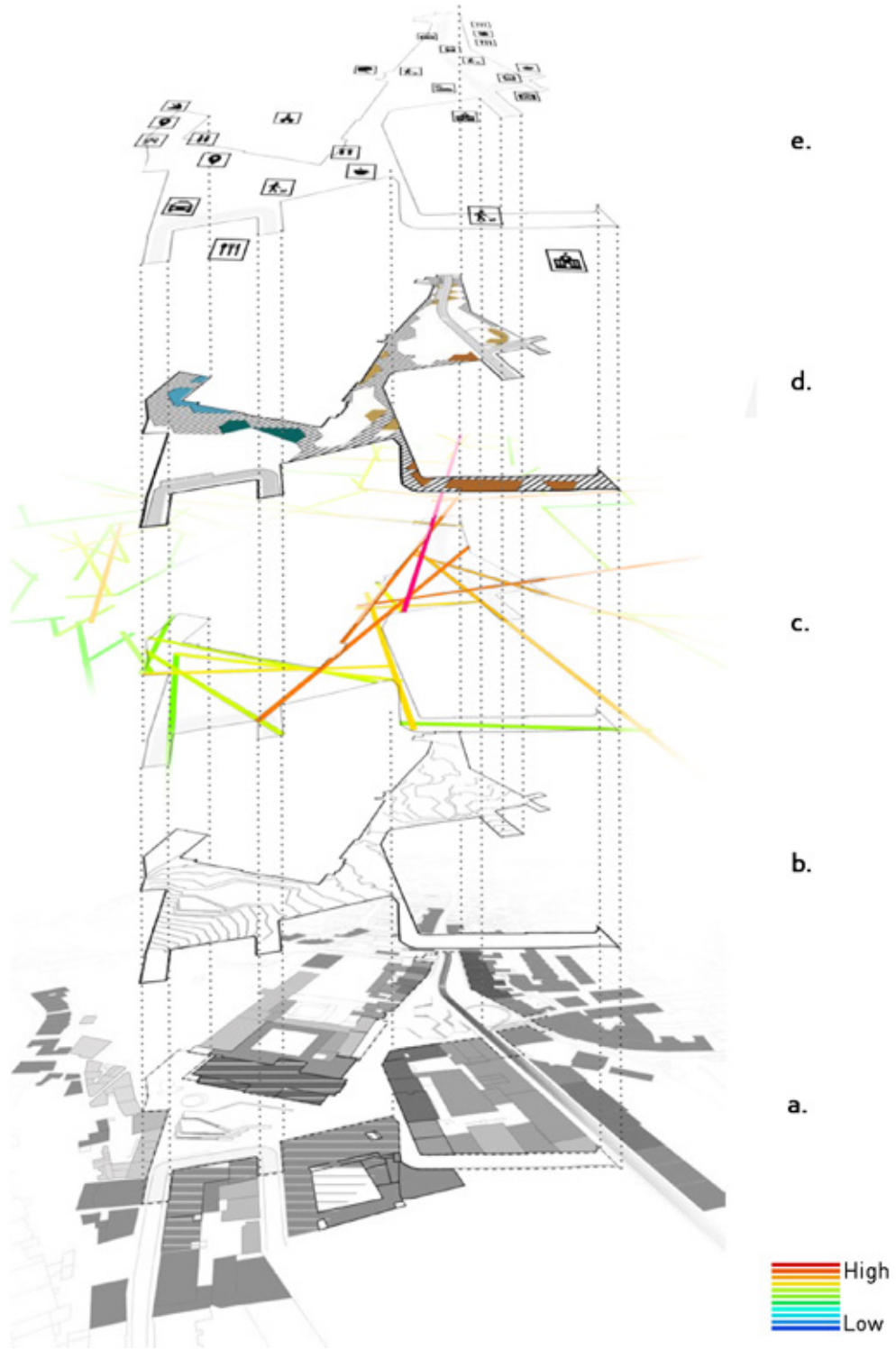


Figure 2 - Overlapping of significant layers. a. Volumes distribution; b. The designed topography; c. Axial integration; d. New greenery distribution; e. Program and functions.

The project originates from a superimposed hierarchical grid, created to structure and define the square's spaces and built components, their function and spatial disposition. The design is parametric, thus increasing the control over the project and the possibilities of further investigations at various scales (Motta, 1999). The design strategy is built on the principle that only the presence of people coupled with weak or no barriers creates a public space (Ghel, 2011). Therefore, a serious deficiency of the square, highlighted by the VGA and agent analyses, is the virtual absence of movement across the heart of the square, caused by the existing topography and the current disposition of the retaining walls (Conroy-Dalton, 2003). This consideration leads to the development of a new proposal in which the morphology is designed so to invite people inside the square and to unify its space. The stairs accommodate stationary activities in areas with higher clustering coefficient values and suitable thermal comfort conditions (Fig. 2). The fountain is moved from the centre of the square into an area with a lower integration value, leaving the central space free. The lighting system is designed according to the natural movement patterns (Choi et al. 2006). The benches are placed where control is higher, that is near the corners. Pedestrians' safety is increased by reducing road sections and by drawing wide sidewalks and zebras in two key spots, where the registered high level of informal crossings was suggested by the passage of two main axial integrators.



Figure 3 - 3D visualization of the final project

4. RESULTS AND CONCLUSIONS

To sum up, it is suggested that some structural difficulties in interpreting contemporary complex spaces can be better addressed by collecting contributions from several disciplines. The poster shows that it is possible to identify a limited number of significant variables (Integration index, Clustering coefficient, Neighbourhood size, Control, Interaction index, Gate count) suitable for describing the main features of public squares. The variables reduction customises the analysis and ultimately helps the designer to focus on the most significant properties, while simplifying the control over the project and its evaluation. Furthermore, it shows how it is possible to convey the main concepts of a configuration-informed design, through a few maps showing the effects that design actions will produce in the public realm. In this way, it seems possible to achieve highly informed design proposals (Fig.3) for a "spatial retrofit" which takes into account notions of comfort, security, equality, use and appropriation.

REFERENCES

- Can, L., Çil, E., Yaylali-Yildiz, B., Kiliç-Çalğıcı, P., Velibeyoğlu, K. (2013), Morphological analysis of the transformations of Konak Square in Izmir, Proceedings of the 9th International Space Syntax Symposium, Seoul.
- Asriana, N., Indraprastha, A., 2016, Making sense of agent-based simulation : Developing design strategy for pedestrian-centric urban space, Proceedings of the 21st International Conference on Computer-Aided Architectural Design Research in Asia, p. 343-352.
- Benedikt M. L. (1979), 'To take hold of space: isovists and isovist fields', *Environment and Planning B: Planning and Design*, Vol. 6, 1979.
- Choi, A.-S., Kim, Y.-O., Oh, E.-S., Kim, Y.-S. (2006), 'Application of the space syntax theory to quantitative street lighting design', *Building and Environment*, 41 (3), p. 355-366.
- Conroy-Dalton, R. (2003) The secret is to follow your nose. Route path selection and angularity. *Environment and Behaviour*, 35(1), p. 107–131.
- Cutini, V. (2003), 'Lines and squares: towards a configurational approach to the morphology of open spaces', Proceedings of the 4th International Space Syntax Symposium, London.
- Dursun, P. (2007), 'Space syntax in architectural design', Proceedings of the 6th International Space Syntax Symposium, Istanbul.
- Guerreiro M. R.P., Eloy, S., Guarda, I, Lopes, P. F. (2014), Networks and Opportunistic Urban Design: a strategy for regeneration of public spaces in Lisbon, *New Urban Configurations*, p. 766 – 771.
- Heitor T., Kruger M., Muchagato J., Ramos T., Tostões A. (1999), Braking of the medioeval space, The Emergence of a New City of Enligthenment, Proceedings of the 2nd International Space Syntax Symposium, Brasilia.
- Hillier, B., Hanson, J. (1984), *The Social Logic of Space*, Cambridge University Press, Cambridge.
- Hillier B., Penn A., Hanson J., Grajewski T., Wu J. (1993), 'Natural Movement: or, Configuration and Attraction in Urban Pedestian Movement', *Environment and Planning B: Planning and Design*, 20.
- Hillier, B. (1996), *Space is the Machine: A Configurational Theory of Architecture*, Cambridge: Cambridge Uni-versity Press.
- Hillier, B. and Iida, S. (2005) Network and psychological effects in urban movement, *Spatial Information Theory*, Vol.3693, p.475-490.
- Hillier B. (2009), *Spatial Sustainability in Cities Organic Patterns and Sustainable Forms*, Proceedings of the 9th International Space Syntax Symposium, Stockholm.
- Karimi, K. (2012), 'A configurational approach to analytical urban design: Space syntax methodology', *Urban Design International*, 17 (4), p. 297-318.
- Krier, r. (1981), *El espacio urbano*, Barcelona, Ed. Gustavo Gili.
- Koohsari M.J., Kaczynski A.T., McCormack G.R., Sugiyama, T. (2014), Using Space Syntax to Assess the Built Environment for Physical Activity: Applications to Research on Parks and Public Open Spaces, *Leisure Sciences*, 36 (2), p. 206-216.
- Kubat, A.S., Ozer, O., Gumru, F.B., Argin, G. (2015), Evaluating the impacts of an urban design project: Multi-phase Analyses of Taksim Square and Gezi Park, Proceedings of the 10th International Space Syntax Symposium, Istanbul.
- Lavedan, P., Huguenev, J. (1966), *Histoire de l'urbanisme*, Antiquité, Paris.
- Lawson, B. (2003), *How Designers Think*, Architectural Press.
- Lopes J.V., Paio A., Beirão J.N., Pinho E. M., Nunes L.(2015), Multidimensional Analysis of Public Open Spaces - Urban Morphology, Parametric Modelling and Data Mining, Proceedings of the 33rd eCAADe Conference (1), University of Technology, Vienna.
- Motta, E. (1999), *Reusable Components for Knowledge Modelling: Case Studies in Parametric Design Problem Solving*, Amsterdam, IOS Press.
- Paio A., Cutini V., Pezzica C., Lopes J. V., Bevilacqua M.G. (2016), Urban Squares Morphologies, Contributes of a Multidimensional Analysis, Proceedings of the 11th Conference of Nexus Architecture and Mathematics, San Sebastian.

Penn, A. & Turner, A. (2001) Space syntax based agent simulation, Proceedings of the 1st International Conference on Pedestrian and Evacuation Dynamics, Germany, 1-16. pp.7.

Pezzica C., Paio A., Lopes J. V. (2016), Square Design: from digital analysis to urban design, Proceedings of the XX SIGraDI conference, Buenos Aires.

Sitte, C. (1953 [1889]), L'arte di costruire le città, Officine Grafiche Antonio Vallardi.

Space Syntax Limited, (2004) Nottingham Market Square, Site Analysis and Public Realm Design Input, Space Syntax Limited, London.