

Pattern-driven Design for Small Public Spaces

An analysis of pattern books and toolboxes

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Urban spatial patterns that can enhance the city's cultural, social, environmental, material and structural performance advance beyond the old notions of design patterns by incorporating the digital design. Pattern books such as "A Pattern Language" are revisited and toolboxes /toolkits are used in contemporary urban designs by laboratories and offices. The aim of this paper is to analyze the particularities and congruencies between some systems of patterns, pattern books, toolboxes and toolkits aimed at small public spaces, also considering the context of digital culture. The methodology proposed is the construction of a taxonomy that relates and classifies these selected patterns, by these following steps: a) selecting of patterns applicable to small public spaces; b) classification of patterns by "type" (location, behavior, processes and design components) and by "driven designs" approach (data-driven design, performance-driven design, and material- driven design) and relation to the recurrences of patterns between the systems; c) making and inserting in the taxonomy platform a table of elements and connections; d) filtering by classes for analysis. From the results obtained in the visualizations, it is possible to consider a larger volume of "location" type patterns and a smaller volume in "processes" indicating a field that can be developed.

Keywords: *Urban patterns, urban toolbox, small public spaces, data-driven design, pattern language*

1. INTRODUCTION

Using patterns that emerge from a coherent system of rules is part of the history of architecture, from historical treaties to algorithms and shape grammars. A recurring issue, therefore, is the hypothesis that using patterns would lead to the standardization of architecture. Patterns, on the contrary, are ways to take advantage of proven design strategies that bring out

variously coherent and inexhaustible solutions from a complex system. Technology, binary systems, in short, digital also works through commands that are based on patterns.

According to (McGrath and Marshall 2009), the new urban design patterns are in the way of cities as living organisms, which deal with rapid urbanization, with the movement of people, climate change,

such as digital and mobile communication technologies and intelligent infrastructures. The compilation and the sharing of these patterns systems can be found through pattern books, toolboxes or toolkits that users and planners can merge patterns or adapt them to their reality.

The aim of this article is to analyze the particularities and congruences between some systems of patterns, pattern books, toolboxes and toolkits aimed at small public spaces, in order to understand the approaches present in each one, also considering the context of digital culture. This article is part of broader research on spatial patterns for small public spaces as a way to guide a design process with driven design approaches.

2. SYSTEMS OF URBAN SPATIAL PATTERNS

Concepts and theories from different eras can be placed as systems of patterns, treaties, theories about the order, symmetry, and proportion (Mitchell and Celani, 2008). In a historical perspective, (Gehl and Svarre, 2013) reflect on patterns centered on human behavior and social life in small urban spaces (Whyte, 2001, 2012), on the importance of spaces between buildings (Gehl, 2011), on the habitable and walkable character of streets (Appleyard et al., 1981; Jacobs, 1995) and basic activities such as walking, sitting and walking (Gehl and Svarre, 2013). Many of these publications are still, today, based on studies of public spaces and strategic city planning.

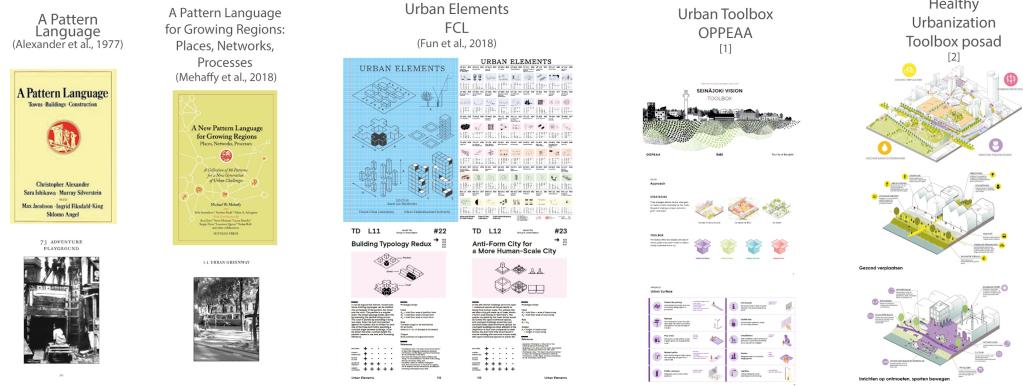
One of the theories using patterns most significant was created in 1977, the book "A Pattern Language" (figure 1), from theories by Christopher Alexander, which lists 253 spatial patterns that form a network that connects them, with the intention of helping participatory processes. According to (Garcia, 2009) based-on (Alexander et al., 1977), other spatial patterns about the city emerged at this time with some of the precursors of public space studies, such as (Venturi et al., 1977), Jacobs (1961) and Lynch (1960). Pattern systems in books format are still lines of research in the design of urban public spaces, for example, "A pattern language for growing regions:

places, networks, processes" (figure 1) by (Mehaffy et al., 2018) resumes presentation structure of "A Pattern Language". The 80 standards proposed in the new book are focused on the quality of the development of regions around the world, based on the guidelines of the New Urban Agenda, proposed by the United Nations (UN).

Another current urban pattern system was developed by the Future Cities Laboratory (figure 1), from Singapore-EHT, in a work called "Urban Elements" (Fun et al., 2018). According to the book, urban elements form the urban tissue and usually refers only to the physical blocks of the city, buildings, and spaces between them, which can be combined. However, just like (Alexander et al., 1977), they argue that these urban elements do not work alone, as they become useful in a context, as well as in a language that interrelates elements through principles and rules. "Urban Elements" considers the city as a metabolic system in which the city's physical tissue interacts with various flows based on the following themes: (UF) Urban Form; (TD) Typology & Density; (FU) Function & Use; (ES) Eco-Systems Service; (EM) Engaging Mobility; (SE) Sustainable Energy.

Not only research groups but also some offices developed and applied some urban spatial patterns through toolboxes and toolkits. The Finnish office OOEAAA developed in collaboration with Gehl and the city of Seinäjoki (figure 1), an urban toolbox for future interventions at various scales. With the aim of creating accessible and inclusive urban designs, they created four main sets: Surface, Green, Services and Urban Form [1]. The Dutch office Posad developed a toolbox aimed at healthy urbanization grouped into four categories: a) healthy movement around the city; b) public spaces designed for exercise, recreation, socialization, and sport; c) synergy between public and private spaces; and d) healthy basic facilities. The "Healthy Urbanization Toolbox" (figure 1) from the Posad office was applied in the city of Utrecht as a form of urban development targeting cities and healthy citizens [2].

Figure 1
Systems of Urban
Spatial Patterns



3. DIGITAL CULTURE IN URBAN DESIGN

The issue of design today, according to (Oxman, 2017), is based on explicit processes, which are not a simple triggering of steps, but systemic and parametric views, thinking of a society in constant transformation. Digital culture in architecture and urban design is part of what some authors call “intellectual revolution”, in a search for more objective approaches and a multidimensional vision (Kotnik, 2017; Picon, 2015; Carpo, 2017). Like the rhizomatic thinking proposed by (Guattari and Deleuze, 2000), digital culture points to a search for understanding connections, heterogeneity, mutation, and information in order to understand the relationships and controversies present in the process of building cities.

With the emergence of digital design, this systemic character and the growing volume of information available to architects and planners, some niches of design process began to appear, mostly called driven designs: data-driven design, performance-driven design, citizens -driven design, material-driven design (Oxman, 2012, 2017; Kolarevic, 2003). Although the term pattern-driven design is not widely used, many of the pattern systems developed today, can or are already guided by these driven design and digital culture approaches.

Data-driven design is one of the most comprehensive, in an emerging view of evidence-based and

data-driven processes, in which digital design is the great ally in its processing capacity (ARUP and RIBA, 2014). The design data is the objective information that the designer uses: analyses, patterns, and data that involve a large number of issues considered in the process. Comfort and performance, laws and regulations, user behavioral patterns, mathematical analyses based on topology, tectonics, demographic data, budgetary issues, and many other data available today, that increasingly lead society to understand and treat large volumes of data generated in the city.

Ratti and Claudel (2016) and Offenhuber and Ratti (2014) refer to the information generated in the city as a fundamental source for research. According to ARUP and RIBA (2014), cities are beginning to realize the potential of new agendas, such as Smart Cities (Leite, 2012; Townsend, 2014, when using information and communication technologies, allowing the optimization of urban metabolism and the opportunity for collaborative processes (Picon, 2015). With new digital technologies, the reality of design and citizen participation has easy access to the internet, smartphones, GPS and large availability of data (Gehl and Svarre, 2013; Mitchell, 2000).

4. METHODOLOGY

The proposed methodology is the construction of a taxonomy that relates and classifies the patterns for small public spaces present in a given corpus. This analysis is one of the steps towards broader research that seeks to develop a new system of patterns for small public spaces consistent with the new demands of the digital age. Therefore, the construction of this taxonomy allows discussing some of the paths that urban spatial patterns have been developing.

The selection of the corpus was based on four pillars: temporality, location, presentation, and authorship (table 1). A succinct number of systems, which could represent diversity, works developed in different periods, countries, presented in different formats, in addition to contemplating authorship of architecture offices, laboratories, and theoretical authors. The corpus chosen was the selection of five systems presented in section 2: "A Pattern Language" (Alexander et al., 1977), "A Pattern Language for Growing Regions: Places, Networks, Processes" (Mehaffy et al., 2018), "Urban Elements" (Fun et al., 2018), "Urban Toolbox" [1] and "Healthy Urbanization Toolbox" [2].

	Date	Country	Format	Autorship
A Pattern Language (Alexander et al., 1977)	1997	EUA	pattern book	academic
A Pattern Language for Growing Regions: Places, Networks, Processes (Mehaffy et al., 2018)	2018	Sweden	pattern book	academic
Urban Elements FCL (Fun et al., 2018)	2018	Singapore	pattern book + scripts	academic
Urban Toolbox OPPEAA [1]	2019	Finland	toolbox	office
Healthy Urbanization Toolbox posad [2]	2015	Netherlands	toolbox	office

According to (Cledou et al., 2018) taxonomy is the science of classification and has the ability to transmit information in groups, establishing their relations and providing a framework for discussion. In the un-

derstanding of urban space, classification helps to reduce complexity, as it brings out the essential and discards the non-essential. Classification is a necessity for filtering empirical and complex elements, like urban uses, because it promotes the investigation of the characteristics of certain elements in order to determine ways of grouping them based on their similarities (Pissourios and Lagopoulos, 2017).

Taxonomy seeks to classify and relate the patterns of each system. The validation of using taxonomy in this methodology occurs through the consistency of the proposed classes and the wide use of taxonomies in the field of architecture studies. The process followed these steps: a) selection of patterns applicable to small public spaces within each system; b) classification of patterns by "work", by "type", by the "driven design") and the relations among them ; c) making and inserting a table of elements and connections on the Kumu.io platform; d) filtering by classes for visualization and analysis.

The platform chosen was the online network visualization tool Kumu.io, cause it is a friendly and accessible interface, which allows the use of colors and interactivity when viewing connections.

4.1 Classification

Type. The classification by type was thought to understand which focus and stage of the design process each pattern fits, divided into four classes (figure 2).

Location - patterns that show relations with other urban elements, without actually indicate how the components should be designed.

Behavior - patterns that show the urban uses and how they contribute to the liveliness of the public space.

Processes - indicate the way to do the design, analyses, tools or data collection.

Work. This class identifies which system that pattern belongs to, showing which system has more patterns applicable to the small public spaces (figure 3).

Driven Design. Design Components - refers to the patterns that actually indicate rules for the design of an urban component.

Table 1
System
Characteristics

Figure 2
Taxonomy
visualized by the
"type" class

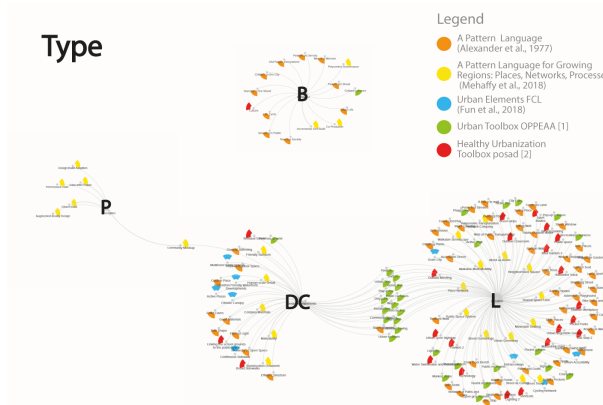
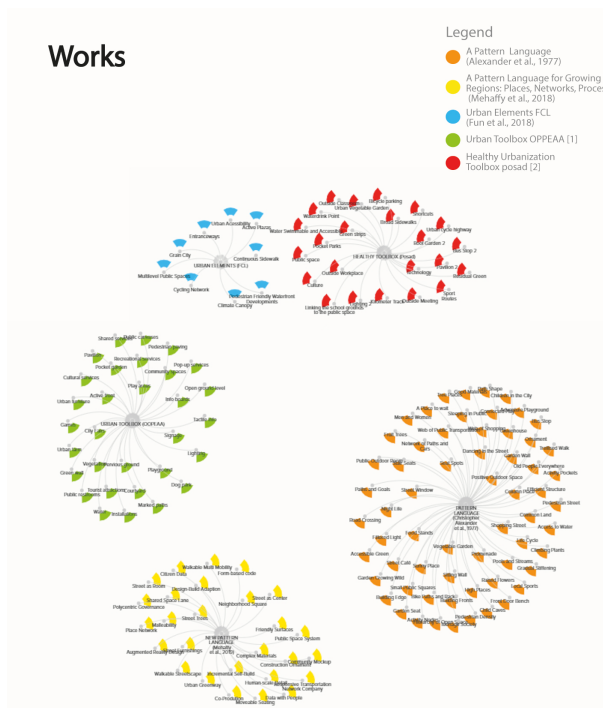


Figure 3
Taxonomy
visualized by the
"work" class



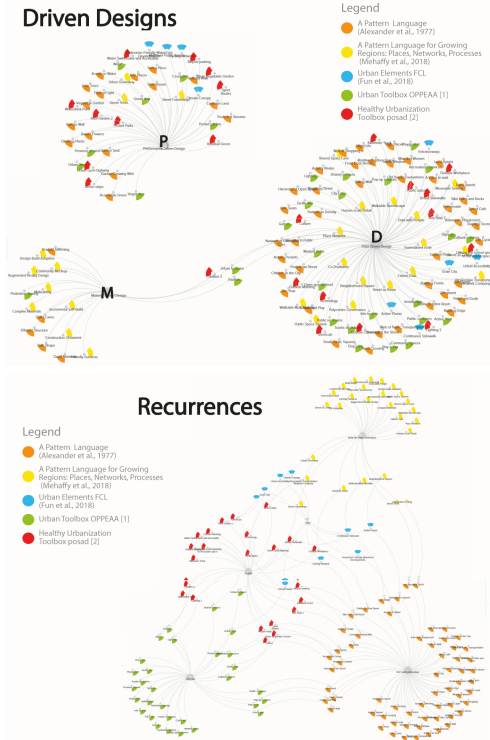


Figure 4
Taxonomy
visualized by
“driven design”
class

The class driven design classifies which approach fits better on that pattern even though there is no discussion of digital culture, based on three classes: data, performance, and material (figure 4).

4.2 Relations

It was necessary to create a new taxonomy to assess just the relations between the recurrences of patterns with the same theme, without classes, in order to verify which patterns are more commons (figure 5).

5.RESULTS

The aim of this paper is to analyze the particularities and congruencies between some systems of patterns, pattern books, toolboxes and toolkits aimed at small public spaces, also considering the context of

digital culture. The analysis benefits from taxonomy when it shows graphically the concentration of patterns in each class.

The congruence with larger volume in “type” class was formed by the patterns classified as “location”, followed by “design components”, “behavior” and finally “processes”. The larger volume of “location” patterns may indicate a common effort by systems to present the relations between urban components, without intending to treat the design of the components themselves. These combinations in a digital design context suggest more qualitative relations, in a parametric language more aligned with combinations type of if/and/or between the elements. The lower volume in “processes” indicates an aspect low explored by these systems and that can be improved, in order to incorporate more ways to design the city. Especially talking about toolboxes in the context of digital culture, the presentation of digital processes and digital tools for the construction of these new cities becomes essential. The generative component tool DeCodingSpaces Toolbox [1] [4], which is part of the “Urban Elements” research, is an example of this new kind of tools but has not been included in the analysis of this article. The analysis of generative components like this demands a deeper study, both theoretical and practical, about parametric and algorithmic design processes in urban planning.

The large volume congruence in the “driven design” class was formed by patterns classified as “data-driven design”, followed by “performance” and “material”. The accumulation of patterns in “data-driven design” indicates the potential of this approach, but it also indicates the breadth meaning of the term. Therefore, there is a need to understand what data are truly useful for city planning and how they can work together. The low concentration in “material driven design” is also a field that can be more incorporated into toolboxes and pattern books, together with discussions about new materials and new ways of building emerging in the digital age.

Figure 5
Relation of
recurrence

In the “works” class, it is possible to visualize the group with the largest number of patterns compatible with the scale proposed, small public spaces. The work “A Pattern Language” by (Alexander et al. 1977) has the larger number and the set “Urban Elements” of FCL-EHT Singapore [1] has the smaller. However, it is necessary to consider that the “Urban Elements” system presents a script set that allows the creation of new urban patterns, but which will not be addressed in this article.

In the analysis of the relation between the systems, it was possible to visualize which patterns are most repeated, showing which are the most recurring questions. The patterns that refer to the theme of sidewalks and walkability in the streets were the most recurrent, appearing in 4 of the 5 systems of the corpus. With recurrence 3 appear patterns that indicate qualities of outdoor public space; active entrances to buildings; urban vegetable gardens; pocket gardens; spaces for culture and local sports.

Regarding the particularities of each system, the taxonomy shows that the work of (Alexander et al. 1977) presents a large number of patterns of the location and behavior class because the book’s proposal is to establish relations between urban qualities and the historical context of behavioral analysis. The work of (Mehaffy et al., 2018) has an interesting feature, as it is the only one that presents process patterns. The system that most presents the design components class is the authoring system of the OOPEAA office, with a wide variety of components that can contribute to the liveliness of these urban spaces.

6. DISCUSSION AND CONCLUSIONS

The use of interactive taxonomies tools allows visualization and graphic manipulation, a difficult task using only books and infographics. The main contribution of this study is to relate systems of patterns from different contexts, in order to analyze a larger number of approaches on the public space, in discussions that complement each other. From the results obtained in the visualizations, it is possible to consider a larger volume of “location” type patterns and

a smaller volume in “processes” indicating a field that can be developed. In practice, this study can contribute to architects, when it encourages them to include patterns in current approaches, helps to visualize which are the most recurring patterns in different discussions about urban spaces, and shows paths to study the new public space production processes.

The study of public space through patterns also has limitations, a system of patterns is able to emerge just a few layers of information from a complex reality of public spaces, because some social narratives, historical and political facts need to be associated, otherwise, this can decontextualize the patterns of local reality.

The initial effort to relate these sets of patterns is a step towards understanding the most coherent paths for urban spatial patterns. This ongoing research suggests some next steps: a) integrating new systems and new digital tools into taxonomy; b) understanding of the most consistent patterns for the local development of these small public spaces in the context of digital culture; c) development of a new system of patterns that adapts and references others; d) study of a friendly platform for making manipulating and share them.

It has not yet been possible to incorporate sets of generative components, scripts, plug-ins, and sets of algorithms in this study. This would be one of the future steps, in a depth study about the role of these digital tools in generation and adaptation of new patterns.

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