THE CONSTRUCTION OF ARCHITECTURAL IDEAS

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ABSTRACT

This study discusses how ideas are constructed in the design process of architecture projects, identifying what enables their emergence, development, selection, and elimination. A qualitative and exploratory research method was used. Our basic assumption is that ideas are mainly the result of knowledge, although influenced by designers' subjective factors: criticism acts as a filter of ideaation, thus governing the process of selection and disposal of ideas. Theories, assumptions, and arguments of other researchers on the subject of creativity were confronted with our findings. This showed a pattern in the construction of ideas during architectural design processes which puts into question the theory that ideas arise from the interaction between designers and their sketches.

Keywords: Public Oratory. Monument. Popular devotion.

RESUMO

Este trabalho discute o modo como as ideias são construídas no processo de projeto de arquitetura e urbanismo, apontando o que possibilita seu surgimento, desenvolvimento, seleção e eliminação. Utiliza-se, para isso, um método de pesquisa qualitativa e exploratória. O pressuposto básico é o de que as ideias são fruto sobretudo do conhecimento, embora influenciadas por fatores subjetivos do projetista: a crítica atua como um filtro da ideação, governando, assim, o processo de seleção e descarte de ideias. Os dados foram levantados em entrevistas realizadas com estudantes de graduação da Escola de Arquitetura da UFMG. A análise crítica dos dados levou em consideração teorias, pressupostos e argumentos de outros pesquisadores do assunto, procurando confrontá-los com os achados das entrevistas. Após essa análise, foi possível vislumbrar um padrão na construção de ideias no processo de projeto, que coloca em escrutínio o argumento de que as ideias surgem da interação entre o projetista e o desenho. Espera-se investigar esse padrão mais profundamente, visando sua validação ou refutação.

Palavras chave: criatividade, ideação, projeto de arquitetura, resolução de problemas.
INTRODUCTION

Despite its relevance to the design process, little is investigated about the construction of the ideas which promote this process. Where do architectural ideas come from? What enables their emergence, acceptance or disposal? What underlies this process? This article investigates some of these issues, aiming to increase knowledge about creation processes in architecture to support teaching and, ultimately, professional practice.

We delimited the design process in three stages: initial design, development, and completion. Despite their variable dynamics, all stages involve the generation and development of ideas, which prefigure a product (a result). We are interested in understanding this entire process, which is cyclical but has a beginning and an end: beginning with ideation and ending with the production of technical guidance documents.

Ideation - or the formation and selection of ideas - is the starting point of the creative activity carried out in the design process. As Lawson (1990, p.96) points out, “Of all the questions we can ask about the project, what occurs in the designer’s mind is by far the most difficult, although the most interesting and vital”. For Runco (2010, p.415) “Ideation is described by both process theories and product theories, and in fact, it may need to be targeted in any effort to translate mere potential into actual performance.”

Hillier, Musgrove, and O’Sullivan (1972) argue in the same direction, stating that research in architecture can only have an impact on the quality of design practice if it is able to influence professionals in their design stages, overcoming what they call the “applicability gap,” which is the disconnection between the production of research and better projects. They criticize and reject research which generates “packaged information” to fit rationalized design procedures and defend the use of the heuristic capacity of scientific procedures to explore the possible through the real.

This research concurs with this viewpoint and, for this reason, was developed to investigate the intervening factors in the design process rather than in its procedures. It is clear that didactic-pedagogical approaches to enhance student creativity would be more easily developed if design teachers got to know these factors better.

Although this research focuses on how architectural ideas come about, we consider design outcomes as an equally important part of the process. The final product can be an important indicator of creativity and its evaluation was crucial to assess if the intentions designers stated were coherent with the final result of the project and consistent with its development. The focus on the process aims to facilitate the understanding of the creative experience, assisting in the future elaboration of a plan of action to intensify this experience.

THE METHOD

This work is supported by a qualitative and exploratory research which intends to find clues to what underlies the emergence, development, disposal, and acceptance of ideas.

Firstly, a search on the literature on design process, creativity, and instrumentation was conducted to better understand the theories which address these subjects. This procedure helped us assemble and unveil our reference theoretical frameworks and analyze the obtained empirical data. Thus, the searched bibliography serves as a theoretical and critical support for developing our investigation, analyzing the obtained empirical data.
data obtained, and discussing our results, rather than as a specific and informative item. References appear dialogically throughout this draft.

The intangible character of the process of constructing ideas makes it difficult to observe and collect data. This entailed that we devised a way to explain how the designer has ideas and develops them. Thus, semi-structured interviews were the chosen investigative method. This type of interview combines a previously established structure with the possibility of asking subsequent questions, which is essential when dealing with such an abstract topic, as it allows the detailing of an answer and explanations of imprecise points.

The method called “protocol analysis” in its retrospective form was also used in the interviews, mainly in questions in which the students were prompted to recall and describe their creative process. Protocol analysis is a very popular method in research which seek to access ideation (CHAI; XIAO, 2012), as shown by Suwa and Tversky (1997) and Gero and Tang (2001). It can also be applied in the form of “think aloud protocols”2, or “concurrent protocols,” in which designers describe their thoughts and actions while carrying them out, such as in the research carried out by Goldschmidt (1991), Dunbar (1997), and Cross (2006). The common point in these research methods is, basically, the use of verbal records as data.

According to Darke (1984), one must understand the mental process the designer goes through to know a design process. The best way to access this process is to ask the designer to recollect it. Additionally, according to Lloyd, Lawson, and Scott (1995) and Landay and Myers (1995), concurrent protocols may interfere with designing. Following this perspective, our research preferred verbal reports over observing sketching and other forms of representation. Through these interviews, one can discuss the creation process in more depth without running the risk of affecting it by being present during the process itself.3

2.1 - The interviews

A total of 24 interviews were carried out with 35 participants from different terms, which represents 6%4 of the total number of students enrolled in the Architecture School at the Universidade Federal de Minas Gerais (UFMG). The interviews were held shortly after the students presented their projects to their class and teachers, in which one of the researchers was present. The data added up to 14 hours of recording, with an average duration of 24 minutes per interview. In a total of 24 interviews, 17 were individual, four were in pairs, and three in trios. The questions were intentionally open, aiming to give students as much freedom as possible to describe their design processes while also minimizing the need for the interviewer to speak or interfere. The answers were quantitatively organized in percentages and the students numbered from S1 to S35. Quantification was able to assist data analysis but did not attempt to conclusively quantify data, as this would imply suppressing the complexity of the design process.

Quantification was possible due to the similar answers given by students in their interviews. When students mentioned, for example, that they had previously worked on a similar design problem, we would quantify how many claimed this helped them in the new design task (83% was the percentage), so conclusions could be qualitatively drawn from that number.

2 Developed by Ericsson and Simon (1993).
3 In practical terms, it would also be very hard to observe the design process of all interviewed students, as many of them work at home on their projects throughout the semester without prescheduled hours. There would be too many gaps to fill, and we would inevitably have to perform a protocol analysis in its retrospective form.
4 According to data given by the Teaching Department at the UFMG Architecture School, in 2019.
Accessing imaginative processes is very challenging because it involves the need to use imprecise means such as speech and memory. Verbal reports on nonverbal processes, such as prefiguration, can be difficult — even though students were resourceful and at ease in their descriptions. In spite of these difficulties, inability to remember processes was minimum (to the point of being negligible and having little effect on the collected data). We tried to minimize the uncertainty of the facts reported by making follow-up questions. Furthermore, student’s project presentations were confronted with the shown projects to check for the consistency of what was said with what was in fact shown. This practice proved to be very effective: students recalled their processes in a manner which was coherent with what was seen in the visualizations.

Although we were only present during the final presentation of the projects, we were able to access the design process thoroughly through the interviews. This was possible because the asked questions focused on the process: the student would talk about what was the main idea of the project, what were the first ideas, if these ideas were abandoned (if so, when and why), how other choices were made (materials, structure etc.). They talked about which tools were used when developing these ideas and in which order, how these tools helped or interfered with development, and how skillful he/she was in using the chosen tool. We also asked if they had faced a similar design problem before and if so, if that had helped them in any way. They were asked about how and when they researched architectural projects and how this affected their specific design. To analyze teachers’ influence on the process, we asked if teachers determined that a particular process or tool be used, if a specific product was required (a physical model, number of drawings etc.), and if analogous projects were shown to the students in any way (if so, if that influenced the design). At the end of the interview, students were asked if they could perceive a pattern in their design process. In most cases, we did not need to ask all these questions because the answers arose naturally after the first ones (those which targeted ideation more directly).

Teachers were not interviewed. This may have positively influenced students’ critical assessments of the teaching they received. These assessments regarded the specific design class in which they had just presented their project and evaluated the entire Architecture course. The presence of the researcher in the evaluation boards as an observer enabled them to watch students’ project presentations, intentions, and justifications, as well as the panel’s critique. This aided the researcher’s understanding of the project and enriched the conversation during the interviews.

3 - DISCUSSION OF DATA

Following Ostrower’s view (2018, p.11) that every creative act is intentional and that an inner mobilization is necessary for it to occur, we sought to identify the triggers and moments of mobilization via the interviews. Although 26% of students failed to specify the exact moment in which they had the main idea of their project, we could find what stimulated this idea in 94% of interviews. An example of this is students’ desire to have little impact on the natural topography of the site. Thus, they designed levels, accesses, and the main shape of the building to achieve that.

The initial conception of ideas seems to be a process of connecting what designers already know to the problem at hand, seeking something new. Our assumption is that architectural ideas are the result of knowledge (MALARD, 2013) — rather than emotions, as erroneously believed — although the latter play a role in the selection and disposal process, i.e., by critical

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1 Project presentations were also sent by e-mail to the researchers after the interviews.
2 At UFMG Architecture School, students present their project for critique to teacher(s) and colleagues.
3 Popper, in his book “Intellectual Autobiography” develops this notion very clearly by examining music. This is also Gombrich’s understanding.
evaluation (self- or third party- criticism, including confrontations with concepts, technical information, and aesthetic paradigms). Thus, to organize the data for analysis, we have grouped the factors involved in the construction of ideas in three categories: theoretical knowledge, technical knowledge, and subjective factors (emotions).

Theoretical knowledge mainly involves the particular language of architecture and cultural manifestations of spatializations; technical knowledge concerns everything addressing the materialization of architecture and, mainly, its representation and construction; subjective factors are those which make up the designer’s individuality, such as values, culture, and sensitivity which, in short, generate emotions. Despite this division, we recognize that these three categories form an interactive triad during design which constantly influence each other in a cyclical, nonlinear way.

Students described the “main idea” of their project in their answers to our first question in the interview, corresponding to the idea which was selected and developed until the end of the process. We found that their main idea occurred in early stages of the process. Students relate something they know about the challenge at hand, creating a bridge which enables them to imagine a solution. The creation of this bridge takes place consciously; students see a connection. Even if there is the so called “free association,” at some point it is necessary to consciously associate elements to have an idea. Many researchers, such as Cross (1984), Goldschmidt (1991), and Schön (1983), have questioned ideation as a conscious act.

Our interpretation corresponds to Gombrich’s (1984) understanding that artists must have a vision, an approach which will guide their work. The choice of how to express oneself depends on the questions asked, which are by no means innocent or passive. Thus, before sketching, artists have the idea, which is then expressed in lines and forms (sketch).

As students described their project and its development in the interviews, we found that other, important ideas concurrently emerged with the main one, influencing the whole process. The description of the development of the project also showed what influenced the formation of those ideas, how choices which transformed them took place, what factors influenced these transformations, and how design actions took place over time.

To exemplify factors which influenced choices, we will cite a few: the definition of priorities (to gain something you usually lose something in a design), the best relation between cost and benefit when picking one idea from the other, cultural interpretations such as what a material conveys symbolically, legislation concerning buildings, aesthetic preferences, environmental comfort, difficulties regarding instrumentation (developing forms and solutions which surpassed their abilities when using pieces of software and other design tools), and criterions students created themselves which were independent of teachers or the problem itself (such as innovating in how to access residential units in a student housing project).

We observed that there are students who reproduce ideas more than they produce them: they acritically look for project references, repeat programs and forms seen in other projects, and justify their choices with common-place arguments. Certain students’ identification of processes and take on Architecture and design practice showed that those who try to develop more personal approaches and are more critically aware of the complexity of design practice and pre-structure problems show more consistent proposals with more widely justified decisions. These characteristics possibly generate better projects.

8 The first question was “When did you have the main idea of this project?” It was strategic not to directly ask what was the project main idea so that it would come up during the first three questions without pressuring students (the subsequent questions were “2. How did you have that idea?” and “3. How did you start designing?” The interviews had a total of 12 questions).

9 Gombrich (1984) addresses representation and creation in art. Although we are discussing the architect’s occupation, we consider a common essence to the representation of ideas via shapes and lines which justify the use of his arguments and thoughts to analyze the creative process of architects.
Students who have an overall critical view – of Architecture, of projects, of the learning-teaching process, of technology, etc. – have an enormous advantage over other students because they are able to make better choices and, thus, better projects. A good example of this is a student who chose a type of structure based on what he learned in structure classes: what would be best for the topography and room spans according to building use. He then chose a software which would best assist the development of his main idea (a tool which favored precise orthogonal drawings due to the chosen modular structure). After critically thinking about the particularities of the site location – inside a university campus –, he had an innovative take on the façade and security concerns. When deciding how to communicate his design, he chose to highlight the modular structure with color, adopting an “Archigram” aesthetic\(^{10}\) to simplify the required work and hand in the project on time. His process enabled him to accomplish a cohesive project by a sequence of appropriate ideas based on his knowledge and preferences. This resourceful student was clear about the need to question teachers’ views and to have a good knowledge of different tools to assist him on representation. He was also interested in architectural theory (specially modernism) and able to describe his individual design process, which he achieved by critically thinking about his previous processes and his fellow students.\(^{3}\)

3.1. The role of criticism

Despite the uncertainty about how ideas are formed in our mind - divergent thinking, free associations, etc. - scholars share an apparent consensus that creativity is not a phenomenon with an origin which can be precisely mapped but a process manifesting itself in different ways and from various stimuli (DIETRICH, 2016). This research shows that theoretical and technical knowledge mediates the construction of ideas and subjective factors (emotions) influence it, which we call the interactive triad. This happens for both groups of students – critical and acritical\(^{11}\) – what changes is how much knowledge they have (which can be superficial) and how well they apply it (the justification and coherence of the solution based on the problem presented by the design challenge). What also changes is how they use subjective aspects assist their design choices: “just because I like it/ because I think it looks nicer” shows a low critical approach. For example, acritical students’ ideas might emerge from a desire to experiment with a formal result such as rotating slabs of a building just because they saw it in architectural design pages on the internet, even if this is by no means connected to the design problem, its surroundings or challenges. Nonetheless, this idea came from knowledge of these designs, their technical characteristics, aesthetic results, etc. and, therefore, this acritical student’s idea is based on the exact same triad.

For Weisberg (2010, p.248), “If we can get into the database of the creative thinker, we may be able to understand creative thinking as a process based on the direct application of knowledge.” Nonetheless, it is impossible to apply a person’s entire knowledge (technical or theoretical) or subjective aspects (sensitivity, predilections, visual memory, etc.) into one single project, however complex and broad it may be. Thus, it is imperative to “filter” this totality, allowing the selection of criteria from the extensive base which makes up the triad so that one idea - among so many - is chosen. Therein lies the main role of criticism.

Criticism (self- and third-party criticism) governs the process of selecting and discarding ideas. As a filter, it allows the equation of the intervening factors, leading our mind to a common point which provides the means for ideation. Although criticism is more easily identified in the process of eliminating, altering or improving ideas, if we focus on some key points of designing, we can see that it permeates the entire architectural process:

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10 Archigram – a group of avant-garde British architects established in the 1960s – many times conveyed their designs through cartoon-like, colorful drawings and perspectives.

11 All students must be critical to choose between ideas. Obviously, it would be more precise to say that every student is critical to some extent, but to simplify, we are calling the group which was observed as not very critical as “acritical”.

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- Design processes: criticism allows students to evaluate colleagues and other architects’ processes. This assists them in constructing an individual process. When forming this process, criticism enables them to evaluate procedures and to correct or maintain approaches.

- Pre-structuring problems: criticism helps define the parameters adopted in the project, in addition to those already provided by the client or teacher. It is what will determine which requirements will be met and to what degree, enabling the orchestration of demands, which is decisive in design\(^{12}\). It will also assist decision-making by scrutinizing the triad and its intersections for critical reflection, as knowledge influences preferences and vice versa. In other words, criticism evaluates the flexibility of conditions and possible changes in focus when addressing the problem, enabling its solution. Thus, criticism makes it possible to pre-structure problems.

- Instrumentation: The choice of appropriate tools for the designer’s workflow and for the challenge presented, combined with the understanding of its potential and limitations for the representation of ideas, influences the construction of ideas. Criticism supports the assessment of tools after their use – in the evaluation of how tools have helped or limited designing – and how they suit the design intent, enabling informed choices and the effective use of instrumentation.

In sum, critical activity fosters creativity as it allows students to be actively involved in teaching and learning. It enables students to perceive teachers’ worldview explicit in their analysis in class and to evaluate how they themselves fit into this view via self-criticism. Critical students reflect more broadly about teaching, evaluation criteria, and the act of designing itself. Thus, criticism enhances learning.

Moreover, criticism of the status quo and of imposed truths about traits of architectural spaces seems essential to allow inventive design and the resulting production of knowledge. Criticism can benefit students in all aspects of the project, as exemplified by one critical student who, when discussing technology, said: “The sky changes, the whole environment changes, there is no need for a kinetic façade.” (S1). Thus, critical students show how “design situations vary not just because the problems are dissimilar but also because designers habitually adopt different approaches.” (LAWSON, p.4, 1990).

To bring to conscious thought the principles that underlie the spatial and formal patterns that transmit culture through buildings, and to formulate possible alternatives that work as though they were culture — since architecture must be an addition to culture not simply a removal of it — is an intellectual as well as a creative task. It requires not only the conceptualization of pattern and configuration in vacuo, but also comparative knowledge and reflective thought. This is why architecture is a reflective as well as an imaginative project, one which seeks to replace — or at least to add to — the social knowledge content of building with an enquiry into principle and possibility. (HILLIER, 2007, p.39)

We argue that teachers may contribute enormously to the formation of future architects if they can foster a critical view of design principles throughout the course by encouraging the critique of all factors involved in the construction of ideas in our field. It is essential to understand that design ideas are not autonomous and need to be fostered by knowledge and by a critical view so that designers have the means to make good design.

Thus, criticism interferes with the way in which the intervening factors involved in the construction of ideas are addressed. Therefore, it defines the designer’s approach and the project itself. What is the project’s approach if not the proposed solutions to a problem

\(^{12}\) Much like the primary generator discussed in Darke’s research (1984).
after its critical evaluation? What turns a multitude of information about a problem into synthesis? There are indications that it is in fact criticism.

Therefore, considering that criticism is the determining factor for the development of design processes; designers’ use of instrumentation; students’ relationship with the teaching-learning process; and the approach given to design problems, it is clear that criticism is fundamental for the quality of ideas and, ultimately, for the quality of the architectural project itself.

3.2. SKETCHING A PATTERN

Although the so-called “design steps” have an intrinsically linear aspect, the same cannot be said about creative processes, even at their most conventional practice. The process of constructing ideas has many different degrees of non-linearity and many different outcomes. Systematizing the creative process in architecture is a complex task since it can vary immensely depending on the professionals involved, working conditions, and many other variables. To make this systematization feasible, simplifications and generalizations are necessary.

After learning about the Design Methods Movement’s13 struggles, we intend to discuss principles (rather than procedures) in our systematization. The creation of a process model was tirelessly practiced by methodology scholars and proved to be of little use (LAWSON, 1990). Nevertheless, it enabled us to identify a pattern of how students construct ideas from start to finish and helped us communicate our findings. We do not intend to show how the design process itself takes place but to visualize how architectural ideas are constructed within the design process. Therefore, this pattern is not about designing a method but about making a diagnosis.

The following diagram, shown in Figure 1, illustrates the pattern found in all respondents of this research. It is shown in a non-linear way, with loops at every point in which ideas are eliminated. It is important to note that the interactive triad formed by theoretical knowledge, technical knowledge, and subjective factors (emotions) is what enables the criticism of ideas and, therefore, permeates all points of the model. This was represented as the line of criticism on the inferior part of the diagram. To cite just a few examples, the way in which the designer verbally communicates largely relies on this triad (we only speak words we know), as well as how visual communication takes place (we only represent what we are able to imagine and represent), how the elimination of ideas and their improvement occurs (through criticism), etc.

This research has shown that the first design ideas come up before any kind of visual representation (thus, before the use of instrumentation). The following ideas arise from verbal discussions of the first one, but what prevails is discussion via the visual representations of these ideas, regardless of the chosen support (sketch, computer, physical model, etc.).14 These new ideas can arise from visualizing their own representations or their colleagues.' Ideas can even come from misinterpretations of someone else’s representation (where a section is represented, one sees a floor plan and ideas can arise from this confusion, for example). Regardless of support, ideas are formed in the mind and then represented and this cycle is repeated over and over again, erratically and with loops15.

The factors which influence decision making for selecting and discarding the first ideas then begin to influence the selection of the following ideas. This shows that the designer learns about the problem by testing solutions, thus improving his/her following choices. Rittel (1972), Hillier, Musgrove, and O’Sullivan

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13 In the 1960s and 1970s, a group of researchers (John Chris Jones, Christopher Alexander, and Horst Rittel) were motivated by the systematization of methods developed in several areas of scientific research, to try and give scientific credibility to design and lead a movement called Design Methods Movement. In 1962, a conference marked the flowering of this movement after a Conference held in London, in which participated professionals from different areas, generated the publication of 17 articles. 14 As also defended by other researchers, such as Lawson (1990), Darke (1984), and Suwa and Tversky (2001). 15 As argued by other researchers, such as Dubberly and Pangaro (2015), Ranco (2010), Lawson (1990), and Locher (2010)
(1972), followed by Lawson (1990), also claim that one knows the problem better after the critique of previous solutions. The process of learning about the problem enables the designer to change its pre-structuring since a problematization reoccurs, aiming at improving the solution (i.e., having better ideas).

**Pattern of Construction of Architectural Ideas**

Technical knowledge, theoretical knowledge, and subjective aspects of the designer (we can call the latter emotions) form the basis for the construction of ideas. Technical knowledge fosters ideas related to the attributes which VITRUVIUS (1999) called “firmitas,” ensuring the structural stability and constructability of the object. It is linked to the scope of construction materials and technologies, its theories and methods of application. Theoretical knowledge addresses the cultural and conceptual notions needed to make the object suitable for its particular time and environment, which would correspond to Vitruvius’s “utilitas.” It refers to the scope of environmental comfort, building installations and the operating systems of buildings, and its theories and methods of application. Lastly, subjective aspects relate to aesthetic appreciation, perceptual issues of buildings, and its theories and methods of application, referring to the Vitruvian concept of “venustas.” In sum, we can see the triad SUBJECTIVE ASPECTS, THEORETICAL KNOWLEDGE, AND TECHNICAL KNOWLEDGE as a reinterpretation of the Vitruvian triad (firmitas, utilitas, and venustas) which can be expressed in the following diagram:

**FIGURE 1 - Pattern found in the process of constructing architectural ideas. (Developed by the authors, 2021).**
This triad has several intersections and mutual influences. When a design challenge presents itself, the triad enables prefiguration via imagination: an image is mentally conceived. When faced with the stimulus of a project challenge, the knowledge and particularities which constitute the human mind lead to a synthesis or idea. This idea is criticized mentally. If it is eliminated, the relation between the triad and imagination produces another idea. Student S10 commented on how he tends to criticize his ideas just before he communicates them: “I take a little step back. I think: ‘Am I really going to put this idea on the table?’”

Thus, if the idea is maintained after an individual mental critique, it is communicated. After its verbalization, whoever had the idea criticizes it again because the very process of verbalizing something abstract contributes to its reassessment. Verbalization can continue until, at some point, a visual representation of the idea is necessary and it is transported from the mind to the chosen support, following the green process shown in the diagram. For Ostrower (2018, p.32, our translation), “[…] thinking can only become imaginative through the embodiment of matter or it is nothing more than an uncompromised ramble, aimless and without purpose.”

The tool adopted for visual representation varies from designer to designer, according to their preferences and knowledge. This representation can be made by all of those involved in the process but is usually made by the designer who puts the idea on the table. After the visual representation, everyone mentally criticizes the idea based on what they interpret from that representation. This criticism is verbalized (or not) and the representation can receive new layers on top of it. These can improve the idea or raise new ones based on the one being discussed – its pros, cons, and generating principles fuel this process. Therefore, new ideas can emerge or be eliminated at any given time, so the process is always cumulative even if ideas are dropped. Thus, the critique of solutions – trial and error – as in a scientific experiment, expands the understanding of the problem, enabling the construction of better ideas.

In sum, the selection of ideas takes place in the midst of this circular and cumulative process until an idea or several are selected and developed to compose a structured proposal which is formed gradually. Even then, this process can be interrupted, which leads to the beginning of a new cycle. However, at some point in this process, the selected idea and its secondary ones generate advances and are no longer abandoned. They are completed to be understood by those who did not participate in its construction.
For Lawson (1990, p.43), “Design problems are often both multidimensional and highly interactive.” We hope that the formulation of this pattern adds to the knowledge in the field of architecture design process and assists in similar research.

FINAL CONSIDERATIONS

The analysis of data collected in this research enabled us to glimpse the basis of creativity in architectural design processes and give clues as to where they come from, how they are developed, and what influences their evolution. Future research can further explain these glimpses. We managed to graphically illustrate a typical pattern of the construction of ideas in an Architecture design process and we hope to investigate this further, aiming at its validation, correction or refutation.

This research also shows that teachers from all subjects – not just design and project – composing Architecture courses are responsible for teaching students how to design, as knowledge as a whole is what forms the triad which enables ideation. Thus, fragmenting contents in static academic departments, as Malard (2018) pointed out, makes it difficult to convey knowledge which, associated with emotions, foster creativity. A diverse university and freedom of thought can assist students to pre-structure problems and synthesize solutions with different perspectives, strengthening discussions and the fluency of ideas.

The existence of a specific cognitive domain which enables the development of architectural ideas was found when we examined the searched bibliography16 and the data obtained from interviews. Considering this analysis, we argue that imagination (which transforms concepts into spatial visions), visual representation (which materializes, even if virtually, imagination), and spatial vision (which mentally organizes shapes and volumes) are the elements which form this domain. The critical development of these aspects can be a start to stimulate and enhance creativity.

The investigation of the construction of ideas in creative processes is a transdisciplinary field which is little explored and of foremost importance to the understanding and improvement of the cognitive activity in design. We are unaware of any national or international research which applied such a thorough interview with undergraduate architecture students. We believe the results and broad discussions here are a direct consequence of this novelty.

16 Darke (1984); Hillier, Musgrove, and O’Sullivan (1972); Kaufman and Steinberg (2010); Lawson (1990); Ostrower (2018); Rittel (1972); and Weinberg (2010).
REFERÊNCIAS


