ESSAY

A perspective about design cognition to research through making validation in graphic design

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Abstract

In graphic design the visualization instinct is particularly relevant but limited before complexity. The manipulation of representations helps the process in the absence of stimulus, the processing is assisted in a dialectic nurtured by the sensory experience of the world. The image is important in analysis and synthesis, and memory is an essential learning process support. Our discussion about design cognition involves phenomenology, all senses experience in the analytical process. The production of meaning is done without loss of significance when knowledge about reality is obtained by research through making, revealing conditions for facing the question of objectivity in design.

Keywords
Complexity; phenomenology; visual thinking; design cognition; research

Una perspectiva sobre la cognición del diseño para validación de la investigación través del hacer en el diseño gráfico
Resum

En diseño gráfico el instinto de visualización es particularmente relevante pero limitado ante la complejidad. La manipulación de las representaciones ayuda al proceso en ausencia de estímulo, el procesamiento es asistido en una dialéctica alimentada por la experiencia sensorial del mundo. La imagen es importante en análisis y síntesis, y la memoria es un soporte esencial del proceso de aprendizaje. Nuestra discusión sobre la cognición del diseño involucra la fenomenología, la experiencia de todos los sentidos en el proceso analítico. La producción de sentido se realiza sin pérdida de significado cuando el conocimiento se obtiene investigando a través del hacer, revelando condiciones para enfrentar la cuestión de la objetividad en el diseño.

Palabras clave
Complejidad; fenomenología; pensamiento visual; cognición del diseño; investigación

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Introduction

The challenges of creating meaning in graphic design increasingly require an integration of multidisciplinary knowledge about the dynamics of interaction between people and contexts, with digital changes bringing more acceleration and changing the references. The communication graphic solutions are reconfigured responding to complex problems, requiring more disciplinary cooperation to approach the solutions of new problems. Complexity, according to Morin (2003), has a path made of research and strategy, a sequence prepared from the beginning to receive the unexpected and modify its actions according to the emerging information. For Morin (2003) the individual and his context are elements of the process where all phenomena have a relationship of interdependence. Research is carried out today with a greater volume of data, indispensable for understanding reality, identified as a fundamental activity in design processes. These conditions require designers to master research and analysis methods and tools. Methods that are available to the challenge of complexity, but which are essentially methods validated by science. The interpretation of designers' way of operating continues to be understood in the field of speculation and subjectivity, characterizing their cognitive strategies in the processes of cumulative knowledge construction. The way graphic designers carry out research about the nature of the problem is different from the objective and more applied approaches, considered to be the most appropriate. However, we consider the way designers develop research activities, based on analysis and synthesis, open to the emergence of new possibilities emerging throughout the process, with freedom to adjust and changing direction to pursue an idea. These characteristics has conditions to claim objectivity before the particular cognitive nature of design. Aiming to reflect about the value of research through making in design graphic this essay is supported on a methodology based on literature review.

The design process as a process of creating things

The design process is made of thought and action, dominated by the interaction with the materials of the design situation to conceive a solution. The designers' solutions accrue from an active construction process, generating solutions from making, with freedom to synthesize knowledge for new ideas. It is often pointed out to design approaches too intuitive and informal, embracing subjectivity, in contrast to the formal analytical approaches of science. However, it is important to understand that the design field deals with the creation of things, giving space to creation and invention, with an objective: defining "how things can be" and, as such, focused on the solution. Science, on the other hand, is focused on the problem, aiming to understand the "how" and "why" of a given manifest of reality, describing the phenomena, that is "how things are".

Design cognition

In graphic design, thought flows through words, images and drawings, in the interaction with points, lines and shapes, models and prototypes, translated throughout the process into possibilities for solution proposals. The manipulation of visual elements is crucial to the creative process of designers and can be considered in the initial investigation phase. Contemplating areas of inquiry in design (Pontis and Van der Waarde, 2020) to understand the problem implies demanding in-depth analysis, synthesis, and evaluation activities, which occur in a non-linear and non-predictable way. Designers' cognitive resources to produce meaning to visually communicate abstract ideas and messages are also used in visual exploration, as such also useful for problem definition. While visual thinkers' designers do not separate into distinct and autonomous stages the research and the creative process focused on the solution, using the same cognitive resources.

The problem and the solution emerge together, they co-evolve, in a kind of negotiation led by the designer. In the initial phase, the clarification of the problem requires the integration of knowledge from other areas, demanding the ability to make connections between multidisciplinary knowledge. The understanding of complexity is made from knowledge about reality, to solutions that integrate more knowledge about multiple interactions in different systems. The challenge for designers is also to be able to identify and allocate relevant knowledge to the process, with explanatory power, empirically adequate and cognitively masterable, make it move from the abstract domain to the materialization of the solution. The dialectic arising from the designer's interaction with the representations in cycles of analysis, synthesis and evaluation takes place in a process whose configuration is not possible to determine from the outset given the ill-defined and poorly structured nature of design problems. The designer's skills to manipulate images, either mentally or through the performance of transformations of the graphic representations, is based on perception (Fish,1999).

Figure 1. Communications challenges in outdoors and indoors city spaces

The imagery character of design, largely dominated by the analogy to the primary sensory experience, which visual language facilitates in a different manner from verbal language, places design in a favorable position to deal with the uncertainty and the unknown.

The articulation between research and the development of solutions. The knowledge necessary to a designer to make choices and decisions is developed, as mentioned, essentially through a process of reasoning by analogy, which allows the emergence of new configurations. This reasoning process, which in our perspective is the basis of the design process, is supported using information and knowledge of visual and verbal nature from different sources, such as situations carried out by the designer and whose experience results in stored data in his memory; of processes carried out by other designers in similar design situations, which are object of learning; and the specific environment of each design situation. In the first moment of the design process, confronted with the data about the design situation, the image the designer generates mentally as a possibility is quite fluid, still weakly defined (Goldsmith, 1999). This image is externalized through representation to continue the process. The designer continues the representations using the knowledge stored in his long-term memory by analogy to the situation he is experiencing, in a selective process that is based on the verbal and visual components with which data are stored in our memory, that will be recovered to the working memory to allow its manipulation (Goldsmith, 1999). This activity leads us to consider design as a process of *learning-knowing creative heuristic*, with cognitive conditions for

discovery and invention that reflects the human ability to interpret reality. This awareness underpins our assumption that research in graphic design through making is valid and should be part of the complexity approach.

The design practice requirements evolution pressures the transformation of skills, placing the emphasis on the development of more rigorous research skills in design education, highlighting the importance of the methods quality used by designers today (Frascara, 2020). The research led by evidence exploration should be a fundamental component of the design process, with areas of inquiry which boost the evolution of the process (Pontis and Van der Waarde, 2020). The problem approach implies questioning them as complex systems in rapid change, requiring more organization and leadership in a process that becomes more chaotic, but that allows more conscious and clarifying discussion, arguing, and comparing to knowledge flow throughout the non-linear process (Figure1). Our perspective about design cognition seeks to contribute to the clarification of the dichotomy between design and science regarding the investigative exercise, in design as formal as exploratory. Visual exploration as a way of clarifying a problem has cognitive bases that validate the knowledge achieved. In doing so, designers are in a favorable position to broaden their knowledge, providing a direction for possible further inquiry.

Visual thinking in graphic design research. The cognitive activity based on the particular domain of cognitive devices, responsible for the production, manipulation and transformation of images and that are intensively explored by designers in solving problems, as mental representations and

external representations, depends on the instinct of visualization inherited from our evolutionary process, which is particularly relevant as a mental resource for thinking. But this innate ability has limitations before the complexity of the synthesis activity, in the creation of imagined images (Fish, 1999). Our ability to process visual information needs help in the absence of the appropriate stimulus in the process of designing new configurations. As images are probably the main content of our thinking, as proposed by Damásio (1995), the visual stimulus to the reasoning process is fundamental, this is the role of drawing as a thinking support. In design, the visual representations of designers have a double role, they are visual resources in the absence of the visual stimulus, and they are simultaneously manipulable resources to create. They are an external helper that allow us to adapt our visual resources to complex tasks for which they have not yet evolved.

Information processing assisted by drawing has to do with the relationship between thinking and representation, in a dialectic made of reflection-in-action (Schön, 1983). The designer is thinking while acting, making choices, and taking decisions as he encounters tensions and conflicts in visual interactions when manipulating images (Goldsmith, 2000). These tensions lead him to new interactions that occur in multiple dimensions that bring knowledge. Cognition in design is not just about the work of the mind fed by the sensory experience in the interaction with the world, the individual and collective shared, which is part of knowledge as we mentioned earlier. In design, the presence of the real world, from mind and from all senses, is considered in the process, and by its simulation through representation and visual manipulation in interactions for new knowledge. Graphic designers also use their visual memory, the stored knowledge that they put into action in an essentially reconstructive logic of reality whenever they remember something. As memory is an essential support of learning processes, it is crucial that images are a resource in the process of analysis and synthesis when it comes to understanding the material world. Experienced designers easily use their long-term memory to expand their working memory capacity. This mental skill, a competency, exists because they have developed data retrieval structures in their long-term memory from existing cues in short-term memory. This activity is at the base of the ability to mentally manipulate images, a skill that can be trained and developed, which is amplified using drawing in its externalizations and interaction.

A phenomenological perspective about design cognition. The way designers process visual information considers a phenomenological approach, a hypothesis to explain the value of research through making in design graphics. To analyze this approach and clarify the hypothesis we need to understand the contributions of important authors in the field. According to Merleau-Ponty (1999) the experience of the senses must be contemplated in the formal analytical processes for integral knowledge, without it the own symbols of science could not exist. The realm of subjectivity, the world of the living experience, which means the real world experienced, the one in which we live, for Husserl (2000) an intertwined matrix of sensations and perceptions, is an important collective field of fully lived experiences from many different angles. Phenomenology comprise perception, which means a deeper involvement in the reciprocal relationship between the body that feels and what is perceived in our spontaneous engagement with reality (Abram, 1996), which cannot be lost in processes of knowledge contemplating analysis and synthesis of reality as it is (Husserl, 2000). As literature reveals, information processing in graphic design is based on the operations of analysis and synthesis that are developed mainly in a perceptual dimension and not in a formal logic basis, inherent to the analytical processes of science essentially supported in abstraction. The production of meaning in graphic design is based on the visualization instinct, as such the meaning creation through images, those of the designer's mind and the external representations that he makes, is done without "total" loss of meaning, holding better conditions to inform more complete knowledge about reality. Designers' research will be rich in knowledge, with favorable conditions to understand the problems complexity, making connections between multidisciplinary knowledge about multiple interactions occurring in reality and that visual communication solutions must serve. The nature of knowledge put into action by designers when approaching problems articulates a rational approach, which also involves the quantification of problems, and knowledge based on the experience of interaction with reality revealed by reflection-in-action throughout the design process. We identify in these processes a phenomenological approach implicit in its analytical activities, which in our perspective contributes to the corroboration of our hypothesis.

Research through making in graphic design
Searching for the validation of our hypothesis in the argumentation about the specific nature of the

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Figure 2. Reality inputs to communication problem formulation

investigation phase in graphic design we consider relevant a reflection about design cognition. This is particularly necessary to understand the problem, focused on the value of the activity of designing artifacts whose function is essentially to lead the design process dynamics of reflection-in-action. Investigating through making is consistent with the objective of uncovering thoughts and ideas about "things", specifically about the tangible nature of solutions, moving between conceptualization of intangible dimensions, inherent to people's behavior in the interactions with contexts, especially when we talk about audiences and their needs (Figure 2). The use of concepts with the potential to inform solutions is for designers an important synthesis tool, useful for bringing the knowledge processing to the process, knowledge also coming from other areas. In the moments of disciplinary interaction in problems approach the designers' resource to the formulation of concepts facilitates the clarification, together with their ability to visualize allows the realization of moments of analysis, making the selection of what is relevant and not relevant for the development of possibilities focused on solutions. For graphic designers, these actions are carried out in the interaction with the visual materials of the design situation that act as catalysts of the process (Fish:1999), fundamental when we are before a predominantly visual mode of thinking and when the solution has a visual nature.

In our approach to the validation of research through making in graphic design processes, all these aspects we mentioned are of great relevance for the operationalization of the design process in the most advantageous conditions, enabling the thinking that leads to ideas that are relevant to develop. These conditions will be the more adequate the better they allow the flow of thought from the

problem to the solution without loss of meaning. The challenge for designers to offer a tangible possibility of what a solution might look like, in the form of an artifact or a system of artifacts, which may not even exist yet, implies initiating a thought process of imagination, creation and invention supported by a path that depends on a process of construction and not of discovery. This construction process requires dealing with knowledge of a complex nature, knowledge that is provided to the process and that must flow to constitute the knowledge generated by the process, taking part in the development of new knowledge that can be a solution. The validity of graphic designers' solutions will be based, in our perspective, on the understanding of the design process as a process of approaching complexity that deals with multidisciplinary knowledge, where the verbal mode may predominate, relevant to shape solutions though materialization of visual messages that serve complex communication goals. We consider these increasingly present in the requirements of graphic design processes and imply the validation of the research phase through making, with the predominance of thinking made of images in processes of analysis and synthesis of information and knowledge, as we have already mentioned. This process will be richer and more productive, and it can also be said that it will be more rigorous, considering the externalization of the processing using visual representations that enable the flow of thought from the investigation phase of problem data to the configuration of solution hypotheses.

The way graphic designers generate knowledge from the treatment and analysis of data uses cognitive resources that are also used in the expression of knowledge in response to problems. We believe that make sense to validate the investi-

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gation of the graphic designer that is based on the way of thinking of making, which is involved in the definition, configuration, and construction of solutions, in cycles of divergence and convergence that characterize the process of design, and that are validated in investigation about reality in information and knowledge intensive processes. The nature of design activity in addressing problems is methodologically oriented and characterizes design, recognizing its evolution, as BEDA (2014) refers, from an intuitive and mainly introverted process to an increasingly inclusive and participatory highly complex approach, running on equal parts empirical and theoretical fuel.

Conclusion

Research in graphic design and its management, assumed as a learning process before the possibility of a solution, configures a process open to numerous possibilities of interpretation of reality phenomena and as such rich in knowledge (Muratovski:2020). The methods quality, but above all the data volume and nature, are increasingly important requirements in the design process, demanding the so-called areas of inquiry (Pontis and Van der Waarde, 2020), which must be led by evidence of the real conditions of interaction of people with different and changing contexts. This pressure already placed on graphic design by the non-linearity and fragility of an increasingly complex and incomprehensible reality, configures the accentuated pertinence of working teams diverse in culture and skills. In addition to more data a greater number of stimuli is essential to the process to enable connections that generate new possibilities, facing the complexity of reality as an integral phenomenon requiring a phenomenological approach. Voûte, Stappers, Giaccardi, Mooij and Van Boeijen (2020) consider essential to connect inputs from various disciplines in the design process cycles of divergent and convergent thinking, framing, and reframing with synthesis and evaluation to promote clarification, discovery, and creation. This is particularly pertinent before the demand placed by richer inputs. To face the challenges presented by the problems of the 21st century, it will be necessary to put into action new ways of approaching complexity for new possibilities (Whitney and Nogueira, 2020). The way we think about reality cannot be framed exclusively by technical objectivity, instead it requests the understanding of the whole form by people and contexts. The global challenges we face depend on model validation for problem approaches that take advantage of visual exploration as an opportunity to leverage our thinking and abilities to change the way we encourage the development of fundamental skills for new results, such as creativity and critical thinking. We look at the graphic design process as a rigorous and objective process that implies validating the investigation carried out through making, made of visual exploration, with reflection and action, in a process leading to a solution with learning about the problem in situations in which neither the first nor the last are known.

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