

# idea

investigating  
design in  
architecture  
2023 edition

edited by  
Gaia Leandri

foreword by  
Angelo Schenone







Conference Proceedings  
IDEA – Investigating Design in Architecture  
2023 Edition  
April 17, 2023  
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This meeting stemmed out from studies, investigations and PhD lectures, in particular:

- 2022, Departamento de Expresión Gráfica Arquitectónica, Universitat Politècnica de València (UPV) and Dipartimento di Neuroscienze, Riabilitazione, Oftalmologia, Genetica e Scienze Materno Infantili (DINOEMI), Università degli Studi di Genova (UNIGE): Gaia Leandri, PhD thesis *Freehand digital drawing: a boost to creative design the observer's eye and the draftsman's brain*;
- 2022, Dipartimento Architettura e Design (DAD), Università degli Studi di Genova (UNIGE), lectures to PhD students in Architecture, Design, Digital Humanities and Neuroscience;
- 2023, Post Doc Consolidator Scholarship: *Ideazione dell'immagine e neurofisiologia: l'apporto creativo e gli strumenti per la comunicazione visiva*, Dipartimento Architettura e Design (DAD), Project Supervisor: Prof. Ruggero Torti; Research Fellow: Dr. Gaia Leandri.

The promoting committee is composed by professors, lecturers, PhD students and researchers from Italy, Spain, the US and the UK:

Angelo Schenone, Marco Testa (DINOEMI, Unige); Maria Linda Falcidieno, Andrea Giachetta, Gaia Leandri, Linda Buondonno, Elisabetta Canepa (DAD, Unige); Francisco Juan-Vidal, Susana Iñarra Abad (UPV); David Sunnucks (Queen Mary University of London).

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Angelo Schenone, Marco Testa, Lucio Marinelli  
(DINOEMI)

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*è il marchio editoriale dell'Università di Genova*



I contributi qui pubblicati sono stati selezionati dal Comitato Scientifico del Convegno.

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# Imagination and digital media in the architecture design process

Linda Buondonno, Andrea Giachetta

*Università degli Studi di Genova*

Architectural design is a complex process that involves various professional figures, knowledge in multiple fields and competencies, managed by specific cognitive abilities, and that has always found the opportunity to develop, and finally potentially reach a tangible outcome, by integrating tools capable of absorbing some of these abilities.

This research arises from the need to question the role of technology in architectural design, defined as the set of digital tools available to the architect, now that it is equipped with ever greater potential (parametric control of the drawing, management of physical, economic information...) and with interfaces that even exceed the "traditional" screen (es. virtual reality, augmented reality).

Digital media have a direct impact, from the early stages, on the design process and determine the outcomes. This is investigated in various studies in the field of cognitive sciences that have focused on the differences between sketch and digital media in different aspects (Bilda & Demirkan, 2003; Häggman et al., 2015; Ibrahim & Pour Rahimian, 2010; Rahimian & Ibrahim, 2011; Ranscombe et al., 2019; Stones & Cassidy, 2010).

Despite the full diffusion and the well-established integration of digital tools in the practice of architects, it remains surprisingly little investigated their impact in particular in relation to mental imagery, one of the many cognitive skills put in place in the creative process and one of the most "powerful", as it is able to reverse the neuronal patterns activated during the perceptive and multisensory experience of space through the re-elaboration in a new meaningful organization of fragments extracted from long-term memory (Arbib, 2020).

Research in this direction is particularly important because it is increasingly evident, also given the many discoveries made in the field of cognitive sciences in recent years, that the boundary between the designer's mind and the instrumental apparatus at their disposal is increasingly blurred. Studies (Bruner, 2018; Clark & Chalmers, 1998; Malafouris, 2019) consider the interaction between mind and matter with a systemic approach:

body, brain, and "active externality" (Clark & Chalmers, 1998) constitute a network of inseparable interactions, by which the brain undergoes continuous reconfiguration. Going further, Poulsgaard and Malafouris (2020) define digital models of architecture as «technologies of perception, that are inextricably bound up with knowledge and imagination in the wider field of architecture».

We believe that mental images and digital tools are, among the various involved, two of the most interesting components to be compared to analyze mutual interactions, given their similarity and notable differences at the same time. Both are tools for modeling a hypothetical material reality, and yet, if imagination uses sensory content to define a model, digital tools do so by translating matter into binary language, which, as we know it, derives from rational-mathematic reasoning.

This account originates from considering the perception of the environment essentially as atmosphere, that is, an immediate contact from which a synergy of sensory perceptions arises (Canepa, 2022). In this sense, the design must consider that the experience of space is primarily embodied and precognitive (Jelić, 2015) and that the human body is going to interact with space in terms of affordances (Condia *et al.*, 2020)

From a neuroscientific point of view, imagination, according to the IBSEN model (Imagination in Brain Systems for Episodes and Navigation) developed by Arbib (2020, 2021), «can "reverse" the multimodal experience of contemplation and action perception cycle to design spaces that support them»

According to the enactive theory on imagery (recalled or not), imagination is constituted by the (partial) emanation of the perceptive acts that would be performed if one actually perceived what one is imagining (Thomas, 2021). Precisely because of this characteristic, imagination, although used with different degrees of awareness, makes the architect a sentient subject of the space during the design phase. If enhanced and actively used, imagination can be a true instrument of phenomenological control of space. As Peter Zumthor (2019) states, «[Memories of this kind] constitute the basic nucleus of images and architectural atmospheres that I try to fathom in my practice as an architect».

And it is precisely this "fathoming" the other theme that makes imagination a potential tool for design. Kosslyn (1999), the neuroscientist responsible for the recognition of the cognitive effectiveness of mental images, achieved this result by studying the inspection and transformability of mental images in relation to time. Many authors, then, recognized spatial ability and visual cognitive style as some of the main cognitive abilities that favor the professional activity of the architect (Cho, 2017).

With remarkable and undeniable advantages in the speed of modification operations on modeled reality, digital tools have evidently been an integral

part of the architect's creative process for decades. The progressive development of software dedicated to design, however, makes the contrast even more evident, especially with the immersive allowed by the imagination. What are the consequences of this constant mandate of capacities that define us as human beings? (Malafouris, 2013)

As mentioned before, experimental studies have been developed to investigate the possible interactions between digital architectural design tools and other spatial modeling and prefiguration systems; sketch and CAD are the two most studied design tools. Although there is already some interesting evidence of the potential of mental images as a design tool in architecture (Athavankar, 1997; Bilda & Gero, 2008), compared to others, the relationship between mental images and digital tools is much less studied, and represents a promising research field.

With the aim of obtaining some initial evidence about the interaction between imagination and digital media, we structured a preliminary cognitive experiment, thanks to the collaboration with Prof. Carlo Chiorri, professor of psychometry (University of Genoa), and Prof. Manila Vannucci, professor of general psychology (University of Florence).

We asked a group of undergraduates of architecture to perform a simplified design activity in two different modalities, namely using "2D-3D CAD software" vs. using "only imagery" (within-subjects design). The task consisted of the design of an outdoor space with a very simple program, using given wood construction elements. Cognitive and emotional dimensions of the experience were evaluated right after the task, by using an ad hoc questionnaire. Expertise with the software and individual differences in psychological dimensions of interest were also assessed.

Under the "only imagery" condition participants reported a more concrete and embodied experience compared to the "software condition", as they simulated concrete interactions with the objects of design, remembered previous similar experiences, and globally felt less constrained in their process of ideation.

These data suggest that the process of architectural design is sensitive to the tools used, at least in terms of the subjective experience reported by participants.

Experimental research on the topic is only at its beginnings and we believe its future developments and results could have an impact on architectural education (Robinson, 2022) as well as on professionals' metacognition of their own creative process.

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