

Aurora Saidi: ARHITEKTURA V PRIMERJAVI Z NEVROZNANOSTJO: INTERPRETACIJA RAZISKOVALNIH REZULTATOV V NEVROZNANOSTI V PODPORO FENOMENOLOŠKIM VPRAŠANJEM V ARHITEKTURI

ARCHITECTURE VS NEUROSCIENCE: THE INTERPRETATION OF RESEARCH RESULTS IN NEUROSCIENCE TO SUPPORT PHENOMENOLOGICAL ISSUES IN ARCHITECTURE

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1.02 Pregledni znanstveni članek / Review Article

IZVLEČEK

Vprašanja človekovega odnosa do grajenega prostora, kako ta oblikuje človekova fizična, duševna in družbena stanja in/ali kako ta stanja oblikujejo človekove izkušnje z grajenim prostorom so že več stoletij predmet odprte razprave med fenomenologi. Medtem ko fenomenologija razlaga izkušnje predvsem s prvoosebne vidika, nevroznost ob uporabi učinkovitih novih tehnik merjenja empirično, na ravni nevronskega kroga, proučuje, kako številni notranji procesi, kot so občutki, zaznavanje in spoznavanje, ustvarjajo izkušnje. Le malo dognanj v nevroznosti glede izkušenj sveta na splošno – in zlasti grajenega okolja – je zanesljivo odgovorilo na dolgo obravnavana fenomenološka vprašanja o naravi arhitekture. Zato je skupina nevroznanstvenikov in arhitektov spodbudila razvoj interdisciplinarnih raziskav, ki vključujejo tako nevroznost kot arhitekturo. Med prvimi arhitekti, ki so ta pristop uporabili kot podlago za svoja fenomenološka opazovanja, je bil Juhani Pallasmaa. Arhitekt obravnava spregledano utelešeno naravo arhitekture, pri čemer svoje ugotovitve naslanja na nevroznost in poziva k širjenju zavedanja o tem vprašanju med sodobnimi arhitekturnimi krogi. Toda ali dognanja v nevroznosti res podpirajo Pallasmaajeve trditve? Nekateri nevroznanstveniki so namreč izrazili dvome o arhitektovi razlagi njihovih dognanj. Članek obravnava Pallasmaajeve zaključke in na splošno prikazuje, da arhitekti, ki podpirajo interdisciplinarne raziskave v nevroznosti in arhitekturi, pripisujejo prevelik pomen dognanjem v nevroznosti za krepitev lastnih stališč, medtem ko so nevroznanstveniki – četudi so navdušeni – mnogo bolj zadržani pri svojih sodbah in pozivajo k nadaljnjim poglobljenim raziskavam.

KLJUČNE BESEDE

arhitektura, nevroznost, Juhani Pallasmaa, filozofija, fenomenologija.

ABSTRACT

The relationship that people have with the built environment, how it shapes their physical, mental, and social states, and/or how these states shape their experience of the built environment has remained an open discussion among phenomenologists for several centuries. Whereas phenomenology interprets the nature of experience mainly from the first-person perspective, neuroscience, using powerful new measurement techniques, investigates empirically at the level of neural circuits how multiple internal processes such as sensation, perception, and cognition yield experience. Few available findings in neuroscience regarding the experience of the world in general and the built environment in particular have proved sufficient to seal long discussed phenomenological issues about the nature of architecture. As a consequence, a group of neuroscientists and architects have initiated and promoted interdisciplinary studies combining neuroscience and architecture. Among the first architects that embraced this approach to support their phenomenological observations was Juhani Pallasmaa. Concerned about the disregarded embodied nature of architecture, he relies on findings in neuroscience to call for a greater awareness amongst contemporary architectural circles. But do findings in neuroscience really support Pallasmaa's arguments? While the architect is very enthusiastic, some neuroscientists have raised doubts about his interpretation of their findings. This article examines Pallasmaa's conclusions, and in general shows that architects who support interdisciplinary studies in neuroscience and architecture exaggerate the implications of neuroscience findings to advance their positions, while neuroscientists, even though they are enthusiastic, are more reserved in their judgments, calling instead for further in-depth research.

KEY-WORDS

architecture, neuroscience, Juhani Pallasmaa, philosophy, phenomenology

1. INTRODUCTION

Juhani Pallasmaa, Harry F. Mallgrave, Sara Robinson, Alberto Pérez-Gómez, and Steven Holl, to mention just a few, have expressed concerns that architectural culture today deals only with the technical, formal and material dimensions of the subject while disregarding the way people interact with the built environment and how they experience it. In a series of books and writings they intend to raise awareness of the disregarded embodied and psychological dimensions of architecture. However, because their approach is more phenomenological than empirical it has left much room for doubt and disbelief.

A person's every experience has a neural counterpart in the brain (Chatterjee, 2014). New technologies in neuroscience enable brain activity to be registered with considerable precision, and have provided an understanding of the "neurophysiological brain mechanisms that make possible our interaction with the world" (Gallese & Gattara, 2015, p. 161). This empirical methodology has been embraced and promoted by certain architects in the hope that it will provide objective evidence for architectural culture to shift its attention towards its hitherto unacknowledged embodied and psychological dimensions. Questions about the relationship between people and the built environment have also raised interest among some neuroscientists. They have started to think of ways in which neuroscience might be of use to architecture. While the benefits of an interdisciplinary approach involving philosophy, neuroscience, and architecture appear overstated by some architects, neuroscientists are more reserved. They look forward to more in-depth research before making any generalized conclusions. The hesitation and uncertainty expressed by some neuroscientists with regard to the way these architects have interpreted research results to support their phenomenological viewpoints is the subject of this article.

The problem will be illustrated by complementing Juhani Pallasmaa's viewpoints and opinions on the interdisciplinary cooperation between architecture and neuroscience with those of neuroscientists. His phenomenological approach is characterized by certain crucial statements about the experience of architecture. The most important of these is the disregard for embodied and multisensory nature of architecture in architectural education and practice. It follows with the supremacy of the tactile sense over the visual in the architectural experience, the intuition of the whole in an architectural setting over the identification of its parts, and the nature of emotional engagement with architecture. Only then can the subject be understood. Pallasmaa's interpretations have been chosen as a case study because he is among the first architects that have used research results in neuroscience to support his viewpoints and opinions about the nature of the architectural experience. He has written and spoken vociferously on the importance of interdisciplinary studies in understanding the relationship between people and the built environment.

2. THE DISREGARD FOR THE EMBODIED NATURE OF ARCHITECTURE

Juhani Pallasmaa is well-known as the architect and the theoretician who is attempting to raise awareness of the disregard for the multisensory and psychological nature of architecture as experience among architectural circles in particular, and contemporary culture in general. Influenced by the writings of Christian Norberg-Schulz, Gaston Bachelard, Martin Heidegger, and especially of the phenomenological philosopher Maurice Merleau-Ponty on the nature of perception, he criticizes

the over-rationalized formalism of architectural design of the past few decades. Furthermore, his greatest concerns are the tendency in the last few decades to conceptualize architectural design through computers, to present and advertise its qualities utilizing 3D models and pictures, and to build cities as if they were intended to be explored by the fast moving eye from motor vehicles or from the air (Pallasmaa, 2005).

The architecture of our time, according to Pallasmaa (2005, p. 30) is "an architecture of visual images" or a "mere retinal art of the eye" that in its essence treats the eye as detached from the body in its interaction with the world. Ignoring the way each sense, especially the tactile, interacts with the world in yielding the architectural experience, the architecture of the last several decades has failed to engage people emotionally (Pallasmaa, 2005, p. 17–19). He suggested that "an architectural work is not experienced as a collection of isolated visual pictures, but in its fully embodied, material and spiritual presence" (Pallasmaa, 2005, p. 44), "...life enhancing architecture has to address all the senses simultaneously and fuse our image of self with our experience of the world" (Pallasmaa, 2005, p. 11).

The embodied nature of the architectural experience initially introduced by Pallasmaa in one of the three essays in *Questions of Perception: Phenomenology of Architecture*, was further explored by him in *The Eyes of the Skin: Architecture and the Senses*. In the latter, the same issue was presented but with more confidence, because he had discovered that his viewpoints were supported by recent neuroscientific discoveries. His phenomenological approach, driven by his "personal experience, views and speculation" (Pallasmaa, 2005, p. 10), had arguably been confirmed by empirical evidence.

The model used by neuroscientists to illustrate the idea that we experience the world as bodies and brains interacting with it is called the action–perception cycle (Arbib, 2016). Pallasmaa (2005) noted that this describes the embodied nature of architecture as experience: the senses are not simply registering the world 'out there.' However, the information that senses are able to sample from the built environment are interpreted and reconstructed through our current schema (that is, our knowledge about the world built through experience), while an understanding of what is out there is generated, and on that basis we choose to act following our current needs and goals. During movement, the information that senses can sample changes constantly according to our goals and needs; the newly gained knowledge during this cycle changes how we see the world and perhaps our future goals and needs.

To grasp the model of the action–perception cycle in its entirety, firstly, for the sake of understanding how people interact with the world and secondly, to analyze Pallasmaa's viewpoint on the experience of architecture through the prism of neuroscience, it is necessary to provide a more detailed explanation of what schemas represent and how they are generated and stored. Schemas are the brain mechanisms that make possible, mainly through the subconscious, the recognition of the environment's affordances. They represent the building blocks of knowledge, a stored mental representation about the world that both compete and cooperate to provide coherent interpretations, or give meaning to the information that reaches us through the senses (Piaget, 1952).

Arbib (2015, p. 78–79) distinguished two types of schema: perceptual and motor. A perceptual schema is the process of recognizing an object, a person, or even abstract concepts such as personality, truth, or religion. To understand the enviro-

nment, it is necessary to recognize not one object at a time but many different objects and their relationships. A motor schema calculates and executes the action according to what affordances might have provided the detected objects for our goals and needs. The whole process is an endless cycle of simultaneously coordinated multiple perceptual and motor schemas that are activated and then compete in parallel to yield experience and understanding. For the brain to recognize an object as a computer does, pixel by pixel, would require enormous time and energy. Instead, it applies multiple levels of associations and meanings to sensory information to make possible a rapid understanding of the current state of the world. Schemas operate due to a cluster of neurons that fire whenever the individual sees a house, hears someone talking about a house, or imagines an event that happened in the house (Mlodinov, 2018). The world out there is mainly a constant world, but whenever we face something new, schemas merge, split, and cooperate to yield understanding and hence build new schemas. This means that people's experience of the world is yielded through the embodied condition of the human mind (Varela, Thompson, & Rosch, 1991). Our immediate interaction with the world is through our body via various sensorimotor capacities but also through our memorized experiences, which are shaped by exploring the world in different biological, psychological, and cultural contexts.

3. THE SUPREMACY OF THE TACTILE SENSE OVER THE VISUAL

Pallasmaa's phenomenological approach goes beyond an emphasis on the embodied condition of the human mind in the experience of architecture. With the introduction of the concept of hapticity (Pallasmaa, 2000, 2005), he intended not only to attack the cultural bias of our time toward the vision sense at the expense of other senses, but also to emphasize the fundamental and primary role of the tactile sense in the experience of architecture. Even though his approach appears as a revolt against architectural culture that designs only for the engagement of the eye, it is in fact a revolt against one of the two pathways of visual processing—the focused vision—and toward the treatment of the eyes as organs detached from the body that interact in the world. And rightly so.

The schema of the action-perception cycle confirms that a three-dimensional model or a picture of an architectural setting could not emulate the qualities of a real architectonic setting with various affordances awaiting to be explored and interpreted with all the senses during movement. Also, research has shown that only 5% of the information that reaches the eye can be processed consciously, through focused vision, while the rest is processed subconsciously, through peripheral vision (Mallgrave, 2018). While we are walking we are not consciously aware of every piece of information that surrounds us, even though that information subconsciously guides our behavior. We avoid, mostly subconsciously, the obstacles that might otherwise interrupt our walking while we are looking for a friend in a crowd, for example.

Nevertheless, the primacy of the tactile sense over the visual is not fully supported by neuroscience. Each of the sensory modalities provide different and unique aspects of the world. Vision makes it possible to process information in the distance and in a wider context, recognizing shapes and their spatial location, while touch makes it possible to engage in an emotional experience with the object, exploring its texture and materials in closer proximity (Goldhagen, 2017; Papale *et al.*,

2016). But of the total capacity that the brain devotes to processing information via the senses, one third of it is reserved for the processing of vision (Mlodinov, 2012).

Supporters of the concept of hapticity (e.g., Pallasmaa, 2005) insist on its importance in the experience of architecture. Hapticity relies on the fact that people can create spatial and social representations of the world when they lack one sensory modality. This attribution of the brain to perceive and represent perceptual schemas independently of the sensory modality is called supramodality, or degeneracy. Visually impaired people can process and represent in the brain distinct elements of forms and surfaces. This means that sensory systems cooperate and exchange information. Activity in the visual system is mapped to the auditory or haptic system, and auditory or haptic activity is mapped to the visual system (Papale *et al.*, 2016; Smith, 2005).

Because of the ability of the brain to assign multiple associations and meanings to a perceptual schema, we are able to recognize the texture of wood when we see it far away, along with the sensation of how it would feel to touch it, but we can also recognize that it is a wooden texture and generate a mental image of it with closed eyes simply by touching it (Williams Goldhagen, 2017). As Pallasmaa (2005, p. 42) noted, "through vision we touch the sun and the stars." However, even the concepts of supramodality or degeneracy and the evidentiary findings of neuroscience do not fully support the primacy of the haptic system in the experience of architecture. They can, on the other hand, encourage parties to consider more seriously the multisensory nature of architecture as experience, and also to investigate ways to integrate this knowledge within the field of architecture and promote further research in this domain.

4. THE WHOLE AND ITS PARTS IN AN ARCHITECTURAL SETTING

Within the framework of the action-perception cycle, Pallasmaa (2013, p. 13) emphasized the nature of the experience of architecture: "We have an amazing capacity to grasp complex environmental entities through simultaneous multi-sensory sensing of atmospheres, feelings, and moods. This capacity to instantaneously grasp existential essences of vast entities, such as spaces, places, landscapes and entire cities, suggests that we intuit entities before we identify their parts and details." Insofar as the action-perception cycle is an endless cycle, parts and details from the built environment continuously update the schemas from the consistency of the initial impression. The details may confirm or change the initial impression. Its qualities can be amplified or fade fundamentally. Arbib (2013, p. 73) stated that one should not underestimate the power of the details because it is the essential style of the brain to mix bottom up and top down processes in yielding experience about the world.

Consideration of the dialog between bottom up and top down processes in the brain is essential when discussing Pallasmaa's statement that people engage emotionally with architecture and art before they understand them. This is true, but again it describes more an initial impression whose meaning might continuously alter during an embodied interaction with an object or artwork, especially when the individual encounters new situations that are

not yet mapped in perceptual schemas. Arbib (2019) also suggested that this initial effect is not accidental, but the designer must think about all the qualities of the details and how they might affect the impression as a whole as much as how the whole might affect the understanding of its details.

5. THE MIRROR NEURONS

Discussions among leading architects as Juhani Pallasmaa (2000, 2005, 2013) and Harry Francis Mallgrave (2013), the philosopher Mark. L. Johnson (2015), and the neuroscientists Vittorio Gallese (2015) about how neuroscience can help to understand the hidden relationships of people with the built environment and how the built environment might shape people's physical, mental, emotional and social states, give enormous importance to the neuroscientific discovery of the mirror neuron system. Mirror neurons are the neurons that fire whenever one executes specific types of action, and also when one observes somebody else perform that type of action. As far as people are able to experience the feelings of an action performed by somebody else, due to mirror neurons, they are able to generate feelings, emotions, and empathy (that is, the ability to share and understand the feeling of another) for buildings as well. Because people have bodies, they map the building in their body, and hence feel its weight as if it were carried by their own muscles/body.

However, Arbib (2013, pp. 63–65) noted that "mirror neurons don't do action execution and recognition (or empathy) all by themselves." Research carried out on a person observing a human talking, a monkey teeth-chattering, and a dog barking showed that there was considerable mirror neuron system activity in the first case, a small amount in the second, and none in the third. Thus, the person was able to recognize that the dog was barking, but could not know how it felt because barking is not a human activity. Arbib explained that "...all these actions can be recognized without the aid of mirror neurons, but if an action is in our own repertoire the mirror neuron activity enriches it by tying it in to our own motor experience." Instead of assuming that mirror neurons are responsible for empathy for buildings in the same way that they are for people, he suggested that further research be initiated with the aim of understanding whether this overlap exists at all, and if it is, whether it is due to mirror neurons. Mirror neurons are just part of the overall perceptual cycle.

6. CONCLUSION

This article intended to show the complex implications of the interdisciplinary approach that unites neuroscience, philosophy, and architecture as experience. The nature of architecture as experience is in itself very complex, and the use of the philosophical approach, which interprets the experience of architecture from the subjective or first-person point of view, has very often proved to be misleading, generating only necessarily partial knowledge, or producing controversial interpretations within the field. Therefore, since the neuroscientific approach promises to

provide objective evidence of the experience of architecture through studies of the nervous system (the third-person aspect of experience) many architects, philosophers, and neuroscientists introduced the neuro-phenomenological approach as a solution to long discussed phenomenological issues concerning the nature of architecture. In the same fashion, Juhani Pallasmaa, among others, attempted to use research results in neuroscience to confirm his observations, viewpoints, and opinions about the nature of the architectural experience. However, while some findings in neuroscience seemed to confirm his statement regarding the embodied and multisensory nature of architecture, matters were much less clear when he attempted to use them to support his claim for the primacy of the haptic system in the architectural experience, either in terms of the perception of architecture as a whole anticipating the perception of its parts/details, or of the emotional engagement with architecture anticipating its understanding. Some neuroscientists have implied that Pallasmaa has overrated and overgeneralized research results to support his statements, or has given only a partial explanation for the phenomena he describes. The example of the mirror neuron system illustrates that empirical evidence from neuroscience about a phenomenon, if not carefully processed, interpreted, and used in its entirety by architects can be misleading in understanding the interrelation between people and the built environment. Whether the same mechanisms are engaged in empathy for buildings as they are for people remains to be investigated. There is no doubt that future interdisciplinary studies encompassing architecture and neuroscience will generate new knowledge about the hidden relationships between people and the built environment, but as long as there are so few studies in this area, and since the aim of the approach was to avoid the confusion caused by multiple controversial interpretations that existed within the field of architecture, the advocates of interdisciplinary studies may perhaps need to be more circumspect when interpreting findings to avoid further confusion. There is nothing wrong with recognizing potential, nor indeed with 'romantic' interpretations of the available scientific evidence, but it is better that connections between the two disciplines be presented in the form of hypotheses rather than statements.

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