MORE-THAN-HUMAN DESIGN PRACTICE: REVIEW OF APPROACHES IN MAPPING SUBJECTIVE PARAMETERS OF PEDESTRIAN EXPERIENCES

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ABSTRACT

This paper focuses on the concept of more-than-human design, which involves the inclusion of non-human actors, such as technology and infrastructure, in the design process. Specifically, the paper examines the technology of the urban environment as infrastructure and its potential use in designing complex and dynamic urban spaces that cater to different types of users.

The paper explores how environmental data can act as a bridge between humans and nature, promoting empathy towards more-than-human perspectives. It emphasizes the need to question the human-centric approach to design and to form new design practices that integrate different abilities and contextual significance of data.

The aim is to establish interactions between humans, objects, and other things through design practices that recognize and integrate different abilities, both human and artificial while overcoming technological determinism that dominates many narratives. This is achieved by expanding design theory and methodology towards "more-than-human design." The paper presents a review of existing approaches and methods from various fields as new input in considering subjective parameters of urban experience and new design practices in line with "more-than-human design" paradigms.

The paper illustrates the urban user experience through the example of pedestrian traffic in interchange systems. While subjective parameters of users can be shown through various surveys, the paper emphasizes the importance of visual perception in collecting spatial information and its connection with cognitive processes. Developing eye-tracking technologies is becoming increasingly popular in spatial cognition research. The paper proposes using visualization of eye-tracking data to create mental maps that help in the cognitive mapping of the urban pedestrian experience in complex processes. The processed results can be used as input for user interfaces and new design practices. Designers need to take the underpinning technology seriously before they can design with it.

KEYWORDS _ *more-than-human design, technology, urban environment, cognitive/mental mapping, pedestrian experience*

INTRODUCTION

A term "more-than-human" used critically to remind human geographers that the non-human world not only exists but has causal powers and capacities of its own (Castree, Kitchen, and Rogers, 2013). Today, "more-than-human" is employed to attribute concepts typically associated with humans, such as sentience, intelligence, and agency, to entities other than humans where scholars are increasingly acknowledging a range of diverse "more-than-human" indigenous ontologies and their associated sustainability benefits. More-than-human design includes various types of non-human actors in the design process, such as the natural environment, animals, plants (Poikolainen Rosén, Normark, and Wiberg, 2022), as well as technologies and infrastructure.

Unlike that, human-centered design focuses on the interaction between individuals and technology, emphasizing that the designed artifact should consider the instrumental relation between a person (or people) and the technology. As we move beyond individual interactions, it becomes crucial to recognize and manage the numerous connections a technology has with other entities, as well as the diverse reasons people use it, highlighting the necessity for a more-than-human centered design that navigates multiple relations simultaneously without privileging any specific one (Giaccardi and Redström, 2020). Despite the clear rationale for more-than-human-centered design, there is a deficiency in design methods grounded in this perspective (Poikolainen Rosén, Normark, and Wiberg, 2022).

This approach can be particularly useful in designing urban spaces that are complex and dynamic, and that involve different types of users. In this paper, the focus is on technologies and infrastructure, specifically observing technology as infrastructure in the urban environment.

We can define this concept between technology and infrastructure, but also between design and place where place is the most important part of design process. We can design everything, but what about place?

More than human design, *from technology perspective*, could be defined as a human cognition used in machine and digital tasks. In that sense, we need to define human cognition, but also decompose cognition for usage in unreal environment.

On the one hand, cognition process in design consists of several inter-linked processes, including attention, thinking, memory, perception, learning, planning, and decision making (Alnanih, 2019), but on the other hand there are four properties that impart more human-like intelligence to machines (Singer, 2022). Key aspects include developing a "world model" for simulating scenarios, understanding the "Theory of Mind" for predicting others' actions, continual learning for updating mental models, and incorporating "late binding context" for contextually specific responses.

From the infrastructure perspective, we can distinguish urban spaces that are more or less connected with the living environment, or that have simple or complex usage systems. One example of a complex system is interchange spaces in cities where there is a high intensity intersection of vehicle and pedestrian users. Walking through these environments could be challenging from the aspects of orientation as well as coexisting with other living beings.

This paper aims to integrate human and artificial abilities in design, moving beyond technological determinism. It reviews approaches for considering subjective urban experience, using the example of pedestrian traffic in interchange systems. Emphasizing visual perception and cognitive processes, the paper suggests using eye-tracking data visualization to create mental maps for improved urban design practices.

In the next chapters, the methodology will be introduced, the Mostar Interchange in Belgrade will be described as an example of an urban space with a complex usage system, and the results will be presented in the form of theoretical considerations from different perspectives, along with future directions of research.

METHODOLOGY

Theoretical approach

The paper is focused on search and review methodology, especially thematic review obtaining knowlegde from different perspectives and disciplines considering issues of eye-tracking data and more-than-human design in fields of spatial information and research, new design practices as well as statistical methods and/or with visualization techniques.

Additionally, there are also implemented behavioral observations in order to detect pedestrian usage in urban space described here not as a means of transport – walking as a way of getting somewhere (else) – but as a nonetheless necessary practice, as well as examines immobility – stopping – as an active accomplishment, something other than the absence or tethering of movement, and reciprocally linked to the pedestrian activity described (Hall and Smith, 2013).

Interchange space as study area has been already mentioned as an example of an urban space with a complex usage system that involve different types of users as well as challenging from the aspects of orientation, but also coexisting with other living beings. In the following section, the study area will be presented.

Study area

Mostar Interchange in Belgrade is considered as study area as a good example of complex system situation there are different types of users with issues of orientation as well as coexisting with other living beings in urban space. This interchange, located in the old part of Belgrade, is a critical traffic hub (Figure 1). The pedestrian underpass is a vital link between two sections of the urban area divided by the highway, significantly impacting the daily lives of the local population. Additionally, this area features bus and tram stations.

Furthermore, this interchange represents socialist and modernist heritage in the city, which is neglected and raises questions regarding its future development and protection.

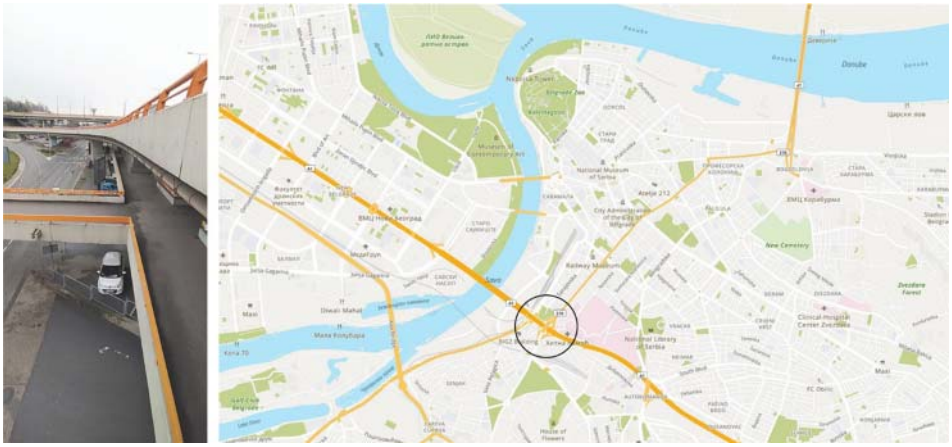

Figure 1: Mostar Interchange - photo (left) and map with position in the urban tissue (right) (Author: N.Mitrović)

There are ambiguities regarding whether this transport infrastructure point should be considered a place or a non-place. Groups of individuals, all with the goal of reaching a destination, are termed “momentary communities,” but without information on how they form, their needs, usage aspects, and how they contribute to shaping the lived experience in this place (or non-place). Despite the

interchange's liminal position, it holds hidden values in the daily mobility patterns of users, revealing the life of a pedestrian hub with its rules and problems (Mitrovic, 2022).

RESULTS

The results will be presented in the form of thematic theoretical considerations from various perspectives, along with future research directions.

New design practices diverge from industrial-era norms, emphasizing outcomes over control in a complex landscape. These shifts challenge traditional notions of control and highlight the need for adaptive, context-aware approaches in a *more-than-human design context* (Giaccardi and Redström, 2020). In current user-centered design, understanding user needs and refining designs iteratively is crucial. However, in a more than-human design context, outcomes arise from interactions between people, networked devices, and other elements, introducing higher uncertainty. This dynamic requires integrating human and artificial capabilities into co-performances, considering diverse interactions. To navigate this evolving landscape, design methods must evolve to understand and correct inappropriate actions by artificial agents, anticipate consequences, and consider the contextual significance of data used. This shift challenges the traditional separation between design and use time, calling for a more fluid approach. Design theory and methodologies must adapt to acknowledge the expanding influence of algorithms, forms of intelligence, and life forms in design practice, redefining them *as partners in a more-than-human design practice.*

In the context of artifical agents, recent technological developments have led to an increasing popularity of *eye-tracking methodology* for investigating research questions related to spatial cognition, geographic information science (GIScience) and cartography (Kiefer et al, 2017). Future directions in spatial eye-tracking research will likely focus on the increasing potential of mobile eye tracking for real-world studies on *navigation and wayfinding*. Challenges include the laborious processing of mobile eye-tracking data and the trade-off between external and internal validity in real-world studies. Additionally, further exploration of eye tracking in spatial knowledge acquisition and learning, as well as the development of comprehensive and perceptually grounded models of wayfinding, are anticipated. Moreover, there is a need for spatial cognition research to leverage advanced models and measures for eye movement analysis, such as the interplay of ambient and focal attention and the complexity of switching patterns between Areas Of Interest. The increasing pervasiveness of eye-tracking technology raises questions about the future of interaction with spatial information and the potential privacy threats associated with pervasive eye tracking, highlighting the importance of integrating cognitive and computing perspectives in spatial research.

Issues in recent eye-tracking data and research include the increasing complexity of stimuli, such as dynamic content and 3D data, which pose challenges for visualization (Blascheck et al, 2014). There are a wide array of visualization techniques available for analyzing eye tracking data. However, determining the most effective technique for a specific analysis can be challenging. This question cannot be fully answered, as the choice of visualization technique depends on various factors. A common task involves comparing scanpaths of participants to identify regularities or patterns. The visualization of multiple viewers with individual stimuli and the incorporation of smooth pursuit information are areas requiring further exploration. Additionally, the integration of eye tracking with other sensor data, such as EEG (electroencephalogram; measures electrical activity in the brain) or skin-resistance measurements, presents a need for multimodal data visualization techniques. Furthermore, stimuli with active content, like interactive web pages, raise questions about data comparison and annotation accuracy. Combining visualization techniques, statistical analysis, and user interaction is essential for effective analysis and pattern identification in eye tracking data.

Based on observational insights in the Mostar Interchange as a study area, numerous elements could be the subject of eye-tracking data for users, such as vehicles or other users as "dynamic stimuli,"

as well as other moving living beings (birds, cats, dogs, and other animals) or greenery. Moreover, the materialization of the environment in the form of pavement, railings, or ceiling material could be relevant, but there is a question about the lack of elements that contribute to navigation and wayfinding, due to the absence of any content that attracts users or encourages them to linger. The more-than-human approach needs to consider elements that affect the user's perception in order to transform the space into a more livable and legible one.

DISCUSSION & CONCLUSIONS

The mentioned approaches and theoretical positions share a common focus on advancing design and research methodologies to account for complex interactions involving human and artificial elements. They all recognize the need to adapt to changing technological landscapes and incorporate multidisciplinary perspectives. Furthermore, all three approaches emphasize the importance of considering diverse interactions and contexts. *More-than-human design* emphasizes the integration of human and artificial capabilities into co-performances, while future directions in spatial eye-tracking research suggest exploring new visualization techniques to better understand complex spatial behaviors. Issues in eye-tracking research also emphasize the challenges of analyzing data from dynamic stimuli and the need for multimodal data visualization techniques.

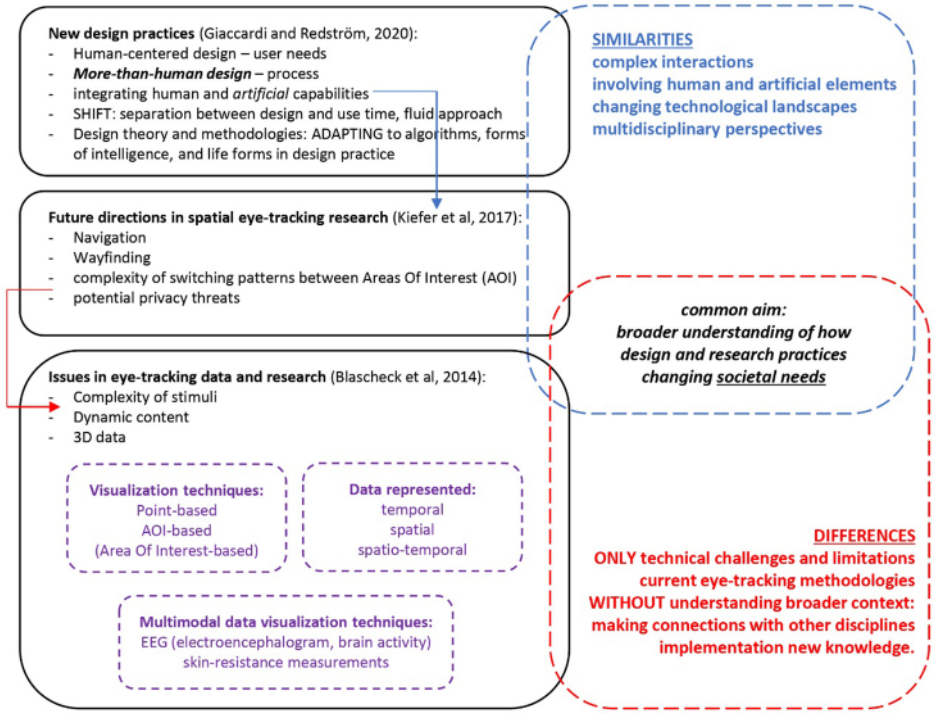

Figure 2: Similarities and differences in approaches between more-than-human design within new design practices, future directions in spatial eye-tracking research and issues in eye-tracking data and research (Author: N.Mitrović)

Despite these similarities, there are also notable differences between the approaches. More-than-human design focuses more on the philosophical and theoretical underpinnings of design practices, emphasizing a shift from industrial-era norms, while future directions in spatial eye-tracking research focus more on the technical challenges and limitations of current eye-tracking

methodologies without understanding broader context of making connections with other disciplines or implementation new knowledge.

While each approach has its unique focus and perspective, they all contribute to a broader understanding of how design and research practices are evolving in response to technological advancements and changing societal needs.

If we consider that the basic difference between cognitive and mental mapping lies in the fact that cognitive mapping refers to the creation of mental maps of the physical environment, while mental mapping refers to the creation of mental maps of abstract concepts and information, the presented approaches and perspectives can contribute to a different view of cognitive mapping. The physical environment can be considered differently, as well as the relationship between humans and the environment, but also elements beyond that relationship.

The factors that define a space as walkable are not limited to the physical dimensions of a place but also include perception. Elements of transformation can be defined by redefining the relationship between different disciplines (Mitrović, 2022). Different paradigms can consider things that simultaneously contribute to the experience of humans, as well as other living beings, as users of space.

This research can contribute to developing future methodologies bridging urban design with other disciplines. Hence, this paper has a significant impact on dissolving gaps between environmental psychology, cognitive psychology, and urban theory by changing the environment through elements of urban design. The review and insights help in making decisions on how to read and analyze contemporary open public spaces, particularly in a post-socialist context.

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