Transparency as an environmental factor that influences cognitive visuo-locomotive experience in large-scale buildings

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The paper examines the relationship between the visuo-locomotive experience, the types of people's movement and the spatial memory. Two movement tasks (exploration and navigation) and their correlation to the environmental factor of transparency are analysed through a multi-modal perspective in a large-scale built environment, the New Parkland Hospital in Dallas.

Keywords: visuo-locomotive behaviour, navigation, exploration, memory, transparency

I. ABSTRACT

VISUO-LOCOMOTIVE EXPERIENCE | MOVEMENT | SPATIAL MEMORY

Embodied visuo-spatial interactions occur at discernible levels [Tversky, 2005]:

"that of the space in reach or in sight around the body, that of the space of navigation too large to be apprehended at once, and that of the space of external representations, of graphics constructed to augment human cognition."

From the standpoint of architectural theory, it is well known that the medium of interaction between people and their architectural environment is user's movement in space [Le Corbusier 1923]. As a result, investigating user's visuo-spatial experience is strongly connected with locomotive behaviour. As also Hoogstad [1990] summarised about the locomotive experience of an observer: Space = Time (+ memory) x Movement, which means that an observer in motion perceives changes successively and adjusts his knowledge. This environmental knowledge acquisition, which is directly related to spatial memory, is depended on spatial aspects as spatial perception, spatio-visual attractiveness, arousal and orientation [Altes & Steffen 1988]. The main aim of our research on visual perception driven Evidence Based Design (EBD) is to:

1. Explore the visuo-locomotive behaviour of users in unfamiliar large-scale built-up spaces, and
2. Identify the environmental factors related to visual perception which are significant for spatial knowledge acquisition in that context.

In particular, we are focusing on the visuo-locomotive experience of users in the context of two distinct movement tasks differing in their respective motives: (1) navigation task, involving wayfinding towards a destination; and (2) an exploration task, without any specific defined goal. We employ a range of sensors for measuring the embodied visuo-locomotive experience of users (eye-tracking, egocentric gaze analysis, external camera based visual analysis, questionnaires determining spatial ability, sketch maps) [Bhatt et al. 2016] to interpret fine-grained behaviour (e.g., patterns of gaze, route preferences, movement speed and pauses), correlate it with the outcomes pertaining to spatial knowledge tasks (e.g., recall, pointing, perspective-taking, distance estimation) and at last to create a new framework for visuo-locomotive behavior analysis targeting EBD.

A STUDY ABOUT THE IMPACT OF TRANSPARENCY TO VISUO-LOCOMOTIVE EXPERIENCE AND SPATIAL MEMORY

Movement in space is primarily governed by short-term working memory (e.g. visuospatial working memory is involved in route learning [Meilinger et al. 2008, Viswanathan et al. 2015, Garden et al. 2002]). Preliminary results from our behavioural analysis of a navigation task at the New Parkland Hospital (NPH) in Dallas (including eye tracking data, questionnaires, and orientation tasks) [Bhatt et al. 2016, 2014] support previous researches which claim that working memory benefits from navigation tasks and particularly the episodic visual memory plays a crucial role to wayfinding but this is not the case in exploration travel mode [Afrooz et al. 2014, Mondschein et al. 2008]. We hypothesis that after a navigation task a user is able to recall more accurately spatial characteristics which create an overview about the 3D built environment (e.g., geometry of the layout, geometry of the scene, number of junctions), whereas after an exploration task a user is able to recall better details of his successive visual scenes, (e.g., transparency features, visual patterns, visual details of color and texture).

Specifically, we investigate the visuo-locomotive behavior of participants in two long corridors of NPH, with and without transparent elements (figure 1) during a navigation task and after that, through a freely movement experience without a goal, where a guide-experimenter is showing the way. The ongoing analysis reveals differences at the visual patterns between the two movement experiences as well as between the two physical structures. For instance, extended fixation periods was recorded and in a wider surface towards the transparent element during the exploration in comparison to the exploration one. Post-experiment interviews also indicate the role of transparency to the memory and the spatial knowledge but there was no distinction between the two kinds of movement experience. Design for navigation and exploration, which are usually two overlapping performances in large scale built-up environments, is a challenging task for designers and architects. Conducting further experiments in a controlled immersive environment, the ongoing investigations aim to extract valuable evidences from user's visuo- locomotive experience and have an impact on EBD.

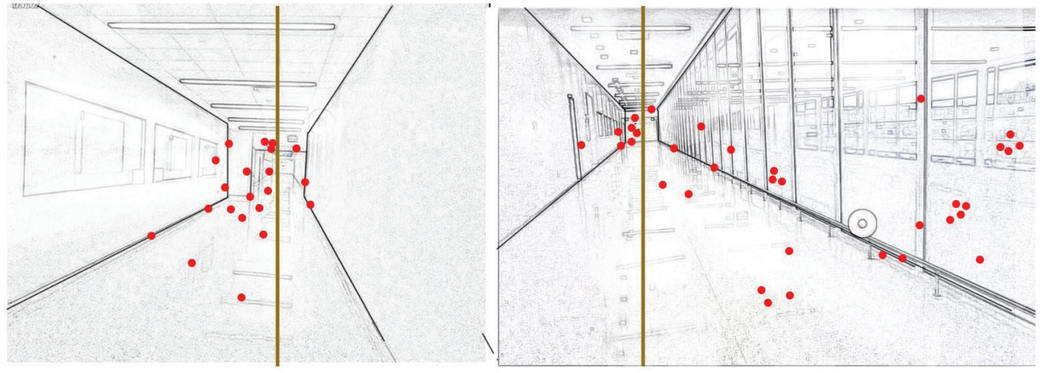

Fig1. The fixation points from the eye-tracking of a participant in the two different setting at the New Parkland Hospital in Dallas.

2. REFERENCES

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3. AUTHOR BIOS

Vasiliki Kondyli is a PhD student at the University of Bremen. After her Architectural Studies at the Department of Architecture, University of Patras Greece, she currently pursues interdisciplinary research between Architecture, Cognitive Science, and Environmental Psychology at the DesignSpace Group (www.design-space.org).

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