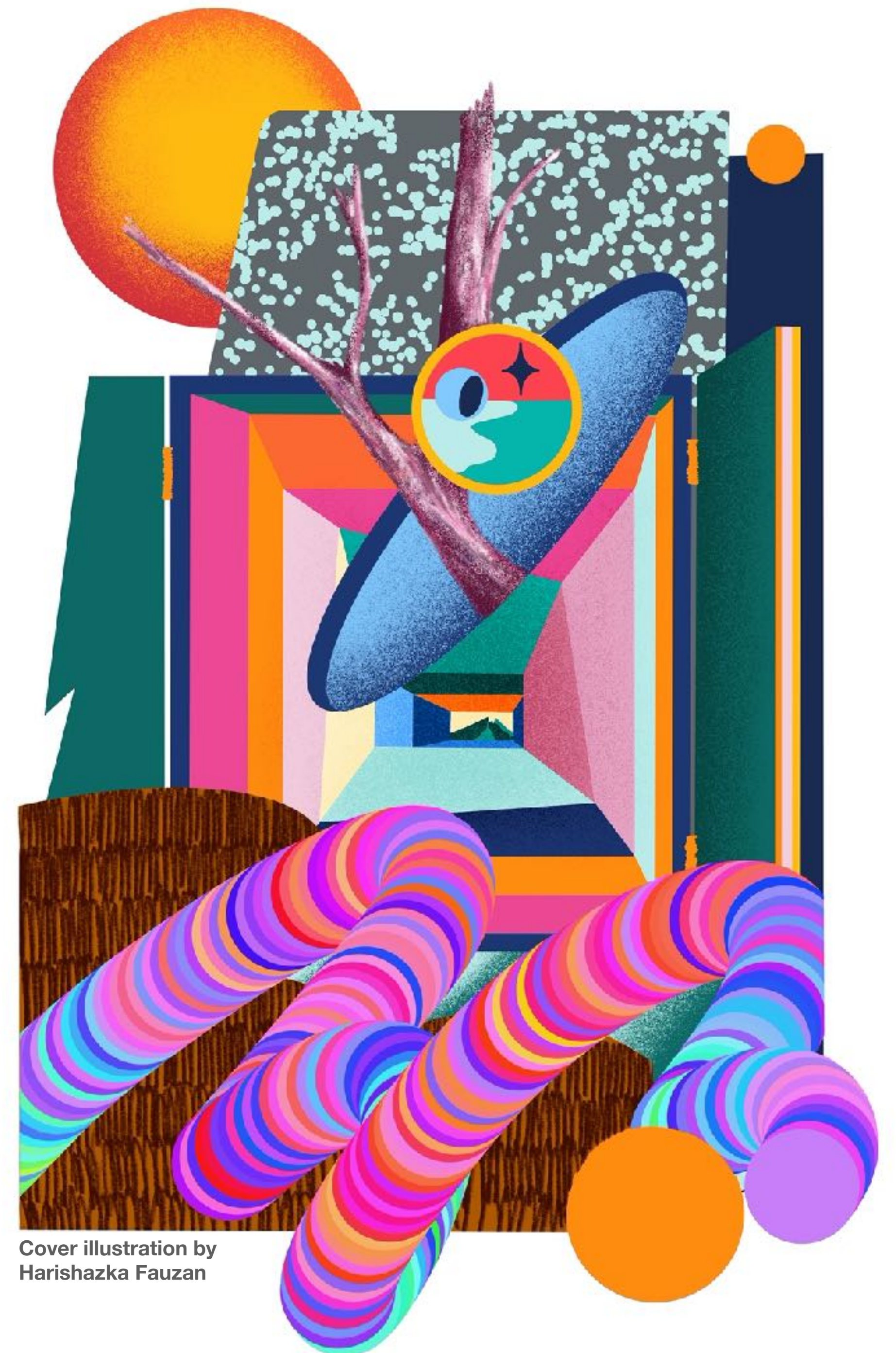


Affordances: A framework to analyse VR Design

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Cover illustration by
Harishazka Fauzan

How do we analyse the effectiveness of VR design? What are the important factors that shape 'a successful VR design'?

Presence

- Coined by Slater and Wilbur as a framework for immersive virtual environment (1995)
 - Presence (sense of being in a VRE)
 - Immersion (degree of presence; objective and quantifiable)

First Presence Questionnaire (Slater, Usoh, and Steed, 1995)

SLATER-USOH-STEED QUESTIONNAIRE (SUS)

1. Please rate your *sense of being in the* virtual environment, on a scale of 1 to 7, where 7 represents your *normal experience of being in a place*.
2. To what extent were there times during the experience when the virtual environment was the reality for you?
3. When you think back to the experience, do you think of the virtual environment more as *images that you saw* or more as *somewhere that you visited*?
4. During the time of the experience, which was the strongest on the whole, your sense of being in the virtual environment or of being elsewhere?
5. Consider your memory of being in the virtual environment. How similar in terms of the *structure of the memory* is this to the structure of the memory of other *places* you have been today? By 'structure of the memory' consider things like the extent to which you have a visual memory of the virtual environment, whether that memory is in colour, the extent to which the memory seems vivid or realistic, its size, location in your imagination, the extent to which it is panoramic in your imagination, and other such *structural* elements.
6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?

Most common Presence Questionnaires

(Chumaira, Díaz-Kommonen, and Bruni, 2021)

No.	Type of Presence Questionnaires	Year Created	Corresponding Studies	Conceptual Distinctions	Research Audience	Number of Questions	Subscales
1	Witmer and Singer (WS)	1998	Coelho, 2013; Coelho et al., 2014	Taking into account the technical aspect (the set-up) of VR experience	VR users in military	32	Control, Sensory, Distraction, and Realism
2	Igroup Presence Questionnaire (IPQ)	2016	Memikoglu and Demirkan, 2020	Creating a subjective measures of VR users' experience	General audience of VR and AR	14	Spatial Presence, Involvement, and Experienced Realism
3	ITC-SOPI	2000	Hameed and Perkis, 2021	Experiments with different movie settings	2D and 3D media users	63	Physical Space, Engagement, Naturalness, and Negative Effects
4	Slater-Useh-Steed (SUS)	1995	Nagao et al., 2018	First quantifiable measurement	VR users	6	Sense of being, visual experience, memory

Criticism towards Presence Questionnaires

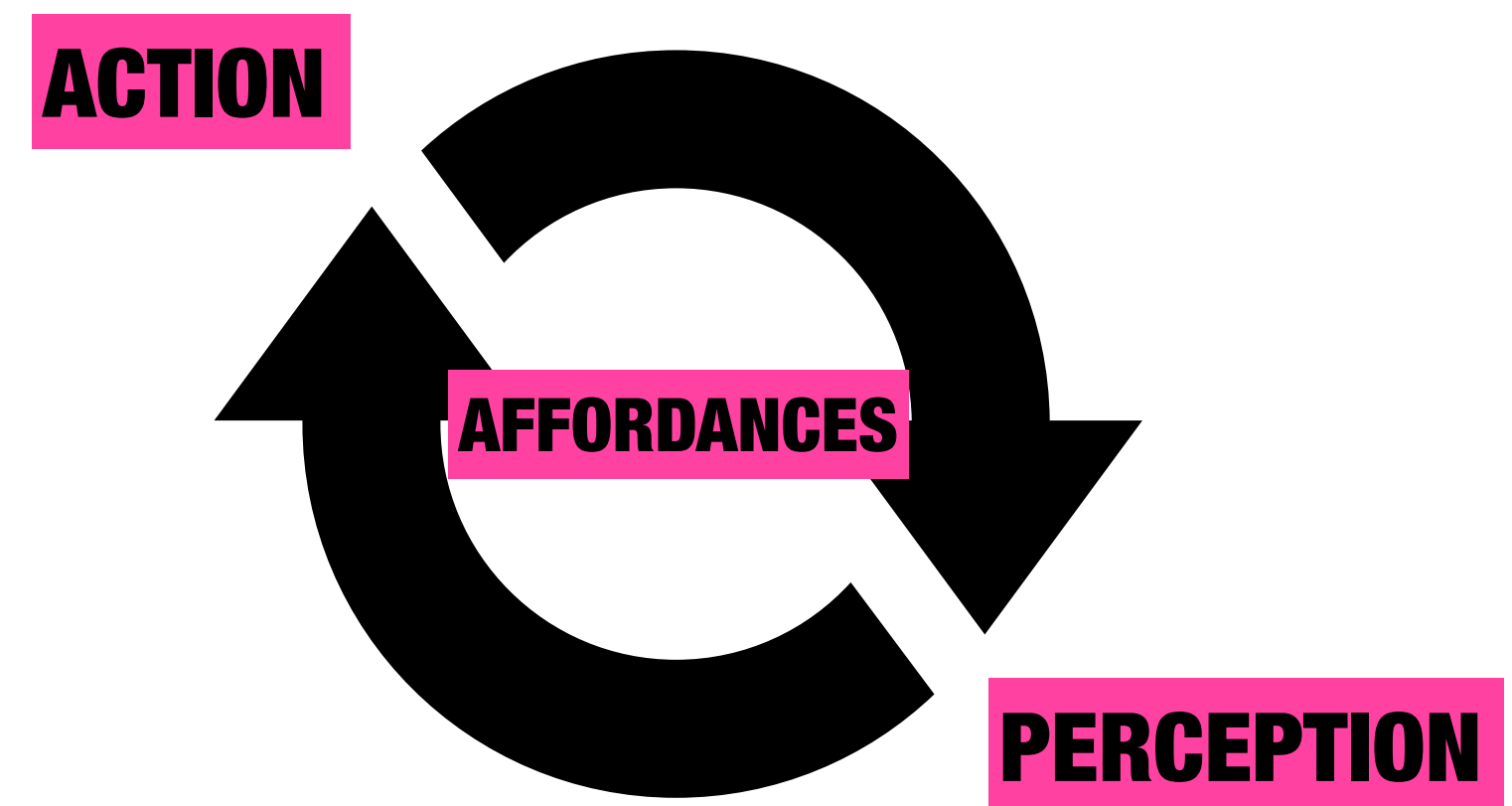
- Post-test
- The objectivity is being questioned
- Too many questions with specific terms

Affordances: Post presence-centric approach

"The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill. The verb to afford is found in the dictionary, but the noun affordance is not. I have made it up. I mean by it something that refers to both the environment and the animal in a way that no existing term does." (Gibson, 1979).

Action possibilities (Dourish, 2006)

Invitation to actions (Pallasmaa, 2009)

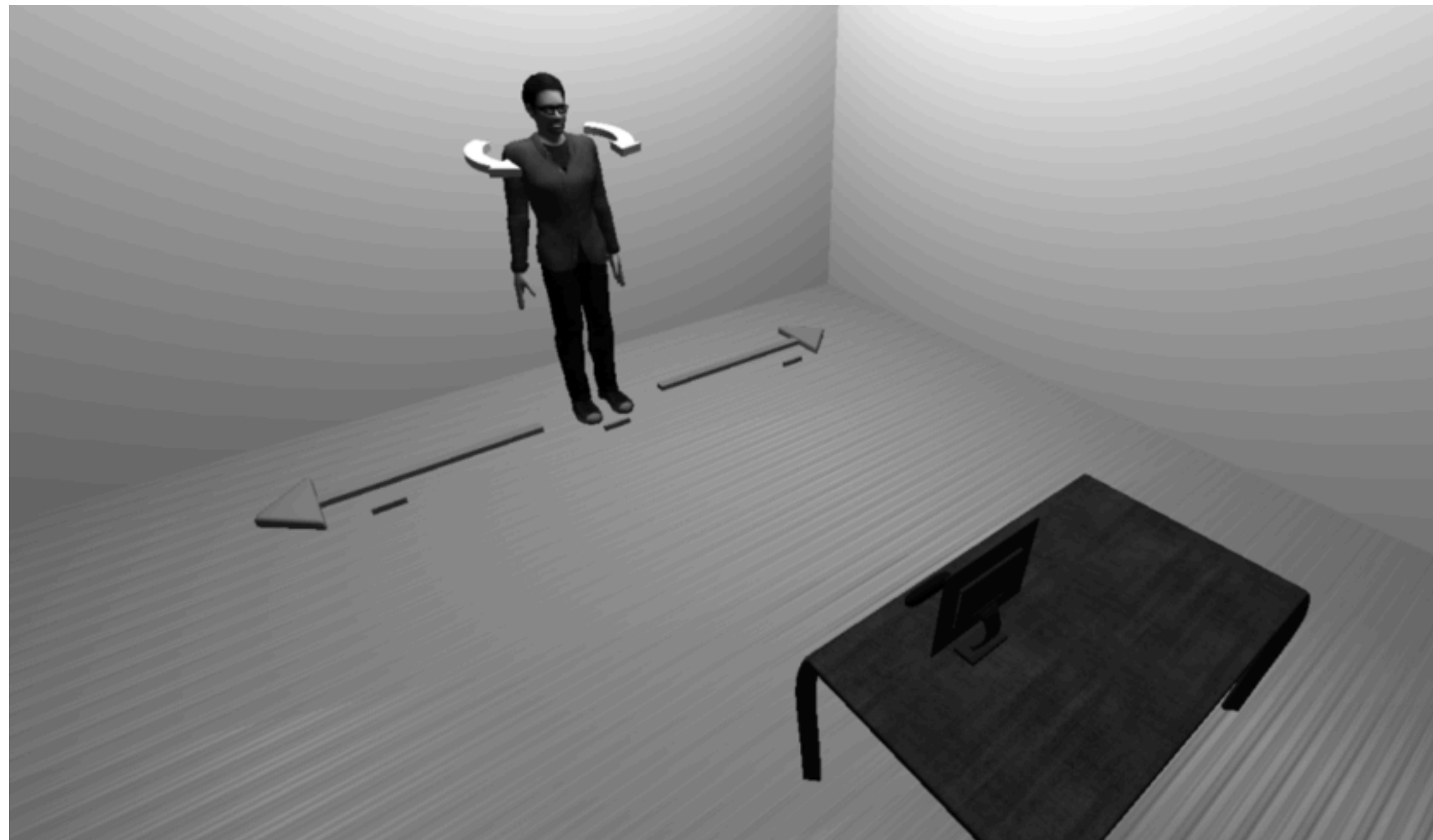


Why affordances? (Maier, et al., 2009)

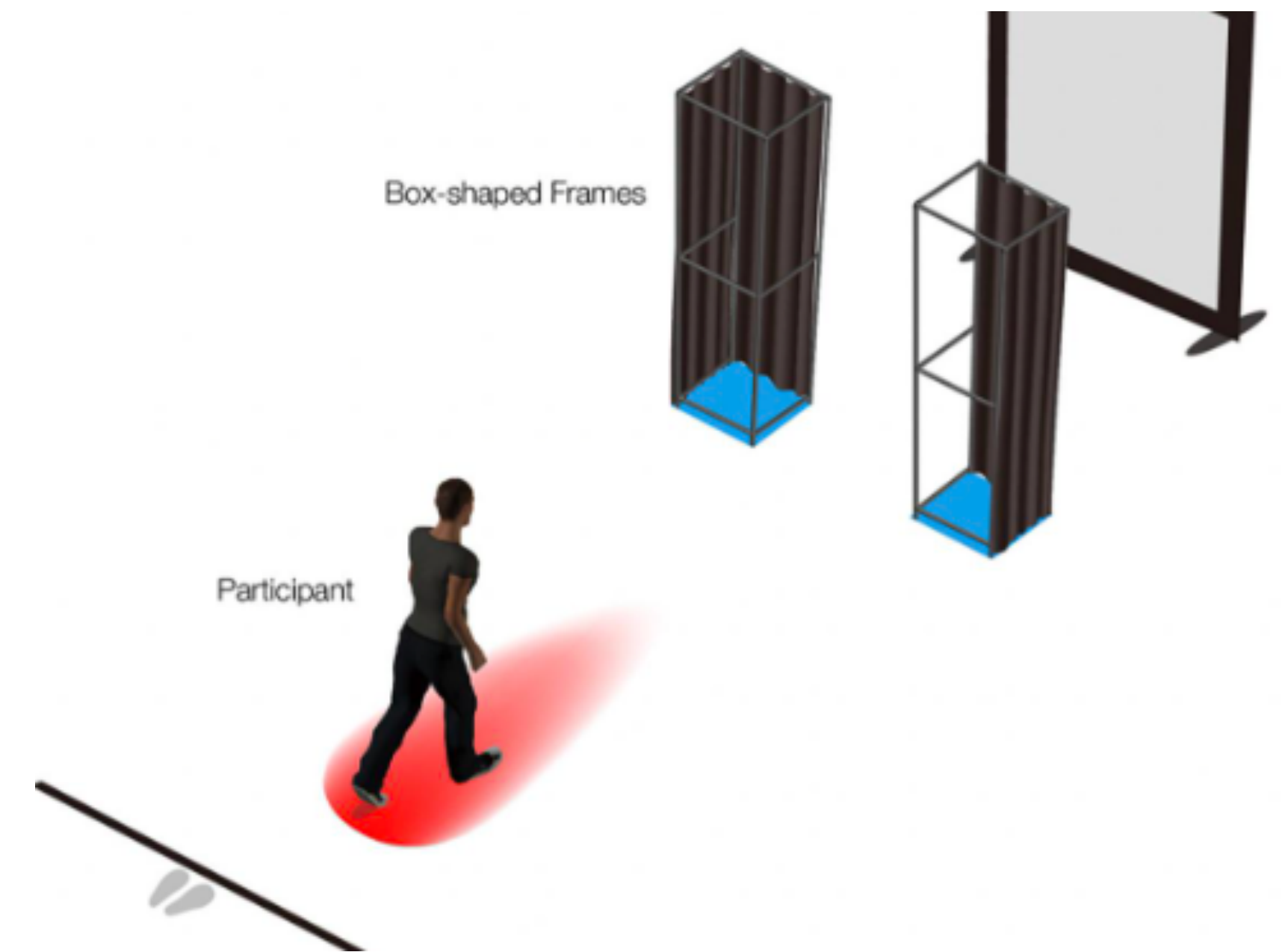
- a conceptual framework to understand the relationship between built environments and humans over time, especially with respect to the form, function, and meaning of design
- allows for a common theoretical basis to improve the design process by offering a shared language among those involved in a design project, for example, architects and engineers
- affordances may be used as an evaluation tool to explore the connection between the initial intentions or objectives of the design with how the artefact is actually used

Some important works on affordances in VR research

(1/3) Common and early works



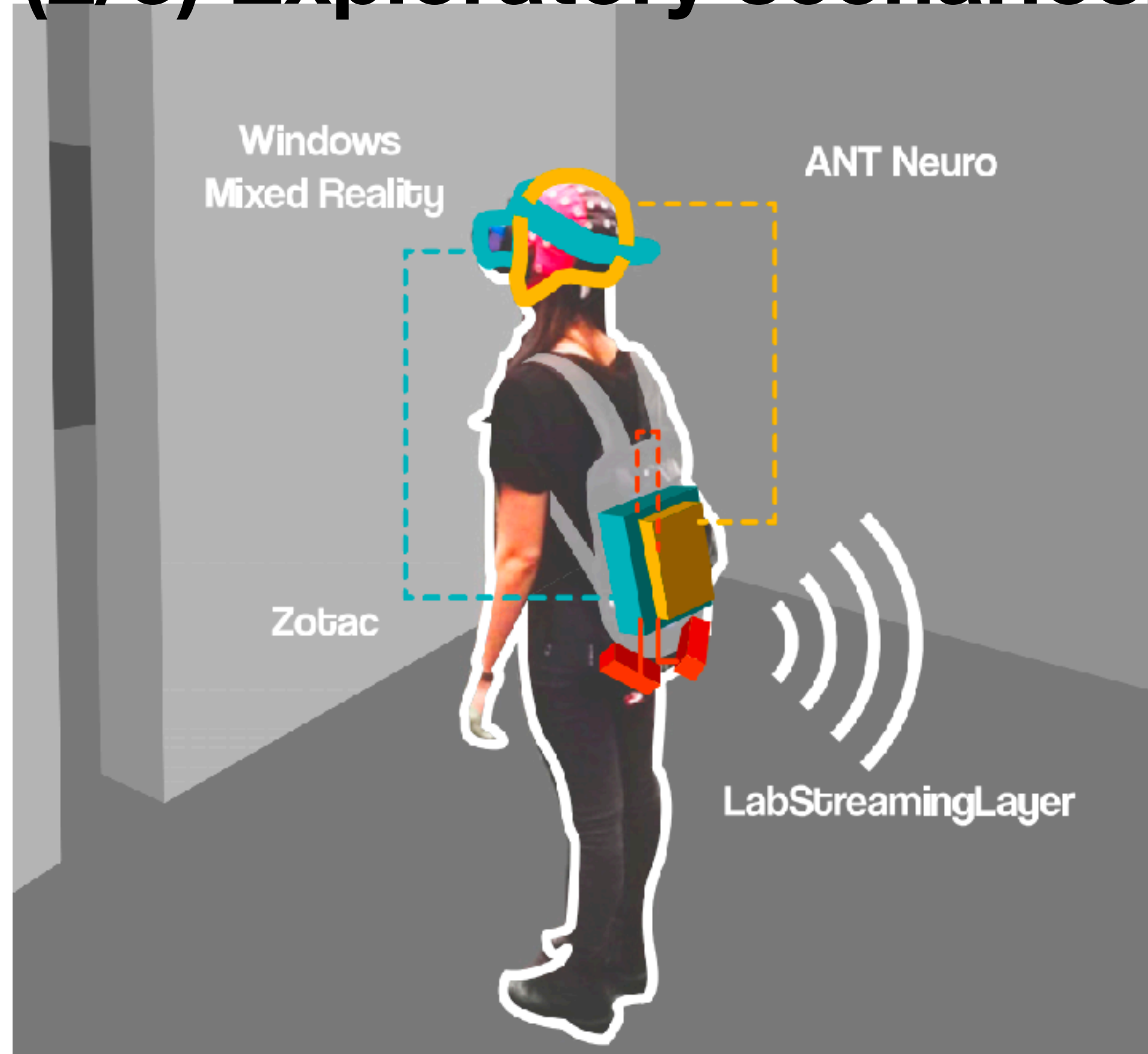
Coelho, et al., 2014



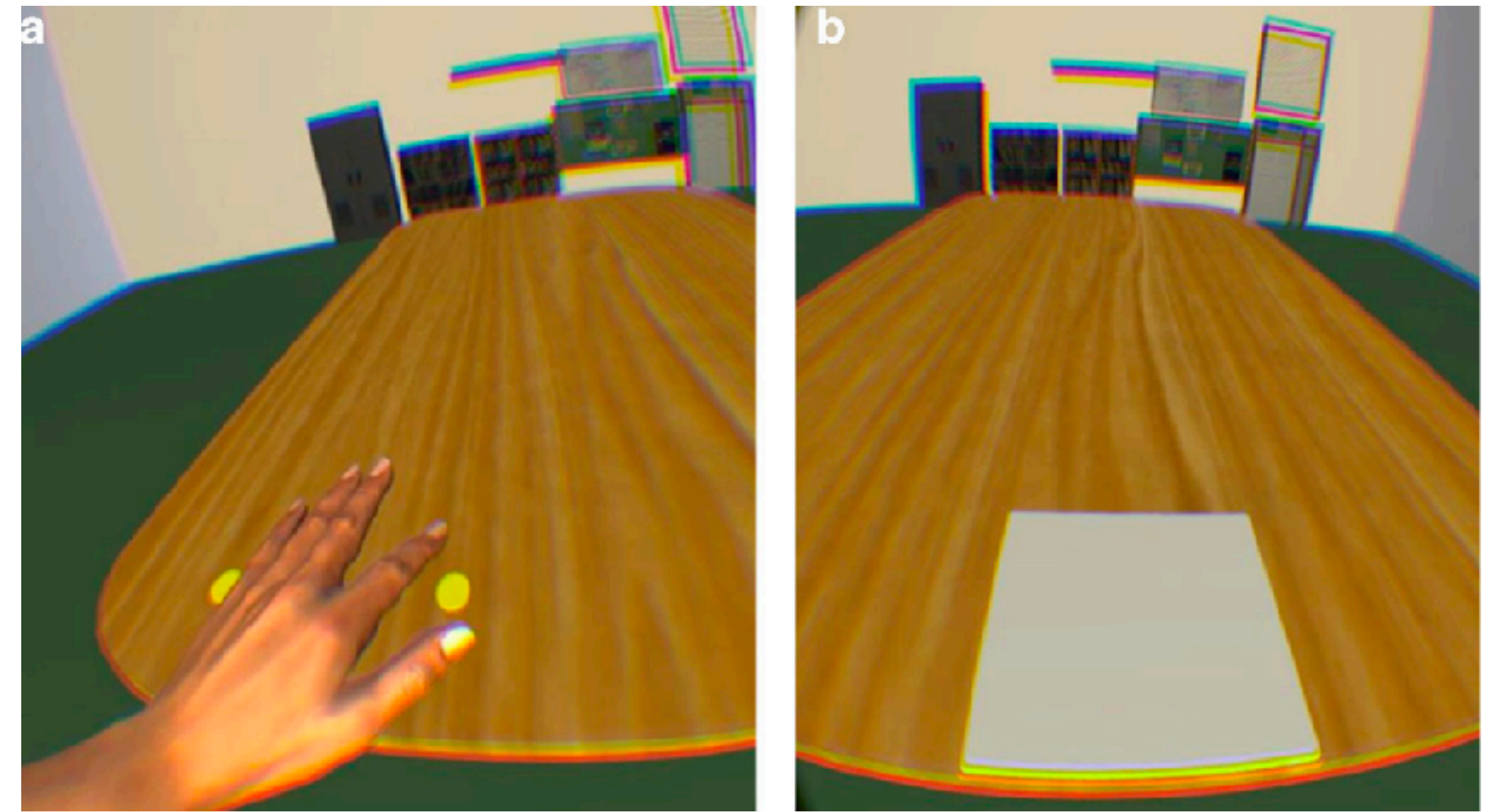
Original work by Warren and Whang (1987).
Image source: Tomono, et al., 2019

Some important works on affordances in VR research

(2/3) Exploratory scenarios; quantitative approach



Djebbara, et al., 2019



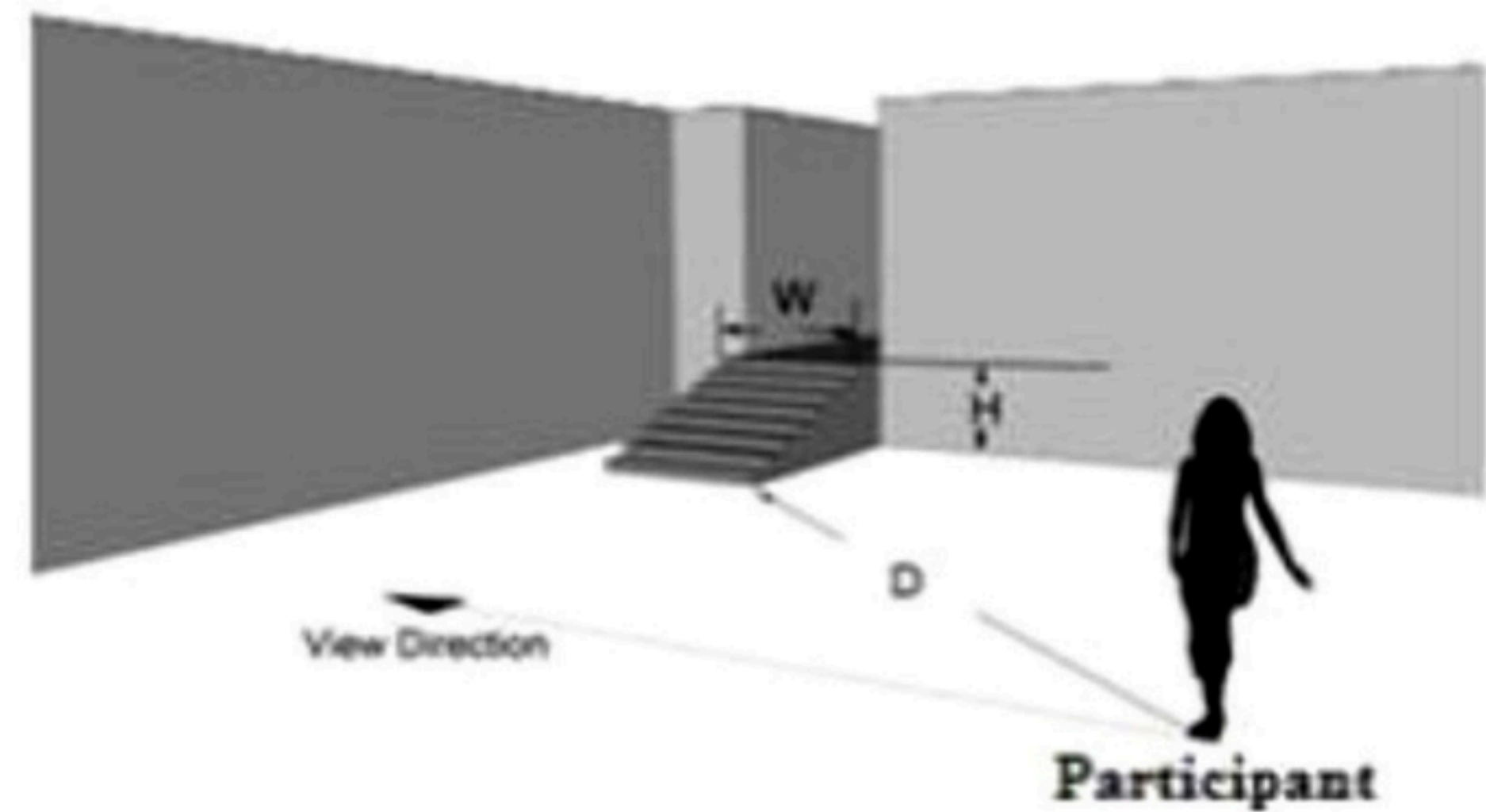
Readman, et al., 2021

Some important works on affordances in VR research

(3/3) Interdisciplinary approaches

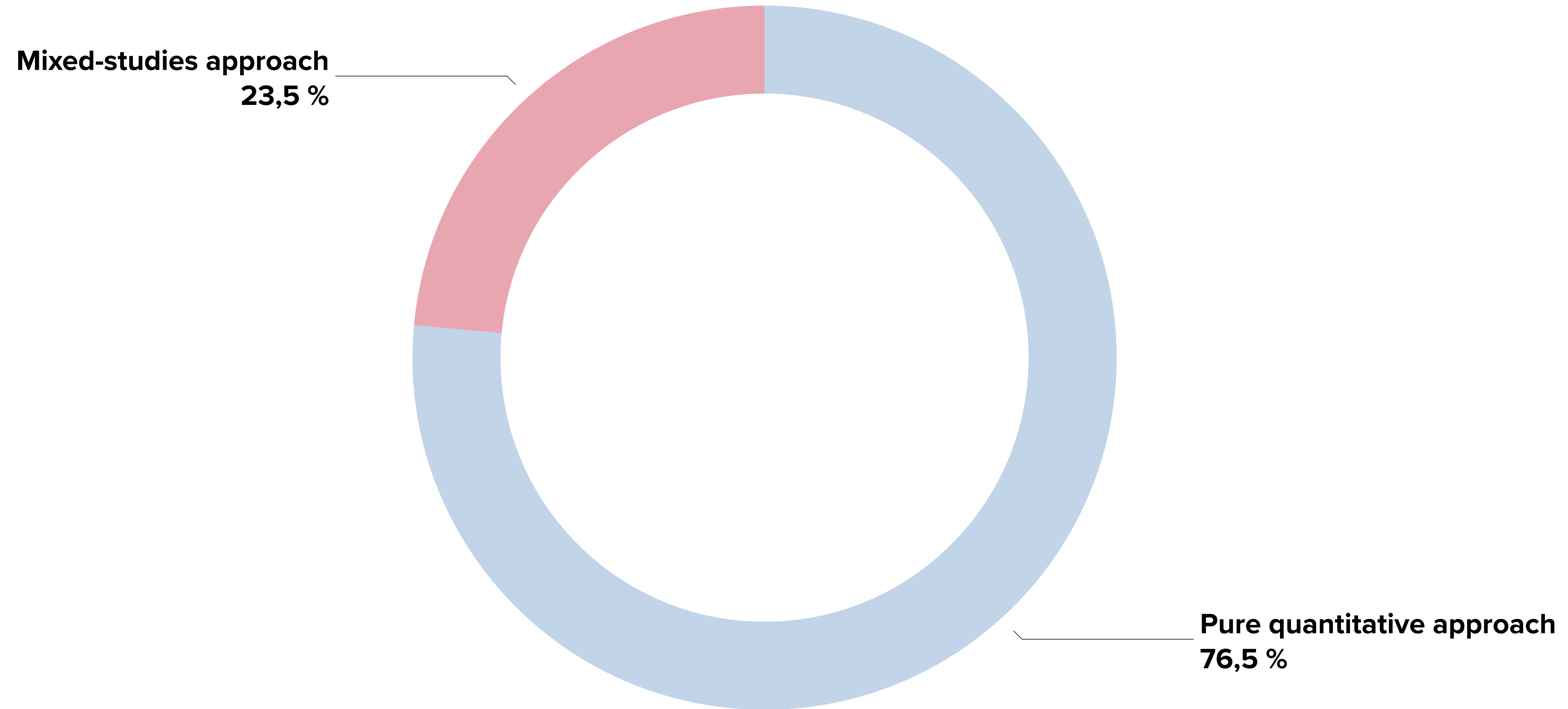


Hameed and Perkis, 2021



Memikoglu and Demirkan, 2020

Research gap the current development



Reading space as a way to 'measure' spatial affordances



Architectural design process involves the process of reading spaces and materialising the information into multimedia forms. The process of reading spaces takes into account our body as the measurement instrument and the point of reference.

Spatial affordances (Chumaira and Díaz-Kommonen, 2022)

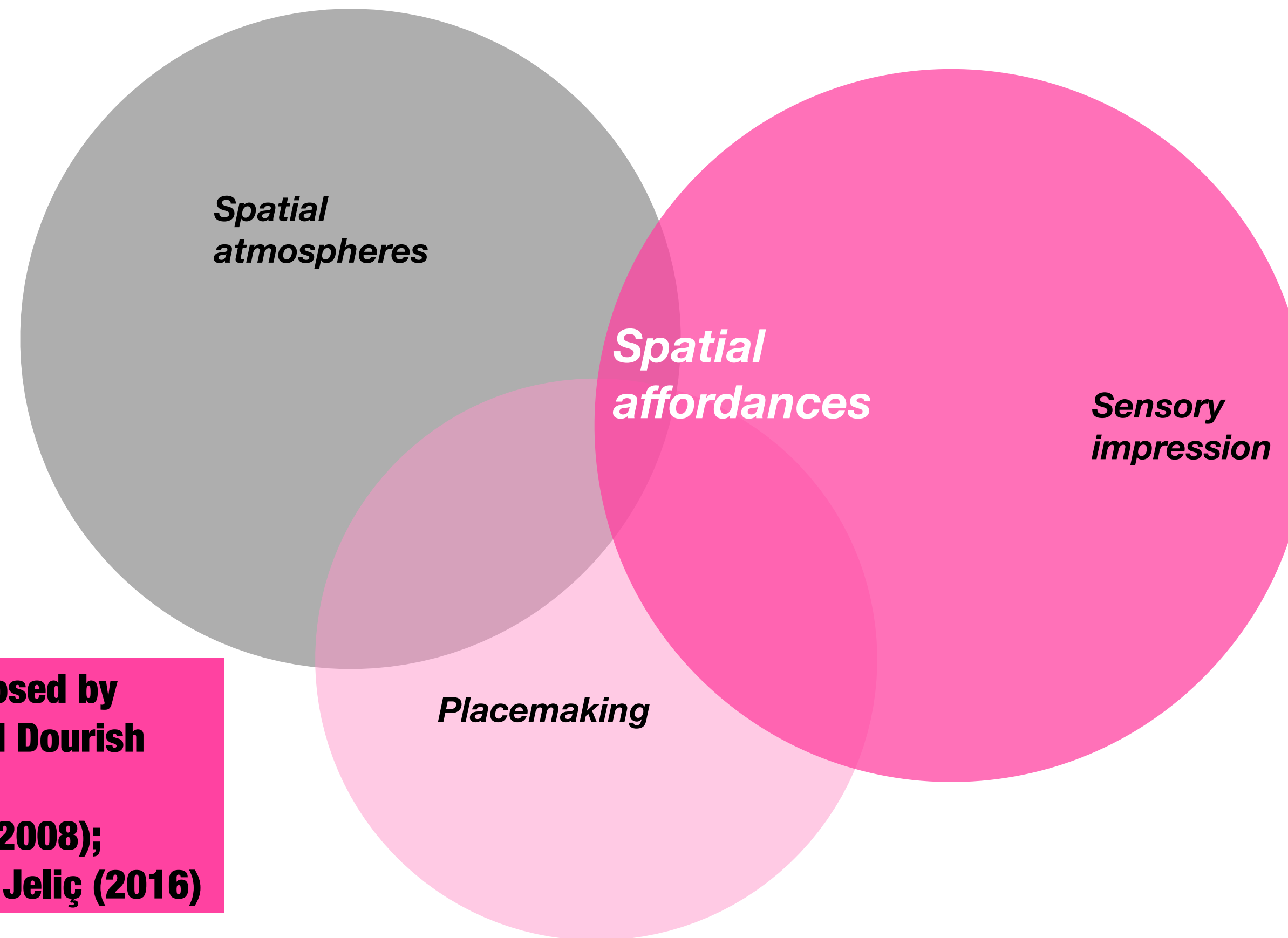
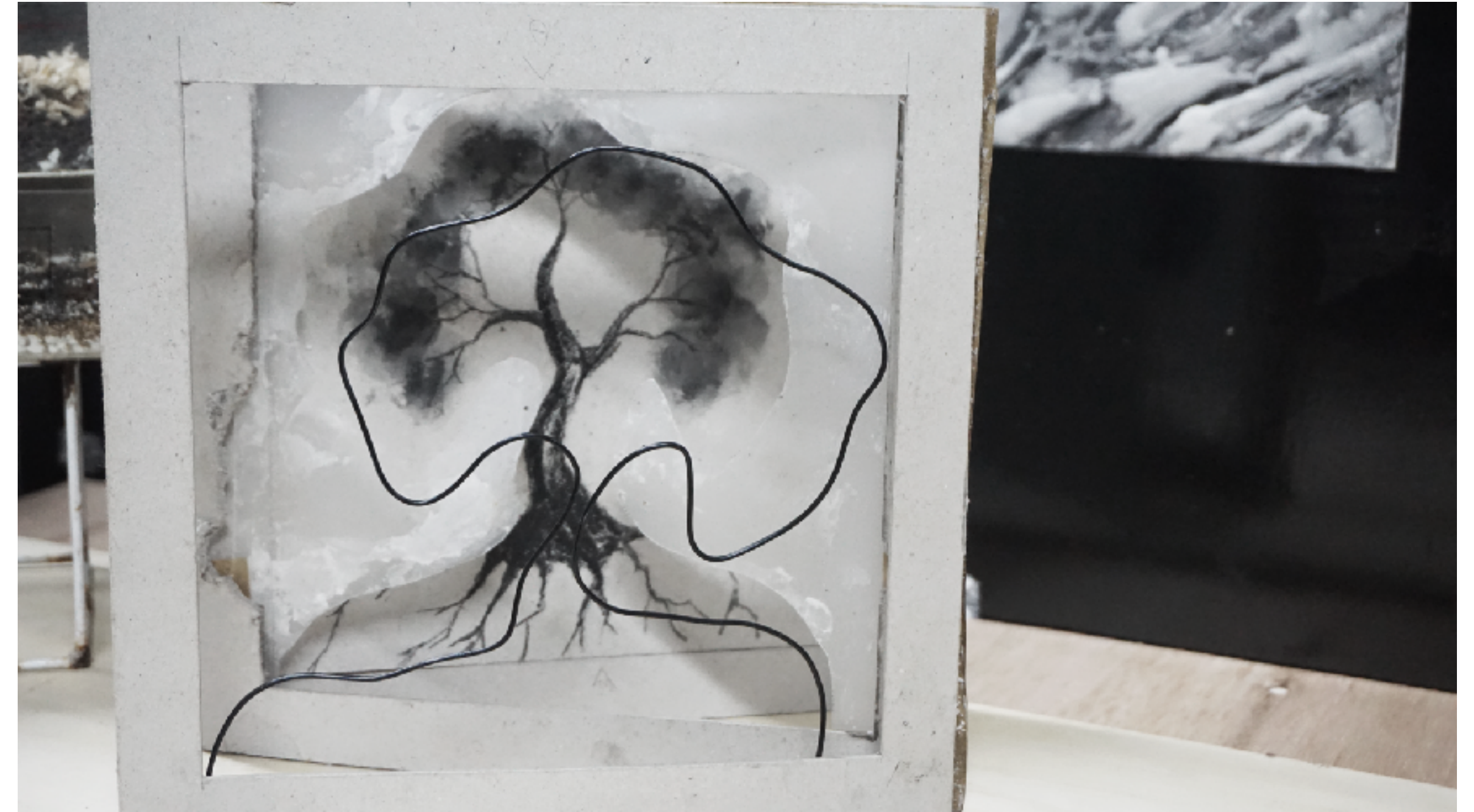
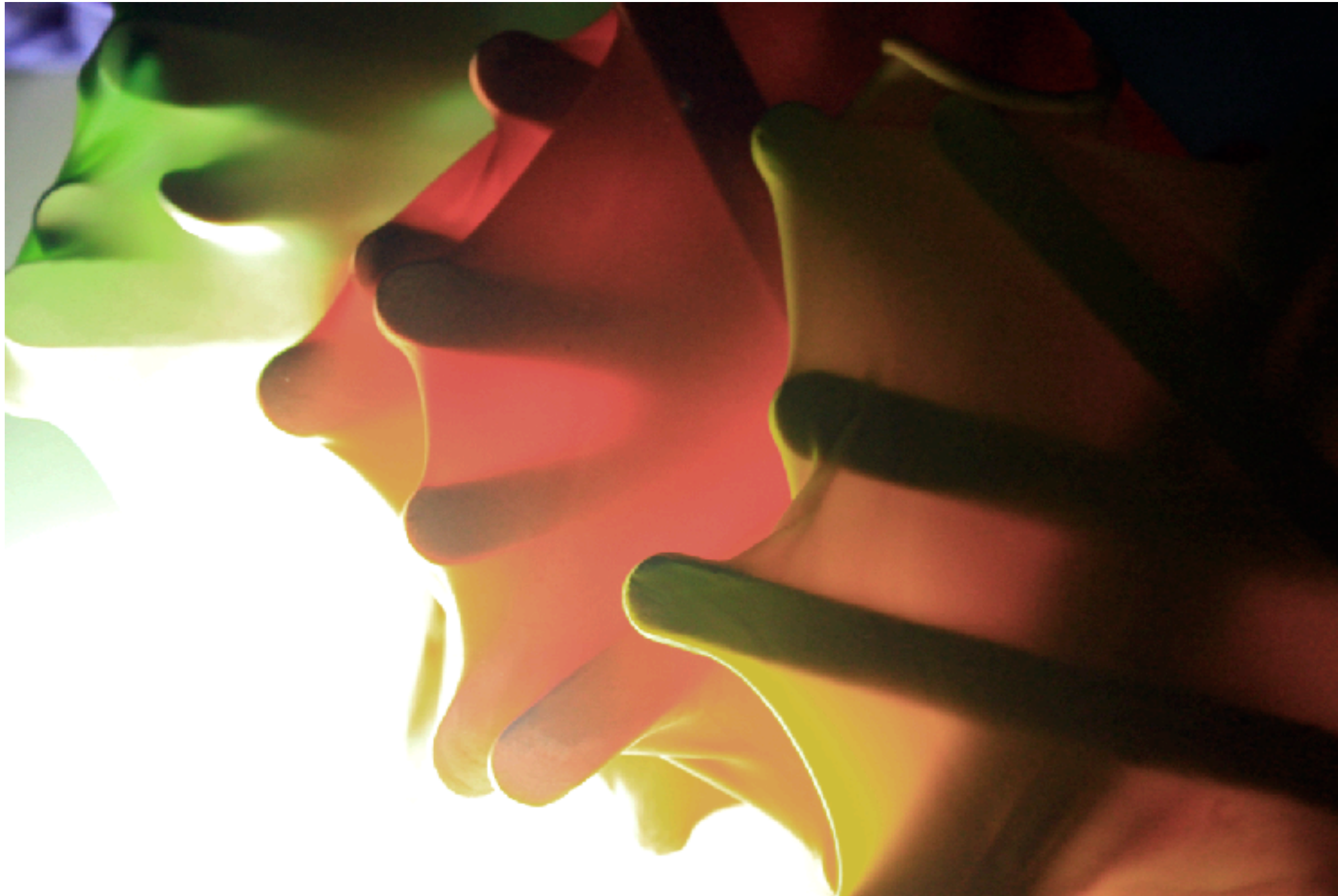


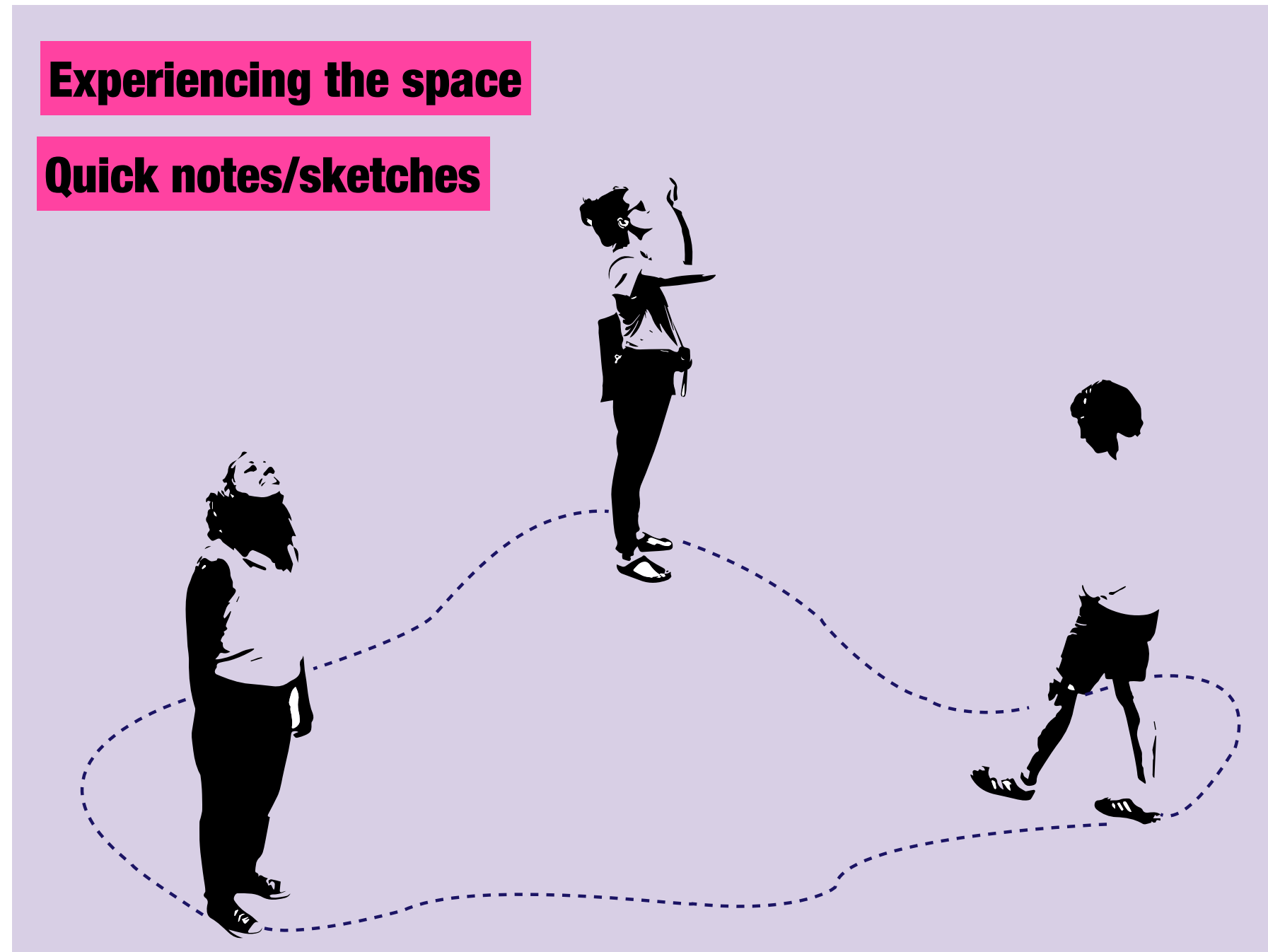
Diagram inspired by theories proposed by James Gibson (1979); Harrison and Dourish (1996); Alva Noe (2004); Himanshu Burte (2008); Tonino Griffero (2014); and Andrea Jelić (2016)

Techniques in reading space : #1 Model-making

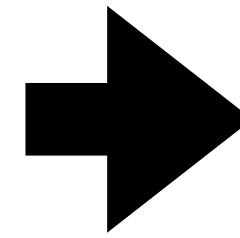


In this study, I have reviewed the three most common techniques in architecture that function as tools to measure spatial experience. The first one is model-making. This technique is usually used to explore the spatial information gathered after a site visit. One can begin by picking a metaphor that illustrates the spatial experience. Then, she can continue to explore the meaning behind the metaphor by creating three-dimensional forms and exploring different types of material.

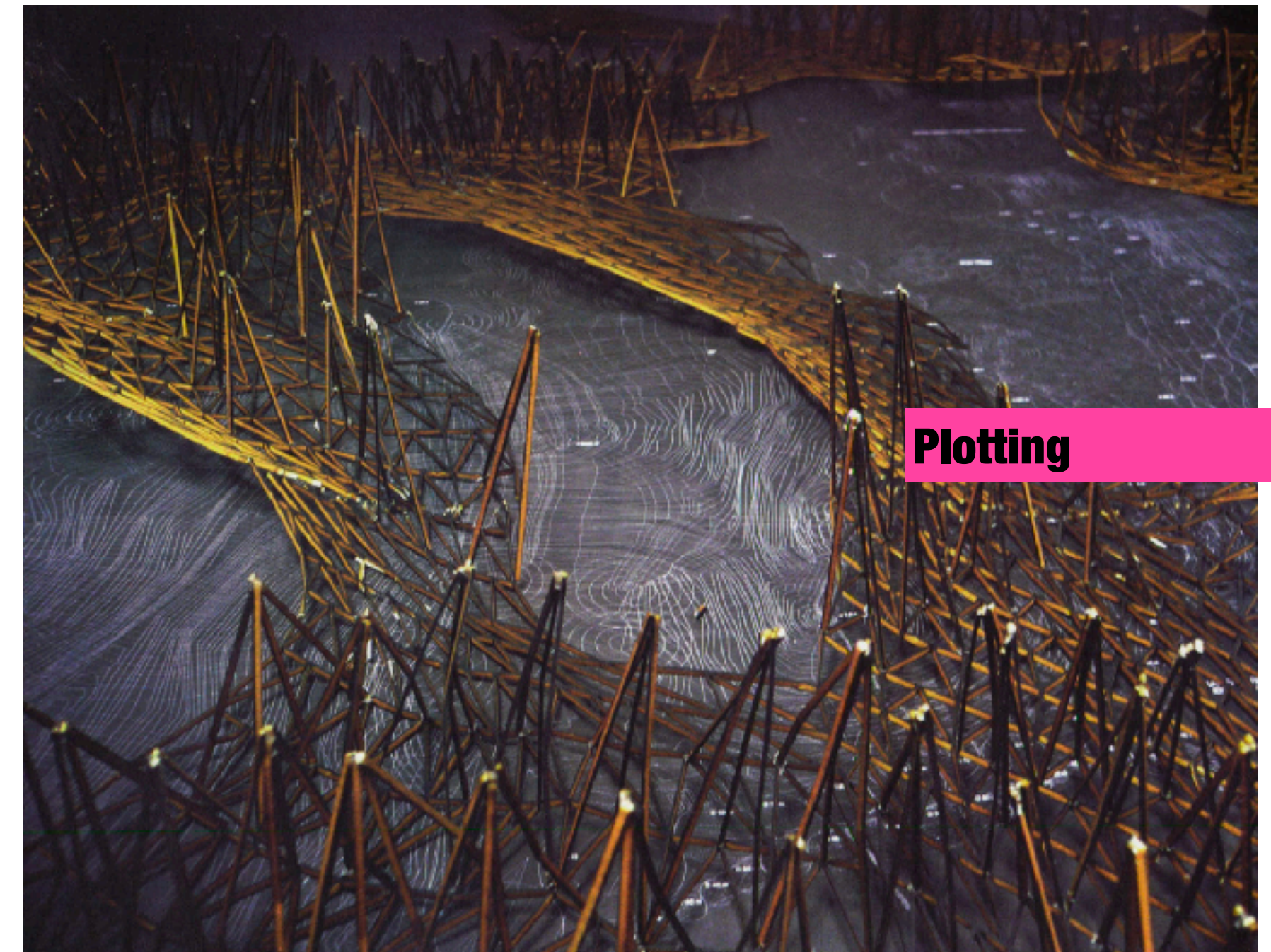
Techniques in reading space : #2 creative mapping



Synthesis/
Extracting



Materialising
spatial experience



Creative mapping trial

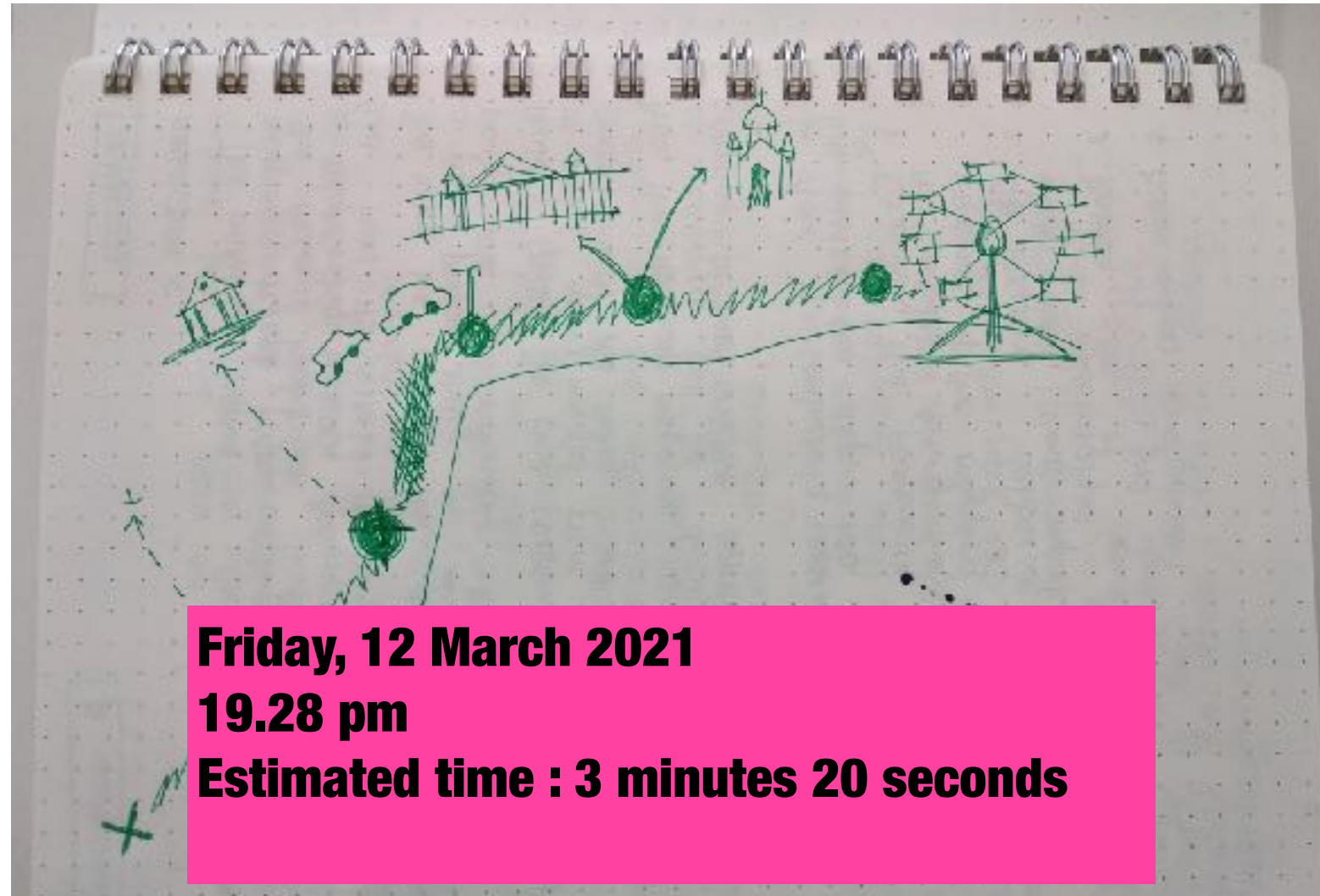


Image capture: Aug 2017 © 2021 Google



Mapping trial using Wander application.

What kind of affordances does your VR design offer?

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