

Embodied Adaptive Architecture

An overview of research conducted at the Mixed Reality Lab

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I. EXTENDED ABSTRACT

Buildings have become adaptive. They adapt to their environments with the aim to be more sustainable and to provide more comfortable conditions for inhabitants. They adapt to inhabitants to, for instance, make spaces more convenient, information rich and more useful. Adaptivity is typically achieved through the integration of ubiquitous computing technologies and the building fabric. There are many adaptations that would be described as mainstream, e.g. those that control the internal climate or lighting. There are also much more radical ideas, suggesting that buildings become mobile, change form, become affective or indeed that they become an interaction partner. Both streams have been captured in numerous publications over the last 10 years [1] [2] [3] [4]. However, there has been very little reflection on the impact on people (e.g. their perception, their behaviour, their well-being) of interaction-centric adaptivity in buildings, and this lack of investigation is also observed by Malgrave, even in the context of standard architecture [5].

This presentation focuses on the contribution that research conducted at the Mixed Reality Lab makes to the emerging space of Adaptive Architecture [6], conceptually, technically and interactionally. Generally, we approach this research by building novel architectural prototypes and interaction mechanisms, which are then studied in the lab and in deployment. This talk will present ExoBuilding [7] as one such prototype. ExoBuilding is a room-sized, mechanically actuated fabric structure, which can respond to people's physiological behaviour, for example their respiration, their heart rate or skin conductance.

Through a first study that linked a participant's breathing to the up and down movement of ExoBuilding, we have indicated how this biofeedback environment can trigger reductions in respiration rates and increases in relaxation[8]. A second study has shown how experiencing respiration mappings from the inside triggers much more strongly felt experiences, than experiencing the same mappings from the outside [9]. A third study (currently unpublished) demonstrates a method to influence people's physiology through regular oscillations, following a period where participants had been in control of the movement. The possibility of such manipulations raises ethical questions in the context of more widespread use. In participatory design work we have then set out to explore how this approach can be used for the teaching of yoga with breathing at its core, studying the teacher-student relationship and how this becomes affected by interaction with the environment [10].

The presentation will conclude with a reflection on the more generalised feedback loop that is created between occupants and the adaptive building, and how we begin to see the two as interaction partners. We frame this by reflecting on embodied interaction, drawing on work by De Jaegher and Fuchs [11] [12], arguing that the biofeedback loop leads to 'mutual incorporation' between inhabitant and prototype and that 'interbodily resonance' can explain the way that both are adjusting to each other. We are discussing this in the context of Arbib's 'Neuroscience of the Experience of Architecture' [13] and more broadly in the context of people experiencing architecture emotionally, i.e. precognitively.

2. REFERENCES

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3. AUTHOR BIO

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