

Can the design of space alter stress responses?

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I. EXTENDED ABSTRACT

I.1. BACKGROUND

Ever since Roger Ulrich showed that the view from patient bedrooms to nature in hospital buildings could shorten hospitalization and reduce the use of painkillers (Ulrich 1984), the tantalizing idea that human physiology can be influenced through the perception of the environment has existed. However, as Ulrich's study is about the view and not architectural space, we set out to investigate whether the design of a space itself could have a physiological impact as well. We theorized that one way this might come about was through the stress system, as stress basically is a recruitment of resources by the organism for a fight-or-flight behavior, and we hypothesized that an open space potentially offering a possibility for escape would result in a less pronounced stress response than would a closed space.

I.2. METHODOLOGY / PROCEDURE

We measured the immune regulatory stress hormone cortisol, released by the Hypothalamic-pituitary-adrenal axis (HPA-axis). A virtual reality version of the Trier Social Stress Test (Kirschbaum et al., 1993; Jönsson et al. 2010), in which a test person has to perform certain tasks in front of a committee, was used as a stressor. Because it was a virtual reality version of the test, it allowed for a systematical variation of the test rooms, ensuring that openness versus enclosure was the only variable. The level of cortisol was significantly lower in the open space than in the enclosed one (Fich et al. 2014). Interestingly, the most pronounced effect occurred after the stress test, and the time needed for the test persons to return to baseline was approximately twice as long for the enclosed room compared to the open one.

I.3. OUTCOME / DISCUSSION

The immediate relevance of these results lies within the working environment where stress is a growing problem worldwide, and within hospital design because of the close relationship between stress and the immune system (Segerstrom and Miller, 2004). As the part of the brain – the hippocampus – that is first attacked by Alzheimer's dementia is a crucial part of the feed-back system of the HPA-axis, it is also possible that these results could be relevant for the design of accommodation for Alzheimer patients. Cortisol itself has a profound influence on a number of cognitive functions such as learning and memory. At the moment, our group is engaged in a four year research program that aims at investigating whether space through the stress mechanisms might have the same effect on physical stress in the form of pain as it had on psychosocial stress, try out other spatial configurations, develop cheaper and more flexible methods and investigate how or if the physiological stress response correlates with the subjective aesthetic experience.

In a broader perspective, the non-conscious mechanism controlling the release of stress hormones seems to be the quintessence of what Antonio Damasio has termed "emotions", defined as "complex, largely automated programs of actions concocted by evolution", in which the actions are as much directed at the body including the brain, as they are at behavior (Damasio 2010, p.109). Harry Francis Mallgrave has drawn attention to the potential of this theory in relation to architecture (Mallgrave 2013, pp. 90-117) and has underlined the need for research addressing this: "The importance of our emotional well-being cannot be overestimated by architects, if only for the reason that designers are principally engaged in constructing the habitats in which we live. Little research has thus been done on how the variables of the built environment affect our emotional life, but it might very well be demonstrated in the near future" (Mallgrave 2010, pp. 190-191).

2. REFERENCES

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3. AUTHOR BIOS

Lars Brorson Fich (presenter) graduated as an architect in 1984, and has worked as a practicing architect until 2008, from 1998 – 2008 as a partner. During this period, he designed well over 100 built projects, ranging from a museum to residential, commercial and hospital projects. In 2008, he changed his carrier and is now teaching and doing research at Aalborg University, Denmark. His Ph.D. focused on whether the perception of architecture potentially can influence the immune system through the stress mechanisms. He is now leading a four year research project on how the design of space can influence the effects of stress on e.g. cognition.

Anne Helene Garde is a professor MSO. Her main research interest is within the psychosocial working environment, working hours and psychophysiology.

Åse Hansen is a professor in psychosocial medicine. Her research interest is how the body reacts to stress and she has specialized in the use of physiological measurement in stress research.

Peter Jönsson is an associate professor in psychology. He has specialized in stress research using virtual models and has led the development of the virtual version of the Trier Social Stress Test.

Laura Petrini is associate professor in neuropsychology and head of the Center of Cognitive neuroscience at Aalborg University, Denmark. Her main research interest is pain studies.

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