

Virtual Restorative Environments: Preliminary Studies in Scene, Sound and Smell

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ABSTRACT

Previous restorative environment (RE) research suggests that exposure of individuals to natural settings can reduce stress, improve feelings of well-being, and help individuals to recover from fatigue following intensive mental activities. This paper focuses on possible future opportunities for exploring Virtual Environments (VE) in the pursuit of restorative and rehabilitative therapies. The paper presents early work in developing such a Virtual Restorative Environment (VRE) and includes results from two preliminary studies. The first study compared two VEs (an urban city scene and a rural coastal scene) and showed the effect of ambient sounds on ratings of anxiety and relaxation. The second study explored the opportunity of incorporating odours into a VE using a novel olfactory display system and evaluated methods for measuring their effect on the user. Throughout, the paper discusses human factors and usability issues for VRE technologies and future research opportunities.

Keywords: Human Factors, Olfactory Display, Restorative Environment, Usability, Virtual Reality, Virtual Restorative Environment

INTRODUCTION

Significant global attention is being paid to the relationship between human physical and mental well-being and the availability and status of the urban and natural environments in which they find themselves. Often referred to as restorative environments (REs), research results suggest that exposure of individuals to natural

settings can promote stress reduction (Ulrich, 1981; Kaplan, 2001) and assist the recovery of attentional capacity and cognitive function following mental activities, or fatigue brought on by directed attention (Kaplan & Kaplan, 1989; Kaplan, 1995; Berto, 2005; Berman, Jonides, & Kaplan, 2008). REs as simple as window views onto garden-like scenes can also be influential in reducing post-operative recovery periods and

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analgesic administration. In an oft-cited paper, Ulrich (1984) compared 23 matched pairs of patients who underwent gall bladder surgery. After surgery, patients were randomly assigned either to rooms facing a brick wall, or rooms with a view of a natural environment. Ulrich found that those facing the natural view had shorter post-operative stays, took fewer analgesics, and rated their hospital stay as more positive than those facing the more urban scene.

In 2004, the influence of the immediate environment on patients' sense of wellbeing and post-operative recovery was acknowledged in a report from the UK National Health Service (NHS) Estates (Lawson, Phiri, & Wells-Thorpe, 2004). This study showed that architectural environments can contribute to the treatment of patients and have a significant impact on their health outcomes. The report concluded that patients make better progress in purpose-designed modern buildings than in older ones and that better designed hospitals create an overall improved atmosphere, leading to patients with mental health problems being less confrontational and general patients requiring less analgesic medication.

Research by Tsunetsugu and colleagues from the Japanese Forestry and Forest Products Research Institute addressed the exposure of subjects to forest and urban settings and the effect that these exposures had on subjective ratings and physiological measures, including blood pressure, heart rate and salivary cortisol excretion (Tsunetsugu, Park, Ishii, Hirano, Kagawa, & Miyazaki, 2007; Park et al., 2007). Their research demonstrated that 15-to-20-minute exposures to natural environments, such as a broadleaf forest, were accompanied by significant lowering of blood pressure, pulse rate and cortisol levels when compared to similar exposures in a busy city area. Subjective ratings of calm, comfortable and refreshed were also higher in forest conditions than those recorded in the city. Other indicators of human response to REs include reductions in blood pressure (Hartig, Evans, Jammer, Davis, & Garling, 2003) and cortisol (van den Berg, 2006). Research also suggests that a reduction

of symptoms related to stress and depression, including those brought about by prolonged adverse weather and annual time changes – a form of “constrained restoration” which may even apply to Seasonal Affective Disorder, can occur as a result of exposure to green spaces and rural outdoor settings (Hartig, Catalano, & Ong, 2007).

Two theories have been put forward to explain why the effects of REs occur. Kaplan (1995), makes reference to Attention Restoration Theory where, it is claimed, when interacting with a rural environment that is “rich with fascinating” (but subtle) stimuli, attention is “modestly” captured in a “bottom-up, involuntary fashion”, allowing directed attention mechanisms to recover. Urban environments also contain “bottom-up” stimuli (e.g. flashing lights, loud “man-made” sounds, signs, etc.), but these “dramatically” capture attention and require directed attention to overcome the impact of the stimuli. In contrast, Ulrich (1981) proposes an Affective Response Approach in which sensory patterns within an individual's field of existence prompt automatic and quite dramatic responses. Natural patterns (e.g. from rural environments) lead to a “replenishment of cognitive capacity” by altering the emotional and physiological states of the individual – the initial affective response shapes the cognitive events that follow. Discussions and exchanges relating to the underpinning theory of restorative environments will, no doubt, continue for some time. However, as pointed out recently by Valtchanov et al. (2010), “since the emergence of these two theories, the questions of “how” and “why” restorative environments reduce cognitive fatigue, decrease stress levels, and increase an individual's ability to focus have not been thoroughly researched.”

VIRTUAL RESTORATIVE ENVIRONMENTS

For many people access and experience of real natural environments may not be possible. These include those in hospitals, hospices, rehabilitation centres, care homes or otherwise

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