Symposium

Restoration in Virtual Nature

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Restoration psychology has used virtual environments as a research tool in laboratory experiments for a long time; mostly as stand-ins for physical environments, thus making research settings more controllable and enhancing internal validity. Just recently researchers focused on the virtual environments itself, its' restorative quality and its' ecological validity (e.g. Kort de, Meijnders, Sponselee & IJsselsteijn, 2006; Martens & Bauer, 2010; Ziesenitz, 2010). This shift in perspective raises questions like:

- How do people experience, feel or act in virtual nature?
- What is it that influences restoration in virtual nature?
- How should a simulation of nature be composed to make it restorative?

The symposium encompasses a broad variety of studies which contribute to a better understanding of restoration in virtual environments and to the usability of virtual restorative environments for practical application. An outlook on new research on this topic will be given. The symposium starts with fundamental research on a comparison between the effect of virtual and real environments and continues with specific components in virtual environments facilitating restoration. Subsequently, the focus moves towards applied questions concerning virtual environments.

Martens and Bauer examined the comparability of virtual and physical/real natural environments by means of cognitive processes, subjective well-being, restorative potential, perceived safety and threat. After collecting the restorative likelihood judgements of different urban streetscapes, Lindal and Hartig examined the impact of varying levels of surface and silhouette complexity as well as the presence/absence of trees of virtual urban streetscapes on the affective state and directed attention capacity. Annerstedt, Jönsson, Wallergård, Johansson and Währborg explored whether adding sound of nature to virtual environments would facilitate stress relief. Furthermore they examined the users' Virtual Reality experience by surveying the sense of presence. Ziesenitz examined the impact of users´ perception and evaluation of virtual nature´s artificiality on restoration. With a clear applied perspective, Dijkstra, Pahl and White tested the effects of different virtual representations of natural environments on dental anxiety.

Concluding, the symposium provides vivid insights into the different restorative effects of virtual environments, the users' experiences as well as the usability of restorative virtual environments.

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Presentation 1: Activation in a virtual world – Evoking real or virtual restoration?

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Society is increasingly characterized by virtual elements in the environment, such as video presentations and computer-animated illustrations. Recent attempts to construct virtual environments have been made to simulate reality especially in computer-animated gaming products, but indoor training facilities use virtual sport environments as well for quite a while. These attempts have been shown to be fascinating for users and thus successful.

This view is not new to restoration psychology, which works with a variety of static and dynamic material, including real, video-produced and animated stimulation in research settings. The effect of natural environments has been shown consistently by different settings. However, research on the comparison of differently presented environments influencing the cognitive processes arising, the restorative potential and perceived safety is rather rare.

This study focuses on a comparison of real and virtual environmental stimulation on people during physical activation, dividing different age groups due to the expectation to achieve different results due to customization processes. It focuses the specific influence of video-presentations of natural environments and real exposure to natural environments. A natural environment with few signs of human influence was chosen to contrast the dimension of virtual and real environments. This urban forest area was filmed for the virtual condition. In a comparative study, a sample of N = 200 was randomly assigned to either the real exposure or laboratory condition with a natural presentation. The laboratory condition required a walk on a treadmill, while the real exposure condition required a walk on a given route in the area. The cognitive process was assessed by items

to be rated on 1-7 point scales and reveled a 5-factorial solution of the focus of mind. Perceived safety and threat again was shown on 1-7 point scales. Additionally, information on aesthetical assessment of the presented nature, socio-demographic data and control variables was given.

Results show that the cognitive process is comparable in laboratory and field settings for 4 factors, which explained 64 % of the variance. A fifth factor, the mental focus on the study itself, showed larger values in the laboratory condition; however, it explained 7 % of the variance only. Additionally, subjective well-being is perceived significantly higher in the real exposure condition, while the perception of danger or threat does not differ. A possible explanation is the subjective beliefs about the influence of natural environments on mental processes and well-being. Results show a base to discuss this line of research, and an outlook towards further research is given. The comparison between real and virtual environments is necessary to make far-reaching practical suggestions in training and gaming environments.

Presentation 2: Psychological restoration in virtual urban environments: Correspondence between measured restoration and restoration likelihood judgments

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Comparisons of different urban environments are lacking in the literature on psychological restorative environments, as is knowledge of how the physical attributes of the urban built environment might affect possibilities for restoration. The present study is based on the premise that the outdoor urban built environment can be designed to serve the restoration needs of people in cities and takes interest in whether virtual simulations of possible future urban environments can differentially affect restoration.

Here, the focus is on urban streetscapes. People in cities commonly walk along or look onto city streets, and restoration may be an important outcome desired with such behavioral episodes. In this study, we chose to inspect two interactive three-dimensional virtual urban environments assumed to promote restoration to different degrees. The comparison environments integrated static images of virtual streetscapes. In our previous studies, subjects rated the likelihood of experiencing restoration if they were to walk within the given streetscapes. The streetscapes with the highest and the lowest mean restoration likelihood ratings were adapted for use as comparison conditions in this study. They were combined to form two neighborhoods expected to vary in the degree to which they would support actual restoration. Each neighborhood consisted of 36 main streets (125 m long) and 12 connecting streets (45 m long). Buildings of the same height were lined up along each street on both sides. The streetscapes included street lamps and traffic signs, but no cars or people were included.

For the neighborhood assumed to afford a low likelihood of restoration, the blocks were composed of buildings that were three stories high, had a low level of surface complexity (i.e., most of the building facades had few details) and a low level of silhouette complexity (i.e., most of the buildings had flat roofs). For the high restoration likelihood neighborhood, the blocks were only one story high. They had high levels of surface complexity (i.e., most of the building facades had many details), high silhouette complexity (i.e., most of the buildings had peaked roofs), and trees distributed along the streets. The neighborhoods were constructed using Google Sketch-Up 7® (free version). To increase realism, overlay photos were applied as textures to all visible surfaces within the model. The game development tool Unity 3D® was used for rendering.

Data collection involves students at Uppsala University (Sweden) randomly assigned to the experimental conditions with stratification by gender. The procedure begins with induction of attention fatigue

through repeated performance of the Sustained Attention to Response Test; SART. Speed and error scores from these administrations of the SART serve as pretest measures of directed attention capacity. A brief measure of affective states is completed just after the fatigue induction. The following environmental treatment involves virtual movement through the given neighborhood for 15 minutes. After the treatment, subjects provide post-test measures of affective state and directed attention capacity. Repeated-measures analyses of variance are used to test whether the degree of beneficial pretest-posttest change in the outcomes is greater in the high restoration likelihood environment, and to assess the role of perceptions of being away and fascination in such change.

Presentation 3: Virtual stress provocation and stress relief in virtual nature, with and without nature sound

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Knowledge on how we perceive different aspects of nature, what senses are involved, and how this influence health and well-being is still under development. Concerning virtual reality (VR) it may serve as a relevant and efficient tool for evaluating stress mechanisms and physiological response to varied environments. Another important aspect of VR research is how to improve the sense of reality and presence, and what other modalities, e.g. sound, may be useful.

The aim of this pilot study was to explore the potential stress relieving effect of virtual nature. In addition we wanted to examine whether adding sound of nature would have any effect on the experience of the virtual environment and if any stress relief would be further facilitated.

To provoke stress in the 30 healthy male test participants we used a virtual version of the Trier Social Stress Test (TSST). Previous studies have shown the virtual version's consistency with the real TSST (Jönsson, Wallergård, Karlson, Johansson, Österberg, Eek et al., 2008; Jönsson, Wallergård, Österberg, Hansen, Johansson & Karlson, 2010). The participants responded to the Spielberger State-Trait Anxiety Inventory (STAI) before any testing started. We collected saliva cortisol and measured heart rate variability and t-wave amplitude throughout the experiment. We compared three groups of different stress-relief conditions – 1) no VR surrounding, simply silent rest 2) silent virtual nature, consisting of a forest environment with a valley towards a stream of water 3) the same virtual nature but with the addition of nature sound (song and twittering of birds, and murmur of water). When the period of stress relief was finished the participants' experience of the experiment was estimated by the STAI. After both virtual environments the participants' sense of presence in the virtual environment was tested with the Igroup Presence Questionnaire (IPQ).

In this study physiological stress responses as well as subjective responses to the experience were tested. The virtual version of TSST was further evaluated and the influence of virtual nature on stress recovery was analyzed. In addition the impact of nature sound was studied both in aspects of stress relief and of experience of the virtual environment. The results seem to be promising and the study may serve as a starting point for several important research projects concerned with stress, nature, perception of surroundings and sound, and how VR can be used as an extended research tool.

Presentation 4: They came, they sensed, they restored: On users' restoration, and their perception and evaluation of artificial nature experiences.

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Virtual nature can be treated as a restorative environment with its' own restorative qualities. But when it comes to the comparability of virtual and physical nature, contradicting results are revealed: virtual nature is either less restorative (Martens & Bauer 2010) or it is as restorative as physical nature (Ziesenitz, 2010). The later result is puzzling because virtual nature, like films or computer simulations, holds a major difference, which is artificiality. First of all virtual nature is genuinely artificial because it is human-made. Second, virtual nature (still) lacks the rich sensory stimulation, which reduces the quality of experience, rendering it artificial. When it comes to nature, humans are very sensitive about artificial items; in fact they dislike them (Anderson, 1981; Birnbacher, 2006). Following the rational of the attention restoration theory by Kaplan and Kaplan (1989) and the psychoevolutionary theory by Ulrich (1983) artificiality violates preconditions of restoration, e.g. dislike is a sign of incompatibility and does not facilitate fascination and pleasure/positive aesthetic affect. According to this line of argumentation, artificiality should lead to a reduced restorative potential of virtual nature. But this was not the case in one of the above mentioned studies.

To clarify the contradicting results a focus on the users' experiences was necessary. The aim of the current study was to examine how users actually perceive and evaluate the artificial nature experience. Furthermore, the impact of these two concepts (experience and evaluation of artificiality) on restoration was analysed. For that purpose a laboratory experiment with a between-subject design was conducted which tested two separate simulations of nature differing in their extent of artificiality. The simulations consist of a video recording and a computer simulation of the same walking track through an urban park. Users (N=59), randomly assigned to the experimental conditions, were asked about the experienced artificiality of different aspects of the simulations and their evaluation of this artificial aspects. Restoration was measured by salivary alpha-amylase, self-reported affect and attention restoration.

Besides interesting insights into the perception and evaluation of different aspects of the simulations, analyses show that users actually are sensitive to differences in artificiality and do favour less artificial aspects of the simulation. But surprisingly this has no impact on restoration. The results contribute to the understanding of the processes leading to restoration in virtual nature. And they do raise further questions about these underlying processes, which will be discussed and hopefully inspire researcher to do further studies in this promising field.

Presentation 5: Virtual nature and dental anxiety

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Dental fear has been shown to lead to the avoidance of necessary dental care, which in turn has adverse effects on the individual's oral health status and reduces the quality of life (Berggren, 1993). Dental anxiety management techniques usually involve pharmacological interventions and behavioral and distraction techniques. These techniques are expensive and either carry risks or are time consuming (Hill et al., 2008).

New anxiety management methods would thus be of great practical value to the dental profession (Toet et al., 2010), considering the high degree of prevalence of dental anxiety (Oosterink et al., 2009).

Research on restorative environments suggests that certain environments are capable of promoting recovery from stress, and shows that especially natural settings have these restorative effects (Hartig et al., 1996). The introduction of indoor plants in a patient room resulted in less pain, anxiety, and fatigue (Park & Mattson, 2009). Exposure to a mural of a nature scene and accompanying sounds showed to be beneficial for patients' pain control while undergoing bronchoscopy (Diette et al., 2003). Both real and virtual nature can thus result in beneficial effects for patients.

Considering these potential healing properties of nature (Ulrich, 1984; Lohr & Pearson-Mims, 2000), exposing dental patients to nature may be an effective way of reducing stress and anxiety. Previous studies demonstrated that listening to music during treatment (Lai et al., 2008) or being exposed to ambient odors while waiting (Lehrner et al., 2005) can help dental patients coping with their anxiety. Since introducing real nature in healthcare facilities is sometimes frowned upon from an infection perspective, the current research focuses on effects of virtual nature.

The current study investigates the effects of a virtual reality (VR) intervention in a simulated dental context. This study will provide insight in the potential power of virtual reality by comparing an interactive and passive VR situation (yoked control) with a control group in which participants only wear the VR goggles. Effects on anxiety, discomfort, perceived control, time perception will be investigated.