

# Symposium

## Sensory dimensions of restorative experiences

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### Introduction

The past three decades, environmental psychology researchers have begun to chart and investigate the beneficial effects of natural versus urban settings for humans. One particular set of psychological effects resulting from nature-contact has received considerable attention, namely nature's so-called "restorative" effects. These effects refer to the common experience that a visit to nature, or even mere visual contact with nature, can promote relaxation and bolster cognitive clarity. The central aim of the current symposium is to contribute to the field of restorative environments research by shedding light on the sensory characteristics of natural scenes that contribute to restorative nature experiences.

Two main theoretical frameworks are commonly invoked to describe and explain nature's restorative effects. According to *Stress Recovery Theory* (SRT) natural environments are restorative by their ability to moderate psychological and physiological arousal in stressed individuals. *Attention Restoration Theory* (ART), on the other hand, interprets restoration more cognitively, and claims that nature's restorativeness lies in the fact that it is able to replenish an individual's capacity to direct attention.

To date little is known about the sensory characteristics of natural scenes that contribute to restoration, above and beyond its natural qualities. For instance, natural settings are often more spatially open than urban settings; both types of environments differ substantially in acoustic qualities; and they probably also activate different semantic associations and goals. The central aim of this symposium is to bring together presentations that address the question of

which *sensory* characteristics of natural settings (beyond "naturalness") makes them generally more restorative than urban settings. The presentations point to a broad range of factors: specific natural content, ambient conditions, and constituent visual features of naturalness.

It is widely known that green settings are more restorative than urban environments lacking greenery. Presentation 1 aims to bring further depth to this literature, by differentiating among the different factors that lead people to integrate plant-life in their homes as a restorative strategy. Presentations 2, 3 and 4 consider a number of distinct *visual* qualities about natural environments. Presentation 2 investigates whether restorativeness is reversed when the fractal properties of natural-like stimuli are suppressed and when urban-like stimuli are made more fractal-like. One of the defining features of nature's fractal geometry is that natural structures display similar visual information, both from very close-by and from far away. Based on this, presentation 3 examines how viewing urban versus natural scenes from different distances influences restoration. The starting point of presentation 4 is the "vastness" characteristic of natural versus urban scenes. It examines the extent to which the particular emotion this quality activates – namely awe – restores our cognitive abilities. Finally, presentation 5 considers a frequently overlooked *ambient* condition of restorative environments, namely sound, and reports how preferred sounds can influence perceived restoration.

# **Presentation 1: To have or not to have plants? That is the question.**

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## **Background**

What leads people to have or not to have plants in their homes? Studies show that the restorative qualities of nature contribute to stress recovery, attention restoration, and in so doing, improve wellbeing. However, adults spend a lot of time inside buildings, that is, many of our everyday activities – such as leisure and rest – occur primarily indoors. Hence, having plants at home can be important, because plants can provide an opportunity to experience restoration in the built environment.

The theory of environmentally significant behavior (Stern, 2000) stresses that four causal variables are important to describe the organism-environment relationship: attitudinal factors, contextual forces, personal capabilities and habit or routine. Stern (2000) emphasizes that “for personal behaviors that are not strongly favored by context, ... the more difficult, time-consuming, or expensive the behavior, the weaker its dependence on attitudinal factors” (p. 416). Thus, the theory suggests that the organism-environment relationship can be compromised due to limitations of physical space, personal ability and personal routine. Based on this, the goal of the study discussed in this presentation was to identify some of the factors that lead people to have or not to have plants at home.

## **Method**

One hundred individuals answered an open-ended questionnaire. Respondents were asked to list five reasons why they have or would have plants in their own home. They were also asked to list five reasons why they do not have or why they would not have plants in their own home.

## **Results and discussion**

Results indicate that the visual stimulus category was the most frequent justification for having plants in the home environment,

mentioned by 82% of the respondents. The relationship between having or not having plants at home and the perception of plants as something that decorates and beautifies the home environment was significant ( $p=0.027$ , Pearson Chi-square). The restorative potential of plants was another reason why people had plants at home. Thirty-eight percent of the respondents associated having plants with words such as “harmony”, “relaxation”, “calm”, “sense of wellbeing”, “peace”, “relief from stress”, and “tranquil atmosphere”. The relationship between having or not having plants at home and the perception of plants as being restorative was also statistically significant ( $p=0.042$ , Pearson Chi-square).

In accordance with Stern’s proposition (2000), reasons that were given for not having plants at home were: time limitations (39%), space limitations (35%) and personal capabilities to care for plants (33%). However, these categories showed no significant differences when comparing respondents which did or did not have plants at home.

The overall conclusion from this exploratory research is that people who view plants as a restorative element will be more likely to have plants at home. Perceiving plants’ positive psychological effects, such as their capacity to provide restoration, may mitigate the limitations of physical space, personal ability and personal routine.

## **References**

- Stern, P.C. (2000). New Environmental Theories: Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues*, 56, 407-424.

## Presentation 2: The influence of fractals on measures of restoration

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### Introduction

In recent years it has been suggested that nature's restorative potential is partly due to its fractal characteristics (Hagerhall et al., 2004). The term "fractal" is a mathematical concept, which relates to the fact that nature is built up of similar shapes that recur on different scales of the structure. The general aim of this experiment was to examine how manipulating the fractality of both urban and natural stimuli impacts restorativeness.

According to Attention Restoration Theory environments are attentionally restoring when they are fascinating, that is, when they attract attention in an effortless manner (Kaplan & Kaplan, 1989). Stress Recovery Theory posits that positive affect is crucial for initiating stress reduction (Ulrich et al., 1991). It thus appears that three constructs are involved in restoration: (1) attention, (2) effortlessness (or fluency), and (3) positive affect. Based on this, we hypothesized that if fractality indeed contributes to restoration, high versus low fractal stimuli would (1) attract attention more easily, (2) would be processed more fluently, and (3) would elicit more positive affect.

### Method

Two studies were conducted, one in which participants (N=95) viewed pictures of real natural and urban settings (study 1), and one in which they watched computer-generated building-shapes and tree-shapes (study 2). The stimuli of study 2 varied on two dimensions: they were either high or low in fractality. In both studies three methods of measurement were used to gain insight into the restorative potential of the stimuli.

First, we administered a dot-probe task to examine which of two adjacent pictures (e.g., natural vs. urban) attracted attention most.

During the dot-probe task two pictures were presented besides each other on a computer screen during 500 ms. After presentation, a dot appeared on the location of either of the two stimuli. Participants were expected to be faster at pressing the key that corresponds to the position of the dot when the dot appeared on the location of the picture that attracted attention most.

Second, a fluency task was used to examine the effortlessness with which each stimulus was processed. In this task, each stimulus was presented within a frame that was surrounded by triangles and squares. Participants had to respond when a target appeared (i.e., a combination of triangles). Participants were expected to be faster at detecting the target when the stimulus inside the frame was more fluent.

Finally, we used an affect misattribution task to examine the extent to which each stimulus triggered positive affect. In this task participants were first briefly exposed to each stimulus after which they had to evaluate a Chinese character. If the stimulus that appeared before the Chinese character elicits more positive affect, they were expected to misattribute this to the Chinese character, and thus to evaluate the Chinese character more positively.

### Results and discussion

It is expected that natural as well as urban stimuli that are high in fractality will score higher on all three measures than their low-fractality counterparts. Results will be presented and discussed at the conference.

### References

- Hägerhall, C.M., et al. (2004), Fractal dimension of landscape silhouette outlines as a predictor of landscape preference. *Journal of Environmental Psychology*, 24, 247-255.
- Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. New York: Cambridge University Press.
- Ulrich, R.S., et al. (1991), Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, 11, 201-230.

### **Presentation 3: Impacts of viewing distance on restorative effects of natural and built settings**

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#### **Background**

Fascination, or the capacity of nature to hold attention in an effortless way, is generally recognized as a key component of restorative nature experiences (Berto, 2005). However, the question remains as to what makes natural settings and elements so fascinating.

Recently, it has been suggested that the fascinating properties of natural settings and elements may be related to their fractal structure (Joye, 2007). One of the defining features of fractals is that they are “self-similar”. Self-similarity implies that the constituent parts of the structure are themselves reduced copies of the whole. Presumably, this self-similar repetition of visual information makes natural settings fascinating to look at, and hence more restorative, than (non-fractal) built settings.

If fractal self-similarity indeed plays a role in restorative nature experiences, one might expect that natural settings retain their restorative capacity even when viewed from a close distance (“invariance of restorativeness”). Built settings, on the other hand, will lose any restorative capacity they might have when viewed from a close distance. The present study was designed to test this hypothesis.

#### **Method**

The study consisted of a laboratory experiment in which 56 healthy participants first underwent a stress-inducing procedure (a video about the 2010 Haïti earthquake) and then were randomly assigned to one of four conditions of viewing slides of natural or built environments photographed from afar or from up close.

The natural settings depicted 28 common natural areas, such as parks, grassy fields, and single trees. The built settings depicted

28 pleasant-looking modern and historical buildings. Each setting was photographed from close-by and from far away.

Restorative state (measured by a self-developed 6-item scale) was assessed at the start of the experiment (t1), after the stressful video (t2), and after viewing the slides (t3).

#### **Results and Discussion**

Viewing the earthquake movie led to a significant deterioration in restorative state in all four groups. In addition, there was a significant three-way interaction between setting (natural, built), viewing distance (close, far), and time (t2, t3) on restorative state. When viewed from afar, both nature and buildings led to a significant improvement in restorative state. However, when viewed from up close, only nature improved restorative state, buildings did not.

The present study contributes to the literature by showing that natural settings possess an “invariance of restorativeness”. This finding is consistent with the idea that natural settings, due to their self-similarity, are fascinating at all scale levels. The study also shows that built settings can be about equally restorative as natural settings when viewed from afar. This finding may be related to the fact that about half of the built settings depicted “fractal-like” historical buildings with much detail, ornaments and irregularities. However, because we did not explicitly measure or vary the fractal dimensions of the settings, other explanations are also possible. Moreover, although we controlled for factors such as time of year and photographic quality, there may have been other potential confounds between the conditions that may explain the current findings. In general, further research is needed to confirm and extend these results.

#### **References**

- Berto, R. (2005). Exposure to restorative environments helps restore attentional capacity. *Journal of Environmental Psychology, 25*, 249-259.
- Joye, Y. (2007). Architectural lessons from environmental psychology: The case of biophilic architecture. *Review of General Psychology, 11*, 305-328.

## Presentation 4: Awe and restoration

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### Introduction

Our presentation will concentrate on a specific emotion which is displayed towards objects or processes that are very vast, namely *awe* (Keltner & Haidt, 2003). In restorative environments research, natural stimuli often seem to be far more vast than urban stimuli (e.g., in scale, in information richness). Therefore, natural scenes almost inevitably score higher on measures for awe than urban scenes. This methodological concern has led us to explore how manipulating awe for both urban and natural scenes influences restoration.

The exploration of the relation between awe and restoration was also informed by theory. First, there seems to be significant overlap between the characteristics of awe (Keltner & Haidt, 2003) and the components of restorative environments (Kaplan & Kaplan, 1989). Specifically, (a) it seems that awe-evoking stimuli are inherently “fascinating”; (b) “extent” (or vastness) seems to be a trigger of awe; (c) awe is known to lead to a weakened sense of self and, as such, it seems to entail a sense of “being away”; (d) finally, the feeling of a “fit” (i.e., “compatibility”) between the person and the restorative environment corresponds with the fact that awe makes people feel as forming an integral part with the awe-evoking stimulus.

A second theoretical issue is that there appears to be common ground between the effects of experiencing awe and restorative experiences. Specifically, it seems that awe recruits/heightens attention to make sense of the awe-provoking stimulus and also makes people to see things from a broader perspective. This parallels the findings that restorative environments improve attentional functioning and facilitate possibilities for reflecting on major life issues.

Based on the previous considerations we hypothesize that in restoration studies not so much a nature-effect is taking place. We

rather propose that awe is one of the drivers of (attention) restoration. We therefore expect that urban as well as nature scenes will lead to more restoration if the scenery induces awe than when it does not.

### Method

The experiment consisted of two studies in which participants first underwent a depletion task and then were randomly assigned to one of two conditions of viewing slides of photographs of either natural or built environments.

In study 1, the natural settings consisted of 20 unspectacular natural scenes, while in the urban condition 20 scenes of common built settings were depicted. The goal of this study was to replicate the main effect of most restoration studies, that is, to demonstrate the restorative superiority of (common) natural scenes. In study 2, participants viewed either 20 pictures of awe-evoking architecture (e.g., richly decorated architecture) or 20 photographs of unspectacular nature scenes scoring low on awe. We evaluated the mediating role of awe. The goal of this study was to see whether adding awe to urban scenes made them more restorative than the natural stimuli.

Restoration was measured after viewing the slides with the Sustained Attention to Response Task. In this task the computer presents single digits at a rate of one per second, and participants are required to press a button to every number, except if that number is 3. The number of misses for target trials is a measure for attentional performance.

### Results and discussion

Data are currently gathered and will be presented and discussed at the conference.

### References

- Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. New York: Cambridge University Press.
- Keltner, D., & Haidt, J. (2003). Approaching Awe: a Moral, Spiritual, and Aesthetic Emotion. *Cognition and emotion*, 17, 297-314.

## Presentation 5: Preferred sounds and restoration

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### Introduction

With increased stress in society the need and demand for environments with high restorative ability is increasing. To date, most attention in restorative environments research has been dedicated to investigating the restorative effects of *visual* exposure to natural environments. The central question of this presentation is whether the results on perceived restoration extend from the visual to the auditory modality.

Van den Berg, Koole, and Van der Wulp (2003) showed that preference for visual environments was partly mediated by the restorative quality of the environment. Carles, Barrio, and Vicente de Lucio (1999) showed that auditory environments with vegetation or water were experienced as more pleasant than their urban counterparts. Based on these two experiments, it is hypothesized that preferred sounds also hold a higher restorative quality, i.e., are associated with lower perceived stress.

### Method

24 male participants participated in the experiment. In the first part each participant rated how much he preferred 12 different environmental sounds. These included: (a) sounds of natural elements (e.g., a water stream, a bird singing), (b) sounds of urban elements (e.g., the sound of a fan, a tram passing by) or (c) a combination of sounds of natural and urban elements (e.g., traffic noise with a bird singing). For each participant the second most preferred sound and the second least preferred sound were determined and these were used as stimuli in the second part of the experiment.

In the second part the participants conducted a computer game which induced stress, followed by 20 minutes rest. During

rest participants either listened to their own preferred or their own non-preferred sounds, and also watched either a structured or a non-structured picture. Levels of perceived stress were determined immediately after the stress induction and after the 20 minutes rest.

### Results and discussion

A 2×2×2 repeated measures analysis of variances on the pictures, sounds, and before and after the rest were conducted. The results show that perceived stress decreases when the participants were exposed to their preferred sounds, whereas stress levels remain the same after the 20 minutes rest when subjects listened to their non-preferred sounds. The visual stimuli did not render any significant differences.

In line with Van den Berg et al.'s (2003) results, the present experiment suggests that also everyday preferred sounds can facilitate the recovery from psychological stress. This parallels, and also extends research on music and stress that shows that listening to your favorite music decreases stress levels (Helsing, Västfjäll, Juslin & Hartig, submitted). The results further support the connection between emotional responses and stress. Certain auditory stimuli tend to evoke strong positive emotional reactions (Bradley & Lang, 2000; Juslin & Västfjäll, 2008) and thus seem a promising avenue to promote restoration.

### References

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