



Stress recovery and restorative effects of viewing different urban park scenes in Shanghai, China



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ABSTRACT

Objectives: Many studies have found that natural environments benefit human health and wellbeing, but few have measured restorativeness of specific landscape components, especially in Chinese settings. Because the rapid urbanization of China is accompanied by increasing predominance of hardscape components in cities, the restorative quality of urban green space is a crucial issue. This study explored the stress recovery effects of different videotaped scenes, using six urban parks and one urban roadway scene. Potentially restorative urban park scenes were controlled for nature-based vs. hardscape components, presence/absence of people, and level of openness.

Methods: Subjects were Chinese university students ($N = 140$) aged 18–24. After completing an oral exam as a stressor, an equal number of males and females were randomly assigned to watch one of the seven videotaped scenes during a stress recovery stage, while data were collected on changes in stress and attentional levels. Physiological responses were measured by Electrocardiography (ECG) and Skin Conductance Response (SCR). Psychological responses were measured by the state (short-term) version of the State-Trait Anxiety Inventory (STAI-S), the Digit Span Backwards (DSB) test, and the Perceived Restorativeness Scale (PRS).

Results: In a Chinese sample, this study confirmed previous findings that nature-based urban park scenes relieved stress and restored attentional levels, while viewing an urban roadway increased negative feelings. Overall perceived restorativeness was significantly higher in two scenes depicting a Lawn without people and a Small Lake, compared with a paved Plaza with or without people, confirming previous findings that restorativeness is associated with predominance of nature-based landscape components. This study also confirmed previous findings that outdoor scenes without people were more restorative than scenes depicting people.

Discussion: This study found different levels of restorativeness associated with different landscape features, and helped confirm that nature-based components are more likely to reduce stress than hardscape components, using Chinese urban scenes with a Chinese population. Findings can be used in future planning and design of urban spaces in China, emphasizing the value of parks and green spaces in relevant contexts.

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1. Introduction

Over thousands of years, human beings have been attracted to nature elements. Exposure to natural settings has been found to

have multiple positive effects, such as releasing tension and anxiety (Adevi and Mårtensson, 2013; Hansmann et al., 2007; Ulrich et al., 1991), relaxing tired minds and preventing mental fatigue (Kaplan, 1995; Sonntag-Öström et al., 2014), increasing and sustaining positive emotions (Jo et al., 2013; Hartig et al., 1991), developing self-discipline and sense of control (Taylor et al., 2002), and boosting happiness and creativity (Fjørtoft and Sageie, 2000). A growing body of research suggests that natural environments are more likely than human-made environments to reduce people's stress (Hartig et al., 2003; Parsons et al., 1998), while crowded

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and noisy urban environments can aggravate people's feelings of anxiety (Cooper et al., 2009; Sullivan and Chang, 2011; Velarde et al., 2007). Relatively little research has been conducted on nature-based restoration specific to Chinese settings and cultural preferences (Lei et al., 2011). For example, an extensive systematic review (Velarde et al., 2007) included mainly European, Scandinavian, and US-based studies, with no studies in Chinese settings; only one Chinese (Taiwanese) study was (Han, 2003) discussed. This study was based entirely on Western-originated research, with no discussion of cultural differences. Although several studies have explored cross-cultural differences in landscape perception (e.g., Herzog et al., 2000; Hull and Reveli, 1989), few studies have compared Asian and Western cultures, and findings are not consistent or conclusive (e.g., Nasar, 1984; Yang and Kaplan, 1990; Zhang and Gobster, 1998). One cultural comparison study (Yu, 1995) found that landscape preferences of a Western expert group correlated fairly well with well-educated urban Chinese people (such as landscape architects and different levels of students), but did not correlate well with those of less-educated rural Chinese such as workers and farmers (who constitute a large part of the population currently moving into Chinese urban areas). Because of the current rapid rate of urbanization in China, it is becoming increasingly important to understand how potentially restorative natural landscapes such as urban parks can be utilized to enhance quality of life in Chinese cities.

1.1. Urban nature and urban parks

In crowded cities, people are more likely to suffer from unwanted stimulation and information overload (Herzog et al., 1982). Currently, most major urban areas in China are rapidly increasing in density, with associated increases in hardscape infrastructure such as high-rise buildings and roadways (Cui and Shi, 2012; Walcott and Pannell, 2006; Ye et al., 2007). The adverse consequences of rapid urbanization can potentially be softened by providing opportunities for people to connect with nature (Stigsdotter, 2012). Studies have found positive psychological and physiological effects of urban nature on human health and well-being (Grahn and Stigsdotter, 2003; Kaplan, 1995; Nordh and Østby, 2013; Rodiek, 2002; Tsunetsugu et al., 2013). Unlike the wilder natural landscapes found in state and national parks, the landscapes in cities are mainly designed and built by people such as city planners and landscape architects (Staats, 2012). As Frederick Law Olmsted noted, scenic beauty has a powerful influence on human health and vigor, and urban parks such as Central Park can become valuable outdoor resources where people of all ages can enjoy nature in high-density environments (Lewis, 1996).

1.2. Relevant research

A substantial body of research has found that natural environments have better restorative outcomes than human-made urban environments. Some studies have compared forest environments with urban sites (Hauru et al., 2012), and others have compared natural and urban environments (Van den Berg et al., 2014), including industrial zones, houses, urban roadways, hills, and lakes (Purcell et al., 2001), or city centers, urban parks and urban woodlands (Tyrväinen et al., 2014). Although these studies suggest the stress-relieving potential of natural landscapes, there is less differentiation among different scene types within mixed built and natural areas, especially urban parks (Tenggart Ivarsson and Hagerhall, 2008).

Several recent studies have addressed the relationship between urban parks and stress restoration. In terms of sensory perception, Grahn and Stigsdotter (2010) discussed the perceived dimensions of urban parks, including serenity, space, nature, richness of

species, refuge, culture, prospect, and social issues. Peschardt and Stigsdotter (2013) further tested the associations between these dimensions and perceived restorativeness. These two studies considered the various characteristics of urban parks as complete units in terms of their restorative quality, but did not focus on specific landscape components within the boundaries of the urban parks.

Using different methods, several studies have addressed the restorative potential of landscape components in urban green spaces. Nordh et al. (2009) assessed landscape components by rating representative photos of urban green spaces, where the components were quantified by the percentage of the variables on the photos. Nordh et al. (2011) used choice-based conjoint analysis to value restorative components of small urban parks. Both studies focused on the amount of landscape components in view, and found natural components such as grass, trees, and shrubs were more predictive of the likelihood of restoration. Although to some extent the landscape components of urban green spaces have been considered in previous studies, few have analyzed these components in terms of spatial organization within urban park areas. Even with the same type and same amount of landscape components, spaces can be organized in different ways, with very different results (Parsons, 1995). Because much of the restorative potential of an urban park depends on the direct experience of the space and activities taking place there (Bowler et al., 2010), research on landscape restorativeness should consider spatial organization when comparing the landscape components of different urban park settings.

1.3. Theoretical perspectives considered in this study

Two theoretical perspectives are especially relevant to the positive effects of human contact with nature. The Attention Restoration Theory (Kaplan, 1978, 1995) emphasizes the perceptive response of humans to the natural world; restorative experiences are concerned with how people perceive, understand and explore the natural settings. This theory maintains that environments with the characteristics of 'being away,' 'fascination,' 'extent' and 'compatibility' are more likely to stimulate people's indirect attention, and potentially reduce stress (Kaplan and Kaplan, 1989; Hartig et al., 1991). From a different perspective, the Psycho-evolutionary Theory by Ulrich holds that viewing natural scenes is important for positive shifts in emotional states and mitigation of the deleterious effects of physiological mobilization (Ulrich et al., 1991; Ulrich, 1993). This perspective proposes that human restorative responses to natural environments occur directly, often within minutes (Ulrich, 1983). Empirical studies have measured emotional and physiological changes from viewing natural environments (Bowler et al., 2010; Haluza et al., 2014), such as reduced blood pressure (Lee et al., 2009), reduced muscle tension (Chang et al., 2008), lowered heart rates (Laumann et al., 2003; Ottosson and Grahn, 2005), and decreased salivary cortisol level (Lee et al., 2011). The study reported here was influenced by both of these different theoretical perspectives: the selection of landscape characteristics was informed by aspects of the Attention Restoration Theory, while biological measures were used to measure direct restorative responses.

1.4. Significance of this study

Urban parks can be described as human-made environments with components from nature such as trees, shrubs, lawns, and flowers. Several previous studies on the restorative potential of landscape components from urban green space have provided psychological evidence for increasing the amount or percentage of natural elements in urban areas (Nordh et al., 2009, 2011; White et al., 2010). However, because few studies have analyzed how specific landscape features and space configurations within

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