

Full Length Research Paper

Effect of characteristics of urban natural landscapes in increasing perceived restorative potential of urban environments

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The current literature on restorative environments showed the role of urban natural settings in increasing restorative potential of urban environments, however little is known the role of visual characteristics of urban natural landscapes in increasing restorative potential of urban environments that led to reduce mental fatigue and move toward public health. In an experimental study, participants rated a criterion variable, perceived restorativeness potential (PRP) and four predictors of preference include Coherence, Complexity, Legibility and Mystery of 12 color slides of urban natural landscapes. The result showed that predictors of preference except for Legibility positively explained PRP. Three predictors of preference -Coherence, Complexity and Mystery - was found as effective characteristics of urban natural landscapes in increasing PRP that led to reduction of mental fatigue. In comparisons among three predictors, Mystery had the highest significant beta weight and also appeared to be most influential on PRP over other predictors. The results of this study may be of significant benefit to city planners, landscape architects and developers with regards to the influence of landscape characteristics in increasing the restorative potential of urban environments.

Key words: Restorative environments, predictors of preference, visual preference, characteristics, urban nature, mental fatigue, health.

INTRODUCTION

One of the basic demands of modern society is to have a high quality of life in a healthy and beautiful environment particularly in urban settings (Simoni, 2006). In this respect, a good management of urban landscapes would have major influence in developing a quality environment (Tahir and Roe, 2006). The majority of researches supported the role of urban nature in increasing not only the restorative potentials of urban environments but also people's health (Berto, 2005; Berto et al, 2008; Grahn and Stigsdotter, 2010; Karmanov and Hamel, 2008; Stigsdotter et al., 2010; Van Den Berg et al., 2010).

However, a few studies on restorative environments

investigated the role of visual characteristics of urban natural landscapes in increasing potential of urban environments that led to reduce mental fatigue and move toward public health.

According to attention restoration theory (Kaplan and Kaplan, 1989), natural environments provide fairly good that, in combination, emerge less commonly in other types of environment. First, being in nature gives a person a getaway physically and/or psychologically from opportunities for psychological restoration, because transactions with natural environments possess several qualities everyday thoughts and daily routines that

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impose demands on directed attention that is referred to "Being away". Second, natural environments hold a person's attention effortlessly and to some extent involuntarily. This quality is called soft Fascination (Herzog et al., 1997; Kaplan and Kaplan, 1989). Furthermore, the natural environment allows a sense of "Extent", "hang together" in a way that is not too confusing, that has continuity, and that individual's brain can build into a cognitive map. Natural environments are also rich enough and coherent enough so that they constitute a whole other world. Finally, experiences in natural environments typically involve a high degree of Compatibility that is to say, what the environment can offer and what the visitor desires and supports one's inclinations or purposes. Thus, natural environments were served as restorative environments. Attention restoration theory also stated that four cognitive benefits of restorative experiences: Clearing the mind, recovery from fatigued directed attention, the opportunity to think about personal and unresolved problems, and opportunity to reflect on life's larger questions such as direction and goals. Later, Herzog et al. (1997) grouped these levels into two groups, attentional recovery and reflection and referred to them as the perceived restorative potential (PRP).

Majority of researches on restorative environments showed the role of urban natural settings in increasing perceived restorativeness and PRP of urban settings (Hartig and Staats, 2006; Herzog et al., 2003; Kaplan and Kaplan, 1989; Laumann et al., 2001; Purcell et al., 2001). Further, they reported viewing urban natural landscapes of during a walk, viewing from a window, looking at a picture or a video, or experiencing vegetation around residential or work environments can help in minimizing stress, restoring attention (Kaplan and Kaplan, 1989), improve concentration and task performance (Berto, 2005; Grahn and Stigsdotter, 2003; Grahn and Stigsdotter, 2010; Kaplan and Kaplan, 1989; Stigsdotter et al., 2010; Ulrich, 1981; Van Den Berg et al., 2010). A few researches has also shown that, in addition to naturalness, others variables of urban environments, such as aesthetic attributes (harmony, openness, luminosity, suitability for leisure, and meeting place), components of environments (hardscape, grass, lower ground vegetation, flowering plants, bushes, trees, water, and size) and different scene types influenced perceived restorativeness of urban environments (Galindo and Hidalgo, 2005; Herzog et al., 2003; Nordh et al., 2009; Purcell et al., 2001). However, the effect of these variables on increasing PRP for urban environments is not yet known.

Furthermore, Kaplan et al. (1989), in the information-processing theory proposed that visual preference for a landscape is derived from two basic human responses to an environment: the need to understand and a desire to explore. Information can be elicited immediately from an environment, or it can be inferred. These two dimensions

(human needs and information availability) were utilized by Kaplan et al. (1989) to make up a preference matrix which has four key information variables: "Coherence", "Complexity", "Mystery", and "Legibility". However, whether visual preference as visual characteristics of urban natural landscapes might play a positive role in increasing restorative potential and improve the mental fatigue of people, is not known yet. Therefore, the purpose of this research is to investigate the relationship between predictors of visual preference and PRP.

METHODOLOGY

Participants

The sample consisted of 120 undergraduate students (43 males, 77 females) from university Putra Malaysia. Participants gave their consent to participate in this experiment.

Stimulus materials

The settings consisted of 12 color slides, 3 from each predictor (Coherence, Complexity, Mystery, and Legibility). These images were chosen from a pool of slides taken of scenes in and around the capital city of Kuala Lumpur by a group of panelists. They had a background of expertise on the topic. The purpose of this procedure was to ensure the use of variables in the presented pictures. All images were captured at eye level and with a normal lens using a Canon digital camera set. Urban settings that contained prominent natural components, such as trees, shrubs, flowers, weeds, grass and water (Herzog, 1989), were represented as Urban Natural Landscapes. No people were visible.

Measures

Each participant is asked to rate preference predictors of each scene, using development of standard definitions by Lee and Kozar (2009) with 16 items. This research used this instrument, whereas standard definitions for assessing preference-matrix predictors may be difficult for most participants to understand, and items should be straightforward, user friendly, and free of jargon.

Sample items included "This setting contains a good variety of components that keep me involved (Complexity); it is clear where I can go in this setting (Legibility); this setting makes me feel there is something interesting to explore (Mystery), there is a clear order in the physical arrangement of this place (Coherence). High reliability of instrument was found for each construct with a value of Cronbach alpha over 0.84 (Lee et al., 2009; Lee and Kozar, 2009). Furthermore, based on previous studies, an additional item assessed the target variable PRP, "This setting would be excellent for taking a break and restoring my ability to study for an exam or work effectively on a demanding project" (Felsten, 2009; Herzog et al., 2003; Nordh et al., 2009).

Each participant rated each of the 12 settings with 17 items that consisted of a target variable, PRP; and the four predictors of preference (16 items). A 7-point Likert Scale of agreement ranging from 1 (not at all) to 7 (a great deal) was used to rate all the items.

Procedure

After describing the task and getting informed consent, the first 5

Table 1. Correlations among predictors of preference and PRP.

Parameter	PRP	Coherence	Complexity	Legibility	Mystery
PRP	-				
Coherence	0.65**	-			
Complexity	0.68**	0.74**	-		
Legibility	0.54**	0.72**	0.67**	-	
Mystery	0.71**	0.72**	0.79**	0.60**	-

PRP is "perceived restorative potential", ** $P < 0.01$.

Table 2. Multiple regression analysis of four predictors of preference on PRP.

IV	DV	B	S.E	Beta	t	Tolerance	VIF
Coherence	PRP	0.26	0.04	0.20	6.72**	0.33	3.06
Complexity		0.27	0.04	0.22	6.90**	0.30	3.36
Legibility		0.03	0.03	0.02	0.84	0.44	2.28
Mystery		0.43	0.03	0.38	12.63**	0.34	2.95
$R^2 = 0.57$							

PRP is "perceived restorative potential"; (B) Unstandardized regression Coefficients; (Beta) Standardized regression coefficients, (VIF) Variance inflation factor; ** $P < 0.001$.

slides were shown briefly without being rated. This is to familiarize participants with the procedure. Then the participants rated one practice slide. This procedure is designed to help all the subjects begin the actual experiment in a similar and stable condition so that possible biases might be reduced. The subjects' task was to observe the landscape slides as visual stimuli and to document their evaluation of the variables of interest for each slide whilst the slides were still being shown on screen.

Participants were also requested to imagine themselves attentively fatigued and they require taking a break to continue (Felsten, 2009; Herzog et al., 1997, 2002, 2003). Respondents then rated each of the 12 scenes with 17 items, taking a break after every 6 scenes. These slides were presented in two orders. One was showed randomly with the constraint that no more than two slides of the same setting were in successive order. The second involved interchanging the first order. The two slide orders were to reduce the effect of order on the results (Han, 2009; Herzog et al., 2003). There were a total of six experimental sessions in order to incorporate enough subjects. All sessions were conducted in a room at the Faculty of Design and Architecture at University Putra Malaysia.

RESULTS

A reliability analysis was performed for each of the subscales using Cronbach's alpha. The result showed a high internal consistency in line with earlier studies. The alpha of these constructs ranges from 0.83 to 0.89 (0.85 for Coherence, 0.83 for Complexity, 0.83 for Legibility, and 0.89 for Mystery).

Table 1 contains correlations among predictors of preference and PRP. The finding showed that PRP and all predictors except for Mystery were moderately correlated. Coherence and Complexity and Mystery had a high correlation with each other. Legibility was

moderately correlated with Complexity and Mystery while it had a high correlation with Coherence.

Multiple regression analysis was used to estimate the relationship between the four predictors of visual preference (independent variables) and the PRP (dependent variable). Tolerance values ranged from 0.30 to 0.44 and Variance Inflation Factor (VIF) values ranged from 2.28 to 3.36 so the model was not biased with any serious level of multicollinearity (Table 2).

The predictors of preference explain 57% of the variance in PRP ($F(4, 1435) = 465.94$). However Legibility was not a significant predictor of PRP. It was found that Mystery was the more influential variable in predicting PRP ($\beta = 0.38$, $t = 12.63$, $p < 0.001$), while Complexity and Coherence, respectively, had less explanatory power prediction ($\beta_{Complexity} = 0.22$, $t = 6.90$, $\beta_{Coherence} = 0.20$, $t = 6.72$, $p < 0.001$).

DISCUSSION

This study determined the relationship between visual characteristics of urban natural landscapes and PRP that based on Information Processing Theory and the Attention Restoration Theory (Kaplan and Kaplan, 1989). Knowledge about the role of the predictors of visual landscape preference as characteristics of urban natural landscapes in increasing the restorative potential of urban environments would be very helpful for urban planners and designers.

The result showed that three predictors of preference (Coherence, Complexity and Mystery) positively explained PRP while Legibility appeared to be a predictor

of PRP. In comparisons among four predictors, Mystery had the highest significant beta weight and also appeared to be most influential on PRP over other predictors. In general, urban natural landscapes that seemed to invite individuals to enter more deeply into it contributed to increasing PRP in urban environments. Complexity also explained PRP. It seems that urban natural landscapes that contain a lot of distinct elements contributed to the variety and richness of a scene led to increasing PRP.

Coherence was another predictor of preference in explaining PRP. Some researchers found Coherence did not align in overall PRS (Peron et al., 2002; Purcell et al., 2001; Tengart and Hagerhall, 2008), however the finding of this research showed that the combination of Coherence with the predictors of preference led to increase the restorative potential and the recovery of mental fatigue. It shows urban natural landscapes that contains order and organization of elements and viewers can make distinctions about different space contributes to increasing PRP. The last predictors of preference that did not explain PRP was Legibility. The result showed urban natural landscapes that people can understand immediately and explore it without getting lost does not influence increasing restorative potential of urban environments.

In general, three predictors of preference -Coherence, Complexity and Mystery - was found as effective predictors in increasing PRP that led to reduce of mental fatigue and contribute to individual in focus and working effectively on a demanding project.

The present study investigated the role of visual characteristics of urban natural landscapes on increasing PRP in urban environments; however the study is not without limitations. First, four predictors of preference was investigated in increasing PRP, however there is other exiting variables in researches on landscape preference that warranted for future studies. Secondly, this research focused on the role visual preference of natural landscapes in urban context, however rapid urban development have been caused to the domination of urban landscape by buildings and roads and the questions about role of visual characteristics of the urban built landscapes in urban context is not yet known. Finally, due to the limitation of time and resources, the effects of the demographic features of the participants such as age, gender, residence, education, and occupation on their responses were not examined here.

The result of this study showed the role of predictors of visual preference as characteristic of urban natural landscape in increasing PRP of urban environments. The findings may be of significant benefit to city planners, landscape architects and developers with regards to the influence of landscape characteristics (Coherence, Complexity, Mystery) in increasing the restorative potential of urban environments and to consider them when designing new landscapes or improving existing landscapes in cities where we live, work, and go for

healing. Thus, move towards recovery of mental fatigue that led to public health in society.

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