



Design intensities in relation to visual aesthetic preference

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ABSTRACT

Design intensity is defined as the amount of the original landscape changed and the degree of artificiality of added elements to the landscape by design. In spite of the significance for landscape design, it has been neglected for a long time by academic research. How does a designer choose an appropriate level of design intensity for a specific landscape to satisfy the users' aesthetic preference? The answer is still unknown and important to research. This study explored the effects of three levels (low, moderate and high) of design intensity on visual aesthetic quality of two landscape types: natural and restored, using visual images as stimuli. The results indicated that, compared to the low or high level of design intensity, the moderate level not only led to a higher landscape quality, but also had a better marginal effect on promoting aesthetic preference. However the marginal effect was dependent on the landscape types: for the natural landscape, low design intensity had the highest marginal effect, with the original pictures' quality having a non-significantly negative association to design intensity's influence on visual aesthetic quality. The Intermediate Disturbance Hypothesis which suggests a moderate level of disturbance leading to maximized biodiversity is used to explain the results. In design practice high design intensity should be abandoned.

1. Introduction

In the last few decades, the importance of visual aesthetic quality (VAQ) has been widely recognized for maintaining human mental health (Velarde et al., 2007; Kurdoglu and Kurdoglu, 2010), protecting cultural heritage (Jessel, 2006), promoting recreational activities such as fishing and hunting (Rolloff, 1998), attracting tourists in many regions (Lothian, 1999) and evoking strong emotions and inferences about social status and friendliness (Nasar, 1990). Furthermore, VAQ is also linked with the ecological quality (Zhao et al., 2017a). Therefore, VAQ is considered as an important natural resource similar to water, soil, mines and fossil fuels (Kane, 1981). Some experts even suggest that protection and improvement of VAQ are the central issue for sustainable development (Wang et al., 2016) because ecological project proposals in a city may fail due to lack of the public's support (Junker and Buchecker, 2008). As a result, many scholars have devoted their talents to such research and devoted their efforts to determining the role of design in improving VAQ (e.g., Arriaza et al., 2004; Bulut and Yilmaz, 2008; Chen et al., 2016; Hauru et al., 2014; Molnarova et al., 2012; Yao et al., 2012; Zhao et al., 2013; Wang et al., 2016).

Natural environments are usually evaluated with a high rate of aesthetic quality over built environments (van den Berg et al., 2003;

Kaplan et al., 1972; Ulrich, 1993), and even, built settings with natural elements are more preferred than settings without natural elements (Herzog, 1989; Sheets and Manzer, 1991). The naturalness of landscape has proven to be a strong factor in the landscape preference of people (Kaplan and Kaplan, 1989; Purcell and Lamb, 1984, 1998; Ode et al., 2009; Hull et al., 2001), and the significance has also been demonstrated across a number of regions and cultures (Balling and Falk, 1982). However, some researchers suggest that some kinds of nature would make people feel fear, for instance, the dense dark forest may appear to be a hiding place for potential attackers Burgess (1995), and Zhao et al. (2013) conclude that when the ratio of natural elements is more than 70% in sight, natural elements have a very weak influence on landscape preference. On the other hand, Nassauer (1995) indicates that neatness is a significant predictor of landscape preference because it implies care or stewardship. These contradictory findings can confuse landscape architects: when they work with a natural landscape how should they proceed? Options may include doing nothing to let nature adapt and change without human intervention, doing something to build the connection between nature and human activity, or creating a groomed, highly maintained, artificial landscape. Existing literature fails to provide reliable evidence for the decision maker. In this paper, we propose a new concept: design intensity which is defined as the

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amount of the original landscape changed and the degree of artificiality of added elements to the landscape by design.

The paper explores the effects of three design intensities (low, moderate and high) on the aesthetic quality of two landscape types: natural and restored. In this paper, the natural landscape is defined as an environment developing freely without human interference or traces thereof, and the restored landscape as a heavily disturbed or destroyed environment that goes through a natural succession and recovers to an early or moderate stage of the local ecosystem. We expect to answer the question: which level of design intensity is better as a means to improve people's aesthetic preference? The possibility of relating individuals' landscape preferences to design intensity allows planners and decision-makers to incorporate public perception explicitly into the policy-making process in a more proactive and innovative way.

2. Materials and methods

2.1. Photographic images

Photographic images were used as surrogates for real landscapes. This method has been widely used by previous researchers (e.g., [Arriaza et al., 2004](#); [Zhao et al., 2013, 2016](#); [Wang et al., 2016](#)), and its reliability has been demonstrated ([Kaplan and Kaplan, 1989](#); [Nassauer, 1983](#); [Palmer and Hoffman, 2001](#)). Eight photographs were collected, which included four restored landscapes and four natural landscapes. All photographs were taken in landscape format in similar light conditions (on clear or mostly clear days) by the second author at eye level (about 162 cm above the ground) in the summer 2016. These photographs are selected to represent the scenes which a visitor experiences in situ. Based on these pictures, three gradients of design intensity (low, moderate and high) were applied for each picture using the photomontage simulation. The photomontage method allows the researcher to create different images by adding, deleting and composing elements to form a well-integrated image ([Waldheim et al., 2014](#)). Thirty-two images were created in total. The low level of design intensity focused on adding a path to the picture for accessibility with some elements slightly changed to fit the path; the moderate level, based on the image with low design intensity, added a few ornamental plants and man-made facilities; and the high level added more ornamental plants and paved areas to the moderate level images. [Fig. 1](#) shows the examples of four scenes with three gradients of design intensity and the original photographs.

2.2. Aesthetic preference assessment

2.2.1. Participants

Internet surveys were used to collect the data. This method, comparatively, is useful in reducing the higher costs of on-site surveys and often reduces the difficulties in participant accessibility. The reliability of an internet survey has been evidenced by previous researchers ([Roth, 2006](#)). To avoid the respondents' perception of the images being manipulated by photomontage, the 32 images were divided into four groups: original, low level of design, moderate level and high level, with each group including eight images. Each group was evaluated by different respondents. Online surveys included four questionnaires conducted by four postgraduates, respectively, using the snowball sampling method to invite respondents to participate. To avoid one respondent evaluating two questionnaires or more, the four postgraduate students were told not to invite the respondents in their common circle of friends. 893 personal evaluations were received: 183 for the original pictures, 249 for the images with low design intensity, 221 for moderate design intensity, and 240 for high design intensity.

2.2.2. Procedure

The online survey was conducted from October to November 2017. When the participants opened the web page, found a title "Imagine you

were in the scenery representing by the picture, please choose the degree of beauty based on your perception." The aesthetic preference was assessed using a seven-point Likert-type scale ranging from "1 = not at all" to "7 = very beautiful". Before the submission, the participants could change their rating for any images freely. It took an average of one and a half minutes to complete the questionnaire.

2.3. Data analysis

Statistical analysis was carried out with SPSS 17.0 software. The interclass reliability of preference scores was tested first. Then the one-way ANOVA and correlation analysis were employed to analyze the data for researching the design intensity's effect on the aesthetic preference of respondents and further exploring the influence of the aesthetic quality of the original photograph and the landscape type on design intensity's effect. The preference score of each image was determined by the average score of all participants' judgment.

3. Results

3.1. Reliability

The interclass reliability of the preference scores of four surveys was calculated, respectively. Cronbach's Alpha for the preference scores of the original pictures was 0.916; for the images with low level of design 0.882; for the images with moderate design intensity 0.893; for the images with high design intensity 0.887. If the Cronbach's Alpha is more than 0.801, it is almost perfect ([Landis and Koch, 1977](#)). Thus, the results showed a good internal reliability of the preference scores.

3.2. Comparison of visual aesthetic quality among design intensities

The preference scores of 32 images were shown in [Fig. 2](#). The mean preference score of original pictures, the images with low, moderate and high level of design were 4.57, 4.80, 5.13, 4.90, respectively, on a seven-point scale. All images with moderate level of design possess higher preference scores than their three counterparts except for the natural landscape 3. It is very clear that the images with a moderate level of design were much more preferred by the respondents. The one-way ANOVA showed that there was a significant difference in preference scores among four design intensities ($df = 3$, $F = 3.435$, $p = 0.030$) (the original pictures were treated as zero design intensity), but all the pairwise comparisons indicated no significant difference except for the original pictures vs. the images with moderate design intensity, which means that moderate level of design is a reliable method to improve the VAQ of a landscape. When the eight scenes were divided into two landscape types, some changes happened. For the natural landscape, the one-way ANOVA suggested no significant difference in preference scores among design intensities ($df = 3$, $F = 0.665$, $p = 0.590$) and no significant difference among all the pairwise comparisons; for the restored landscape, there was a more significant difference among design intensities ($df = 3$, $F = 6.659$, $p = 0.007$) and significant differences of three out of six pairwise comparisons were found. These results seem to indicate that the design intensity's effect on visual quality is linked to landscape type.

3.3. Marginal effects of design intensities on visual aesthetic quality

The marginal effects of the three design intensities on landscape preference of original eight pictures were calculated ([Fig. 3](#)). Based on the average values of eight scenes, the marginal effect of moderate design intensity (0.33) was higher than those of low intensity (0.23) and high intensity (-0.23). These results suggested that moderate design intensity had much more power to improve the landscape quality, but it was dependent on the landscape type. The restored landscape had a similar pattern with the combination of two landscape types (eight

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