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Landscape and Urban Planning 77 (2006) 393–407
LANDSCAPE AND URBAN PLANNING
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Relationship between landscape visual attributes and spatial pattern indices: A test study in Mediterranean-climate landscapes

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Received 6 May 2004; received in revised form 29 April 2005; accepted 1 May 2005
Available online 1 August 2005

Abstract

The analysis of the relationships between landscape visual quality and landscape structural properties is an active area of environmental perception research. The aim of this study was to determine the relationship between landscape spatial pattern and the rating of visual aesthetic quality. Eight landscape photographs were evaluated for 11 visual attributes by 98 respondents. The scores obtained for these 11 attributes were subjected to principal components analysis in order to summarize the qualities used by the respondents and thus determine their visual preferences. For each photograph, three window sizes were defined (with respect to a landcover map) to cover the different areas corresponding to the visual field (foreground, mid-ground and background). The landscape spatial structure for each window was analyzed using spatial metrics. The correlation between each dimension and the spatial pattern indices of the landscape were then calculated. Positive correlations were obtained between visual aesthetic quality and a number of landscape pattern indices. The results suggest that landscape heterogeneity might be an important factor in determining visual aesthetic quality.

Keywords: Visual aesthetic quality; Spatial metrics; Landscape quality; Landscape structure

1. Introduction

1.1. Landscape visual quality assessment

In recent years, the scenic beauty of the landscape has become an important component of planning practices and management strategies (Daniel, 2001; Scott, 2002). Historically, scenic beauty has played an important role in the way landscape has been protected and in the conservation of places considered to be of singular beauty (Preece, 1991). Social concern for the degradation of the landscape has renewed the importance of scenic value as a key aspect of landscape management and planning.

Landscape visual quality can be defined as "the relative aesthetic excellence of a landscape" (Daniel, 2001) and examined in terms of observer appreciation (Lothian, 1999). Knowledge of the elements and processes that organize landscapes is indispensable, but so too are the perceptions, opinions and valuations of the

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doi:10.1016/j.landurbplan.2005.05.003

public (Kline and Wechelns, 1998). Little is known, however, about the relationships between landscape structure and perception; better knowledge of them would be clearly advantageous (Litton, 1979).

The assessment of the visual aesthetic quality of the landscape has seen important developments in recent years. There are two main paradigms of the theory of landscape aesthetics, both of which are on the basis of landscape assessment methods: the "objective" paradigm (where visual quality is inherent to landscape properties) and the "subjective" paradigm (where landscape quality is "in the eye of the beholder") (Lothian, 1999).

With respect to these two paradigms, two approximations to landscape assessment can be differentiated. In the "expert-based" approach, the biophysical features of the landscape are transformed into formal parameters (form, line and variety), which are assumed to be indicators of landscape quality (Daniel, 2001). Some studies have emphasized the role of vegetation in landscape preferences (Bishop, 1996), as well as spatial diversity or complexity (understood as the variety of the landscape's constitutive elements) (Crawford, 1994), waterform (Bishop and Hulse, 1994), landform, topography and viewshed (Hammitt et al., 1994; Purcell and Lamb, 1998). Naturalness has been shown to have a positive effect on the aesthetic quality of scenery (Schroeder, 1987). Human influence, such as residential backgrounds (urban, suburban and rural), city streets (Baldwin et al., 1996) or industrial areas (Purcell et al., 1994), etc., can have a negative impact on preference (Strumse, 1994).

In the "perception-based" approach (Daniel, 2001), landscape visual aesthetic quality is considered to be a product of the visible features of the landscape interacting with psychological processes taking place in the human observer. This approach can be assessed through sensory–perceptual parameters or cognitive constructs. This relies on the idea that environments are sources of information and that humans are information-seeking animals actively pursuing knowledge. Kaplan and Kaplan (1982) proposed a model for landscape preferences in which landscape organization is understood as a source of information that satisfies the motivation to comprehend and explore and indicated the importance of the following factors in the determination of preference: coherence (logical placement, order), legibility (permeability of the scene, accessibility and ease of orientation), complexity (diversity of elements and visual richness) and mystery (the concealment of parts of the scene and the promise of more information that encourages exploration) (see review by Stamps, 2004). In this model, understanding is favored in environments that are coherent and legible and exploration is enhanced in those that are complex and mysterious. Appleton (1975) identifies two components of landscape aesthetic preference: the possibility of accessing the information harbored by the landscape, termed "prospect" and safety or the possibility of refuge termed as "refuge". Prospect is the opportunity to gain a clear view, refuge is the opportunity to hide from the view of others.

According to Bernáldez and Gallardo (1989), affective responses to landscape depend as much on visual characteristics as on the characteristics of the spectator; certain spectator attitudes appear to be correlated with landscape preferences. Formal configurations (the organization of components), such as shape, colors, pattern, etc., stand out as positive influences. Semantic characteristics (the process of recognition of the objects that compose the scene), such as diversity, viewshed, transparency, etc., are also important.

These models relate quantifiable aspects of landscapes with subjective landscape preferences, but they cannot be easily used to evaluate the scenic quality of large regions (Hunziker and Kienast, 1999). Further, they are not directly usable by planners and natural resource managers, who work primarily with maps and other aerial representations of the landscape rather than individual perspectives, thoughts and perceptions (Forman, 1995; Palmer, 2004). A synthesis of both approximations, i.e., of the "expert-based" and "perception-based" methods, would provide a more comprehensive approach to the study of landscape quality.

1.2. Landscape visual quality and spatial pattern

The possibility of relating landscape spatial metrics to quantitative measurements of landscape preference is an area of great theoretical and practical interest (Giles and Trani, 1999). Crawford (1994) and Palmer (1997) have suggested that the spatial metrics commonly used in landscape ecology could be used as indicators of visual aesthetic quality.

Several studies have recently been performed in this area. For example, in Salamanca (Spain), Saldaña