

The Use of Visualised Landscapes in Order to Challenge and Develop Theory in Landscape Preference Research

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Abstract

This paper presents a framework showing how computer generated landscape visualisations could be used for the challenging and developing of theory within landscape preference research; thereby eliminating site specific situations and looking at more general preferences for landscape patterns and compositions. The paper draws on methods and results from previous research in an effort to present a coherent framework.

1 Introduction

There has been an interest in trying to understand what in the landscape drives preference and affect potential for psychological restoration and how this relates to the content of the landscape as well as to various background variables of respondents (KAPLAN & KAPLAN 1989). The work by KAPLAN & KAPLAN (1989) has been influential in preference research, despite providing few direct measurement of the environment. In disciplines like landscape architecture this shortcoming has been addressed by linking quantifiable environmental content like trees, bushes and ground cover to behavioural outcomes like preference and attention restoration, with successful procedures and significant result (NORDH et al. 2009). A common approach is to maximize variation in the stimuli material, for instance by using a dichotomy of nature versus built scenes. However, it has been shown that respondents adjust their evaluations to the rating context, and it is clearly possible to get informative and significant results even if the differences between the studied environmental stimuli is quite small, for example when a virtual environment is used to study the effect of changing a particular element while keeping everything else constant HÄGERHALL & NORDH (2013). While there are more than just visual components that are important in the formation of preference (c.f. GOBSTER et al. 2007) the focus of the work presented here will be on visual quality and its link to landscape composition.

In 2006 TVEIT, ODE & FRY presented a framework for analysing the visual character of landscape through an indicator approach, linking indicators of the spatial composition and

structure to nine theory supported visual concepts (cf. naturalness, stewardship, coherence, visual scale, disturbance, historicity, imageability, complexity and ephemera). We believe that the framework developed by TVEIT et al. (2006) could also work as a support for a more systematic exploration of the relationship between landscape composition and landscape preference, as well as a tool for identifying threshold values for when changes in composition affect the character of the landscape. A more systematic approach, leaving the site specific and looking on more general preference for landscape patterns and compositions is needed in order to challenge and advance, as well as formulate new theory on human environment interactions further.

Computer generated landscape visualisations could fill an important role here, which would allow for a more systematic testing of the linkage between spatial composition and landscape preference.

2 Visual Stimuli in Landscape Preference Research

Landscape preference research has traditionally been carried out using photographs as visual stimuli (KAPLAN & KAPLAN 1989), which has shown to be an adequate substitute for visual assessment in the field (HULL & STEWART 1992). Visual stimuli used in these types of surveys have often been selected to cover a specific gradient (cf. degree of openness) or, through deliberate inclusion / exclusion of image content to test for formulated hypothesis in relation to landscape preference (cf. TVEIT 2009). Manipulation of photographs using image editing software is an often used technique when including or excluding specific content of the images (cf. JORGENSEN et al. 2009).

Landscape visualisations have been used as a mean to show the outcome of both proposed or alternative changes to a landscape based on different scenarios of landscape change (cf. APPLETON & LOVETT 2005; DOCKERTY et al. 2005). The use of visualisations has been found to work well as a substitute for photographs and as a good medium to increase people's awareness and willingness to engage in relation to landscape change processes (cf. MILLER 2009). Several recent perception studies have also confirmed a concordance in assessment between photographs and computer generated 3D models (PARTIN et al. 2012; PIHEL et al. 2014). ODE et al. (2009) identify several reasons why visualizations could be seen as advantageous compared to the traditional use of photographs. Visualizations enables absolute control over scene content (for instance excluding features that could be familiar or have a cultural significance to a particular group and keeping weather, lighting and vegetation type and ground texture constant across scenes). Furthermore, using visualizations makes it possible to vary the parameters to be tested in a systematic way. Lastly it is considered an advantage to use imagery that would be recognizable as a landscape but which would be neutral in relation to the wide variety of landscapes and cultural groups that respondents could represent.

Several examples exist where computer generated visualisations have been used in order to explore preferences as well as restorativeness in a more systematic way (cf. ODE et al. 2009; ODE & MILLER 2010; HÄGERHALL & NORDH 2013; HÄGERHALL et al. manuscript). We will use these examples as a basis to develop and present a more general methodology.

In ODE et al. (2009) and HÄGERHALL et al. (manuscript) the aim was to test general preference for a Pan-European and cross cultural level respectively. ODE et al. explored the relationship between indicators of naturalness (Level of succession, Shape index of edges, Number of woodland patches) and preference for a pasture woodland mixed landscape, in a Pan-European study. In HÄGERHALL et al. the relationship between indicators of visual scale (topography and vegetation density) and preference was explored using vegetation in field sites across the globe (cf. East Timor, Malaysia, Surinam and Sweden).

In ODE & MILLER (2010) and HÄGERHALL & NORDH (2013) the respondents were drawn from a smaller geographical location, and hence the environment visualised was based on a real and recognisable landscape. The study by ODE & MILLER explored the linkage between a range of indicators of complexity and preference for a Scottish landscape, and used a generic Scottish upland landscape. HÄGERHALL & NORDH (2013) investigated how varying degree of visual enclosure of the edge of small urban parks affected the possibility of the park to be a restorative environment for people, based on an existing park.

3 Towards a Framework for the Use of Visualisations in Landscape Preference Research

3.1 Neutral landscape

Familiarity with the presented landscape can be a confounding factor in landscape preference judgements. However, the effect seem to be complex and the evidence is still unclear / inconsistent concerning how familiarity affects preference and importantly the size of the effect seems to be dependent on respondent / cultural groups and scene type (PERON et al. 1998; PURCELL et al. 2001). Hence, approaches that use visual stimuli that are not familiar to any particular group would be desirable when exploring if there is consensus or cultural differences in landscape preference. This could be accomplished through the use of a landscape that lacks the kind of cues that are important for identifying its specific geographical location, i.e., a neutral landscape. Through the use of GIS and computer generated visualisations derived from geospatial data it is possible to create imagery of a landscape with desirable components and arrangements that could be spatially analysed.

However, at the same time as wanting to avoid culturally or geographically specific features thus hindering bias related to familiarity, it is important to keep the landscape realistic and close to something that the respondents can relate to. There is therefore a need to identify the type of landscape that the respondents are likely to be exposed to and build the neutral landscape based on these. In the Pan-European study on naturalness (ODE et al. 2009) this was accomplished through photographs collected from across Europe illustrating different form of topography, vegetation patterns, colours and textures. These were later used to form the basis for the creation of a neutral landscape as well as the different scenarios created. A similar approach of collecting photographs in order to capture expressions of the landscape was also used for the Scottish study (ODE & MILLER 2010) and the park study (HÄGERHALL & NORDH 2013). For the cross-cultural study on visual scale (HÄGERHALL et al. manuscript), the field researcher worked as a filtering board providing an input and a discussion forum with regards to too what degree the respondents

were likely to connect to the landscapes created and variables used (see Figure 1 for example of the GIS base layer used in this study).

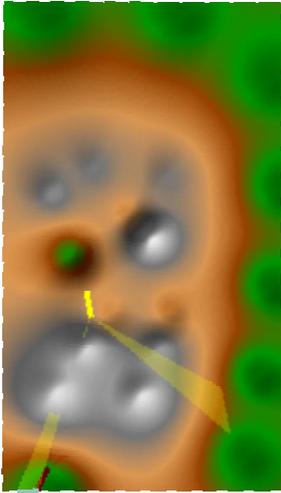


Fig. 1: Base landscape created in ArcMap with camera positioned in VNS (from HÄGERHÄLL et al. manuscript).

3.2 Scenario development and visualisations

In order to explore the relationship between specific compositional features in the landscape and preference there is a need to be specific with regards to what you test. In the example given this was done through the use of a matrix where the amount of levels for each tested variable was specified and fixed levels established. Scenarios of landscape composition were later built by allowing a combination of all the different variables for all given levels. This could be done either using GIS or within a visualisation software.

For the study of complexity a neutral Scottish landscape (ODE et al. 2009) was developed in ArcView with the base land cover comprising of heather moorland and pine forest. This was altered on two levels with regards to the distribution between open and forest land and on two levels with regards to aggregation, resulting in four base scenarios. For each of these base scenarios, two additional levels of amount of land cover were developed. The first additional level split the forest into pine and birch forest, and the open land into heather moorland and rough pasture. The second level added oak forest and improved pasture. This resulted in 12 scenarios of land cover created in ArcView with different levels and types of complexity that could be measured using spatial indicators. For each scenarios two viewpoints were selected that could portray the differences between different scenarios, resulting in 24 different views that was visualised using Visual Nature Studio (VNS) (3D NATURE 2003).

Within the cross-cultural study of visual scale (HÄGERHALL et al. manuscript) the neutral landscape (with regards to topography) was developed within ArcGIS and later imported into the visualisation software VNS. Within VNS the topography and vegetation density were altered using a scenario approach within the project according to the matrix presented in Figure 2.

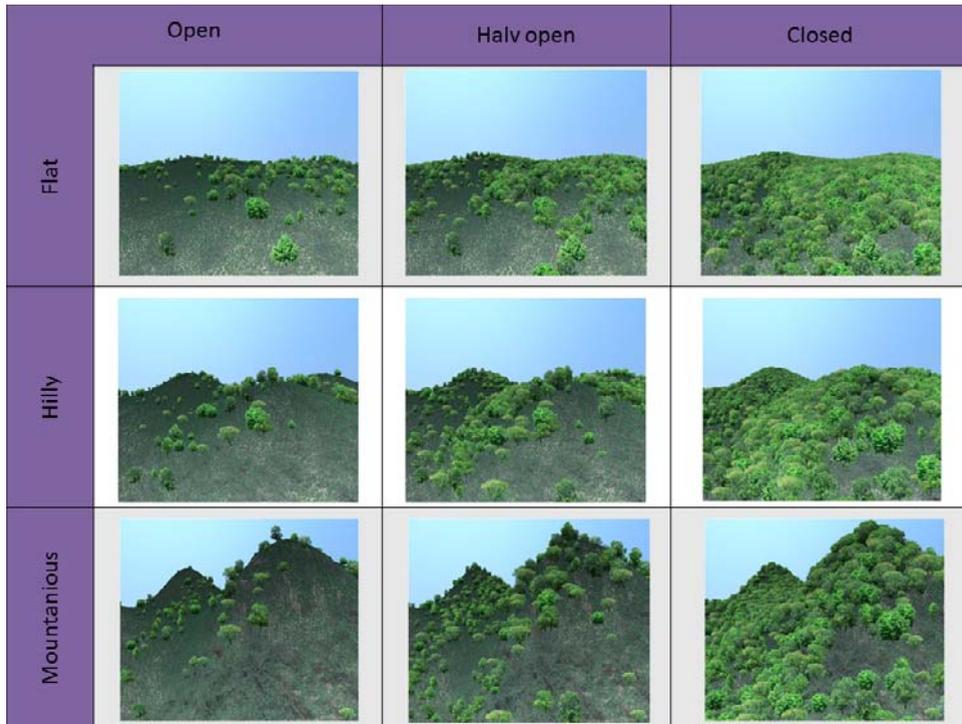


Fig. 2: Matrix showing the variables tested and images used in the study by HÄGERHALL et al. (manuscript). The visualisations were created by GILLIAN DONALDSON-SELBY, James Hutton Institute and modified by ÅSA ODE SANG, SLU.

3.3 Surveying and analysis

Within landscape preference research the use of ranking or rating of images on a Likert scale has been the dominant method for establishing preference (e.g. KAPLAN & KAPLAN 1989). This was deployed in the Pan-European study in relation to naturalness (ODE et al. 2009) as well as the study of restorativeness in relation to park design (HÄGERHALL & NORDH 2013). More recently it has been suggested that choice experiments are more suitable for analysing landscape preference due to their being more closely associated with real world behaviour (ARNBERGER & EDER 2011). This was used in the study of complexity for Scottish landscape (ODE & MILLER 2010) and the cross-cultural study on visual scale (HÄGERHALL et al. manuscript). The different studies differed in relation to the medium used for surveying from field surveys (HÄGERHALL et al. manuscript), internet (ODE et al. 2009; ODE & MILLER 2010), and visualisation theatres (HÄGERHALL & NORDH 2013).

In all the studies each scenario (and hence each imagery of computer generated landscapes) had variables related to the spatial composition. These variables were used in different statistical modelling in order to establish a linkage between preference, landscape composition and configuration, and the background variables of the respondents. The specific

statistical method of analysis varied depending on the type of preference study used (cf. Likert scale rating or choice experiment).

4 Result: A Methodological Framework

In Figure 3 we present a methodological framework showing how to use computer generated visualisations to explore the relationship between landscape and preference. The basis is the use of a neutral landscape, which is influenced by both the respondents and landscape preference theory in order to realise a valid representation. Scenarios of landscape composition are developed based on what we want to test and challenge from the landscape theory. The respondents' home landscape and background contributes to the development of scenarios and computer generated visualisations in order to develop valid and relevant imagery to test preference for. This approach, using systematic visualisations with close link to GIS allows us to establish a statistical relationship between landscape compositional measurement, preference and background variables of the respondents.

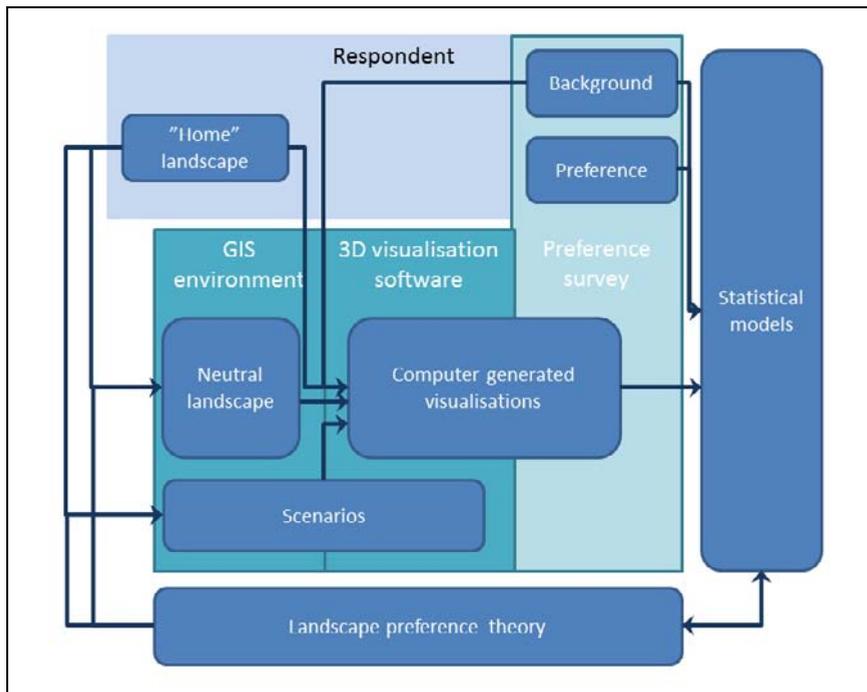


Fig. 3: Methodological framework for the use of visualisations in landscape preference research.

5 Conclusion and Outlook

The proposed method allows us to start to disentangle the relationship between different compositional parameters that affect landscape preference in a more systematic way than the traditional use of photographs in landscape preference research. However, the method is reliant on fine resolution geodata for the creation of detailed visualisations and analysis. The indicators tested and developed based on the proposed methods were built on high-resolution data and hence their applicability is based on finer resolution land cover data than what is often available. There is therefore a need to also explore the effect of up-scaling the indicators to more commonly available geodata sets of land cover.

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