The influence of vision on calculations of experienced based landscape indicators

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Recognition of the value of landscapes, environmentally, economically and to quality of life, in particular the embedding of these concepts in legislation such as the European Landscape Convention, has lead to the need for an 'objective' assessment of these values and the potential impact of changes to them. The European Landscape Convention highlights visual experience as an important aspect to be incorporated in the management and planning of future landscapes [1]. The development of indicators of landscape structure has been found to be a valuable and efficient way to assess changes in landscapes whose complexity and heterogeneity make qualitative assessment difficult.

Within the field of landscape ecology indicators have been developed for analysing landscape patterns, mainly in association with different aspects of ecological function of the landscape [6] but also for assessing other landscape functions (e.g. [2]). The development of software packages such as FRAGSTAT [4] has provided the possibility to apply a huge range of metrics to analysing aspects of 2D landscape pattern, such as land cover diversity, edge density and complexity of shapes. This is usually based on land cover maps or derived from remotely sensed data. Work has also been carried out linking landscape and ecologically based indicators to the experiences and preferences of people [7]. However, the study of human perception and experience of the environment uses a 3D environment (although with photo experiments the three dimensional experience is inferred) in order to explore the relationship between the physical environments and people's preference and perception [5].

This provides us with a significant problem in relating landscape metrics to visual preferences, namely establishing the effect of the process of vision on the metrics themselves. The change from 2D to a 3D environment might for instance change how complex shapes are perceived and the relationship between areas in the landscape (e.g. several separate forest polygons could be perceived as one polygon in a 3D environment), which influences visual indicators. The focus of this paper will be the application of indicators within GIS to landscape preference, with the 3D environment taken into account.

The use of viewshed based indicators is derived from the area visible and therefore would suggest a close correlation with how it is perceived. Viewsheds are defined as the visible area from an observation point, and could be identified within most GIS systems or manually as derived from photographs. Through applying indicators on a viewshed level, a measurement is given that is based on the visible area from a

specific location, and hence can be linked to photographs and preference surveys. However, it is shown that artefacts of the method mean that viewshed metrics do not always provide a strong predictor of preference.

Sang et al. (accepted) propose the use of visual topology as a method for applying visual indicators. One reason for the limited use of topological indicators to date is that software does not usually support their analysis, particularly for 3D data and perspective views. There are technical issues to be overcome before automated identification of visual topology can be achieved. However, the principle of visual topology can be demonstrated through the use of semi-manual methods for analyzing data in perspective that allow existing topological metrics such as those available in FRAGSTAT to be applied [3].

This paper explores and compares different options for applying experience based indicators and considers how well these explain preferences. This was done through the use of data from a Pan European Landscape Preference Survey. This survey recorded preferences for 9 scenarios of landscape composition through visualisations linked to GIS data. The use of viewshed and panoramic scenes, are compared with the standard 2D application. The paper explores the facility of different methods of indicator applications to take the 3D environment into account, and compares the results from them in relation to their ability to predict preference. The study highlights the associated technical problems for indicator application when transferring theories from environmental psychology, which mainly uses a 3D environment (although with photo experiments the three dimensional experience is inferred), to a map based 2D environment. The implications for the role of the respective media in planning are considered, including that of 3D visualisation as a means for eliciting opinion on landscape preference.

References

1. Council of Europe, *Presentation of the European Landscape Convention*. Council of Europe, Strasbourg, 2003.
2. Dramstad, W.E., Fry, G., Fjellstad, W.J., Skar, B., Helliksen, W., Sollund, M.-L.B., Tveit, M.S., Geelmuyden, A.K. and Framstad, E. Integrating landscape-based values—Norwegian monitoring of agricultural landscapes. *Landscape and Urban Planning* 57:257-268, 2001.
3. Germino, M., Reiners, W., Benedict, B., McLeod, D. and Bastian, C. Estimating visual properties of Rocky Mountain landscapes using GIS. *Landscape and Urban Planning* 53:71-83, 2001.
4. McGarigal, K., Cushman, S.A., Neel, M.C. and Ene, E. *FRAGSTATS: Spatial Pattern Analysis Program for Categorical Maps*. Computer software program produced by the authors at the University of Massachusetts, Amherst. Available at the following web site: www.umass.edu/landeco/research/fragstats/fragstats.html, 2002.
5. Sang, N., Ode, Å. and Miller, D. Landscape Metrics and Visual Topology in the Analysis of Landscape Preference. *Environment and Planning B* XX: xx-xx, In Press.

6. Turner, M.G., Gardner, R.H. and O´Neill, R.V. *Landscape ecology in theory and practice: pattern and process.* Springer-Verlag, New York, 2001.
7. Tveit, M., Ode, Å. and Fry, G. Key visual concepts in a framework for analyzing visual landscape character. *Landscape Research,* 3:229-255, 2006.