New Approaches in Visual Landscape Assessment and Modelling

Dietwald Gruehn & Michael Roth

Dortmund University of Technology

School of Spatial Planning

Chair of Landscape Ecology and Landscape Planning

44221 Dortmund, Germany

Phone: +49/231-7552285

dietwald.gruehn@udo.edu michael.roth@udo.edu

http://www.llp.tu-dortmund.de

Key words: Visual Landscape Assessment, Landscape Preferences, Landscape Modelling, Landscape and Environmental Planning

1. Introduction

Landscape variety, landscape beauty and landscape uniqueness is a basis for both recreation of humans in nature or landscape and the leisure industry as a branch which is becoming more and more economically important. Many regions in Europe or even worldwide are competing for tourists by attracting them with a more or less distinctive landscape scenery.

There is a consensus that visual landscape assessment is an indispensable component of landscape and environmental planning. It aims at both ensuring and developing landscape beauty, variety and uniqueness and giving guidelines and recommendations for infrastructure and urban development projects within the framework of impact assessment instruments such as environmental impact assessment or strategic environmental assessment according to European law or impact regulations following national law (Krause, 2001). The main idea of those impact assessment instruments is to avoid and to mitigate impairments to landscape scenery and even to compensate inevitable impairments to landscape scenery by specific measures.

To achieve these aims special assessment methods which also assure common scientific standards are needed. In Germany more than 150 visual landscape assessment methods have been developed and described (Kenneweg & Gruehn, 2001), most of them based on single expert ratings. As it is shown in figure 1 according to a survey carried out by Gruehn, Roth & Kenneweg (2003) in Saxon landscapes, single expert ratings are extremely disputable, because the maximum difference of two expert ratings may be up to 10 ranks on a scale from 0 to 10. In contrast to these differences of expert and laymen landscape

preferences within a random sample (n = 600) are less than 1 and mostly even not significant ($p \leq 0.05$, Mann-Whitney U test).

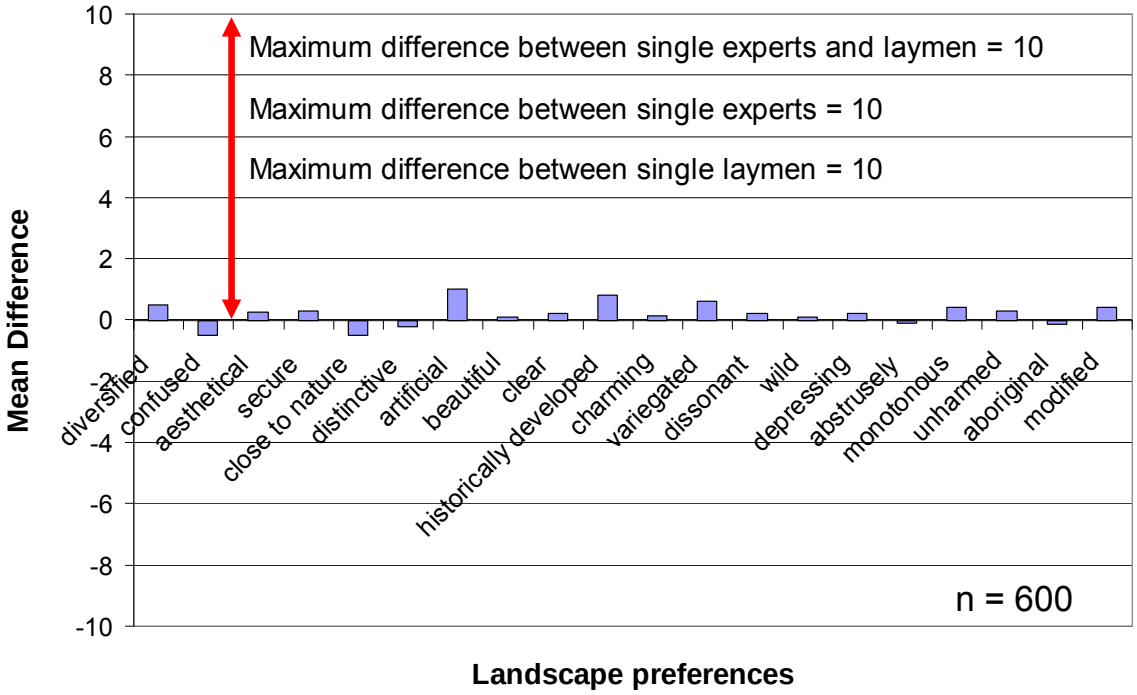

Figure 1: Mean Differences between Landscape Preferences of Experts and Laymen

Our conclusions from the above mentioned survey are as follows:

- Single case studies or single (expert) judgements are scientifically insufficient
- More empirical surveys are needed to understand, to assess and to model landscape scenery of specific landscape types reflecting perception by different social groups.

Our current research aims to extend knowledge on landscape perception as a scientific basis for visual landscape perception in planning practice. On the one hand it is intended to acquire information concerning landscape perception in different landscape types with a main focus in Europe, but in future also including ratings from people with non-European background (cross-cultural-studies). A further attempt is dedicated to the connection between scale and data resolution, especially the resolution of land use and habitat data as a basis for large scale assessments.

2. Methods

The methods being applied in our research are theoretically based on the psychological-phenomenological approach (Nohl, 2001). This approach comprises the real landscape (on an object level), the viewer (on a subject level) and the scenic landscape quality as an interface between real landscape and viewer (image level). According to Nohl (2001)

scenic quality can be described as aesthetically-symbolically interpreted appearance of landscape. Since ratings of single viewers to a large extend reflect subjective experiences, expectations, visions etc. we use large random samples ($n \geq 100$) to avoid biases. For practical and economical reasons we replace ratings in real landscapes by ratings of photographs (of real landscapes). According to Roth & Gruehn (2005) this approach is justified by a strong correlation between people´s ratings of real landscapes and their photograph based ratings. Data acquisition is organised by traditional questionnaires as well as by internet surveys (Roth, 2006). That enables us to investigate whether there are biases in the internet survey or not. The questionnaires contain a large range of different landscape preferences as listed in figure 1. To analyse effects of demographic factors on landscape perception the questionnaires also contain demographic variables, e.g. sex, age, education, professional background etc. We use inference statistics to test effects of certain factor variables on their significance. For statistical analyses parametric and non-parametric methods are used according to mathematical prerequisites. Concerning methodical details of viewshed analysis as basis for GIS-supported scenic quality modelling we refer to the cited literature, e.g. Gruehn, Roth & Kenneweg (2003) and Roth & Gruehn (2005).

3. Results

Figure 2 points out visual landscape quality assessment of 35 different forest types from different regions in Germany by groups from two different regions. The group from southwest Germany stems from the mountainous rural area between Stuttgart and Munich, which is characterised by a high proportion of semi-natural beech tree forests. The northeastern group is located in the lowlands between Berlin and the border to Poland. Typical for this region is a high share of intensively used pine tree forests and the absence of beech tree woods. With one exception there are no significant differences in landscape perception of the two groups (Mann-Whitney U test). Anyhow, the significant difference between both groups regarding the variable “aesthetical” is less than 0.5 on a scale from 0 to 10. Figure 3 presents visual landscape quality assessment results of a beech wood [Lathyro Fagetum] by the above mentioned groups from southwest and northeast Germany respectively. The results clearly demonstrate that there are no significant differences in the ratings of the two groups (Mann-Whitney U test).

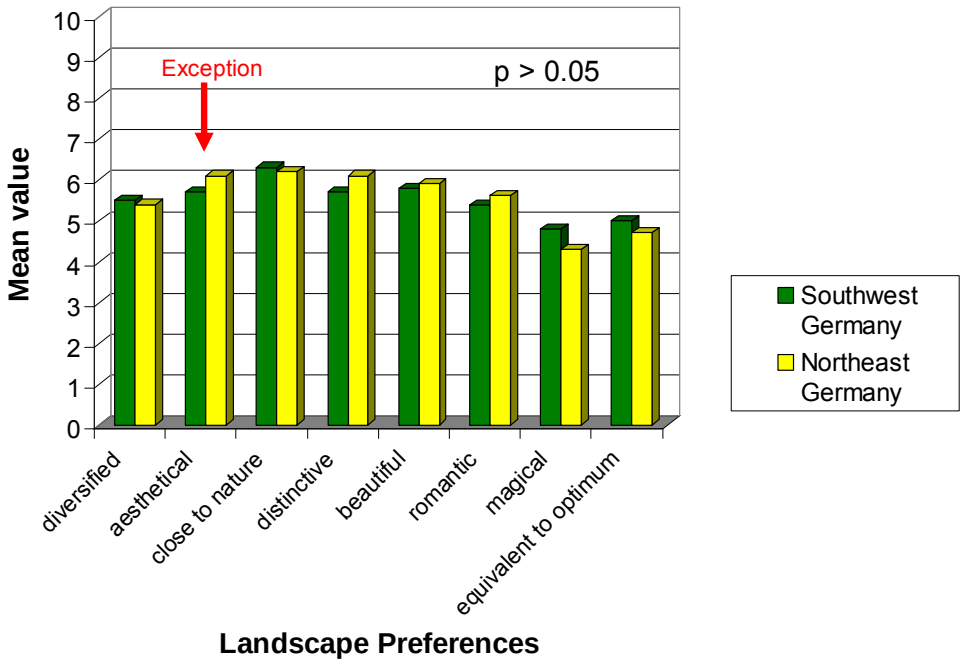

Figure 2: Visual Landscape Quality Assessment of 35 Forest Types by Groups from two Different Regions in Germany

Figure 4 illustrates a comparison of two different types of wood, an oak tree-hornbeam-wood [Carpinetum betuli] and a pine tree bog wood [Ledo-Pinetum].

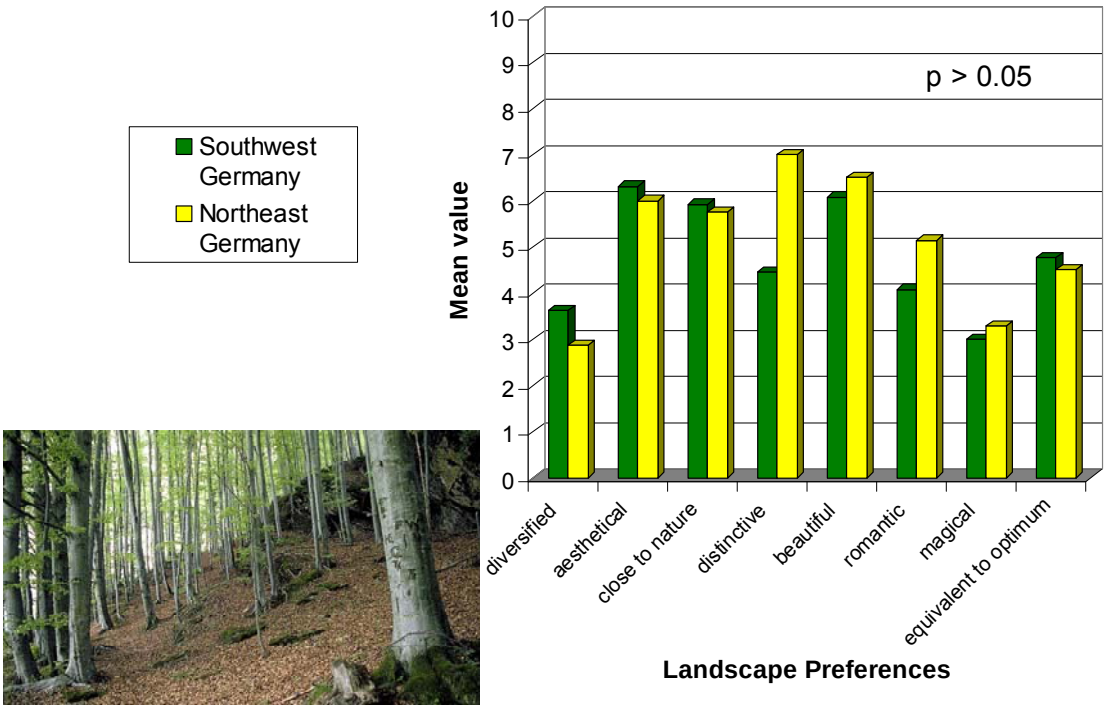

Figure 3: Visual Landscape Quality Assessment of Beech Wood [Lathyro-Fagetum] by Groups from two Different Regions in Germany

These types represent the most extreme differences concerning the landscape preferences of all investigated 35 forest types. The assessment was done by the above mentioned combined groups. The results indicate not only great, but also significant differences (Mann-Whitney U-test). The people significantly prefer oak tree-hornbeam-wood compared with pine tree bog wood. It is perceived as more diversified, more aesthetical, closer to nature, more beautiful, romantic and magical as well as closer to that what people may regard as an optimally featured wood. In contrast to this there are no significant differences regarding the perception of distinctiveness of both wood types.

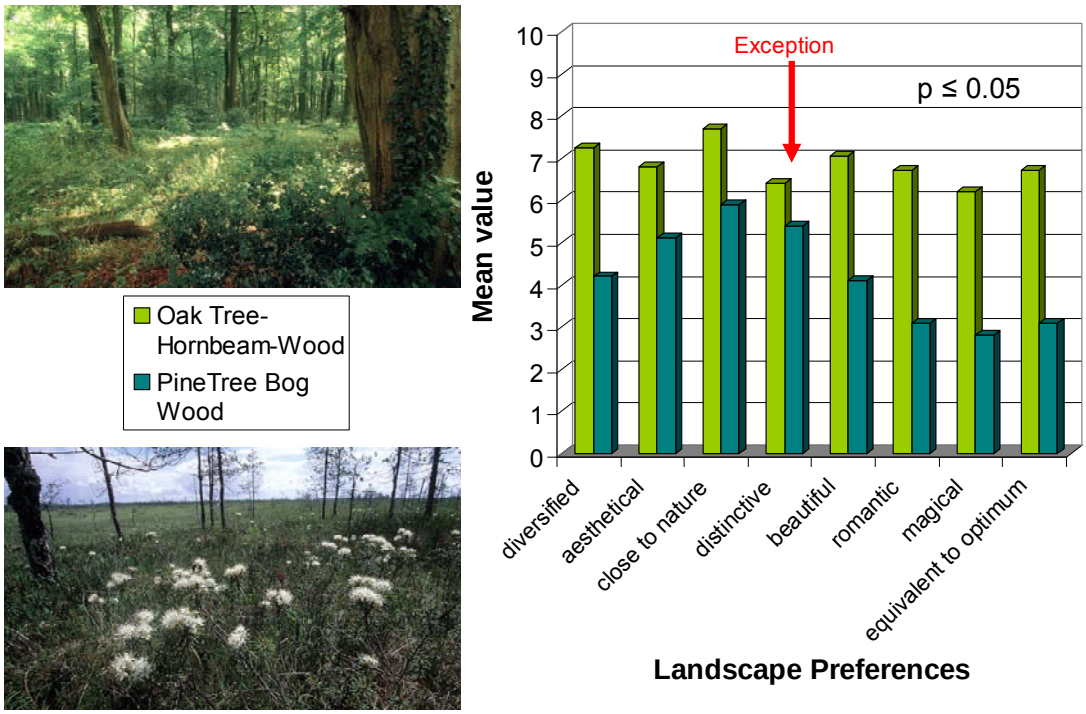

Figure 4: Visual Landscape Quality Assessment of Oak Tree-Hornbeam-Wood [Carpinetum betuli] compared with Pine Tree Bog Wood [Ledo-Pinetum] by Groups from two Different Regions in Germany (combined)

4. Discussion and Conclusions

The study confirms earlier results (Gruehn, Roth & Kenneweg, 2003 as well as Roth & Gruehn 2005), that there are no significant differences in landscape perception by people from Saxony and the region of Berlin. Due to the fact that up to now only 4 German regions haven been investigated intensively it is not tolerable to draw conclusions from the data to Germany on a general level, yet. Furthermore it seems to be fruitful to extend research on European level.

Since data resolution of former research did not enable to distinguish between different forestry land use or habitat types, the above mentioned results reveal that landscape

perception is more affected by features of real landscapes (object level) according to Nohl (2001) than by demographic factors which more or less reflect subjective experience (subject level). As a consequence future small scale investigations of visual landscape assessment need a high resolution in terms of land use or habitat data. Further research should also include meadows, pasture land, heath land as well as bogs.

5. References

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6. Summary

The paper outlines new approaches in visual landscape assessment, especially of forestry landscapes, using surveys and inference statistics. The results reveal that landscape perception to a great extend is depending on different forest land use types.