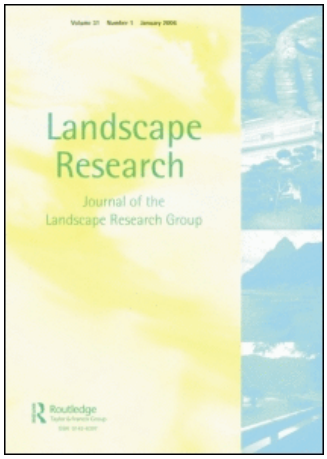

Landscape Research
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713437121

Key concepts in a framework for analysing visual landscape character

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Online Publication Date: 01 July 2006
To cite this Article: Tveit, M., Ode, Å. and Fry, G. (2006) 'Key concepts in a framework for analysing visual landscape character', Landscape Research, 31:3, 229 - 255
To link to this article: DOI: 10.1080/01426390600783269
URL: http://dx.doi.org/10.1080/01426390600783269

Landscape Research,
Vol. 31, No. 3, 229–255, July 2006

Routledge
Taylor & Francis Group

Key Concepts in a Framework for Analysing Visual Landscape Character

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ABSTRACT *A transparent and theory-based scheme for analysing visual character is presented. Based on a literature review, nine key visual concepts are identified: stewardship, coherence, disturbance, historicity, visual scale, imageability, complexity, naturalness and ephemera. The nine visual concepts are presented in a framework of four levels of abstraction, described through the concepts' visual dimensions, landscape attributes contributing to the concepts and potential visual indicators suggested for mapping and quantifying the concepts. Each of these concepts focuses on different aspects of the landscape important for visual quality, where visual quality is an holistic experience of them all. The visual concepts presented are used to describe different characteristics of visual landscapes, rather than presenting a normative value for visual quality. It is believed that this framework can be important for landscape assessment and the compilation of landscape character.*

KEY WORDS: Visual character, visual concepts, landscape assessment

Introduction

One of the major challenges in analysing landscape change is the lack of operational landscape indicators of visual quality. For many environmental issues, including pollution, soil erosion, crop quality, access and biodiversity, we have a strong conceptual base to guide the search for quantitative indicators. For visual aspects of landscapes this conceptual base is weak, which has slowed progress in developing visual indicators, and is urgently required if we are to be able to compare different landscapes or the same landscape over time. An Organization for Economic Co-operation and Development (OECD) meeting on landscape indicators in 2002 (Dramstad & Sogge, 2003) identified the state of landscape indicators as much less well developed than indicators of many of the other countryside values. In other words, the theoretical base for developing visual indicators requires more work to bring it to a level comparable with that already reached by indicators of other interests.

Through the years, several frameworks for analysing and describing visual quality and character of the landscape have been developed (see, for example, the overviews

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ISSN 0142-6397 Print/1469-9710 Online/06/030229-27 © 2006 Landscape Research Group Ltd
DOI: 10.1080/01426390600783269

by Lothian (1999) and Zube *et al.* (1982)). According to Lothian (1999), the work on analysing visual aspects of landscape could be divided into:

- the expert approach, where the focus is on characterizing the landscape as an object;
- the subjectivist approach, where the focus is on the viewer's experience of the landscape.

In order to analyse the effect of landscape changes we believe that it is important to be able to characterize the visual landscape as an object, while the interpretation of these changes needs to take the viewer's experience into account. Between-group differences in aesthetic quality assessment can be considerable (Morgan, 1999), and there is a need to find objective measurements that are meaningful to people.

Palmer (2000) discusses some of the possible reasons for the lack of research in this area, such as the challenge of achieving reliability in the results, the difficulty of representing real multi-dimensional landscapes through photos in empirical studies, and the subjectivity of most landscape analyses. The body of theory in landscape visual assessment is, however, developing.

Three of the most widely applied practical frameworks for analysing visual qualities are Landscape Character Assessment (LCA) (see, for example, Swanwick, 2002), Scenic Beauty Estimation (SBE) Method (for example, Daniel & Boster, 1976) and Visual Resource Management (VRM) system (for example, Bureau of Land Management, 1980). The LCA was developed in the United Kingdom (UK) and has been widely used in various stages of the planning process during the last 20 years. The SBE was developed for the United States (US) Forestry Department during the 1970s and has been widely applied in forestry planning in the USA. The VRM system was developed by the Bureau of Land Management in the USA, where it has been used to maintain and enhance the scenic quality of public lands.

One of the limitations with all three methods in relation to analysing landscape change is that they rely on field data for their estimation. For the LCA and VRM methods it is at the field survey level that most of the visual characterization is assessed, whereas the SBE is based on the rating of landscape photographs. This makes these approaches less applicable for evaluating landscape change based on land-cover data or remote sensing.

We propose a framework for visual character assessment that:

- provides transparent data on landscape structure;
- is consistent between recorders;
- uses readily available data;
- is easily integrated with information on other landscape functions.

Such a framework would make it possible to analyse the consequences of landscape change for visual character in planning and policy evaluation. We contribute to the development of such a framework by proposing an overview of the dominant visual concepts and their theoretical base. Even though most of the literature sources were European or North American, and dominated by agricultural or forest landscape research, we feel that the concepts identified have relevance for other contexts.

We do not claim to present the definitive list of visual concepts, but one supported by landscape research. Our purpose is to describe the steps between the theoretical concepts and visual indicators.

The focus of this paper is on the visual characteristics of landscapes, whereas other aspects of landscape experience, such as sounds and smells, etc. are not included in the study. This framework provides support for the development and application of visual indicators and helps by increasing understanding of what we want indicators to indicate. The framework focuses on the conceptual level, and will not provide a comprehensive set of visual indicators at this point.

Theoretical Framework for Assessing Visual Quality

Within the field of landscape aesthetics several theories for explaining landscape perception and preferences can be found. These can be broadly divided into evolutionary theories and cultural preference theories. The evolutionary theories explain landscape perception and preference as shaped by our common evolutionary history (Appleton, 1975; Zube, 1984). According to this approach, landscape aesthetics are seen as a dimension of human fitness and survival, where landscape preferences reflect landscape qualities satisfying human biological needs to survive and thrive as a species. As all humans have a similar evolutionary basis for evaluating a landscape, this would argue for the existence of a common set of landscape features perceived as positive or negative for all humans. Orians (1980) suggested that all humans enjoy being in savannah-like environments, this being the probable site of our evolutionary origins. Two of the most widely quoted theories related to this idea are the prospect–refuge theory (Appleton, 1975) and the information processing theory (Kaplan & Kaplan, 1982, 1989). The prospect–refuge theory stresses the role of humans as both predator and prey, which results in a preference for landscapes offering both prospect and refuge, i.e. the possibility to 'see without being seen'. The prospect–refuge theory thus interprets this ability to see without being seen as an indicator of environmental conditions favourable to biological survival. Landscapes offering this feature provide a source of aesthetic pleasure (Appleton, 1975). The informational framework as presented by Kaplan & Kaplan (1989) has as its basis the human need for information and the ability to process it to survive. The appreciation of landscapes with properties that make them easily readable would hence be favoured by natural selection, and the genetic bases for such landscapes preference would still be inherent in people today. Our common evolutionary background is thus a strong argument for the existence of a universal set of landscape features shaping preferences for all humans. In this approach, innate human characteristics are seen as the explanation for people responding affectively to landscape in the same way.

In contrast, others have argued that the perception and experience of a landscape are predominantly dependent on the cultural background and personal attributes of the observer. These theories often focus on preferences at a level beyond the immediate and affective preference response and tend to focus more on perceived functions (Bell, 1999). The topophilia hypothesis as presented by Tuan (1974) focuses on personal attributes, such as age, gender, occupation, hobbies, academic background and familiarity, as being important for the forming of landscape

preference. The ecological aesthetic (Carlson, 2001; Gobster, 1999) links preferences for landscape with ethics, suggesting a preference for ecologically sound landscapes. The formal aesthetic has its foundation in design theories, linking the description of landscape with terms developed in the aesthetic philosophy and art, and later transferred to a landscape context. The aim of the approach has been to provide a language to describe the landscape with regard to aesthetic qualities, mainly in relation to design, planning and assessment (see, for example, Bell, 1999). Formal aesthetic theory stresses the role of the connoisseur or expert that has formal training with regard to aesthetics, and is thus qualified to judge the visual quality of the landscape in the same way as there exist wine connoisseurs (Arler, 2000). However, in practice this theory has the weakness that there is a low degree of agreement between experts (Bell, 1999).

These major approaches to landscape theory expose a clear tension between biological and cultural explanations of aesthetic experience, and between viewing behaviour as innate or as learned (Bourassa, 1991). More recently we have seen approaches to landscape aesthetics that accept a mixture of cultural and biological forces as explaining human landscape preference. Consistent with Bourassa, both Bell (1999) and Norton *et al.* (1998) conclude that preferences are formed in humans on the basis of both genetic and cultural influences. All human beings enter the world with a specific genetic make-up, but the genetically based preferences are, however, challenged and changed by cultural influences and experience, such that landscape preferences reflect a combination of the forces of nature and culture. Hartig (1993) argues that nature experience has a transactional character (i.e. that the various aspects of human–environment systems serve to define each other), and that a synthesis of the evolutionary and cultural perspectives is the most appropriate for further research.

We support Hartig's argument, and argue that an integrative theoretical framework is the most appropriate. Due to our common evolutionary history, there exists a common set of landscape features that are preferred across cultures and personal differences. This is not to say that cultural and personal differences do not exist, but to state the need to find both this common set, and also the cultural forces that shape the divergences. This paper sets out to explore the commonalities, the aspects of the visual landscape that most humans respond to, recognizing that responses might differ both in type and in strength between individuals and groups.

Method

The literature reviewed included papers on landscape aesthetics, visual concepts and landscape preferences in rural landscapes. This was to provide a broader base for the development of a conceptual framework for visual indicators. The sources used were:

- academic literature (including scientific journals, reports, conference proceedings, books and theses);
- guidelines and handbooks (including work on landscape character assessment), mainly from the Nordic countries, the UK and the USA;
- policy documents (OECD conferences, national guidelines for visual assessment and European Union (EU)-funded projects and reports).

The selected literature was analysed in order to explore the current terminology describing visual quality. The terminology used for describing visual qualities in the diverse literature used was recorded (see Table 1). This literature on landscape visual quality provided us with many visual concepts, most of which were overlapping or were used synonymously. In our analysis of the terminology of visual quality, we discovered four levels of abstraction in the terminology ranging from the abstract conceptual level to concrete measures of descriptors of the physical landscape. From this analysis we developed a hierarchical structure of four levels relating to the levels of abstraction: concepts > dimensions > landscape attributes > indicators (Figure 1). In this framework the concept and the dimension level are both abstract conceptual levels, whereas landscape attributes and indicators are aspects of the physical landscape. The terminology was ordered and grouped into this scheme. Concepts can be seen as an umbrella term under which several visual dimensions can be found. These dimensions describe different aspects of the concept at an abstract level. Dimensions are determined by physical attributes in the landscape, while the landscape attributes, in turn, can be described using visual indicators. The indicators represent the level at which the physical landscape attributes are counted, measured or scaled to allow different landscapes to be compared or to identify change in the same landscape over time. In the following detailed descriptions of the identified concepts we provide examples of the four levels of abstraction.

At a broad scale, the key visual concepts related to landscapes have been grouped by how they relate to *structure*, *function* or *value*. This three-fold division has been used by Parris (2002) in his description of the development of landscape indicators for monitoring by the OECD. In this study, we have chosen to limit ourselves to concepts that relate to landscape structure—the landscape's physical attributes independent of the attributes of the observer (Lothian, 1999). Concepts that relate to functions that the observer reads into the landscape based on its structure have been left out. An

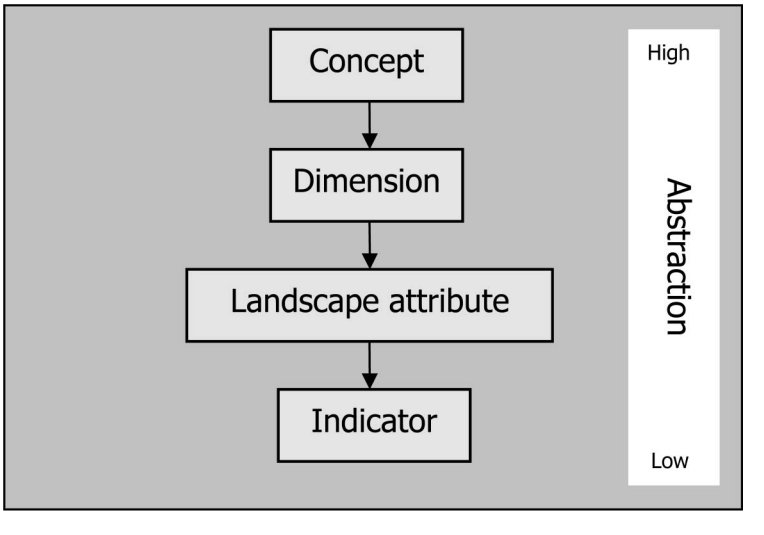

Figure 1. From concept to indicator: the four levels of abstraction identified in current terminology on visual landscape quality.

Table 1. Visual concepts, synonyms used in the literature and references for these

Concept	Synonyms	References
Stewardship	• Sense of order • Sense of care • Upkeep	• Coeterier (1996) • Girardin & Weinstoerffer (2003) • Hands & Brown (2002) • Hartig (1993) • Laurie (1975) • Nassauer (1992) • Nassauer (1995) • Nassauer (1997) • Ode & Fry (2002) • Sheppard (2001) • van Mansvelt & Kuiper (1999) • Weinstoerffer & Girardin (2000)
Coherence	• Correspondence with ideal situation/harmony • Unity • Uniformity • Holistic • Land-use suitability • Balance and proportion • Intactness • Harmony	• Bell (1993) • Bell (1999) • Bureau of Land Management (1984) • Federal Highways Administration (1979) • Forestry Commission (1989) • Hendriks *et al.* (2000) • Herzog (1984) • Herzog (1989) • Kaplan (1977) • Kaplan & Kaplan (1989) • Kuiper (1998) • Laurie (1975) • Litton *et al.* (1974) • Ode & Fry (2002) • Palang *et al.* (2000) • Swanwick (2002) • van Mansvelt & Kuiper (1999) • USDA (1995)
Disturbance	• Intrusion • Alteration • Impact • Lack of contextual fit • Lack of coherence	• BC Ministry of Forests (1997) • Bell (1993) • Bureau of Land Management (1980) • Forestry Commission (1989) • Hernández *et al.* (2004) • Hopkinson (1971) • Institute of Environmental Assessment and the Landscape Institute (1995) • Institute of Environmental Assessment and the Landscape Institute (2002) • Iverson (1985) • Laurie (1975) • Pachaki (2003) • Stamps (1997) • Strumse (1994b) • Ulrich (1983)

(*continued*)

Table 1. (*Continued***)**

Concept	Synonyms	References
Historicity	• Historical continuity • Historical richness	• Fairclough *et al.* (1999) • Fairclough (1999) • Fairclough & Rippon (2002) • Girardin & Weinstoerffer (2003) • Gómez-Limón & de Lucío (1999) • Hendriks *et al.* (2000) • Hooke (2000) • Hägerhäll (1999) • Lowenthal (1979) • Lowenthal (1985) • van Mansvelt & Kuiper (1999) • McNab & Lambrick (1999) • Strumse (1994a) • Strumse (1994b) • Yahner & Nadenicek (1997)
Visual scale	• Landscape room • Visibility • Openness • Enclosure • Spaciousness	• Appleton (1975) • Bell (1999) • Clay & Smidt (2004) • Forestry Commission (1989) • Germino *et al.* (2001) • Gulinck *et al.* (1999) • Hanyu (2000) • Herzog (1984) • Herzog (1989) • Kaplan & Kaplan (1982) • Kaplan & Kaplan (1989) • Laurie (1975) • Lynch & Gimblett (1992) • Nasar *et al.* (1983) • Ode & Fry (2002) • Stamps (2004) • Swanwick (2002) • Vining *et al.* (1984) • Weinstoerffer & Girardin (2000) • Wing & Johnson (2001)
Imageability	• Sense of place • Genius loci • Grandness • Place identity • Vividness • Uniqueness	• Bell (1993) • Bell (1999) • Forestry Commission (1989) • Green (1999) • Litton (1972) • Litton *et al.* (1974) • Lynch (1960) • van Mansvelt & Kuiper (1999) • Norberg-Schulz (1980) • Pachaki (2003) • Proshansky *et al.* (1970) • Proshansky *et al.* (1976) • Tuan (1974) • USDA (1995)

(*continued*)

Table 1. (*Continued***)**

Concept	Synonyms	References
Complexity	• Diversity • Variety • Richness • Spatial pattern/combination	• Angileri & Toccolini (1993) • Bell (1999) • Bureau of Land Management (1984) • Buhyoff & Riesenman (1979) • Countryside Commision (1993) • Dearden (1987) • Dramstad *et al.* (2001) • Fjellstad *et al.* (2001) • Forestry Commission (1989) • Germino *et al.* (2001) • Hands & Brown (2002) • Hanyu (2000) • Herzog (1989) • Hunziker & Kienast (1999) • Kaplan & Kaplan (1989) • Kuiper (1998) • Kuiper (2000) • Laurie (1975) • Litton (1972) • Litton *et al.* (1974) • Ode & Fry (2002) • Palmer (2004) • Stamps (2004) • Swanwick (2002) • USDA (1995) • Weinstoerffer & Girardin (2000)
Naturalness	• Intactness • Wilderness • Natural • Ecological robust • Vegetation health	• Anderson (1991) • Clay & Smidt (2004) • Dearden (1987) • Gobster (1999) • Green (1999) • Hands & Brown (2002) • Hanyu (2000) • Hartig (1993) • Hartig *et al.* (2003) • Herzog (1989) • Herzog *et al.* (2003) • Hägerhäll *et al.* (2004) • Kaplan (1977) • Kaplan & Kaplan (1989) • Laurie (1975) • Lindhagen & Hörnsten (2000) • Litton *et al.* (1974) • Macaulay Land Use Research Institute & Edinburgh College of Art (2004) • Nasar & Li (2004) • Ode & Fry (2002) • Orland (1988) • Purcell & Lamb (1998)

(*continued*)

Table 1. (*Continued***)**

Concept	Synonyms	References
		• Real *et al.* (2000) • Taylor *et al.* (2002) • van Mansvelt & Kuiper (1999)
Ephemera	• Seasonal change (human imposed and natural) • Weather changes	• Akbar *et al.* (2003) • Clay & Daniel (2000) • Gourlay and Slee (1998) • Hands and Brown (2002) • Hendriks *et al.* (2000) • Hull & McCarthy (1988) • Højring & Caspersen (1999) • Jorgensen *et al.* (2002) • Litton (1972) • Litton *et al.* (1974) • Morgan (1999) • Pachaki (2003) • Trent *et al.* (1987)

example is accessibility, which is a function of landscape structure (for example presence of obstacles or paths) and also of the mobility and other attributes of the observer. We have also excluded concepts related to the observer's values and to specific landscape evaluation techniques (for example willingness to pay for a view).

This delimiting of the scope of this paper should not be seen as an underestimation of the importance of function and value related to visual concepts. As stated previously, we find an integrative theoretical framework the most appropriate for landscape research, taking into account both our common evolutionary history and cultural and personal differences. What we want to focus on in this paper is a framework for describing landscape visual character. We believe function- and value-related concepts are more tied to the cultural and personal characteristics of the observer, and fit more into an evaluative framework, which is not the focus of this paper. However, the work reported in this paper can be a useful contribution to future research on the relationships between visual landscape structure and visual quality and value.

Visual Concepts

The review presented an interesting challenge in matching and finding common denominators in the vocabulary used to describe visual aspects of landscape. The initial review comprised a large variety of sources, which together form the basis for the conceptual framework describing visual character as developed and presented in this paper. In Table 1, nine key concepts are presented with synonyms used within the reviewed literature and references for each concept. The literature used includes references covering different types of landscape, such as forest, agricultural and coastal, in different geographical regions. However, the focus has been on European agricultural landscapes. We are aware that this review does not cover all published

material related to visual quality assessment, but it provides a large enough sample for the development of a theoretical framework for visual character assessment and reflects an increasing agreement of the key concepts in the recent literature.

In this review, the nine key concepts identified reflect the dominant or rapidly growing aspects of the visual landscape as visual guidelines and in the research literature. The framework developed around these nine concepts is aimed to increase the understanding of what theoretical concept indicators are showing by making the linkage between theory and indicator clearer. This will be a valuable support for increasing the understanding of the visual aspects of planning and monitoring landscape change. Although we found that visual concepts are used under various synonyms in the references, we have tried to be consistent and derive a set of visual concepts with minimum overlap. However, this is not to claim that these visual concepts or the landscape structures that contribute to them are independent. Some of the concepts may be mutually exclusive, while others may overlap in certain contexts. This we elaborate on further in the discussion.

Stewardship

- *Concept:* we define stewardship as the presence of a sense of order and care, contributing to a perceived accordance to an 'ideal' situation. Stewardship reflects human care for the landscape through active and careful management.
- *Dimensions:* sense of order; sense of care; upkeep.
- *Landscape attributes:* signs of use/non-use; vegetation succession; buildings, linear features (fences, paths etc.) management detail; drainage; waste.
- *Potential indicators:* percentage of abandoned land and stage of succession; status of maintenance of buildings; management type and frequency; length and condition of linear features (for example fences and walls); presence of waste; wet areas in crop fields; presence of weed.

In the literature, several synonymous and interchangeable terms are used to express stewardship. These include *upkeep* (Girardin & Weinstoerffer, 2003; Weinstoerffer & Girardin, 2000), *careful management* (van Mansvelt & Kuiper, 1999) and *care* (Nassauer, 1995, 1997). The terms have been used in relation to land management, including farming procedures and the maintenance of buildings and elements in agricultural landscapes. The term upkeep also relates to management intensity (Girardin & Weinstoerffer, 2003). Van Mansvelt and Kuiper (1999) expressed that good maintenance or upkeep of cultivated elements in the landscape shows that the land is well kept and cared for. Nassauer (1997, p. 68) has identified an "aesthetic of care", parallel to the aesthetic of the scenic. In order to analyse the presence of care in the landscape "cues of care" are used (Nassauer, 1995). These cues are familiar to us all and tell us whether the landscape is well looked after or not; they include mowing, tidy fences and footpaths, bright flowers, and trimmed, straight edges. The concept of care is taken further by Sheppard (2001), who develops an aesthetic theory of care to supplement scenic and ecological theories. In this perspective, cues of care (visible stewardship) are argued to be consistent with other theories of aesthetic preference, such as the human habitat theory of Orians (1980), and socio-cultural theories that link sustainability with stewardship.

Coeterier (1996) argues that optimal maintenance standards may depend on the context. Too much or too little maintenance may be valued negatively, where too much maintenance results in an artificial and sterile landscape, while too little looks shabby and uncared for. He argues that modern landscapes tolerate less neglect and carelessness than traditional rural landscapes because of the generally higher intensity of use now.

Coherence

- *Concept:* we define coherence as a reflection of the unity of a scene, where coherence may be enhanced through repeating patterns of colour and texture. Coherence is also a reflection of the correspondence between land use and natural conditions in an area.
- *Dimensions:* harmony; unity/holistic; land-use suitability.
- *Landscape attributes:* land use; water; pattern.
- *Potential indicators:* percentage land use in correspondence with natural conditions; water presence and its spatial location; repeating colours and patterns.

The concept of coherence or unity is developed and used both within the professional approach to landscape assessment (see, for example, Bell, 1999) and within environmental psychology (see, for example, Kaplan & Kaplan, 1989). Interchangeable terms found and used in the literature are *harmony*, *readability* of a landscape and *unity*. Visual impact assessment often uses the term unity as "the degree to which all visual elements combine to form a coherent, harmonious pattern" (Federal Highways Administration, 1979, p. 58).

Kaplan & Kaplan (1989) suggest that a coherent landscape setting contributes to one's ability to make sense of the environment through providing a sense of order and directing the attention of the observer. Bell defines coherence as: "the ability to see and comprehend the pattern inherent in a scene (the opposite to chaos)" (1999, p. 85). Coherence enhances people's ability to orient themselves, both in time and space, which is dependent on the readability of the landscape (van Mansvelt & Kuiper, 1999). Another dimension of coherence is the comprehension of unity where the whole is more significant than the parts. Van Mansvelt and Kuiper (1999) refer to unity as an added value, one that is not possessed by any of the single elements of the landscape but arises from their combined effect. Thus, the character of the whole is more important than that of the parts. Bell (1999) also explains coherence in terms of an ordered landscape structure that we can understand and where comprehension of the whole is more significant than that of the individual parts.

Several authors use coherence as an expression of land-use suitability, e.g. the relationship between actual land use and natural conditions. According to Kuiper (1998) and van Mansvelt and Kuiper (1999), landscape patterns should reflect the underlying physical processes that have shaped the landscape in order to be coherent. A coherent landscape should reflect its basis in geomorphology (vertical coherence), the interconnectedness of its elements and structure as a whole (horizontal coherence), and the development of landscape through time and in

response to seasonal or vernal patterns (temporal coherence) (van Mansvelt & Kuiper, 1999). See also ephemera.

Water features are given special attention in the literature in relation to coherence. Water bodies often form characteristic patterns in the landscape; usually perceived as harmonious and with focal quality, thus adding to the coherence of the scene (Litton *et al.*, 1974). Water is also seen as adding to the sense of orderliness in a landscape (Kaplan, 1977).

Disturbance

- *Concept:* we define disturbance as lack of contextual fit and coherence, where elements deviate from the context. Disturbance is related to constructions and interventions occurring in the landscape, of both temporary and permanent character.
- *Dimensions:* lack of contextual fit; lack of coherence.
- *Landscape attributes:* extraction; natural disturbance (for example: fire and windfall); constructions (for example: motorway; infrastructure; urban elements; temporary constructions).
- *Potential indicators:* number of disturbing elements; percentage area impacted by disturbance, visibility of disturbing elements.

Disturbance is referred to in the literature mostly in connection with perceived interventions, constructions and landscape change. Visual disturbance is mostly created by man-made elements that have a disruptive effect due to their size, incongruous style or lack of integration in a specific context (Bell, 1993; Pachaki, 2003). In visual impact analysis, it is presumed that introducing certain types of elements is experienced as a disturbance in the landscape (Institute of Environmental Assessment & The Landscape Institute, 2002), where a negative effect of landscape change (disturbance) is defined as being "at a complete variance with the landform, scale and pattern of the landscape; would permanently degrade, diminish or destroy the integrity of valued characteristic features, elements, and/or their setting" (p. 140). Hernández *et al.* (2004) discussed the disturbing impact of human interventions in landscapes, emphasizing the need to reduce the visual contrast between the introduced element and its setting.

Hopkinson (1971) quantified the loss of amenity resulting from the introduction of large disturbing artefacts as a Visual Intrusion Index. The Visual Magnitude rating of Iverson (1985) provides another measurement for assessing visual disturbance, as it calculates the relative size of a landscape unit as viewed from either ground-based or above-ground points. Stamps (1997) suggested that the intensity of visual impacts can be measured with a scientific paradigm for distinguishing significant from non-significant visual impacts. The British Columbia (BC) Forest Service calculates Visual Alteration as human-made landscape alterations caused by activities such as forestry, mining, road construction, utility corridors and agriculture, as part of their Visual Landscape Inventory procedures (BC Ministry of Forests, 1997). These measurements also take into account the relative sensitivity to disturbance of an area. Ulrich (1983) discusses the impact of man-made features in natural settings, quoting Wohlwill's studies on fittingness or congruity and his definition of

fittingness: "the sense of harmony or clashing between a man-made feature and its natural background". Suggested aspects of fittingness are colour contrast, textural contrast, size and congruity of shape (Ulrich, 1983).

In landscape design, approaches have been developed for assessing such intrusions and how to reduce their effect in the landscape by careful and sensitive planning (Bell, 1993; Forestry Commission, 1989). The US Bureau of Land Management's Visual Contrast Rating analysis of disturbance takes into account both context dependency and possible mitigation of disturbance through design (Bureau of Land Management, 1980).

Historicity

- *Concept:* we define historicity as determined by two dimensions, historical continuity and historical richness. Historical continuity reflects the visual presence of different time layers, also influenced by the age of the layers, while historical richness relates to the amount, condition and diversity of cultural elements.
- *Dimensions:* historical continuity; historical richness.
- *Landscape attributes:* visible time layers; cultural elements (for example, historical agricultural buildings, grave mounds, ruins, cairns, signs of earlier cultivation, fences, stone walls, historical roads and paths); traditional agricultural structures.
- *Potential indicators:* presence of cultural elements; shape and type of linear historical elements; age of historical elements; number of time layers; percentage area of historic continuity; presence of traditional land use and pattern.

Several researchers have found that historicity and the presence of historical elements "enlarge today's landscapes" (Lowenthal, 1985, p. 248) and are important for landscape perception and preference (see, for example, Hägerhäll, 1999; Strumse, 1994a). Hooke (2000) and Lowenthal (1979) discussed the importance of reminders of our heritage in our landscapes, also for the perspectives of landscapes of the present time. With reference to historical continuity, Yahner and Nadenicek (1997) argue that landscapes that contain both past and present can provide their residents with a feeling of community integrity and richness. This historical continuity gives the landscape a depth of meaning and a sense of time, providing recreational resources and enhancing landscape aesthetics. Hägerhäll (1999) suggests that traditional Swedish red cottages and fences increase the attractiveness of Swedish cultural landscapes.

A wide range of landscape attributes contribute to experienced historicity. The English Heritage Historic Landscape Project (Fairclough *et al.*, 1999) identified three attributes through which a landscape's historicity is characterized (Fairclough, 1999, p. 14). These are historical process, time-depth and complexity/diversity. Historic landscape characterization is described as "concerned with recognizing the many ways in which the present countryside reflects how people have exploited and changed their physical environment and adapted it through time" (Fairclough & Rippon, 2002, p. 202).

Girardin and Weinstoerffer (2003, pp. 198–199) claim that land-use practices contribute to the concept of historicity. Gómez-Limón and de Lucío (1999) discuss changes in land use and their effect on landscape preferences, relating preferences to

cultural components and expectations. Yahner and Nadenicek (1997) argue that landscape elements that, through their different form, material, wear and patina, differ from recently built structures are important for the visual quality of the landscape. Strumse (1994b) studied single landscape elements, reporting higher preference ratings for traditional over modern landscape elements. The state of historical artefacts may range from those still in use to those reduced to traces and ruins. Historic artefacts are seldom isolated, but typically form systems or interrelated networks that we call historical environments or historic landscapes (McNab & Lambrick, 1999).

Visual Scale

- *Concept:* we define visual scale by the perceptual units that reflect the experience of landscape rooms, visibility and openness.
- *Dimensions:* visibility; openness; grain size.
- *Landscape attributes:* topography; vegetation; man made obstacle.
- *Potential indicators:* viewshed size; viewshed form; depth of view; degree of openness; grain size; number of obstructing objects.

Visual scale is a concept strongly emphasized in theories relating to visual quality and landscape preference. The concept of visual scale deals with the experience of landscape rooms or perceptual units: their size, shape and diversity. Scale is affected by line-of-sight and viewable area and is related to the grain size or degree of openness in the landscape. The degree of openness is directly related to landscape preferences (Clay & Smidt, 2004; Hanyu, 2000; Nasar *et al*., 1983).

The concept of spatial scale links to evolutionary theories (Kaplan & Kaplan, 1982), and to the formal aesthetic (see, for example, Bell, 1999), and encompasses several functions established in theory, including mystery and prospect. In the prospect and refuge theory of Appleton (1975), prospect is used to describe the degree to which the environment provides an overview, and is claimed to be important in landscape preferences. Germino *et al*. (2001) described the degree of prospect as the depth and aerial extent of the view. Mystery, as put forward by Kaplan & Kaplan (1989), describes the degree to which a viewer is drawn into a landscape by the intrigue of what lies ahead, which in turn is related to the ability of the viewer to see the landscape and hence a function of the scale.

Several methods for analysing visual scale have been developed based on techniques of visibility analysis in a geographical information system (GIS) environment (Germino *et al*., 2001; Gulinck *et al*., 1999; Lynch & Gimblett, 1992; Stamps, 2004; Wing & Johnson, 2001). Another approach suggested by Weinstoerffer and Girardin (2000) uses openness as an indicator that is defined by the ease with which an observer can obtain an extensive view over the landscape. In this context, forest and linear wooded margins are typical landscape objects restricting the view.

Imageability

- *Concept:* we define imageability as qualities of a landscape present in totality or through elements; landmarks and special features, both natural and cultural,

making the landscape create a strong visual image in the observer, and making landscapes distinguishable and memorable.
- *Dimensions:* spirit of place; genius loci; uniqueness/distinctiveness; vividness.
- *Landscape attributes:* spectacular elements; panorama; landmarks; water; iconic elements.
- *Potential indicators:* viewpoints; presence of spectacular, unique or iconic elements and landmarks; presence of historic elements and patterns, presence of water bodies, percentage area of moving water.

This concept refers to the elements in a landscape or its total impression which create a strong visual image in the observer, and make landscapes distinguishable and memorable. It covers a range of synonymous or closely related concepts, such as spirit of place or genius loci (Norberg-Schulz, 1980), vividness (Litton *et al.*, 1974) and imageability (Lynch, 1960). Spirit of place has been defined by Bell as "where the landscape has a special quality of uniqueness that is identifiable" (1999, p. 96). According to Bell, the "spirit of a place" is "sometimes known as *Genius loci*, when it is especially intense and associated with landscapes capable of producing sensations of beauty or sublimity" (1999, p. 96). Vividness is defined as "that quality in a landscape which gives it distinction and makes it visually striking" (Litton, 1972, p. 285). Litton *et al.* (1974) have linked vividness strongly to water bodies. Imageability was defined by Lynch as "the quality in a physical object which gives it a high probability of evoking a strong image in any given observer" (1960, p. 9).

The concept of imageability relates strongly to concepts within environmental psychology such as familiarity and place identity. However, it is important to clarify that imageability as used in this paper relates to the features in the landscape, not the psychological processes in the viewer. This makes it differ from concepts referring to the landscape shaping the viewer's identity as used by human geographers, environmental psychologists, planners and landscape architects, described in the sense that an individual's identity depends on their physical setting (Bell, 1999; Green, 1999; Proshansky *et al.*, 1970; Proshansky *et al.*, 1976). The connection between what we call imageability (the 'identity' of a landscape) and cultural or personal identity is important, and we acknowledge that the identity of a place can support and develop cultural or personal identity for the people living in the area (Lynch, 1960; Tuan, 1974). However, as this paper focuses on concepts related to landscape structure, the concept of imageability defined here describes properties of the physical landscape itself.

Used in this context, imageability applies to qualities that are special for a landscape and hence make the place distinguishable from other places (Green, 1999). These physical qualities provide the landscape with a strong identity and often grandness. Imageability is increased by special landscape features, which contribute to forming and enhancing a landscape's character and thereby strengthen the image it creates in the observer. These special features can be natural, such as landform and the presence of water, or cultural elements, with a strong symbolism (Green, 1999). According to van Mansvelt and Kuiper (1999, p. 126), visible signs of a landscape's history contribute to imageability.

Complexity

- *Concept:* we define complexity as the diversity and richness of landscape elements and features, their interspersion as well as the grain size of the landscape.
- *Dimensions:* diversity; variation; complexity of patterns and shapes.
- *Landscape attributes:* linear features; point features; land cover; land form.
- *Potential indicators:* number of objects and types; evenness index; dominance index; diversity indices; shape diversity; size variation indices; heterogeneity indices; edge density; aggregation indices.

Complexity has been identified as a key concept of visual quality (see, for example, Kaplan & Kaplan, 1989; Litton, 1972), and is used in the practice of landscape assessment (see, for example, Bell, 1999; Countryside Commission, 1993). It has been identified as of importance in forest landscapes, in management guidelines (Ode & Fry, 2002) and for landscape preferences (Stamps, 2004).

Researchers have suggested different forms of complexity. Kaplan & Kaplan (1989) define complexity "... in terms of the number of different visual elements in a scene; how intricate the scene is; its richness" (p. 53). They divide complexity into types, with or without order (Kaplan & Kaplan, 1989). Complexity with order provides visual richness to a scene, while disordered complexity can be considered as a chaotic component (Hanyu, 2000). Litton (1972) stresses the need for order and organization in order for high complexity to be able to indicate high aesthetic quality. Kuiper (2000) suggests measurements of diversity at different scales, or grain sizes. These measurements include the diversity of landscape types, landscape units, elements and species. Kuiper (1998, 2000) emphasizes that there is no relationship between diversity at different scales and that a given level of diversity is not perceived in the same way in different landscapes.

Weinstoerffer and Girardin (2000) focus on the farm level, and assess diversity through shape, linear and point diversity indices. In a study by Germino *et al.* (2001), complexity is divided up into two properties (or dimensions): diversity and edge. Diversity refers to the abundance and evenness of land-cover classes in the view, and edge refers to the amount of edge dividing up land-cover types.

Complexity is one of the visual concepts for which there has been an active development in indicators, mainly in relation to landscape ecology, but also visual indicators (see, for example, Dramstad *et al.*, 2001; Fjellstad *et al.*, 2001; Hunziker & Kienast, 1999; Palmer, 2004). However, few studies focus on what actually constitutes complexity with regard to landscape elements and how these relate to preferences. Which elements in the view contribute most to diversity and to what extent spatial patterns of these elements are important are some of the questions that would benefit from further studies.

Naturalness

- *Concept:* we define naturalness as closeness to a preconceived natural state.
- *Dimensions:* intactness; wilderness; natural; ecologically robust.
- *Landscape attributes:* natural feature; structural integrity of vegetation; vegetation/land-cover type; water; management; patch shape; edge shape.

- *Potential indicators:* fractal dimension; vegetation intactness; percentage area with permanent vegetation cover; presence of water; percentage area water; presence of natural feature; lack of management; management intensity (type and frequency), naturalism index, degree of wilderness.

Both environmental psychologists (Purcell & Lamb, 1998) and supporters of the ecological aesthetic (Gobster, 1999) see naturalness as a key aspect of visual quality. Within environmental psychology, the concept of naturalness is linked to evolutionary theories of preferences (Purcell & Lamb, 1998). The ecological aesthetic interprets landscape preferences from an ethical perspective, arguing that a landscape known to be ecologically robust will be preferred (Gobster, 1999). Studies have shown relationships between the naturalness of a scene and human restoration or stress recovery (Hartig *et al*., 2003; Herzog *et al*., 2003). Taylor *et al*. (2002) found that improved school performance and self-discipline of children related to the vegetation in their home environments.

Naturalness, as a concept, is generally used to describe how close a landscape is to a perceived natural state. Perceived naturalness can thus be different from ecological naturalness. Clay and Smidt (2004) evaluated descriptor variables used by agencies assessing scenic quality along roads, and presented naturalness as one of four most common descriptors used (related descriptors were intactness and naturalism). They explicitly made no distinction between 'ecological' naturalness and landscapes only appearing to be natural. Perceived naturalness is context dependent in the sense that what is perceived as naturalness in an urban setting might not be seen as such in a more natural context.

A typical distinction in landscape assessment is between natural and artificial/man made (Green, 1999; van Mansvelt & Kuiper, 1999) or between semi-natural and man-made (see, for example, Macaulay Land Use Research Institute & Edinburgh College of Art, 2004). Parameters for assessing naturalness include indications that the landscape has developed naturally; natural elements, lines, patterns and materials; the presence of natural and semi-natural small biotopes and old trees (van Mansvelt & Kuiper, 1999). Hanyu (2000) assessed naturalness as the cover of trees, flowers and other vegetation in residential scenes.

Naturalness has been found to enhance landscape preference (see, for example, Hägerhäll *et al*., 2004; Hands & Brown, 2002). Real *et al*. (2000), in their study in northwestern Spain, found naturalness as part of a constellation of characteristics common to preferred landscapes. On the other hand, studies of forest preferences have shown that a high degree of naturalness, as found in virgin forests, is not always perceived as positive (see, for example, Lindhagen & Hörnsten, 2000). These findings indicate that the relationship between naturalness and preference is not necessarily linear. Vegetation is clearly important in determining visual preferences, but the degree of actual rather than perceived naturalness may be less important (Purcell & Lamb, 1998). Studies often fail to present clear and quantifiable definitions of perceived naturalness. In contrast, quantitative ecological definitions of naturalness have been presented by ecologists (see, for example, Anderson, 1991).

Water is seen as a key element shaping human landscape preferences (Kaplan, 1977; Litton *et al*., 1974), and it is argued that this is partly through its

contribution to perceived naturalness (Real *et al.*, 2000). Thus preference for water fits with general human preference for naturalness as expressed in environmental psychology theories (see, for example, Kaplan & Kaplan, 1989; Nasar & Li, 2004).

Ephemera

- *Concept:* we define ephemera as elements and land-cover types changing with season and weather.
- *Dimensions:* seasonal change (human imposed and natural); weather related changes.
- *Landscape attributes:* land cover/vegetation; animals; land use (ploughing, etc.); water (colour reflections and waves); weather.
- *Potential indicators:* percentage of land cover with seasonal change; presence of animals; presence of cyclical farming activities; percentage area water; projected and reflected images; presence of weather characteristics.

The concept of ephemera relates to landscape changes throughout the year and in response to weather conditions, which give short-term effects contributing to landscape perception. Litton (1972) uses the term 'time variability' in order to capture these, defining them as "the effect of natural phenomena occurring at a given point in time, producing a visual product that is characteristic of that moment" (p. 272). Pachaki (2003, p. 243) described such elements under the name of "special effects". Højring and Caspersen (1999) and Trent *et al.* (1987) have argued that ephemeral phenomena are important elements of landscape experience, also as permanent features in the aesthetic potential of the landscape. Colour, and especially variety of colours, has been found to have positive effects on preferences (Hands & Brown, 2002), lending importance to ephemeral changes in vegetation colour. Flowers, in particular, have been found to have positive effects on preferences (Akbar *et al.*, 2003; Gourlay & Slee, 1998), although Jorgensen *et al.* (2002) suggested that plants that are attractive during the flowering season might actually have negative visual impact outside the flowering season. Weather-related elements, such as mist and snow, are also defined as ephemeral elements.

Water is a key feature of the concept of ephemera as it gives quite different expressions as a result of weather, seasons, etc. A lake will enhance the colour effects in autumn by reflecting vegetation colour; its surface will change as it ripples in the wind or freezes in the winter. As Litton *et al.* put it: " ... the reflective patterns which are altered by the wind, wave action, and the light, and patterns of colour which derive from both sky and bottom are some of the major textural qualities which give water its fascination" (1974, p. 237).

A Framework for Assessing Visual Quality

This review presents a theory-based framework for analysing visual character. We see it as a strength of the framework that it is transparent and thereby open to criticism and development by peers. This framework is based on nine key visual concepts, namely stewardship, coherence, disturbance, historicity, visual scale,

imageability, complexity, naturalness and ephemera. These nine visual *concepts* are described through their visual *dimensions*, the physical landscape *attributes* contributing to the dimensions, and finally through mappable and quantifiable visual *indicators*. This framework can be an important contribution to the compilation of information needed to assess landscape character.

Interrelated Concepts

Although the nine concepts are presented independently, they are interrelated and work together to form the totality of the visual landscape. The nature of these interrelationships and their integration are not fully understood. They can vary between landscape types where some concepts enforce each other and others cancel each other out. Some concepts are more closely linked than others, or are overlapping, while some may be interpreted as opposites. Examples of opposite concepts might be coherence – disturbance or stewardship – naturalness. However, describing these pairs as opposites to each other is also an oversimplification. This is shown in Figures 2 – 5, where the nine visual concepts presented in this paper have been applied to photographs of European landscapes according to the physical

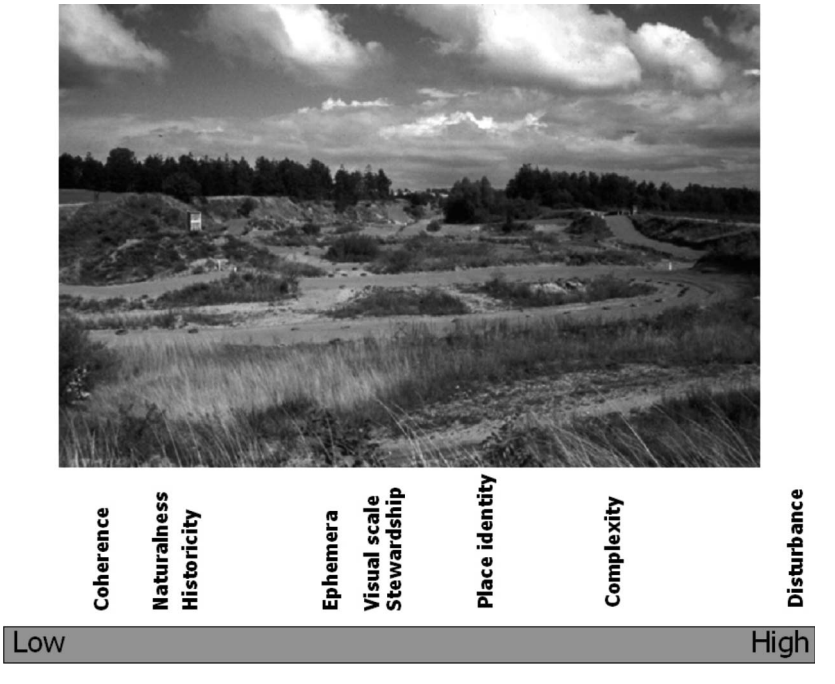

Figure 2. A recreation landscape in Zealand, Denmark. This landscape shows a high degree of disturbance and complexity due to the patterns made by the recreation activities. The recreational area shows little consideration of the context and hence the landscape scores low in coherence, naturalness and historicity. This provides a character to the landscape, and hence imageability. There is a limited degree of visible stewardship within the photo. Due to the dominance of grass vegetation, seasonal changes will be present, though not dramatic. The visual scale of the landscape is medium. *Source:* Photo by Åsa Ode.

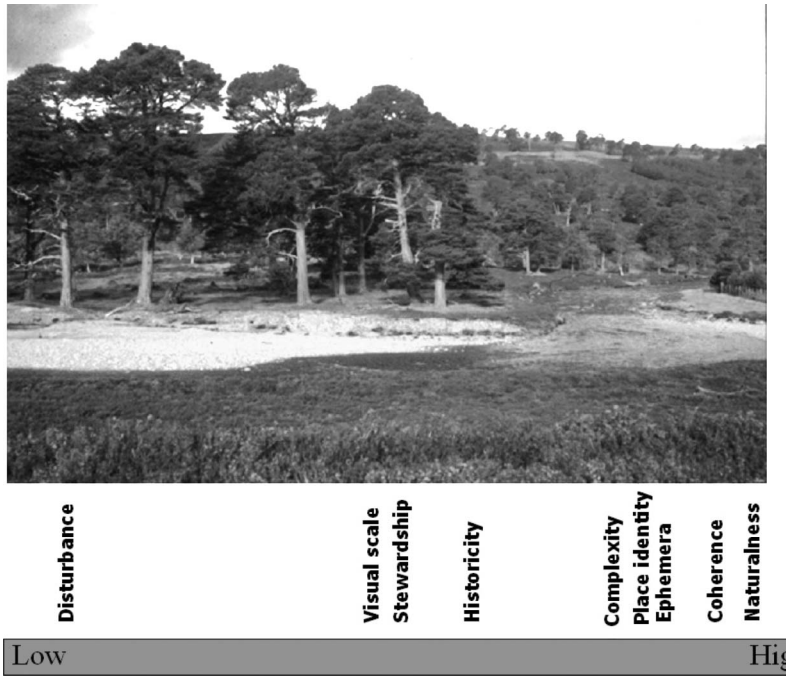

Figure 3. A Scottish riverside in the Cairngorms, with native Scots pine. This landscape is perceived as a natural landscape with a high degree of coherence, imageability and complexity. The water, together with the grazed areas, results in seasonal changes. There is a limited degree of stewardship related to extensive grazing. There is a feeling of timelessness, though no evidence of historical elements are found in the photo. There are no signs of intrusive elements in the landscape. *Source:* Photo by Åsa Ode.

landscape attributes apparent in the images. From the figures, we can see that contrasting concepts (e.g. coherence – disturbance; stewardship – naturalness) are not always at opposite ends of the scale. The examples illustrate how combinations of these concepts manage to capture and describe different aspects of the visual landscape.

Non-linear Relationships between Concepts and Visual Quality

The interpretation of the expression of each concept in the figures does not reflect absolute measures, but more an illustration of how combinations of concepts differ between landscapes. This is likely to be a useful tool in characterizing the visual landscape. We emphasize that these are not normative scales that can be interpreted as the higher the value, the higher the visual quality. Increasing values in some concepts may mean increased visual quality, or they may be related to visual quality up to a threshold and then decrease. For example, increasing stewardship may lead to increased visual quality, up to a point. After this, it may be perceived as too ordered or unnatural and hence visual quality may decrease. Knowledge concerning how changes in landscape structural attributes affect perceived visual quality in different contexts is urgently required for assessing the impacts of landscape change.

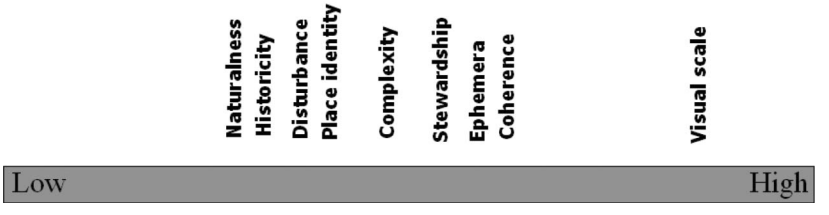

Figure 4. An agricultural landscape in Zealand, Denmark. This landscape is a flat agricultural landscape, providing high visibility and a fairly low degree of naturalness. The intrusion of roads and power lines represents limited disturbance and a certain degree of coherence remains. The mixture of different types of farming provides a degree of complexity, stewardship and ephemera through seasonal changes. The landscape has only limited signs of a history through buildings. *Source:* Photo by Åsa Ode.

Context-Dependent Concepts

The relative importance or weighting of the different concepts in shaping perceived visual quality will depend on the context. Purcell *et al*. (2001) showed this context dependency for landscape types. An investigation into perceived naturalness of different landscape types in the Netherlands showed that what is perceived as natural in an urban setting might not be seen as such in a rural setting (de Groot & van den Born, 2003). Regarding disturbance, the context of introduced elements will determine the visual impact perceived by the viewer. In preference studies, modern scenes with human dominance and urban elements lacking visual integration in the existing landscape character tend to be the least preferred (Strumse, 1994b).

Observer-Dependent Concepts

The interrelationships between the concepts and how they work together in shaping visual landscape quality will also depend on the observer. Visual concepts are given different relative weights by different people and according to the purpose of the observation. An ecologist might, for example, give a higher weighting to naturalness than to historicity, whereas an archaeologist assessing the same landscape might do

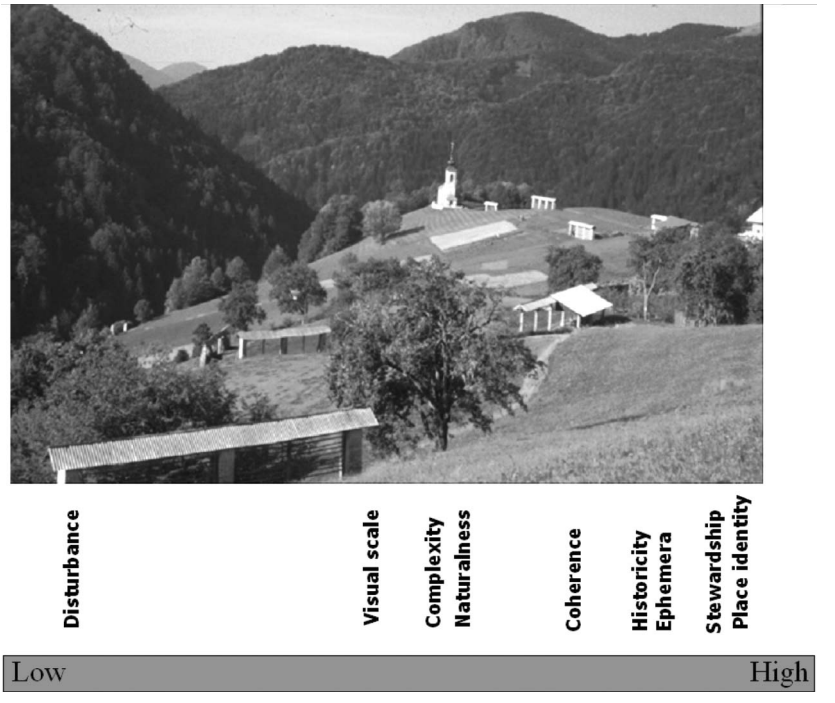

Figure 5. A Slovenian mountain landscape. This is a mountain landscape with a strong imageability and historicity related to the church and traditional agricultural structures. The neatness and tidiness, together with the presence of well-tended elements and crop fields, are strong visual cues of stewardship. The broadleaved forest, together with the grazed and small crop fields, provides a high degree of ephemera. The mix between well-managed areas and the broadleaved forest gives a limited degree of complexity and naturalness, and there is a fairly high degree of coherence in the landscape. The vegetation, together with the landform, limits visibility and hence visual scale. There are no intrusive elements in the scene and hence a low degree of disturbance. *Source:* Photo by Åsa Ode.

the opposite. Some visual concepts are probably less sensitive to cultural and personal background than others. Theory and empirical preference studies suggest that some key drivers of visual landscape experience are general, such as features related to visual scale (openness) or complexity (readability) (see, for example, Appleton, 1975; Kaplan & Kaplan, 1989). On the other hand, the relative importance of concepts like historicity and imageability in determining visual quality is probably more dependent on the personal and cultural attributes of the observer.

Effects on Landscape Preferences

Even though the visual concepts presented are descriptive rather than normative, theory suggests that there is a relationship between the visual concepts and human landscape preferences. The literature provides us with an indication of the nature of this relationship for some of the concepts, but further empirical evidence is urgently needed. For instance, studies have shown that preferences increase with increasing stewardship (Nassauer, 1997) and naturalness (Hägerhäll *et al.*, 2004). Further

testing of the effects of landscape changes on human landscape preferences is necessary in order to use the framework for assessing visual quality.

Conclusion

We have identified nine visual concepts and for each of them described four levels of abstraction down to their physical expression in the landscape. This framework provides a transparent and theory-based framework for assessing visual character. The framework can be a useful first step in establishing visual indicators that can help us to quantify, measure and compare landscapes and the effects of landscape change on visual character. This strengthening of the conceptual basis for landscape assessment is important, as it increases the understanding of what we want visual indicators to show.

During our work on investigating the conceptual base for visual assessment, we have identified a wide range of currently used visual indicators. However, the empirical testing of many of these visual indicators is lacking. We see a necessity to test the applicability of visual indicators in different contexts and landscape types, in order to be able to provide a comprehensive framework for landscape assessment, including the development of visual indicators. We suggest that this should be the emphasis of further studies on visual landscape assessment and aesthetic qualities of landscapes.

Acknowledgements

This work has been funded by the EU-project VisuLands, QLRT-2001-01017. The authors would like to thank their partners in the VisuLands project for valuable input to the process of writing this paper and analysing visual concepts.

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