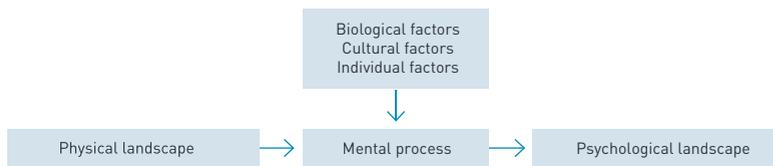


# PSYCHOLOGY OF THE VISUAL LANDSCAPE

## 2.1 INTRODUCTION

While environmental psychology is a leading discipline in the study of human responses to the visual landscape, various other disciplines contribute to our understanding of the psychological perception of landscape as well, such as human geography and sociology. Despite the disciplinary differences, all approaches share, explicitly or implicitly, three core assumptions (Jacobs, 2006: 47): (1) the way people perceive landscapes is influenced but not determined by physical landscape attributes, (2) a complex mental process of information reception and processing mediates between the physical landscape and the psychological landscape, and (3) various factors can exercise influence on this mental process, to be divided into biological, cultural and individual factors (Bourassa, 1990, 1991). Figure 1 illustrates these shared assumptions, and can be seen as a pre-disciplinary research model for studying the psychology of the visual landscape.

Disciplinary approaches differ with respect to the aspects of landscape perception under study (e.g. landscape preferences, meanings assigned to places), to the factors studied that influence landscape perception, and to the theories employed to explain how those factors influence landscape perception.



**Figure 1**  
**A default pre-disciplinary landscape perception research model**

This chapter presents contributions of various disciplinary approaches to the study of psychological responses to the visual landscape. Rather than giving a comprehensive overview, which would require a lengthy chapter (see Jacobs, 2006: chapter 4, for an elaborated overview), the aims are to present examples of approaches that stress biological, cultural and individual factors to explain the constitution of the psychological landscape (i.e. how landscape perception and experience come into being), to emphasise Dutch contributions within this framework, and to discuss the various bodies of knowledge in the face of GIS systems that support landscape policy, planning and design. To do so, the next three sections deal with examples of research into landscape perception devoted to biological, cultural and individual factors respectively. In the conclusion, the applicability of the various bodies of knowledge to developing GIS based support systems for landscape policy, planning and design will be discussed.

## 2.2 BIOLOGICAL FACTORS

The term ‘biological factors’ denotes innate dispositions that are evolutionarily determined and fixed in our genetic make-up. Adherents of the adaptive approach within environmental psychology contend that some landscape preferences are inborn as responses to physical landscape properties that have emerged in the course of biological evolution, because these responses enhanced survival (Saegert and Winkel, 1990). To appreciate this approach, a little understanding of the working of emotions is crucial. Generally, preferences are manifestations of emotions (LeDoux, 1996: 53; Jacobs, 2009): we tend to like objects or situations that invoke positive emotions (e.g. happiness), and tend to dislike objects and situations that invoke negative emotions (e.g. fear). Generic emotion research has demonstrated that many aspects of emotions are innate (Darwin, 1872; Ekman, 1992, 1999; LeDoux, 1996: 113). The innate aspects include some emotional bodily reactions, such as an increased heartbeat or the tendency to freeze in the case of fear. These responses were beneficial to the survival of organisms, for their adaptive value in dealing with fundamental life tasks (Damasio, 2001: 60; LeDoux, 1996: 40; Ekman, 1999). The tendency to freeze decreases the likelihood of being

spotted by a predator (predators typically react to movement), and the increased heartbeat prepares the body for a flight reaction (Jacobs, 2009). Research has also demonstrated that some stimuli automatically lead to emotional responses, without any previous learning being involved (Jacobs, 2006: 171). For example, rats that are being raised in isolation in a laboratory, never having seen a cat, show fear responses when exposed to a cat (LeDoux, 1996: 132). The advantage of automatically responding with an emotional reaction to some stimuli is that this response is quick: if an antelope would have to figure out the situation when it faces a lion, the antelope would be the lion's lunch (Jacobs, 2009). Thus, the emotional system has evolved as an adaptive system that serves survival, and includes automatic responses to some objects and situations.

The adaptive approach is concerned with these automatic, innate, quick, emotional responses (Ulrich, 1983). Since the environment is crucial for survival, it is very likely, within the framework of general evolution theory, that we have innate predispositions related to certain aspects of our environment. Genes that predispose us to particular emotional reactions to certain landscape attributes have survived in the course of evolution because those reactions have turned out to be adaptive responses to situations of life importance for human beings. Thus, innate landscape preferences are preferences for landscapes that were beneficial for our distant ancestors (but not necessarily for us, because over the last couple of thousand years, since the advent of agriculture 10.000 years ago, humans have created artificial environments at a pace that is much faster than our genetic make-up can adapt to).

The first theoretical accounts of biologically determined landscape preferences were based on the arousal theory, a general motivation theory developed by Berlyne to explain why people are inclined to stick to certain situations for a longer period of time than to other situations. Something (an artwork, a situation, a landscape) has a positive hedonic value if it is pleasant and rewarding to keep in touch with it (Berlyne, 1974: 8). For example, landscapes highly preferred by people have a high positive hedonic value. The stimuli that constitute an optimal hedonic value are a mixture of arousal-increasing and arousal-decreasing properties (arousal being the general level of excitement or activation). These stimuli make it cognitively difficult to understand the situation, but at the same time make it possible to resolve the problem. Thus, an optimal arousal potential trains our cognitive skills to resolve problems, and these are capacities we need to survive (Berlyne, 1971). While the complete arousal theory is a lot more complex (Berlyne, 1971, 1973, 1974), early environmental psychologists have used the rather simplified version as explained here. Wohlwill (1976) compared the results of then published environmental psychological research with Berlyne's theory, and found a relation between landscape preference and the degree of mystery. He also found a relation with the degree to which different landscape features fit to each other (Porteous, 1996: 119; Wohlwill, 1976).

Kaplan and Kaplan assert that landscape preferences are ‘ancient and far-reaching’ (Kaplan and Kaplan, 1989: 10), and have developed the preference matrix to explain for which landscapes we have innate preferences. The preference matrix globally resonates with Berlyne’s theory and describes the conditions that optimise the possibility to gain knowledge of the surrounding landscape. Gaining knowledge of a landscape depends on four factors: coherence, legibility, complexity and mystery (Kaplan and Kaplan, 1983, 1989: 53; Kaplan, 1987). According to Kaplan and Kaplan, we prefer those landscapes that score high values on all four factors. Coherence and legibility facilitate understanding a scene. Enough complexity makes a scene interesting, and mystery raises the expectation that there is more to learn about the scene. These four factors as such are not biological factors, but reflect perceptual factors that give the best opportunities to obtain the knowledge that is needed for survival. Thus, the biological factor in this theory is the assertion that liking those landscapes that foster obtaining knowledge trains the cognitive system, and thus contributes to survival. Kaplan and Kaplan (1989) report eleven empirical studies that have tested their theory: coherence and mystery appeared significant predictors of landscape preferences in most of these studies, while complexity and legibility were significant in only one study.

The theories of Berlyne and Kaplan and Kaplan share the assumption that we have evolutionarily developed preferences because they serve optimal cognitive functioning. This explanation, however, is very problematic in the face of recent progress in generic emotion research. Comparative phylogenetic research has demonstrated that the emotional system came into being at a much earlier stage in evolution than the cognitive system did (LeDoux, 2000). Therefore, the emotional system cannot be an adaptation to exercise cognitive capacities (Jacobs, 2006: 199). Explanations for innate landscape preferences must be much easier than the ones offered by Berlyne, and Kaplan and Kaplan. We have innate landscape preferences not because certain landscapes contribute to optimal cognitive functioning, but because certain landscapes have features that immediately serve survival. From this perspective, Appleton’s prospect-refuge theory is a better explanation for innate preferences.

According to Appleton (1984, 1996), the relationship of the human subject to the perceived environment is comparable to the relationship of an animal to its habitat. The innate human preference for landscape features is a spontaneous reaction to the landscape as a habitat (Appleton, 1975: 70). To put it simply: we prefer those landscapes that offered our primitive ancestors the best chances of survival (Appleton, 1975; Orians, 1986). We like to see without being seen: we prefer landscapes that allow us to hide, as well as to survey the environment. Our ancestors - hunters and gatherers - needed to be able to hide from large predators. They also needed to be able to survey the landscape, in order to gather vegetables and hunt for prey. Appleton’s prospect-refuge theory states that landscapes that provide both prospect and refuge opportunities are highly preferred, because they met the biological needs of our distant

ancestors. Thus, half open landscapes would be preferred over open landscapes or closed landscapes, an assertion that is corroborated by empirical findings. These empirical findings, however, do not necessarily determine whether Appleton's explanation rings true, as alternative explanations are still possible (e.g. half open landscapes often provide an optimal mix of coherence and mystery).

In addition to half-openness, an abundance of vegetation and an abundance of water are thought to be landscape properties for which we have an innate preference (e.g. Schroeder and Daniel, 1981; Ulrich, 1981, 1983, 1993; Yang and Brown, 1992). These innate preferences are easy to explain: we need water to survive, and the presence of vegetation often indicates the presence of food, water and a place to hide. Some scholars have suggested that we have an innate preference for nature (e.g. Herzog, 1989, 1992; Schroeder, 1991; Ulrich, 1993; Zube, 1991). However, it is highly unlikely that this hypothesis is true. Firstly, it contradicts the findings of historians who revealed that, during the Middle Ages, people disliked nature (Corbin, 1989; Lemaire, 1970). Secondly, because the hypothesis of an innate preference for nature contradicts basic premises of the evolutionary approach itself. The genetic make-up of humans does not change fast. We must theorise what the benefit has been for our distant ancestors – i.e. a hundred thousand years ago – to explain innate preferences. In those days, the whole environment was natural. Hence, there was no evolutionary benefit at all for our ancestors to have genes that predispose us to a preference for nature. Probably, those who argue that we have an innate preference for nature conflate nature with vegetation. While natural landscapes often contain more vegetation than human-made landscapes, it is the vegetation, not the naturalness, which triggers inborn mental dispositions to like those landscapes. To conclude, theoretically, it is very likely that we have innate preferences for half-open landscapes, and for landscapes with vegetation and water, as empirical studies indicate. While extensive cross-cultural research is absent, studies in various countries corroborate these assertions. Importantly, nobody argues that landscape preferences are solely based on innate dispositions: learning during the course of life affects those preferences as well.

## 2.3 CULTURAL FACTORS

While landscape perception and appreciation are in the end individual mental phenomena, culture exercises great influence on the individual mind, and hence, might explain certain experiential dispositions towards landscapes. Lehman et al. (2004) conclude in their review study on psychology and culture that “much recent research has demonstrated the strength of culture in influencing the perceptions, construals, thoughts, feelings, and behaviours of its members”. Culture consists of a set of collective views and habits (Jacobs, 2006: 143). Culture influences individual minds by means of public expressions: any material sign that can be

used to convey a message from one mind to another, which include written and spoken words, paintings, videos, body language, et cetera (Jacobs, 2006: 151). An individual, living in a culture, is exposed to a perpetual stream of public expressions that might influence his thoughts about the object the public expressions expound on. For example, all individuals in western culture get socialised into a certain view on nature by means of public expressions about the way nature works (e.g. texts on ecosystem theory), what nature looks like (e.g. paintings, TV documentaries), and what kind of experiences people have had in natural settings (e.g. poems, conversations) (Jacobs, 2006: 152).

Although many sociological and anthropological studies are somehow related to places (since social processes are often intimately related to places), sociological and anthropological studies and theories are seldom explicitly about place or landscape experiences (Gieryn, 2000). This is a logical consequence of the object of the studies conducted by sociologists: social processes and structures.

The bond between community and landscape is studied in anthropological work (Hirsch and O' Hanlon, 1996). For example, van Assche (2004) and Duineveld (2006) describe the various bonds between images of places and self-definitions of communities. These works focus on discourse, regarded as the production of meaning, that includes images of reality out-there as well as images of self (van Assche, 2004; Duineveld, 2006). In this approach, landscape experience is seen as dependent on discourse, for in discourse, ideas and meanings are conveyed between individuals.

Several historians have studied diachronic changes in the way people ascribe meaning to landscape and nature (e.g. Schama, 1995; Corbin, 1989; Pyne, 1998). According to de Groot (1999), for our distant ancestors – hunters and gatherers without a permanent residence – nature was taken for granted as the immediate, omnipresent religious universe. Trees and stones were thought to be animated. In that time, nature and culture were not separated. As agriculture entered human history, people built permanent settlements. Man projected intentions onto places; for example, a place has to be a field to grow corn. Nature and culture became divided. Nature appeared as a disorderly thread, producing plagues, weeds and vermin. Nature was an enemy of man (de Groot, 1999). For example, in the Middle Ages the ocean was regarded as the chaotic domain of the devil, abandoned by god, inhabited by sea monsters and ruled by chaos and death (Corbin, 1989). In the modern era, man started to master nature by using technical innovations (de Groot, 1999). The fear of primeval nature slowly faded. Writers, explorers, philosophers and painters constructed a romantic image of nature. The appreciation of nature, then, is a typical product of modern western culture.

Historians pay little attention to the diversity of ideas in a particular space of time. Moreover, historical research is often limited to the ideas of the upper class, such as writers, statesmen, painters, scientists and explorers. Little is known about the ideas of laymen. Since the 1990s, several Dutch philosophers and sociologists have been investigating images of nature amongst the public. Images of nature are complex formations of meanings, functioning as overall frames of mind, that structure the perception and valuation of nature (Buijs, 2000; 2009; Jacobs et al., 2002; Keulartz et al., 2000). This formation of meanings includes a cognitive dimension (what nature is), a normative dimension (how to act towards nature) and an expressive dimension (what the experiential values of nature are) (Keulartz et al., 2004). In different images of nature, a particular natural phenomenon can be given different meanings. For example, the ocean can be seen as primeval nature by people who have a particular image of nature. For people who have another image, the same ocean can be seen as space that provides leisure opportunities. Buijs (2009) has revealed five different images of nature amongst the Dutch public: the wilderness image, the autonomic image, the inclusive image, the aesthetic image and the functional image. People with a wild image of nature regard only nature that is untouched by man to be 'real' nature; they consider it not right to exploit nature for human purposes and regard rough nature without traces of human use the most beautiful. At the other end of the spectrum, people who have a functional image of nature consider nature that is highly influenced by man nature as well, consider it right to use nature for human purposes and consider nature ordered by man to be the most beautiful. The other images fall in between these extreme images. For example, people with an inclusive image consider everything to be nature as long as it grows spontaneously. In this image, man is allowed to intervene in nature, but not too much. Nature that expresses peaceful coexistence between man and nature is regarded as beautiful. The results of other empirical studies (Jacobs et al. 2002; Keulartz et al., 2004, van den Born et al., 2001) resonate with the findings of Buijs.

Based on more than 20 years of landscape perception research in many areas in the Netherlands, Coeterier (2000) argues that, within local cultures, inhabitants develop a special way of looking at the surrounding landscape. Often, a leading theme, which depends on the specific landscape, guides this way of looking. For example, in one region he found that the predominant theme for people was to divide the landscape into a front, consisting of paved roads where housing and human activities are concentrated, and a back, unpaved drives where nature and silence were to be found. This leading theme comprises the nature of the landscape as a whole and its function. Furthermore, Coeterier (1996, 2000) has found that other important attributes that determine landscape perception and evaluation by inhabitants are maintenance, naturalness, spaciousness, development in time, soil and water, and sensory qualities. These attributes are abstract perceptual qualities, and the way people fill them in depends on the leading theme. Thus, Coeterier developed a system of categories that determine a local culture's way of assessing landscape.

The individual mind is permeated with culture. Historical, sociological, and anthropological studies into landscape have demonstrated cultural influences on the way people perceive categories of places (e.g. natural places) and particular places (e.g. a specific region). Individuals are members of different cultural communities on different levels. As members of a global western culture they might be socialised into a general appreciation of nature, as historians have shown. As members of a national culture, they might be influenced by national discourse, e.g. the Dutch discourse of fighting against water, or the Polish discourse in which the forest is given a specific nationalistic connotation since the forest was the place where resistance to foreign powers started (Schama, 1995). As members of a local culture, people might gradually adopt a specific way of assessing the place they inhabit. Cultural influence, then, is a multi-layered set of influences.

## 2.4 INDIVIDUAL FACTORS

Next to biological factors, which point to cross-cultural commonalities in landscape perception, and cultural factors, that indicate meanings assigned to landscape that are shared within a cultural group and which may vary across groups and across time, the way a person perceives landscapes also depends on individual factors: mental dispositions that result from individual previous experiences or differences in personality traits. Think of a garden. According to the adaptive approach, someone's preference for the garden is predictable on the basis of general, non-individual factors, for example because it is a good mix of prospect and refuge opportunities (Appleton, 1975) or because it is complex, mysterious, legible and coherent (Kaplan and Kaplan, 1989). According to the images of nature approach, different people might appreciate the garden differently, dependent on their image. Apart from that, the garden can have special meanings for its owner and it can have a particular identity for people who visit it often. During the course of life, people give meaning to particular places and become attached to places (Tuan, 1980).

Previous experiences, and especially recurring patterns in previous experiences, leave traces in the human brain, which is highly plastic (open to change) in nature. Psychologically, these traces can be called mental concepts: enduring elementary mental structures, which are capable of playing discriminatory and inferential roles in an individual's life, in the sense of influencing various mental operations (Jacobs, 2006: 124). Neurologically, these mental concepts are constituted by specific neural circuits. The neural mechanisms for acquiring new mental concepts are unravelled by Kandel (2001): "our studies provide clear evidence that learning results from changes in the strength of the synaptic connections between precisely interconnected cells". He demonstrated that learning new concepts is established by the building of new specific circuits in the brain. These concepts play a crucial role in perception. Perception

is the experience of a meaningful image, based on sensory input. While sensations as such are chaotic, we organise the incoming raw information with help of mental concepts (Jacobs, 2006: 124). It is of importance that we have many mental concepts – probably millions. We have mental concepts for different categories e.g., for the tree it could be beauty, but also we then have more particular concepts, e.g. for that specific tree in your back yard it could be the place you were raised, and then mental concepts that relate to specific events, e.g. your tenth birthday. Mental concepts are mutually connected. Thus, somebody's mental concept for a specific place might become connected with mental concepts that represent personal memories of that place, mental concepts that denote general knowledge of that place, mental concepts that reflect value judgements, et cetera. Thus, people gradually develop networks of place meanings. Someone's sense of place is the specific network of mental concepts that is connected to his/her mental concept for a particular place – a network of mental concepts that specifies a place as a particular place for the subject, one that is distinct from other places. Subjects have a sense of place for a particular place as soon as specific mental concepts or specific combinations of mental concepts for the particular place have been created in their minds. By perceiving the particular place, or by thinking about it, the network of specific mental concepts, or parts of it, may be activated, thus contributing to a specific experience of place for the subject. Not all mental concepts that make up someone's sense of place are experienced during a particular experience of a particular place. Experiences and memories of a place may be different every time for an individual subject. And sometimes hardly any of the mental concepts that make up someone's sense of place may be part of his experience. It is not necessary at all to receive stimuli from the particular place for the mental concepts that constitute a sense of place to be activated. One may just think about the place while being elsewhere, or a sense of place may play a role in experience when seeing other places that resemble properties of a particular place, even if one is not consciously aware of this association.

In human geography, the study of the meanings that people assign to places is often labeled the concept of sense of place (Manzo, 2005; Patterson and Williams, 2005). Sense of place – understood as the total collection of meanings that people assign to a particular place (Jorgensen and Stedman, 2001) – is thus an overarching concept (Hay, 1998; Shamai, 1991) that includes all meanings an individual assigns to a place. The concept of place meaning is a broad concept that stresses any form in which a person is related to a place, for example, ways of using a place, aesthetic values, feelings of belonging, emotional attachment, memories of a place, or knowledge of a place. Importantly, place meanings are properties of subjects; the meanings are assigned to places, or features of places, by people (Manzo, 2005). Some scholars consider sense of place a holistic concept, and are therefore reluctant to distinguish between its components or dimensions (e.g. Relph, 1976; Tuan, 1980). Others have distinguished sense of place dimensions, such as cognitive, affective, and behavioral or conative meanings (Altman and Low, 1992). A compatible distinction between attachment to (emo-

tional bonds with the place), dependence on (perceived behavioral advantage of a place), and identification with (the role of the place in overall self-identity), is used to develop and test a psychometric scale for quantitative measurements of sense of place (Jorgensen and Stedman, 2001, 2006). These dimensions are based on an abstract theoretical distinction that goes back to Plato (Ajzen, 2001), who argued that man has three basic psychological faculties, viz. knowing (cognitive domain), feeling (affective domain), and willing (conative domain). In a similar vein, the two components of place dependence and place identity were measured in a psychometric approach to place attachment (Williams and Vaske, 2003). Jacobs and Buijs (2010) adopted a different approach to reveal various dimensions of sense of place. Instead of a theoretically determined categorisation, they formulated dimensions on the basis of an open, in-depth account of people's place meanings as elicited in two studies. Five categories of abstract place meanings emerged from the data-driven analysis: beauty (place meanings related to aesthetic judgments), functionality (place meanings that express ways of using the landscape), attachment (place meanings that convey belonging relations between subjects and the place), biodiversity (place meanings pertaining to species and nature), and risk (place meanings that articulate worries about current or expected problems). These categories of abstract place meanings, that considerably overlap with categories revealed by other studies (e.g. Tunstall et al., 2000; Davenport and Anderson, 2005), represent aspects of place that stand out to people.

Apart from individually developed place meanings that guide the way people perceive particular landscapes, individual variation in landscape perception can also result from differences in personality traits. While the effects of personality traits are not yet extensively studied, van den Berg and Winsum-Westra (2010) have demonstrated that a personal need for structure is positively correlated with the perceived beauty of manicured allotment gardens, and negatively with the perceived beauty of wild allotment gardens.

## 2.5 APPLICABILITY TO GIS SUPPORT SYSTEMS

The division into biological, cultural and individual factors is not only useful to appreciate various bodies of scientific knowledge about the psychology of the landscape, but is also a good basis to discuss GIS based instruments for landscape policy, planning and design. Note that, related to the subject of this chapter only GIS systems that somehow incorporate psychological values pertaining to the visual landscape will be discussed here. Theoretically, we can divide all planning support mindscape inclusive GIS systems into two types: closed systems, which have a set of fixed values that represent characteristics of mindscape, and open systems, in which values that represent mindscape properties can be moderated by the users of the system. The GIS-based landscape appreciation model (GLAM) that is presented

in chapter six of this book is an example of a closed system. In this model, fixed values (based on empirical studies), that express average landscape appreciation by the Dutch public, are assigned to landscape attributes that are represented in GIS databases. Closed models like GLAM can be useful for landscape policy and eventually for large scale landscape planning. When the values that represent appreciation are fixed, it is possible to produce estimates of landscape appreciation without actually measuring it in each and every different place. These estimates can be used to monitor landscape changes in landscape appreciation over time (based on comparing two GIS datasets that represent the physical landscape at different points in time). Thus, national policy makers can for example learn whether their efforts are successful in terms of landscape attractiveness. In large scale planning contexts (e.g. the Ecological Main Structure in the Netherlands), planners might estimate attractiveness based on GIS data that represent the future situation, and thus perform *ex ante* evaluation, using a closed mindscape inclusive GIS instrument like GLAM.

Of course, a closed mindscape inclusive GIS instrument faces constraints by necessity. Because the values are fixed, only values that reflect landscape preferences that are pretty similar in most people are suitable. Thus, only landscape preferences that are manifestations of either biological factors (more or less the same in all individuals) or high-level (e.g. on the scale of a nation) cultural factors (more or less the same amongst the inhabitants of a country) are useful. Landscape preferences that are based on lower level cultural factors (e.g. local communities), or individual factors cannot be catered for by closed systems, since these preferences would vary across small groups or individuals and thus not be feasible to be expressed as average values. As a consequence, closed systems are not useful for planning and designing intermediate or small-scale local spatial interventions, since differences across groups of people and individuals are often at stake.

In those situations, an open GIS system that can incorporate mindscape characteristics could support planning and design. In an open system, different stakeholders could express their unique special place meanings, bonds with landscape features, or landscape preferences, and assign those mental dispositions as values to specific physical landscape attributes represented in GIS databases. Since an open system is flexible with respect to assigning values to physical landscape attributes it can cater for different groups of people with different opinions and preferences. Such a system could be used in collaborative planning exercises, for example to get a mutual understanding of the consequences of various future scenarios for the mindscapes of different people who are affected, and thus looking for options that most people would be able to agree with.

## 2.6 CONCLUSION

The psychology of landscape – the way the landscape is perceived, experienced and appreciated by the subject – is studied by several scientific disciplines, even by disciplines that do not primarily focus on the individual mind, but on culturally shared meanings or images. The preceding sections presented a short overview, in which some Dutch contributions are emphasised. The Dutch contributions together do not form a separate approach that is distinctive from the international literature. Various Dutch contributions stress different aspects of landscape perception, without being mutually connected by a shared theoretical framework. This reflects the study of the psychology of landscape in general, that is fragmented and dispersed across disciplines. A generic body of theoretical and empirical insights that is generally accepted has not emerged. Rather, there is an abundance of theories, each carrying little explanatory weight, and cross-disciplinary debate is rare. This probably reflects the complex underpinnings of perceiving landscapes, in which numerous factors play a role. Nonetheless, some insights are shared by most scholars involved in landscape perception research. First, psychological responses to landscape are partly innate. Convergent results indicate we have innate preferences for half-open landscapes, and for landscapes with vegetation and water. There are, however, different specific explanations that stress why we are evolutionarily inclined to respond to landscapes in certain ways: the arousal theory, preference matrix, and prospect-refuge theory being examples. Empirical studies have not yet sorted out convincingly which of the specific evolutionary explanations is most adequate. Second, learning, both on the cultural or individual level, plays a role in psychological responses to landscape as well. Even those who address biological factors often emphasise that learning influences landscape perception. Which factors are most important, depends on context. In psychological responses toward landscape scenes not encountered before, biological factors probably play a predominant role. For familiar scenes, cultural and individual factors, which result in assigning meaning to landscapes, come to the fore.

## REFERENCES

- Ajzen, I. (2001) Nature and operation of attitudes. *Annual Review of Psychology* 52(1); 27-58
- Altman, I., and Low, S. (1992) *Place attachment*. New York, Plenum Press.
- Appleton, J. (1975) *The experience of landscape*. London, Wiley.
- Appleton, J. (1984) Prospects and refuges revisited. *Landscape Journal* 8; 91-103
- Appleton, J. (1996) *The experience of Landscape*. Chichester etc., Wiley.
- Assche, K. van (2004) *Signs in time*. Wageningen, Wageningen University.
- Berg, A. E. van den, and Winsum-Westra, M. (2010) Manicured, romantic or wild? The relation between need for structure and preference for garden styles. *Urban Forestry & Urban Greening*, in press.
- Berlyne, D. E. (1971) *Aesthetics and psychology*. New York, Appleton Century Crofts.
- Berlyne, D. E. (1973) The vicissitudes of aplopathematic and thelematoscopic pneumatology (or the hydrography of hedonism). In: Berlyne, D. E., and Madsen, K. B. (eds.) *Pleasure, reward, preference: their nature, determinants, and role in behavior*. New York/London, Academic Press.
- Berlyne, D. E. (1974) *Studies in the new experimental aesthetics: steps toward an objective psychology of aesthetic appreciation*. New York, Wiley and Sons.
- Born, R. J. G. van den, Lenders, R. H. J., Groot, W. T. de, and Huijsman, E. (2001) The new biophilia: an exploration of visions of nature in Western countries. *Environmental Conservation* 28(1); 65-75
- Bourassa, S. C. (1990) A paradigm for landscape aesthetics. *Environment and behavior* 22(6); 787-812
- Bourassa, S. C. (1991) *The aesthetics of landscape*. London/New York, Belhaven Press.
- Buijs, A. E. (2000) Natuurbeelden van de Nederlandse bevolking. *Landschap* 17(2); 97-112
- Buijs, A. E. (2009) Lay people's images of nature: Comprehensive frameworks of values, beliefs and value orientations. *Society & Natural Resources* 22(5); 417-432
- Coeterier, J. F. (2000) *Hoe beleven wij onze omgeving? Resultaten van 25 jaar omgevingspsychologisch onderzoek in stad en landschap*. Wageningen, Alterra
- Corbin, A. (1989) *Het verlangen naar de kust*. Nijmegen: Sun.
- Damasio, A. (2001/1999) *Ik voel dus ik ben (the feeling of what happens)*. Amsterdam, Uitgeverij Wereldbibliotheek.
- Darwin, C. (1965/1872) *The expression of emotions in man and animals*. Chicago, Chicago University Press.
- Davenport, M. A., and Anderson, D. H. (2005) Getting from sense of place to place-based management: An interpretive investigation of place meanings and perceptions of landscape change. *Society & Natural Resources* 18(7); 625 - 641
- Duineveld, M. (2006) Van oude dingen, de mensen, die voorbij gaan. Amsterdam, Eburon.
- Ekman, P. (1992) An argument for basic emotions. *Cognition and Emotion* 6; 169-200
- Ekman, P. (1999) Basic emotions. In: Dalglish, T., and Power, M. (eds.) *Handbook of cognition and emotion*. Sussex, John Wiley & Sons, pp 45-60
- Gieryn, T. F. (2000) A space for place in sociology. *Annual Review of Sociology* 26; 463-496
- Groot, W. T. de (1999) *Van vriend naar vijand naar verslagene en verder*. Nijmegen, Nijmegen University Press.
- Hay, R. (1998) Sense of place in developmental context. *Journal of Environmental Psychology* 18(1); 5-29
- Herzog, T. R. (1992) A cognitive analysis of preference for urban nature. *Journal of Environmental Psychology* 9; 27-43
- Herzog, T. R. (1992) A cognitive analysis of preference for urban spaces. *Journal of Environmental Psychology* 12; 237-248
- Hirsch, E., and O' Hanlon, M. (1996) *The anthropology of landscape*. Oxford, University Press.
- Jacobs, M. H. (2006) *The production of mindscapes*. Wageningen, Wageningen University.
- Jacobs, M. H. (2009) Why do we like or dislike animals? *Human Dimensions of Wildlife* 14(1); 1-11
- Jacobs, M. H., Berg, A. E. van den, Langers, F., Kralingen, R. B. A. S., and Vries, S. de (2002) *Waterbeelden. Een studie naar de beelden van waternatuur onder medewerkers van Rijkswaterstaat*. Wageningen, Alterra.
- Jacobs, M. H., and Buijs, A. E. (2010) Understanding stakeholders' toward water management interventions: the role of place meanings. *Water Resources Research*, in press.
- Jorgensen, B. S., and Stedman, R. C. (2001) Sense of place as an attitude: lakeshore owners' attitudes toward their properties. *Journal of Environmental Psychology* 21(3); 233-248
- Jorgensen, B. S., and Stedman, R. C. (2006) A comparative analysis of predictors of sense of place dimensions: Attachment to, dependence on, and identification with lakeshore properties. *Journal of Environmental Management* 79(3); 316-327
- Kandel, E. R. (2001) The Molecular Biology of Memory Storage: A Dialogue Between Genes and Synapses. *Science* 294(5544); 1030-1038
- Kaplan, R., and Kaplan, S. (1989) *The Experience of Nature. A Psychological Perspective*. Cambridge, Cambridge University Press.
- Kaplan, S. (1987) Aesthetics, affect, and cognition: environmental preferences from an evolutionary perspective. *Environment and Behavior* 19(1); 3-32
- Kaplan, S., and Kaplan, R. (1983) A model of person-environment compatibility. *Environment and Behavior* 15; 311-332
- Keulartz, J., Swart, S., and Windt, H. van de (2000) *Natuurbeelden en natuurbelied: Theoretische en empirische verkenningen*. Den Haag, NWO.
- Keulartz, J., Windt, H. van de, and Swart, S. (2004) Concepts of nature as communicative devices: the case of Dutch nature policy. *Environmental Values* 13; 81-99

- LeDoux, J. (1996) *The emotional brain: The mysterious underpinnings of emotional life*. New York, Touchstone.
- LeDoux, J. (2000) Emotion circuits in the brain. *Annual Review of Neuroscience* 23; 155-184
- Lehman, D. R., Chiu, C.Y., and Challer, M. (2004) Psychology and culture. *Annual Review of Psychology* 55; 689-714
- Lemaire, T. (1970) *Filosofie van het landschap*. Amsterdam, Boom.
- Manzo, L. C. (2005) For better or worse: Exploring multiple dimensions of place meaning. *Journal of Environmental Psychology* 25(1); 67-86
- Orians, G. (1986) An ecological and evolutionary approach to landscape aesthetics. In: Penning-Roswell, E. C., and Lowenthal, D. (eds.) *Landscape meanings and values*. London etc., Allen and Unwin.
- Patterson, M. E., and Williams, D. R. (2005) Maintaining research traditions on place: Diversity of thought and scientific progress. *Journal of Environmental Psychology* 25(4); 361-380
- Porteous, J. D. (1996) *Environmental aesthetics: ideas, politics and planning*. London, Routledge.
- Pyne, S. J. (1998) *How the canyon became grand. A short history*. New York etc., Penguin group.
- Relph, E. (1976) *Place and placelessness*. London, Pion.
- Saegert, S., and Winkel, G. (1990) Environmental psychology. *Annual Review of Psychology* 41; 441-477
- Schama, S. (1995) *Landschap en herinnering*. Amsterdam, Antwerpen, Uitgeverij Contact.
- Schroeder, H. W., and Daniel, T. C. (1981) Progress in predicting the perceived scenic beauty of forest landscapes. *Forest Science* 27; 71-80
- Schroeder, H. W. (1991) Preference and meaning of arboretum landscapes: Combining qualitative and quantitative data. *Journal of Environmental Psychology* 11; 2231-248
- Shamai, S. (1991) Sense of place: an empirical measurement. *Geoforum* 22(3); 347-358
- Tuan, Y.F. (1980) *Topophilia. A study of environmental perception, attitudes, and values*. Englewood Cliffs, New Jersey, Prentice-Hall Inc.
- Tunstall, S. M., Penning-Roswell, E. C., Tapsell, S. M., and Eden, S. E. (2000) River restoration: Public attitudes and expectations. *Water and Environment Journal* 14(5); 363-370
- Ulrich, R. S. (1981) Natural versus urban scenes: some psychophysiological effect. *Environment and Behavior* 13; 523-556
- Ulrich, R. S. (1983) Aesthetic and affective response to natural environment. In: Altman, I., and Wohlwill, J. F. (eds.) *Behavior and the natural environment*. New York, Plenum Press, pp 85-125
- Ulrich, R. S. (1993) Biophilia, biophobia, and natural landscapes. In: Kellert, S. R., and Wilson, E. (eds.) *The biophilia hypothesis*. Washington DC, Island Press, pp 73-137
- Williams, D. R., and Vaske, J. J. (2003) The measurement of place attachment: Validity and generalisability of a psychometric approach. *Forest Science* 49; 830-840
- Wohlwill, J. F. (1976) Environmental aesthetics: the environment as source of effect. In: Altman I., and Wohlwill, J. F. (eds.) *Human behaviour and environment*. New York, Plenum, pp 37-86
- Yang, B. E., and Brown, T. J. (1992) A cross-cultural comparison of preferences for landscape styles and landscape elements. *Environment and behavior* 24(4); 471-507
- Zube, E. H. (1991) Environmental psychology: Global issues, and local landscape research. *Journal of Environmental Psychology* 11; 321-224