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Landscape Perception

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1. Introduction

"... landscape is composed of not only of what lies before our eyes but what lies within our heads."

D.W. Meinig (1979)

Landscape, as a term, has been subject to a wide range of disciplines, such as art, history, geography, ecology, politics, planning and design. Although it has been associated with mainly physical features of an environment, today the term landscape refers to much more than just scenery. Landscape is a complex phenomenon which evolves continuously through time and space. It is a reflection of both natural processes and cultural changes throughout time. Landscapes can be a product of either only natural processes (natural landscapes) or human intervention on natural ecosystems (cultural landscapes). Nowadays, it is almost impossible to encounter with a natural landscape in our daily lives. Most of the natural landscapes have been modified by human activities. Hence, they are embedded with symbolic meanings of our societies' cultural diversity and identity. On the other hand, the deterioration of natural ecosystems has become an important issue in sustainable development, since we depend on natural resources to survive. Thus, as natural and cultural heritages, landscapes need to be protected and managed in the context of sustainability. In 2000, Council of Europe adopted the European Landscape Convention (ELC) to promote sustainable planning, protection and management of European landscapes. ELC defines landscape as:

"...an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors".

The definition of ELC puts an emphasis on the perceptual dimension of the landscape. Since landscape involves a subjective experience, it encompasses a perceptive, artistic and existential meaning (Antrop, 2005). Figure 1 shows the components of a landscape, which hence influence perception of the landscape. There is a mutual relationship between individual and the surrounding environment. People are intrinsically involved with their living environments to survive. They use and shape the physical environment to meet their physical and social needs. While environments are shaped by people, people are inspired and shaped by their environments as well. Thus, perception of the environment or the landscape has become an area of concern of various disciplines in order to understand and explain this interaction between people and their physical settings.

Perception is the process in which information is derived through senses, organized and interpreted. It is an active process which takes place between the organism and environment (Hilgard, 1951 in R. Kaplan & S. Kaplan, 1978). S. Kaplan (1975) states that information is central to organism's survival and essential in making sense out of the environment, to which perception is assumed to be oriented. Perception of our environment helps us to understand and react to our environment. Environmental perception is different to object perception in many ways (Forster, 2010; Ungar, 1999);

- The components of the environment are diverse and complex. Therefore perception of the environment is not immediate and it takes time.
- Scale affects perception of the environment. Environments are larger and, hence more complex systems.
- Environment surrounds people. Thus it is perceived and experienced from inside.
- Navigation skills are needed in environmental perception.
- People usually interact with their environment for a purpose. As a result, we select spatial information related to our purpose.

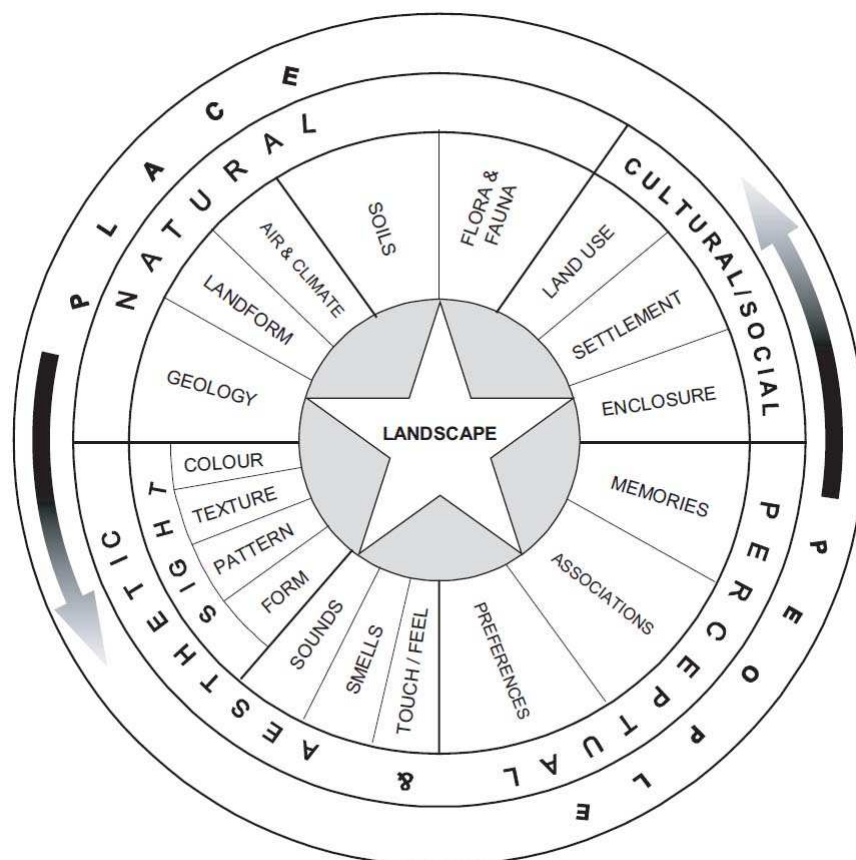


Fig. 1. What is landscape (Swanwick, 2002).

Porteous (1996) discusses that there are two basic modes of perception; autocentric, which is subject centered, and allocentric, which is object centered. He explains that sensory quality and pleasure are involved in autocentric senses, while allocentric senses involve attention and directionality. He states that vision (except color perception) is mostly autocentric, and most sounds (except speech sounds) are autocentric.

The perception of the physical environment is not merely a physiological phenomenon. It is also influenced by the individual's experiences, and both social and cultural factors. Knox and Marston (2003) points out that *"different cultural identities and status categories influence the ways in which people experience and understand their environments"*. Thus, perception of our surrounding environment is learnt, selective, dynamic, interactive and individual (Lee, 1973).

Theories of perception provide foundation for research in psychology. Environmental psychology is the branch of psychology which deals with relationships between physical environment and human behavior. It is a multidisciplinary field where perception of the environment is a fundamental subject. Environmental perception research includes topics such as cognitive mapping, landscape (environmental) preferences, way finding, restorative environments, all which should be considered in landscape planning and design. Landscape architecture aims to create livable, pleasant and sustainable outdoor environments. Although the findings of environmental psychology research can enlighten and influence landscape architects in context of research and practice, it is hard to say that a firm link has been established between two disciplines so far. There is a mutual relationship between people and their physical environments which influences each other. Thus, landscape architects must acknowledge that perception of the environment plays an essential role in comprehension of this relationship.

This chapter presents an overview to landscape (environmental) perception research in context of landscape planning and design. It discusses perception of the landscape based on two fundamental senses; sight and hearing. Firstly, theories and research methodology on visual perception and aesthetics will be presented in order to provide guidance for visual landscape design and planning. Secondly, the concept of soundscape will be briefly introduced and discussed to promote awareness on the importance of sound as a landscape element in design and planning.

2. Visual landscape perception

In landscape planning and environmental impact assessment studies, evaluation of visual landscape character is often based on assessment of physical characteristics of landscapes (such as topography, land cover etc.) and is done by experts. On the other hand public or user preferences are generally neglected. This section aims to present and provide understanding of psychophysical and cognitive dimensions of visual landscape perception for landscape designers and planners.

Although we receive spatial information through many of our senses (seeing, hearing, smelling and feeling) sight is assumed to be the most valued sense. More than 80% of our sensory input is through sight (Porteous, 1996). Hence, most of the environmental perception, and likewise landscape assessment studies, focus on visual dimension of the perception process. Assessment of landscape character is fundamental to decision making process in landscape planning. Landscape assessment is a tool for determination of landscape quality and provides a systematic analysis and classification for sustainable management of landscapes. Within this context, the criteria for landscape perception studies are mostly scenic beauty or preference (Palmer, 2003).

Landscapes are aesthetic objects. There isn't a universally accepted theory for landscape aesthetics. According to Maulan *et al.* (2006) neglect of scenic or preferred landscapes during development stage is one of the problems. Bourassa (1990) argues that landscape aesthetics is beyond the traditional theories of aesthetics. Based on Scruton's approach, he states that people experience and respond to the whole scene, therefore "*it is not relevant to speak of the aesthetics of individual objects in the landscape (e.g. buildings) without asking how those objects contribute to the wholes (landscapes) of which they are only parts*". For Bourassa (1988) there are two principles for landscape aesthetics, namely biological and cultural. The biological principle states that "*aesthetic pleasure in landscape derives from the dialectic of refuge and prospect*". On the other hand, "*aesthetic pleasure derives from a landscape that contributes to cultural identity and stability*". As a product of either natural processes or human intervention, natural and cultural landscapes involve intrinsic (objective) and artistic (subjective) aesthetic values. Thus, theories of aesthetics may provide a basis for landscape scenic beauty assessments. Brief history of aesthetics in philosophical context is given below.

2.1 A brief overview of history of aesthetics

Scenic beauty of the landscape or in a broader sense environmental aesthetics has been an area of concern for assessing visual quality of landscapes and landscape preferences. Although the involvement of aesthetics in environmental psychology and landscape assessment studies does not date back very far, it has been a subject for philosophy since ancient times. The word "aesthetic" is derived from *aisthanesthai*, Greek word for "to perceive" and *aistheta*, which means "perceptible objects" in Greek. The term "aesthetics" was first coined by Alexander Baumgarten, a German philosopher, in 1735. Before that, "beauty" was the focus of the aesthetical debates of philosophers.

The question of "what is beauty" has been central to theories of aesthetics since classical Greek times (Porteous, 1996). According to Socrates, (469-399 B.C.) there is a mutual connection between beauty, truth and symmetry (Hofstadter, 1979 in Barak-Erez & Shapira, 1999). He believed that beauty was desirable for youth and he linked beauty to being good and morality (Lothian, 1999). For Plato (427-347 B.C.), there is an "essential universe", the perfect universe; and there is the "perceived universe" where we perceive the reality through our senses as imperfect copies. Plato believed the beauty was an "idea" and the beauty we perceived in the "perceived universe" was not the real, original beauty, but just an imperfect copy. On the other hand, Aristotle (384-322 B.C.) discusses beauty in context of mathematics. He believed that beauty was associated with size and order, and there were three components of beauty; integrity (*integras*), consonance (*consonantia*), and clarity (*claritas*). Beauty was accepted as a sign of God's existence after Christianity emerged and during medieval times.

With Renaissance, approaches towards aesthetics in ancient Roman and Greek times returned back with the movement *Classicism*. In this period, beauty was associated with order, symmetry, proportion and balance. In the end of 17th century, modern aesthetics emerged in Britain and Germany. For John Locke (1632-1704); "*beauty consists of a certain composition of color and figure causing delight in the beholder*" (Carson, 2002) and therefore, it was a subjective quality. Likewise, British philosophers David Hume and Edmund Burke believed that aesthetics was a subjective concept. According to Hume (1711-1776), people decide whether an object was beautiful or not by their feelings. Burke (1729-1797) identified

beauty as a “social quality” and linked beauty with the feeling of affection, particularly toward the other sex. According to him, the feeling of the beautiful is grounded in our social nature (Vandenabeele, 2012). On the contrary, German philosopher Immanuel Kant’s (1724-1804) approach to aesthetic judgment was based on logic and deduction (Lothian, 1999). He believed aesthetic judgments were based on the feeling of pleasure and they were disinterested. Daniels (2008) explains disinterestedness as “... a genuine aesthetic judgment does not include any extrinsic considerations toward the object of judgment itself, such as political or utilitarian concerns”. Therefore, Kant claimed that aesthetic judgments were both subjective and universal. However, German philosophers Friedrich Schiller and Wilhelm Hegel rejected Kant’s subjective approach on aesthetics (Lothian, 1999). Schiller (1759-1805) claimed that beauty was the property of the object, thus aesthetic experience was rather objective. On the other hand, Hegel (1770-1831) believed that aesthetics was concerned with the beauty of art and beauty of art is higher than the beauty of nature. Like Schiller, for Hegel beauty was the property of the object. According to Baumgarten (1714-1762), who coined the term aesthetics, beauty is not connected to the feeling of pleasure or delight, indeed beauty is an intellectual category and perfection of sensitive cognition is a precondition for beauty (Gross, 2002). In 19th century, romanticism focused on nature as an aesthetic resource. In this period, landscape was viewed in objectivist terms and considered as having intrinsic qualities (Lothian, 1999). However, nature lost its importance as an aesthetic object by the end of 19th century and during the 20th century art has become the main concern for aesthetic debates.

George Santayana, Benedetto Croce, John Dewey and Susanne Langer are amongst the modern era philosophers on aesthetics. Spanish-American philosopher George Santayana (1863-1952) believed that beauty was a subjective concept, rather than objective. He defined beauty as the pleasure derived from perception of an object (Lothian, 1999). Croce (1866-1952) interprets aesthetics as an experience. For Croce, intuition is basis for the sense of beauty. Dewey’s (1859-1952) aesthetics is based on experience as well. In contrast to Kant’s disinterestedness principle, Dewey’s aesthetics require involvement and engagement (Lothian, 1999). While Dewey suggested that aesthetic experience was a biological response, Langer (1895-1985) strongly rejected this idea (Bourassa, 1988). Langer’s aesthetics is based on the concept of semblance. According to Langer, semblance of a thing is an aesthetic symbolic form which constitutes its direct aesthetic quality (Kruse, 2007).

Although philosophical theories of aesthetics may seem relatively relevant to landscape assessment, landscape planners and designers need to understand the fundamentals of aesthetic theories of art and nature in order to develop valid and efficient approaches towards evaluation of landscape aesthetics in context of landscape planning and design. According to Berleant (1992), the idea of environment possesses deep philosophical assumptions about our world and ourselves, thus the study of aesthetics and environment can provide mutual benefit in this changing world.

2.2 Theories on perception and preferences

2.2.1 The biophilia hypothesis

The biophilia hypothesis was developed by Edward O. Wilson, biologist in Harvard University, in 1984. The biophilia hypothesis proclaims that human beings have an inherent

need for affiliation with natural environments and other forms of life. Wilson suggests that preferences for natural environments have a biological foundation as a result of human's evolutionary process. Since human beings spent most of their evolutionary history in natural environments as hunters and gatherers, they have a hereditary inclination towards establishing an emotional bond with nature and other livings. Ulrich (1993) explains the proposition for biophilia as that during evolution certain rewards or advantages associated with natural settings were crucial for survival and humans acquired, and then retained, positive responses to unthreatening natural settings. He states that human's positive responses to natural settings in terms of such as liking, restoration and enhanced cognitive functioning might be influenced by biologically prepared learning. On the other hand, McVay (1993) questions whether biophilia hypothesis can influence our attitudes towards our world in a more environmental friendly manner. He emphasizes the need for realization of our evolutionary based need for affiliation with nature by everyone who shares the responsibility of human future.

2.2.2 Prospect-refuge theory

British geographer Appleton's prospect-refuge theory stems from his habitat theory which proposes that human beings experience pleasure and satisfaction with landscapes that responds to their biological needs (Porteous, 1996). Appleton's habitat theory basically depends on Darwin's habitat theory, but with an aesthetical dimension. For Appleton, aesthetic satisfaction is "a spontaneous reaction to landscape as a habitat" (Porteous, 1996). On the other hand, prospect-refuge theory is about preferences for landscapes which provide "prospect" and "refuge" opportunities. Prospect-refuge theory is based on human's urge to feel safe and to survive. During our evolutionary past as hunters and gatherers, a broader sight of view and opportunities to hide when in danger were essential for survival. Thus, Appleton believes that we intrinsically tend to prefer environments where we can observe and hide. However, ironically, the places with prospect and refuge opportunities are also favorable for potential offender (Fisher & Nasar, 1992). The offender may hide from, wait for and attack to his victim in environments which offer prospect and refuge. Fisher and Nasar (1992) suggested that places with low prospect and high refuge lead to feelings of fear and unsafety. Although Appleton's theory is concerned with natural environments, physical organization of a space is clearly linked to the feeling of safety. Therefore, same principles can be adapted to design in urban environments.

2.2.3 Berlyne's and Wohlwill's approaches to environmental aesthetics

Exploratory behavior, physiological arousal and experimental aesthetics were amongst the main interest areas of psychologist David E. Berlyne (1924-1976). He developed a psychobiological approach towards aesthetics. According to Berlyne, environmental perception is a process of exploratory behavior and information transmission which are triggered by the amount of conflict or uncertainty in the environment (Chang, 2009). Berlyne's theoretical framework involves two main concepts; arousal potential and hedonic response. He identified four factors, which he called "collative properties" that determined the arousal potential of a stimulus; (i) complexity (diversity of the elements in the environment), (ii) novelty (presence of novel elements), (iii) incongruity (extent of any apparent 'mis-match' between elements), and (iv) surprisingness (presence of unexpected

elements) (Ungar, 1999). The arousal potential of the stimulus results in hedonic response in the observer. Berlyne (1972) hypothesized that there is an inverted U-shaped relation between collative properties and hedonic response; increase in arousal also increases pleasure up to a point, however beyond a certain point hedonic response will lessen (Galanter, 2010; Nasar, 1988a). Thus medium degree of arousal potential has a positive effect on preference, while low or high degrees of arousal potential cause negative response (Martindale, 1996).

Wohlwill's studies on environmental aesthetics are based on Berlyne's theory. Both Berlyne and Wohlwill regarded arousal and hedonic value as an important aspect of aesthetic response (Nasar, 1988b). Similar to Berlyne, he proposed that there was an optimal level of information in a landscape and too much information was stressful while too little information was boring (Mok *et al.*, 2006). He also extended Berlyne's arousal theory and hypothesized (1974) that there is an adaptation level where environmental stimulation is at optimal degree for an observer and larger changes in the adaptation level produce negative response (Bell *et al.*, 2001; Ungar, 1999). Adaptation level depends on an individual's past experiences, thus it differs from person to person and furthermore changes in time if exposed to a different level of stimulation (Bell *et al.*, 2001).

2.2.4 Information processing theory

Rachel and Stephen Kaplan of University of Michigan are leading researchers in the field of environmental psychology. They have many published works on human-environment relationship. Kaplans' information processing theory (1979) is amongst the most influential and well-known theories on landscape preferences. Information is the fundamental concept of their approach. Information has been central to human experience and survival throughout the evolution of human being (Kaplan *et al.*, 1998). Not only we need to gain information to make sense out of the environment, but an individual also values environments with promising information for exploration (Kaplan *et al.*, 1998; S. Kaplan, 1975). Understanding of an environment aids an individual to know what is going around and feel secure. On the other hand, people want to explore by seeking more information and look for new challenges (Kaplan *et al.*, 1998). Furthermore information is important to people's ability to function well in the environment (Maulan *et al.*, 2006). Aesthetics reflects the functional potential of things and spaces (S. Kaplan, 1988a).

We gather information from our environment through our senses, mostly through visual sense. Kaplans' theory suggests that information is derived through the contents and the organization of the environment. Organization of an environment is an important variable in perception since it affects the degree of making sense. S. Kaplan (1975) states that acquisition of knowledge should be related to environmental preference. Results of their studies show that scenes with large expanses of undifferentiated land covers, dense vegetation and obstructed views are low in preference (Kaplan *et al.*, 1998). They suggest that if visual organization of spaces is homogenous within an environment, then it suggests that nothing is going on. Besides, there is little to focus on and sameness causes difficulty in keeping interest in the environment. On the other hand although dense vegetation has a rich content, it lacks of clear focus which confuses one. People also are discomforted when the view is blocked, they feel insecure because it is hard to tell what to expect. On the contrary scenes with spaced trees and smooth ground have been found to be high in preference. They

explain that in contrast to large expanses and obstructed views; such combinations of settings provide a clear focus and invite entry.

Based on their results, the Kaplans developed a preference matrix which comprises of four informational factors which affect preferences of landscape (Figure 2). These factors are; coherence, complexity, legibility and mystery. Coherence and complexity of a setting can be understood as soon as when one enters or views the setting, thus they happen in the picture plane (2D) and they are perceived immediately. In contrast, to perceive legibility and mystery degrees of a setting requires time, an involvement with the environment. Hence, they are inferred factors and this inference about the third dimension occurs in longer (a few milliseconds longer) and unconsciously.

PREFERENCE MATRIX		
	Understanding	Exploration
2-D	Coherence	Complexity
3-D	Legibility	Mystery

Table 1. Kaplans’ preference matrix (Kaplan *et al.*, 1998).

Coherence: Coherence of a setting is about the order and organization of its elements. If a place is coherent, then people can easily make sense out of the setting. Kaplan *et al.* (1998) suggest that coherence can be achieved through repeat of themes and unifying textures; however limited degree of contrast is also helpful. Coherence is similar to gestalt principles of organization that states elements are perceived in groups rather than parts (S. Kaplan, 1975).

Complexity: Complexity refers to the degree of diversity of landscape elements. The more complex an environment is, the more information it involves. According to Kaplans’ theory, greater variety in a setting would encourage exploration. They argue that coherence and complexity shouldn’t be confused since a highly coherent setting can still also be very complex.

Legibility: The concept of legibility is about orientation. Way-finding is important for an individual in terms of feeling secure and safe. It is about reading the environment and making sense out of it. Distinctiveness contributes to legibility of an environment. Hence, landmarks or focal points may increase the legibility of a setting. However, one has to experience the setting first, in order to realize what is distinctive and what is not. Spaciousness also supports legibility by increasing the individual’s range of vision (S. Kaplan, 1975). S. Kaplan, (1975) points out that fine texture is also a legibility component; the finer the texture, the easier to distinguish figures from ground.

Mystery: Mystery is the component of preference related to exploration. It is about the setting’s potential of promising information. Mystery requires an inferential process (S. Kaplan, 1975). Mystery motivates people for exploration in order to gain new information. There are various ways to create mystery in a landscape. Kaplan *et al.* (1998) suggest that a curved path or vegetation that partially obstructs the view can add mystery to an environment.

The Kaplans suggest that we prefer environments that involve all of the four components explained above. They also emphasize that information needs to be central in environmental

design and management. However, handling and managing information can also be stressful for people. According to Kaplan *et al.* (1998), our capacity for directed attention is limited, and mental fatigue occurs if one is forced to receive and manage information above his capacity. Mental fatigue may cause difficulties in or loss of concentration, impulsive actions, anger and irritability. Hence, the designers should be aware of the risks of creating settings that offers too many information.

2.2.5 Gibson's Theory of Affordances

Psychologist James J. Gibson has developed his "Theory of Affordances" based on an ecological approach towards visual perception. In his work "The Theory of Affordances" (originally published in 1979, 1986) he describes the environment *as the surfaces that separate substances from medium in which the animal lives*. He continues that the environment offers and provides affordances to the animal. The term "affordances" has been first coined by Gibson, himself. An affordance can be described as a possible action which properties of an object allow or suggest for the observer. For example, a bench affords sitting. Affordances are perceived directly and they are relative to the observer. Gibson states that although the needs of observer can change, the affordance of an object does not change. Gibson's theory is rather different from the conventional perception theories. His theory has received criticism, mainly for being unclear and underestimating the complexity of perception process.

2.2.6 Gestalt principles of visual perception

Gestalt theory was developed by German psychologists Max Wertheimer, Kurt Koffka and Wolfgang Köhler in the early 20th century. The German word *die Gestalt* means "form" or "shape" and Gestalt theory of perception can be summarized as that people tend to perceive things as wholes rather than separate parts. It proposes "laws of organization in perceptual forms" (Wertheimer, 1938) which have been applied by various design disciplines. Basically, people perceive visual stimuli as organized or grouped patterns. Gestalt principles related to spatial design are briefly explained below.

Figure-ground relationship: As Köhler (1938) states "*figure perception is represented in the optic field by differences of potential along the entire outline or border of the figure*". Thus, contrast plays an important role in distinguishing figure from the ground. The most famous example that demonstrates figure-ground relationship is probably the Danish psychologist Edgar Rubin's "Rubin's vase" (Figure 2). The figure-ground relationship is related to legibility in spatial design.

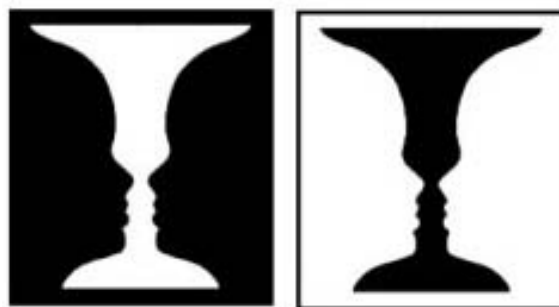


Fig. 2. Figure-ground relationship in Rubin's vase (Baluch & Itti, 2011).

Proximity: Objects located close to each other tend to be perceived as groups. For example; the number “3012” is perceived as two different numbers when a space inserted in the middle: 30 12.

Similarity: Objects that have similar visual characteristics such as color, shape, direction etc. are perceived in groups (Figure 3).

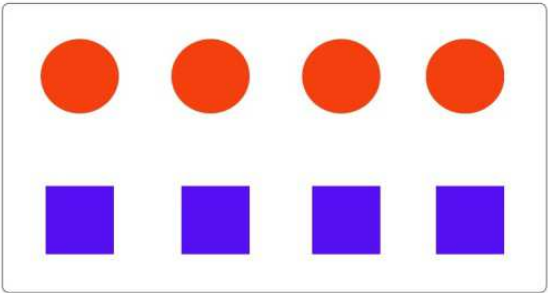


Fig. 3. Gestalt factor of similarity.

Continuation: Graham (2008) explains continuation as “continuation occurs when the eye follows along a line, curve, or a sequence of shapes, even when it crosses over negative and positive shapes” (Figure 4).



Fig. 4. Factor of continuation (Graham, 2008).

Closure: There is a tendency to close and mentally complete the missing parts of an image which is visually incomplete (Figure 5).



Fig. 5. Factor of closure (Graham, 2008).

2.3 Overview of research methodology

Basically, there are two approaches in visual landscape assessment; objective and subjective. Objective approach to visual landscape assessment assumes that visual quality of the landscape is an inherent characteristic and physical attributes of the environment determine its aesthetic value. On the contrary, subjective approach assumes that visual quality is in the eye of beholder and aesthetic value of an environment can be determined through subjective evaluation. There are also studies which have integrated both objective and subjective approaches.

Zube *et al.* (1982) identified four research paradigms on landscape assessment and perception which are; expert, psychophysical, cognitive and experiential paradigms (Taylor *et al.*, 1987).

The expert paradigm: this paradigm is based on expert judgments of visual quality of landscapes. Evaluation of landscape quality depends on formal characteristics of the landscape such as landform, vegetation, color, texture etc. Another assumption of this paradigm is that natural ecosystems have the greatest aesthetic value. This paradigm is criticized for the lack of user environment and being incompatible with users' perceptions (Lekagul, 2002). Furthermore, S. Kaplan (1988a) points out that experts perceive visual environment different to other people, and expert judgments are "a dubious source of objective judgment" about what other people really care about in the landscape.

The psychophysical paradigm: In psychophysical paradigm, in contrast to expert paradigm visual quality of the landscape is evaluated by the general public or special interest groups. The main assumption of this paradigm is landscapes have a stimulus property which is external to the observer who perceives the landscape without conscious thinking. Ranking and sorting are widely used techniques in visual assessments within this paradigm.

The cognitive paradigm: The cognitive paradigm focuses on why people prefer particular landscapes. The research is directed mostly towards developing a theoretical basis. In contrast to psychophysical paradigm, cognitive paradigm assumes that cognitive processes influence aesthetic judgments. Mostly verbal evaluation techniques, such as semantic differential analysis and adjective checklists, have been used to evaluate preferences and meanings. Most of the evolutionary theories on environmental perception (e.g. prospect-refuge theory and information processing theory) form a basis for this paradigm. However, this paradigm neglects the physical environment and rather focuses on meanings associated with landscapes (Taylor *et al.*, 1987).

The experiential paradigm: This paradigm focuses on human-environment interaction. Human experiences affect the landscape's perceived value. This approach is commonly used in "sense of place" studies and mainly by geographers. However, experiential approach is more subjective than cognitive and psychophysical paradigms; therefore reliability and validity of the results are hard to be measured (Taylor *et al.*, 1987).

Although paradigms explained above may seem completely different from each other, each contributes to overall comprehension of environmental perception. In terms of design and planning, the expert paradigm has been the most used approach in visual landscape assessment. However, there is a certain need for involvement of public or users in order to create enjoyable places for people. Fenton & Reser (1988) criticize that human geographers and landscape architects tend to use *atheoretical* and *apsychological* methods while psychologists use mainly theoretically derived psychometric methods. Professional differences might make it difficult to find a common basis for theoretical and methodological research. Nevertheless, collaboration of disciplines involved in environmental perception studies is essential to resolve some of the conflicts.

2.4 Landscape preferences

Assessment of landscape preferences is widely studied in environmental perception research. Landscape preference studies aim to investigate how and why people prefer some

environments to others. People judge and interpret their environments and they respond to environments in terms of affective responses. Environmental preference is not luxury for people but essential and tied to basic concerns (R. Kaplan & S. Kaplan, 1989). Kaplan sees preference as an indicator of aesthetic judgment (1988b) and as a complex process which involves perception of things and space and reacting to them in terms of their potential usefulness and supportiveness (1988a). According to Charlesworth (1976), species has to be able to both recognize and prefer environments in which it functions well (S. Kaplan, 1988a). Preference for specific landscapes is about the organization of the space, rather than the individual elements (R. Kaplan & S. Kaplan, 1989), hence designers should focus on the integrity of different landscape elements.

The bio-evolutionary perspective on landscape preferences were explained in the previous section (Section 2.2): long history of human evolution is believed to be the reason for why we prefer some environments to others. One consistent finding of environmental preference research is that people prefer naturalness or natural environments to human-modified environments (e.g. R. Kaplan & S. Kaplan, 1989; van den Berg *et al.*, 2003). Presence of water also increases the preference ratings (Hull & Stewart, 1995; Yang & Brown, 1992). Natural scenes are also assumed to contribute to well-being by reducing stress levels, and to have positive influence on functioning and behavior (Ulrich *et al.*, 1991). It is assumed that preferences for savanna-like landscapes are linked to human evolutionary history, as an adaptation to East Africa savannas for survival (Falk & Balling, 2010). Ulrich (1979) found that homogenous ground texture, medium to high levels of depth, presence of a focal point, and moderate levels of mystery leads to high level of preferences in natural scenes (Porteous, 1996).

Complexity has been one of the central concepts in environmental preference research. Although R. Kaplan & S. Kaplan (1989) have found that coherence is more significant in explaining preferences, Ode & Miller (2011) suggest that landscape preferences have a relationship between measurements of complexity. Their study on rural landscapes showed that *“a landscape with an unequal distribution of land cover, a moderate amount of land cover, and a low level of aggregation is more likely to be preferred over a landscape with many land-cover classes, equal distribution, and strong aggregation”*. Complexity is also found to have a positive influence on urban landscape preference (Falk & Balling, 2010).

Environmental preference research generally focuses on natural or rural environments and there is little research on urban landscape preferences. This might be due to the fact that urban environments are highly complex structured; there are too many kinds of elements (both natural and cultural) that form urban structure. Moreover, social dynamics have important influence on shaping urban environments. Hence, it is rather difficult to measure and to assess landscape preference determinants in urban landscapes. One of the preference studies in urban environment was conducted by Nasar and his colleagues (1988a). They investigated the visual preferences for urban street scenes. Nasar used bipolar adjectives to describe the environments; closed-open, simple-diverse, chaotic-orderly, dilapidated-well-kept, vehicles prominent-vehicles not in sight, and nature (greenery) not in sight- nature (greenery) prominent. He found (just like he expected) that people preferred ordered, natural, well-kept, and open scenes with vehicles not prominent. However, Nasar was cautious about the interdependence of the variables; he expressed the need for further research for explanation of the relationship between these variables. Nevertheless Nasar

suggested that moderate novelty, increase diversity, increased contrast among buildings, good maintenance, order, more vegetation and reduced vehicle prominence might produce highly preferred urban environments.

According to Bourassa (1990), aesthetic response occurs at both biological and cultural levels. Falk & Balling (2010) also state that *“that human landscape preferences is best understood as a continuous progression of aesthetic ideals, tempered by social convention, passed on from one generation to the next through human culture”*. But do culture and socio-demographic factors really affect preferences? There are several cross-cultural studies that investigate preferences for landscapes and landscape elements. Generally, the results show that despite cultural differences, people seem to have similar preferences for specific landscapes; however the concepts of novelty and familiarity can affect preferences for people from different cultures. Familiarity plays an important role in feeling secure and safe. People feel comfortable and relaxed in environments which they are familiar to (Kaplan *et al.*, 1998). On the other hand too much familiarity may become boring and people seek for novelty. For instance, Yang & Brown (1992) found that traditional Japanese style landscapes and water presence were highly preferred by people from both Korean and Western cultures. However they also found that while Koreans preferred Western style landscapes, Western tourists preferred Korean style landscapes. A similar result was found by Nasar (1988a). His study results showed that although there were consensus on preferences for ordered, natural, open and well-kept scenes; Japanese subjects highly preferred the American scenes and vice versa. His findings supported Berlyne's assumption that people prefer novelty to familiarity. He also pointed out that the results would have been different if subjects had been chosen from older population since Sonnenfeld (1966) claims that younger people prefer novelty and others familiarity (Nasar, 1988a). In their study Yang & Kaplan (1990) investigated landscape style preferences of Korean and Western individuals. They found a cross-cultural similarity in preferences in favor of landscapes with natural styles. Landscapes with rectangular or formal designs were less preferred by both groups.

Lyons (1983) showed that there is a strong relationship between age, gender, residential experience and landscape preferences. She found that preference levels changed in different age groups, adolescent male and females had different preferences, urban and rural residents had different preferences, familiar vegetational biomes were preferred highest, and there was no evidence that landscape preferences were shaped by innate or evolutionary factors. Yu (1995) also reported that people from different living environments (rural vs. urban) had different preferences; rural residents had high preference for novelty and modernity. He also indicated that landscape preferences were strongly influenced by education levels. However, his findings did not show any significant relation between gender and preferences.

Landscape preference studies are generally based on public or user (non-expert) evaluations. Ranking, rating or sorting of visual stimuli and verbal instruments are popular tools in determination of landscape preferences. Participants are asked to rank, rate or sort visual stimuli according to their preferences. The outcomes can be evaluated in terms of most and least preferred scenes, preference predictors (e.g. coherence, diversity, naturalness etc.), correlations between preference and predictors, content analysis of preferred environments or comparison of different landscape characteristics.

Although photographs and slides have been widely used as visual stimuli in preference research, there has been a constant debate on the representational validity of them. While some researchers have found that photographs can be adequate and valid resources to use (Dunn, 1976; Shuttleworth, 1980; Stewart *et al.*, 1984), some others do not agree with this idea (Kroh & Gimblett, 1992; Scott & Canter, 1997). R. Kaplan (1985) points out that use of photographs is less in cost and easy to administer, however sampling of the environments and selection of photographs require careful attention. In-situ assessments are time consuming, expensive and not practical. Besides, other variables of the landscape, (such as air condition and brightness) may vary during assessments and that might affect visual preference judgments of observers. On the other hand, a landscape is definitely more than just a scene and it is dynamic, however photographs and slides reflect landscapes as more static. Sevenant & Antrop (2011) state that depending on the character of the landscapes, some vistas are better presented by panoramic photographs, while some by normal photographs; thus, horizontal angle of view should be considered while selecting photographs. Palmer & Hoffman (2001) also support using panoramic images to increase validity. They also suggest that comparing the ratings of representations and actual field conditions from several individuals would help to establish validity of representations.

Current technology allows further visualization techniques such as computer graphics, 3D-modelling, virtual reality, GIS-based photorealistic visualisation, etc. (Sevenant & Antrop, 2011). However, validity issues remain the same. In their study, Bishop & Rohrmann (2003) concluded that “computer simulations do not necessarily generate the same responses as the corresponding real environment”. On the other hand, detailing seems to be an important aspect in computer visualizations; higher detail levels are believed to increase the validity (Bishop & Rohrmann, 2003; Daniel & Meitner, 2001). Nevertheless photographs still seem to be the most popular tools as surrogates for actual landscapes. However as concern about validity increases, researchers will need to prove reliability of their results and we'll see much more debate on this issue.

Alternatively, sometimes verbal instruments such as verbal descriptions and bipolar adjective scales are used for assessment of landscape preferences. People can explain their preferences better by using words rather than rating or ranking visual stimuli. Although verbal assessments are quick and low-cost, analysis of the data may not be easy. Different people may use different adjectives or descriptions for the same preference judgment. Therefore content analysis of verbal descriptions should be done by experts or trained individuals in order to improve accuracy of results. On the other hand bipolar adjective lists, or semantic differentials, have been criticized for presenting adjectives selected by the researcher and therefore limiting people. However, Echelberger (1979) states that semantic differential may contribute to landscape preference assessment. On the contrary R. Kaplan (1985) claims that using adjectives does not tell much about preferences.

2.5 Environmental images and cognitive maps

Cognition involves perception, thinking, problem solving and organization of information and ideas (Downs & Stea, 1973). Hence, environmental cognition can be defined as perception, understanding, organization and retrieval of spatial information. Through cognition, we construct images of our environment which help us to find our way in our

daily lives. These constructed environmental images form mental representations which are unique to the individual. This process is called cognitive mapping. Memory plays a crucial role in cognitive mapping. As S. Kaplan (1978) states *a cognitive map is based on familiar objects and events*. Hence, cognitive maps can change or improve depending on the individual's experiences.

People derive information from their environments through neurophysiological processes, but they also rely on personality and cultural factors to produce cognitive images (Knox & Marston, 2003). Thus, cognitive maps are highly personal constructs. A cognitive map of an individual can be quite different from an actual physical map in terms of accurate distance and structural organization. Simplification and distortion are two most important attributes of cognitive maps (Knox & Marston, 2003). The images might be incomplete or have inaccurate distance estimates. Nevertheless, cognitive images reflect how we see our environments and how we connect places to each other. Consequently, people's orientation and navigation through space can affect their quality of life. Sense of orientation helps people to feel confident and less anxious (Kaplan *et al.*, 1998). Cognitive maps help people to establish their routes and find their way, no matter how incomplete or distorted they are.

The term of "cognitive map" was first introduced by Tolman (1948) in his study where he investigated the spatial behavior of rats in a maze (Göregenli, 2010). However it was Kevin Lynch (1960) who pioneered cognitive mapping studies in urban design and planning with his famous work "The Image of the City". Lynch puts an emphasis on the concept of legibility for structuring and identifying the environment. Legibility plays an important role in way-finding and environmental images are fundamental for way-finding. An environmental image is a product of both immediate sensation and the memory of past experience (Lynch, 1960). Clarity of environmental images, thus the degree of legibility facilitates one's way-finding. Lynch identified five key elements of urban form which determine the legibility of an urban environment; paths, edges, districts, nodes and landmarks. Although paths were found to be the dominant elements of environmental images, Lynch emphasizes that all of the elements operate together and interrelation of these elements are important in creating legible urban environments.

Lynch's work has been mainly criticized for its small sample size and research technique; his five elements of legibility had already been established before interviewing the subjects. Later, he (1984) also criticized his own work for not being practical but being academically interesting (Pacione, 2005). His work also neglected the importance of symbolic meanings associated with places. Lynch was aware of the influence of meaning attached to a place on one's environmental images, however his work focused on urban form and he stated that form should be used to strengthen the meaning in urban design. Still, his legibility framework is still considered as fundamental and influencing in cognitive mapping studies in urban environments.

Today's fast paced urban life-styles urge us doing our daily tasks in a limited time. Hence, difficulties in getting to the desired destination may cause people to feel stressed out. As a primary component of cognitive mapping, legibility should be considered as an essential objective in place-making. Cognitive maps can be used in landscape architecture to investigate the relationship between characteristics of outdoor environments and perceived legibility. Evaluation of existing structure and organization of the environments will

provide landscape architects to improve their place-making strategies in terms of design and planning.

3. Perception of soundscapes

Sound, as a landscape element, has not received much interest in landscape design and planning compared to vision. Listening to an environment is generally not the primary activity or interest of a person (Jennings & Cain, 2012); however information provided by the visual landscape play a great role in realizing our daily activities. The concept of soundscape has recently gained attention of planning and design disciplines where focus is generally on the visual aspect, rather than the acoustic. One of the reasons might be that most of the time designers' and planners' lack of scientific knowledge on acoustics. Concepts like "weighted sound levels", "absorption coefficient", and logarithmic measurements may seem unfamiliar and intimidating. Although noise mapping is quite a popular tool in environmental assessment studies, sound is rarely considered as a design element in landscape. Sound does not literally mean "noise". While some sounds can be disturbing, some sounds can give pleasure to an individual. However, sound as a sensory experience is rather different from vision. Acoustic space does not have obvious boundaries and is less precise in terms of orientation and localization (Porteous, 1996). Therefore assessment of sound as a design element is much complex than the visual dimension. Sound is an important element of a place which affects individual's perception and understanding of an environment. People derive information from sounds, just like visual environment. Sound can act as a guide for way finding or a cautionary signal for alert. In the context of space, soundscape can be defined as the acoustic character of an environment.

Urban environments are diverse and complex acoustic environments. They include different kinds of sound resources. Therefore, outdoor acoustic environment studies are mostly concerned with urban soundscapes. Evaluation of urban soundscapes is crucial not only for noise mitigation but also to assessment of acoustic comfort which is integral to overall environmental quality.

The term of soundscape was first coined by R. Murray Schafer. In his book "The Tuning of the World" (1977), he describes the soundscape as any acoustic field of the study; it may be a musical composition or a radio program or an acoustic environment. Influenced by Gestalt figure-background relationship (see section 2.2.6), Schafer identified three elements of a soundscape; (i) keynote sounds, (ii) sound signals, and (iii) soundmarks. Keynote sounds are background sounds and can be perceived subconsciously. Schafer suggests keynote sounds might have an effect on our behavior and moods since they are permanently there, whether we hear them consciously or not. Traffic sound is often given as a keynote example for contemporary urban environments. Sound signals, are foreground sounds and are listened to consciously (e.g. sirens). Finally, soundmarks (derived from landmark) are unique to that environment or to people in the community, thus they need to be protected. These elements have established a foundation for many soundscape studies so far.

The most noticeable study on the relationship between landscape architecture and soundscape is Hedfors's (2008) book "Site Soundscapes: landscape architecture in the light of sound". In his book, he analyzes sound in context of landscape architecture. He suggests a hypothetical model, named "the model of prominence" as a starting point for

landscape architects. The model is also grounded on Gestalt figure-background relationship, like Schafer’s work. It is based on description of the sounds. In Hedford’s model figure-ground relationship is combined with two other dimensions; intensity and clarity (Figure 6). According to Hedford, a soundscape can be described as clear if prominent sounds are strongly experienced against a weak background. However, if prominent sounds are weaker than the background, then the soundscape becomes crowded. If both prominent sounds and the background are experienced equally strong, the soundscape can be described as powerful. On the contrary, if both are experienced weak, the soundscape becomes mild.

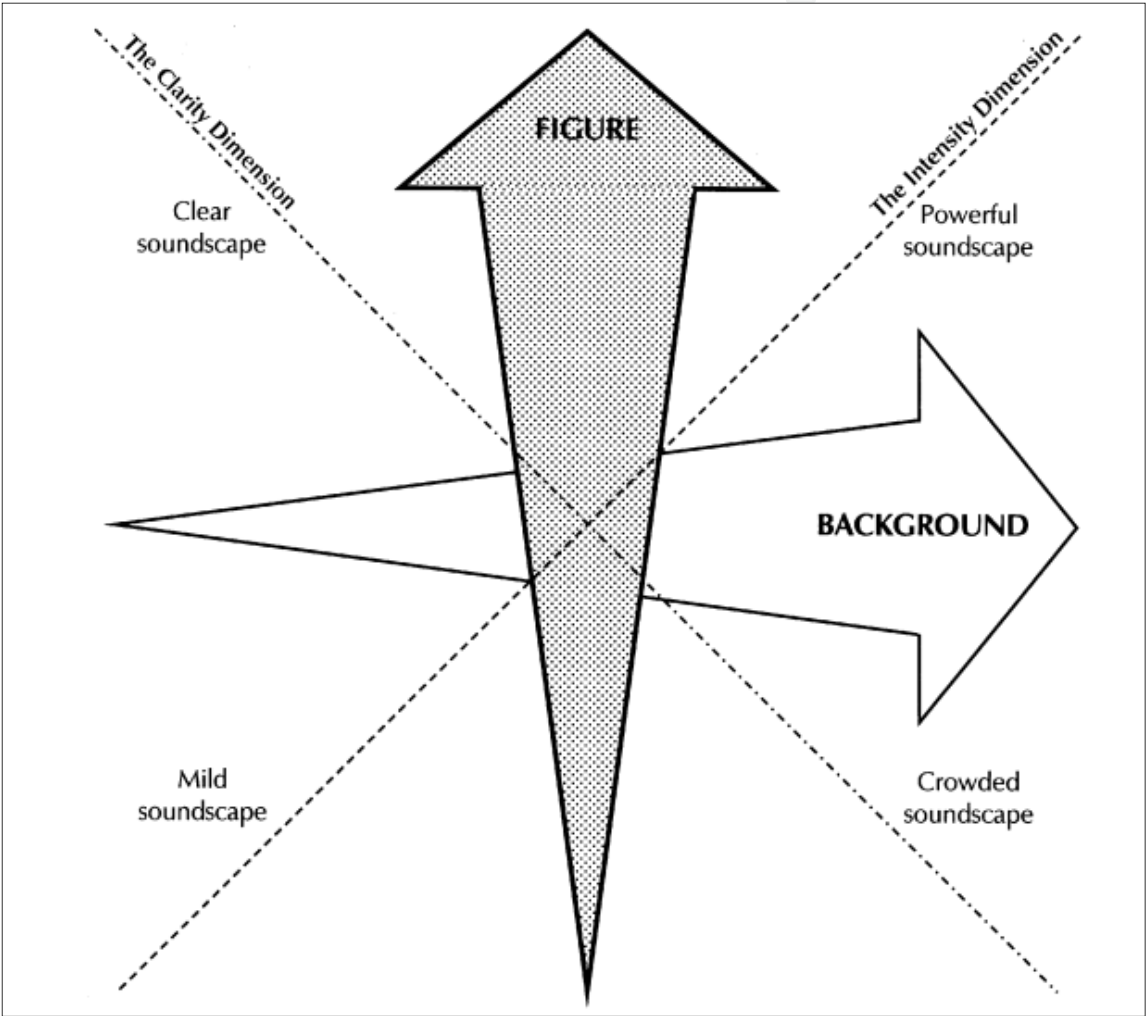


Fig. 6. The model of prominence (Hedfords, 2008).

Similar to natural landscapes, natural sounds such as bird sound and water sound are highly preferred by people. This may be explained through evolutionary perspective on landscape perception as well as therapeutic effects of natural landscapes (please refer to section 2.4). In fact, relaxation is found to be an important factor for urban open soundscapes (Yang & Kang, 2005). It is known that natural sounds such as bird and water sound can help people feel relaxed (Carles *et al.*, 1999).

Since sound perception is assumed to be a personal and therefore unique phenomenon, most researchers believe that perception of the acoustic environment is affected by personal factors such as demographics and culture. Yu & Kang (2010) found that people preferred natural sounds with increasing age and education level. Their results showed no significant correlation between preferences and occupation, and residence status. They found that gender influenced preference only for some sound types (e.g. bird sound).

Anderson *et al.* (1983) emphasize the importance of expectations in people's sound evaluations (Hedfords, 2008). People might tolerate or appreciate undesirable sounds if they expect to hear them in an environment. For instance some traffic sounds were found to be appreciated in urban environments. Thus, cultural and life-style differences might play role in evaluations of environments with different sound levels.

Sound types have also been found to be related to acoustic comfort evaluations; pleasant sounds, with either high or low sound levels, are perceived to improve the acoustic comfort (Yang & Kang, 2005). The source of the sound type can also affect preference. Zhang & Kang (2007) found that while "music on the street" was rated as favorite by 46% of the participants, 15% rated for music from stores, and only 2% rated for music from cars. Perception of the soundscape is also influenced by the activity involved and hence listening situation (Jennings & Cain, 2012).

Although sound level measurements (e.g. A-weighted levels) are widely used in soundscape research, it is also indicated that perception of the acoustic environment is independent from sound levels (Jennings & Cain, 2012; Szeremeta & Zanin, 2009). Reducing sound levels do not always improve perceived quality of acoustic environment (Yang & Kang, 2005). Furthermore, elimination of negative sounds from the environment does not necessarily make the acoustic environment more positive, may even generate anxiety (Cain *et al.*, 2011). However, Yang & Kang (2005) have found that background sound level is an important factor in evaluating soundscape in urban open public spaces; they suggest that reduced background sound level can help to create comfortable acoustic environments.

Visual perception also affects sound perception; Faburel & Gurlot (2009) found that visual images can reduce the negative effect of a sound, equivalent of up to 10dB decrease in the sound pressure level (SPL) (Solène, M., 2011). Yang and Kang (2005) also concluded that visual factors affect acoustic comfort evaluations and they suggested that interaction of visual and auditory perception work together "*as an aesthetic comfort factor*". Carles *et al.*'s (1999) study supports this idea. They presented varying combinations of visual and auditory stimuli and participants were asked to rate each image, each sound, and finally each combination. It is found that sounds in the scenes containing vegetation or abundant water were rated higher; hence they concluded that visual and acoustic information can reinforce or interfere with each other. Furthermore, people are less annoyed by the sounds when the source is not visible (Solène, M., 2011). Zhang & Kang (2007) proposed some suggestions for creation of soundscapes in urban environments. They state that if SPL is higher than 65-70 dBA, then people will feel annoyed. Figure 7 shows their design suggestions.

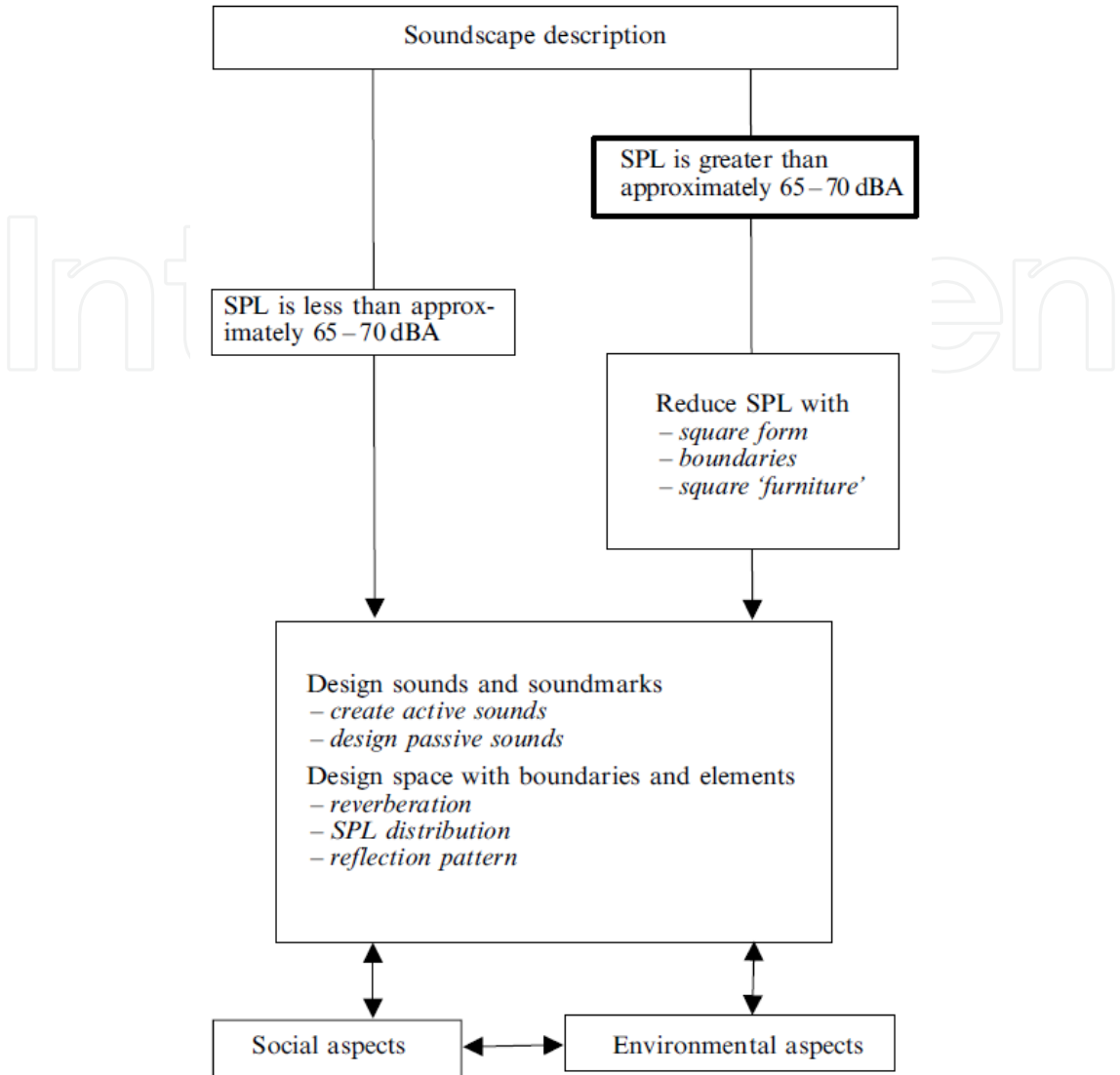


Fig. 7. Soundscape design strategies (Zhang & Kang, 2007).

Research methodology

Besides sound level measurements, perceived acoustic quality and preferences are often evaluated through interviews, questionnaires and soundwalks. During sound level measurements A-weighted equivalent continuous sound level (LA_{eq}) is measured and statistical sound levels (L_{eq90} , L_{eq50} , and L_{eq10}) are calculated. Equivalent continuous sound level presents the average level of noise over a time period, while statistical sound levels are used to define maximum, intrusive, median and background sound levels (Kang, 2007). Identification of the sounds which are perceived by the user is generally the first step of soundscape preference research. This procedure provides researchers an insight to perceived foreground sounds, background sounds and soundmarks. Rating scales are frequently employed in preference research. Participants are asked to rate the acoustic environment or a particular sound. The rating scale generally involves bipolar verbal descriptions such as like-dislike, noisy-quiet, favorite-unfavorite etc. Semantic differential analysis is another tool which is commonly used to investigate people's emotional responses

towards sound types and acoustic environments. These techniques can easily be applied any time to anyone without a hearing deficit or disorder. However, the soundwalk technique depends on more conscious listening state. During soundwalks, participants observe and listen to their environments very carefully while walking along a path and make judgments on the acoustic environment.

Previous studies have been carried out either in laboratories or in-situ. Binaural recordings are preferred for laboratory studies. Laboratory conditions are also suitable for assessment of the interaction between visual and auditory stimuli with different characteristics. However, if the soundscape of a particular place is to be assessed, considering primarily that visual perception affects perception of acoustic environment, it is best to carry out the study in-situ. Furthermore, for researchers from design and planning disciplines it might be difficult to establish and maintain laboratory conditions for acoustic evaluations due to lack of technical and scientific knowledge. Therefore, a multidisciplinary approach might be helpful in designing and conducting more effective research on soundscapes.

Zhang & Kang (2007) proposed a detailed system for investigation of urban open space soundscapes. They identified four facets; (i) characteristics of each sound, (ii) acoustic effects of the space, (iii) characteristics of users and (iv) other aspects of physical and environmental conditions. Description of each facet is summarized below.

Sound: For each sound, it is recommended that both steady state and the statistical SPL, spectrum, temporal conditions, source location, source movement and the psychological and social characteristics should be taken into account. Temporal conditions include variation (hour, day, season), duration and impulsive characteristics. Meaning, natural or artificial sounds, relation to activities, soundmarks and listening state (descriptive or holistic) should be considered in context of psychological and social characteristics.

Space: The shape of the space, boundary materials, street and square furniture, landscape elements, reverberation, reflection pattern and/or echogram, general background sound and sounds around the space are the characteristics to be considered related to the space.

People: Social, demographic, cultural characteristics of users and acoustic condition at users' home, work etc. should be assessed.

Environment: Microclimate conditions, lighting, visual, landscape and architectural characteristics are among the environmental characteristics that need to be taken into consideration.

Jennings & Cain (2012) propose a framework which uses Kano model in order to provide designers and planners a tool for predicting impacts of design interventions on soundscape. Kano model is generally used in product development for determination of customer needs and satisfaction. Jennings & Cain (2012) suggest that Kano model can help to clarify thinking, since perception of the soundscapes is a complex process. To summarize their proposal, there are three attributes to be assessed in Kano model; basic requirements, performance requirements and excitement (or attractive) requirements. The first step is to satisfy basic requirements, such as fulfilling legislative requirements for noise control. Then performance requirements need to be assessed in order to find out user needs and expectations. Use of emotional perceptual dimensions, interactive simulations and soundwalks might be helpful in this step. Finally for the excitement requirements, the

authors suggest that culturally significant sounds or sonic art could be introduced to give a unique character and to increase excitement or attractive quality. The authors state that Kano model is successfully used in automobile industry for sound quality assessments. However, this model might seem confusing for spatial designers and planners. The authors also emphasize the need for application of the framework through real-life examples. Please see the reference for further details of the framework.

Solène (2011) applied cognitive mapping technique in her study on urban soundscapes. Participants were asked to draw graphical representations of sonic ambiances of three urban squares. They were also asked to describe their preference for ideal sonic environments in squares. Boundary was found to be an essential element in perceived ideal sonic environments since most participants described closed or semi-open squares. On the contrary, open squares were associated with negative sonic ambiance. Depending on the results, the author inferred that there is a strong bond between urban typology and perceived sonic ambiance. She concluded that sonic mind maps were appropriate for studying psychoacoustics of an urban environment.

Despite the short history of soundscape research on outdoor environments, there seems to be a variety of research techniques and methodologies which can be adapted to the researcher's objectives. Still, many issues such as interrelationships between factors that affect soundscape preferences and the effects of spatial design on acoustic comfort need to be further investigated. Spatial designers and planners can contribute to the soundscape research by developing new models and methodologies in order to display and emphasize their role on creating livable and high quality environments.

4. Conclusion

Our landscapes are natural and cultural heritage of our societies. With the rapid urbanization and development processes, change has become an inevitable outcome for our landscapes in global scale. Unfortunately, landscape change often occurs in negative ways. Loss of diversity and identity should be the main concern for future design and planning research for landscape architects. However, the role of perception and its effects on spatial behavior and attitudes must be realized first.

If landscape architecture aims to create livable and effective environments for people in the community, people's perception and interpretation of environments must be investigated. One can argue that landscape assessments should be made by experts because of their knowledge and experiences and general public can't judge environmental quality. On the other hand, environmental quality issues are still on the agenda. To some extent, local, national and even international authorities can be blamed for ignoring knowledge and suggestions of environmental designers and planners in sustainable development. Certainly, professionals have a lot to offer in terms of knowledge and skills. However, knowing and understanding the basic relationships between people and their environments is a necessity.

This chapter has summarized basic information and approaches on landscape perception both in visual and auditory context, aiming to provide an insight on perceptual and cognitive dimensions of environmental research. However, there are more to landscape perception research. Reference list can provide readers with valuable resources to read.

Although there is a vast amount of research on landscape preferences, there are still theoretical and methodological issues that have not been clarified yet. The outcomes of environmental psychology research can guide planners and designers in creating and managing our landscapes. Therefore, it is crucial to establish a multidisciplinary cooperation. The relevance and importance of landscape perception research has been neglected in Turkey so far. Most undergraduate curricula in landscape architecture programs do not cover perceptual dimension of the landscape. I hope this chapter draws an attention to the significance of the subject. Finally, I'd also like to emphasize the need for strengthening the role of landscape design and planning on landscape perception research.

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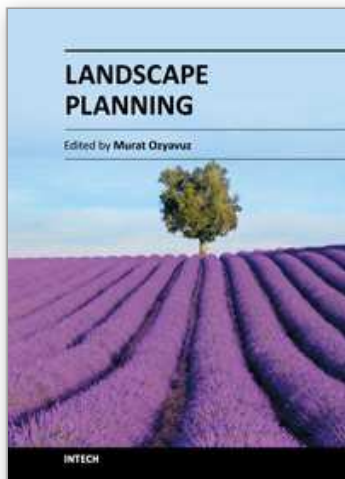
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Landscape architecture is the design of outdoor and public spaces to achieve environmental, socio-behavioral, and/or aesthetic outcomes. It involves the systematic investigation of existing social, ecological, and geological conditions and processes in the landscape, and the design of interventions that will produce the desired outcome. The scope of the profession includes: urban design; site planning; town or urban planning; environmental restoration; parks and recreation planning; visual resource management; green infrastructure planning and provision; and private estate and residence landscape master planning and design - all at varying scales of design, planning and management. This book contains chapters on recent developments in studies of landscape architecture. For this reason I believe the book would be useful to the relevant professional disciplines.

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