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A STUDY OF RESTORATIVE POTENTIAL IN WINDOW VIEWS ADOPTING KAPLAN'S ATTENTION RESTORATION THEORY AND URBAN VISUAL PREFERENCES DEFINED BY LYNCH

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Abstract. Window views can enable restorativeness. Previous studies define characteristics of natural environment that trigger restorativeness, but fewer studies are dealing with restorative characteristics of urban environment. The purpose of this study is to identify qualities that enable restorativeness in natural and urban window views. Using a questionnaire survey as a method for obtaining the research data, responses of architectural students are analysed. To identify restorative potential in window views evaluation method according to Kaplan's Attention Restoration Theory (ART) is used. Additional evaluation method for urban views is applied using Lynch's theory of designing urban space that people can enjoy. Our findings show that urban views can be analysed according to Lynch's visual qualities to identify the restorative potential of urban environments. Our findings also show that Lynch's criteria may coincide with Kaplan's criteria for assessing restorativeness. To define restorative potential in urban views in an early design phase, new evaluation methods are needed to transcend the renowned Kaplan's Attention Restoration Theory into more approachable design mechanisms for designers and decision makers. Well-being of the inhabitants in a future dense urban environment will only be provided with an adequate window view.

Keywords: restorativeness, well-being, window view, natural view, urban view, visual qualities, Kaplan, Lynch.

Introduction

In recent years natural window view has played an important role in maintaining indoor well-being. However, with increasing density of the urban tissue and reduction of green spaces in cities (Zhou & Wang, 2011), providing access to high quality view is becoming a growing challenge. Especially in high-density urban environments, lack of contact with natural environment can cause problems with concentration, deficiency of stimulation, negative emotions, and other forms of psychological dissatisfaction (Collins, 1976). People may even suffer from symptoms such as depression, insomnia, and loss of sense of reality (Sommer, 1974; Logar et al., 2014; Kaplan, 2001; Aries et al., 2010). Many researchers believe that looking at nature through windows affects people in a similar way as if they were in direct contact with nature (Ko et al., 2017; Grinde & Patil, 2009; Honold et al., 2016; van den Berg et al., 2016). All this suggests the importance of visible contact with nature (Spano et al., 2021) and its restorative effect, which proved to be a key factor even during the COVID 19 epidemic, when people were able to leave their homes for weeks and months only under very strict conditions.

Since most information about the environment is received through visual perception (Amini & Adibzadeh, 2020), visual contact with the external environment provides the information needed for everyday activities such as location, time, weather conditions, and activities in the surroundings (Slovenian Institute for Standardization, 2019). The quality of visual information depends on the type and characteristics of the observed view. First and foremost, the composition of the view is a crucial quality. A preferred view encompasses both the foreground and the horizon (Littlefair, 1996). Bell and Burt (1995) specified three *visible layers* that should be included in the view: the upper layer (in the distance, contains the sky and the natural or urban horizon), the middle layer (contains natural or urban elements such as fields, trees, hills, buildings, etc.) and the lower layer (in the foreground, including greenery and soil). View that contains different information is the most desirable. A distant view includes three layers, so it is more desirable than a close one (Kent & Schiavon, 2020).

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In addition to the composition, the content of the view is also decisive. According to various studies the view of nature and natural elements – trees and other greenery, sky, sunlight, and water is the most desirable (van Esch et al., 2019). People are attracted to views that are mysterious and harmonious (Kaplan & Kaplan, 1989). Kaplans (1989) argue that views with natural environment can influence the restorative process. In the Attention Restoration Theory (ART) they suggest that exposure to nature is not only enjoyable but can also help to improve focus and the ability to concentrate. Furthermore, some authors claim that restorative environments also help people to recover from mental fatigue (Li & Sullivan, 2016) and stress (Tyrväinen et al., 2014), increase positive emotions, and improve well-being (Jo et al., 2013). People prefer contact with nature when they are emotionally tired (Korpela et al., 2010).

Findings from various studies indicate that recovery is faster and more complete when people are exposed to natural rather than urban environments (Ulrich, 1991; Tenngart Ivarsson & Hagerhall, 2008; Liu et al., 2021).

There is substantial evidence regarding the positive effects of natural views. Meanwhile there are not many in-depth studies that analyse the restorative potential of urban environments. Twedt et al. (2019) claim that in urban environments, only views of very attractive buildings such as museums, churches, night city images, etc. can be restorative. Some studies highlight the restorative potential of open urban spaces that include natural elements (Peron et al., 2002; Subiza-Pérez et al., 2021; van den Berg, 2016) and help to reduce stress and enhance psychological recovery (Hartig et al., 2003; Tyrväinen et al., 2014).

The identification of these questions has led to the research objectives of this paper. In the case of natural views our findings show that restorativeness can be evaluated with four components of ART as confirmed by studies of other authors (Sonntag-Öström et al., 2014; Ojala et al., 2019; Menatti et al., 2019; Liu et al., 2021). We further examined whether the restorativeness of the urban view could be evaluated by using Lynch's (1960) theory of the perception of urban environments. We hypothesized that visual qualities according to Lynch could contain restorative characteristics similar to ART. 33 views were analysed using an evaluation scale that linked responses in the survey to the four key components of ART and to visual qualities according to Lynch.

The contribution of the study is the finding that urban views can be evaluated using Lynch's visual qualities which can help to identify the restorative potential of urban environments. The results can contribute to a better understanding of restorativeness in natural and urban environments and highlight the need for creating adequate window views already in the design phase.

1. Methodology

To achieve the objectives mentioned above, the work has adopted a mixed – qualitative methodology with a combination of literature review, preliminary study of various views, survey implementation among students of architecture, and the development of criteria to analyse the restorative potential in natural and urban window views.

To prepare the survey, we conducted preliminary research that covered in – situ observations and photographic recording in various locations (Australia, USA, Austria, France, Germany, and Slovenia). The focus of the survey was the subjective reaction of the respondents to the visual stimulus triggered by various views. The selection included 33 views (natural and urban views with or without natural elements) with an emphasis on diversity in composition and content (van Esch et al., 2019; Aries et al., 2010; Kent & Schiavon, 2020; Kaplan & Kaplan, 1989), as well as on different numbers of visible layers (Slovenian Institute for Standardization, 2019; Bell & Burt, 1995).

Views contain characteristics which the literature cites as restorative. We deliberately chose some views which do not show restorative potential at first sight. To check the consistency of the responses, some similar views were chosen. 32 students of the Faculty of Architecture, University of Ljubljana (4th and 5th year of study) participated in the survey. The significance of individual characteristics of the views was not revealed to the respondents in order to obtain their spontaneous responses. We assumed that architectural students have an affinity for space, aesthetics, and nature. Their ability to define spatial visual preferences were essential for conducting a successful survey.

The survey was sent to the respondents (24 women and 8 men) via e-mail. The respondents observed each view for 8 seconds and then submitted the response. The respondents were able to choose from 11 responses: A – *dangerous, frightening, terrifying*; B – *incomprehensible, unpleasant, disturbing*; C – *very disturbing, repulsive, depressing*; D – *boring*; E – *calming, pleasant*; F – *understandable, coherent, legible*; G – *attractive, fascinating, invigorating*; H – *dreamy, romantic*; I – *mysterious*; J – *acceptable, unobtrusive*; K – *neutral*.

Specific responses in the survey were determined subjectively, based on past experiences of researchers and case studies from the literature (Kim et al., 2018; Brown et al., 2013; Aries et al., 2010; Kent & Schiavon, 2020; van Esch et al., 2019; Kaplan & Kaplan, 1989). Responses from A – D were defined as unwanted or negative, and responses from E – K as appropriate or positive.

For the analysis of survey responses, we used key components (*fascination*, *being away*, *extent*, and *compatibility*) that define restorativeness according to ART (Kaplan & Kaplan, 1989). Subjective responses were included in one of the four key components. We were interested in whether the responses were compatible with the key components of ART and whether the views contain negative characteristics that may reduce the restorative potential.

To analyse restorative potential in urban views more specifically, we linked the responses to visual qualities of the urban environment which Lynch (1960) cites as qualities that a designer may use to create enjoyable urban designs.

We examined (1) characteristics that increase restorative potential, (2) characteristics that reduce restorative potential, and (3) characteristics that impair restorative potential.

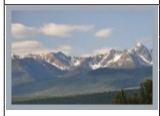
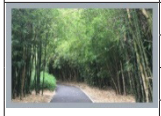
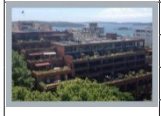
1.1. Measures

We defined the restorative potential of views in several steps.

Firstly, we comprised survey responses in the analysis of criteria that were set according to Kaplan's (1989) and Lynch's (1960) theories. For each view in the survey, we calculated percentages of individual responses. The sum of positive responses was linked to the key component *fascination* (response G), *being away* (response E, H), *extent* (response I) and *compatibility* (response F, J, K). Sums of negative responses were linked to the component Negative.

Secondly, we classified views into three groups according to the percentage rate of negative responses. The first group (Table 1) included views without negative responses. The second group (Tables 2, 3) included views with up to 25% of negative responses, and the third group (Table 4) included views with over 25% of negative responses.

Table 1. Natural and urban window views without negative characteristics

View number and type[1]	Survey responses (%)[2]	Key components	Findings in urban views	Restorative potential
 2 / nature	E = 59%, H = 6%	*being away* (65%)		yes
	G = 31%	*fascination* (31%)		
	F = 4%	*compatibility* (4%)		
		negative (0%)		
 3 / nature	G = 56%	*fascination* (56%)		yes
	H = 22%, E = 19%	*being away* (41%)		
	F = 3%	*compatibility* (3%)		
		negative (0%)		
 10 / nature	E = 25%, H = 22%	*being away* (47%)		yes
	F = 22%, J = 9%	*compatibility* (31%)		
	G = 22%	*fascination* (22%)		
		negative (0%)		
 12 / nature	H = 72%, E = 16%	*being away* (88%)		yes
	G = 6%	*fascination* (6%)		
	I = 3%	*extent* (3%)		
	J = 3%	*compatibility* (3%)		
		negative (0%)		
 13 / nature	I = 38%	*extent* (38)		yes
	G = 28%	*fascination* (28%)		
	E = 16%, H = 12%	*being away* (28%)		
	J = 3%, K = 3%	*compatibility* (6%)		
		negative (0%)		
 20 / urban	J = 39%, K = 14%, F = 10%	*compatibility* (63%)	*form simplicity*	not entirely
	G = 31%	*fascination* (31%)	*singularity*	
	H = 3%	*being away* (3%)	*continuity*	
	I = 3%	*extent* (3%)	*visual scope*	
		negative (0%)		
 31 / urban	F = 25% J = 22% K = 3%	*compatibility* (50%)	*form simplicity*	not entirely
	E = 34%	*being away* (34%)	*continuity*	
	G = 16%	*fascination* (16%)	*singularity*	
		negative (0%)		
 33 / urban	J = 43%, F = 39%	*compatibility* (82%)	*form simplicity, clarity of joint*	not entirely
	G = 12%	*fascination* (12%)	*dominance*	
	E = 3%, H = 3%	*being away* (6%)	*continuity*	
		negative (0%)		

Note: [1]According to numbers in the survey; [2]A Dangerous / Frightening / Scary, B Incomprehensible / Unpleasant / Disturbing, C Very disturbing / Repellent / Depressing, D Boring, E Calming / Pleasant, F Understandable / Coherent / Legible, G Attractive / Fascinating / Invigorating, H Dreamy / Romantic, I Mysterious, J Acceptable / Not disturbing, K Does not arouse special feelings / Neutral.

Table 2. Natural window views with minor negative characteristics

View number and type[1]	Survey responses (%)[2]	Key components	Findings in urban views	Restorative potential
 4 / nature	E = 38%, H = 6%	*being away* (44%)		not entirely
	I = 25%	*extent* (25%)		
	G = 13%	*fascination* (13%)		
	J = 3%	*compatibility* (3%)		
	A = 13%, B = 2%	negative (15%)		
 5 / nature	J = 31%, K = 13%, F = 3%	*compatibility* (47%)		not entirely
	E = 19%	*being away* (19%)		
	I = 9%	*extent* (9%)		
	D = 19%, A = 3%, B = 3%	negative (25%)		
 6 / nature	K = 31%, J = 19%, F = 13%	*compatibility* (63%)		not entirely
	G = 16%	*fascination* (16%)		
	E = 6%, H = 6%	*being away* (12%)		
	B = 6%, D = 3%	negative (9%)		
 7 / nature	E = 38%, H = 9%	*being away* (47%)		not entirely
	I = 38%	*extent* (38%)		
	J = 9%, F = 3%	*compatibility* (12%)		
	D = 3%	negative (3%)		
 11 / nature	I = 56%	*extent* (56%)		not entirely
	J = 9%, K = 6%	*compatibility* (15%)		
	E = 13%	*being away* (13%)		
	G = 9%	*fascination* (9%)		
	B = 4%, D = 3%	negative (7%)		
 14 / nature	E = 50%	*being away* (50%)		not entirely
	J = 19%, K = 16%, F = 6%	*compatibility* (41%)		
	G = 3%	*fascination* (3%)		
	D = 6%	negative (6%)		

Note: [1]According to numbers in the survey; [2]A Dangerous / Frightening / Scary, B Incomprehensible / Unpleasant / Disturbing, C Very disturbing / Repellent / Depressing, D Boring, E Calming / Pleasant, F Understandable / Coherent / Legible, G Attractive / Fascinating / Invigorating, H Dreamy / Romantic, I Mysterious, J Acceptable / Not disturbing, K Does not arouse special feelings / Neutral.

The numbers of the views in the tables are taken from the order of the views in the survey.

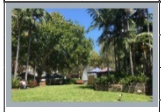
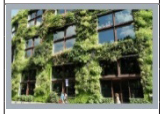
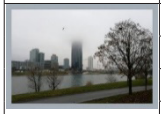
We further assessed the urban views according to Lynch with visual qualities that are described as *singularity*, *form simplicity*, *continuity*, *dominance*, *clarity of joint*, *visual scope* and *motion awareness*.

The final assessment of the restorative potential in window views identified the presence of negative responses, percentages of key components according to Kaplan's criteria, and the presence or absence of visual qualities according to Lynch's criteria (Yes, No, and Not entirely).

1.1.1. Visual qualities of natural environment

In the well-known Attention Restoration Theory, the authors Kaplan and Kaplan (1989) established that people concentrate better after spending some time in nature or by watching natural scenes through a window. The claim is based on the findings of two types of attention: *involuntary attention*, attracted by intriguing stimuli, and *voluntary* or *directed attention*, driven by cognitive-control processes. The function of *directed attention* is to give priority to stimuli from the environment (including working environment) and to effectively ignore irrelevant information. The effectiveness of *directed attention* decreases over time and then it manifests itself in the form of distraction, work inefficiency, and even professional burnout. Mental fatigue is reduced by observing aesthetic scenes from nature, which activates *involuntary attention*. The attention Restoration Theory argues that looking at scenes from nature allows the brain *to sit in the default mode network* and enables relaxation after a period of strictly *directed attention* that is required in everyday life. Free thoughts allow the brain to regenerate the ability of *directed attention*.

Table 3. Urban window views with minor negative characteristics

View number and type[1]	Survey responses (%)[2]	Key components	Findings in urban views	Restorative potential
 1 / urban	E = 53%, H = 16%	*being away* (69%)	*continuity*	not entirely
	J = 16%, F = 3%	*compatibility* (19%)	*clarity of joint*	
	G = 6%	*fascination* (6%)	*singularity*	
	B = 6%	negative (6%)		
 17 / urban	J = 31%, K = 28%	*compatibility* (59%)	*form simplicity*	not entirely
	E = 19%, H = 3%	*being away* (22%)	*continuity*	
	G = 9%	*fascination* (9%)	*singularity*	
	I = 6%	*extent* (6%)	*visual scope*	
	C = 4%	negative (4%)		
 18 / urban	G = 66%	*fascination* (66%)	*singularity*	not entirely
	E = 16%	*being away* (16%)	*continuity*	
	F = 6%, J = 6%	*compatibility* (12%)	*form simplicity*	
	B = 6%	negative (6%)		
 24 / urban	K = 38%, J = 31%, F = 9%	*compatibility* (78%)	*form simplicity*	not entirely
	G = 3%	*fascination* (3%)	*dominance*	
	E = 3%	*being away* (3%)	*continuity*	
	B = 13%, D = 3%	negative (16%)		
 26 / urban	G = 50%	*fascination* (50%)	*singularity*	not entirely
	J = 16%, F = 13%, K = 6%	*compatibility* (35%)	*form simplicity*	
	I = 6%	*extent* (6%)	*visual scope*	
	B = 3%, D = 6%	negative (9%)		
 27 / urban	F = 37%, J = 29%, K = 3%	*compatibility* (69%)	*clarity of joint*	not entirely
	G = 10%	*fascination* (10%)	*dominance*	
	E = 3%, H = 3%	*being away* (6%)	*continuity*	
	B = 6%, D = 9%	negative (15%)		
 28 / urban	J = 34%, F = 13% K = 6%	*compatibility* (53%)	*clarity of joint*	not entirely
	I = 16%	*extent* (16%)	*visual scope*	
	E = 13%	*being away* (13%)	*continuity*	
	D = 9%, A = 6%, C = 3%	negative (18%)		
 29 / urban	J = 40%, F = 16%, K = 16%	*compatibility* (72%)	*clarity of joint, motion awareness*	not entirely
	E = 6%	*being away* (6%)	*continuity*	
	D = 16%, C = 6%	negative (22%)		
 30 / urban	J = 34%, F = 19%, K = 6%	*compatibility* (59%)	*clarity of joint, motion awareness*	not entirely
	G = 22%	*fascination* (22%)	*singularity*	
	B = 16%, C = 3%	negative (19%)		
 32 / urban	J = 40%, F = 28%, K = 9%	*compatibility* (77%)	*form simplicity, clarity of joint*	not entirely
	G = 10%	*fascination* (10%)	*singularity*	
	E = 10%	*being away* (10%)	*continuity*	
	D = 3%	negative (3%)		

Note: [1]According to numbers in the survey; [2]A Dangerous / Frightening / Scary, B Incomprehensible / Unpleasant / Disturbing, C Very disturbing / Repellent / Depressing, D Boring, E Calming / Pleasant, F Understandable / Coherent / Legible, G Attractive / Fascinating / Invigorating, H Dreamy / Romantic, I Mysterious, J Acceptable / Not disturbing, K Does not arouse special feelings / Neutral.

Table 4. Natural and urban window view with predominant negative characteristics

View number and type[1]	Survey responses (%)[2]	Key components	Findings in urban views	Restorative potential
 8 / nature	I = 21%	*extent* (21%)		no
	E = 18% H = 3%	*being away* (21%)		
	K = 9%, F = 6%	*compatibility* (15%)		
	D = 37%, A = 3%, B = 3%	negative (43%)		
 9 / nature	J = 22%, K = 13%, F = 6%,	*compatibility* (41%)		no
	G = 13%	*fascination* (13%)		
	E = 6%, H = 3%	*being away* (9%)		
	I = 6%	*extent* (6%)		
	D = 22%, A= 6%, B = 3%	negative (31%)		
 15 / nature	G = 22%	*fascination* (22%)		no
	K = 16%, J = 6%	*compatibility* (22%)		
	I = 19%	*extent* (19%)		
	A = 22%, B = 3%, C = 6%, D = 6%	negative (37%)		
 16 / urban	K = 16%	*compatibility* (16%)	*form simplicity*	no
	G = 3%	*fascination* (3%)	*singularity*	
	I = 3%	*extent* (3%)	*visual scope*	
	D = 28%, B = 22%, C = 28%	negative (78%)		
 19 / urban	K = 34%, J = 25%, F = 9%	*compatibility* (68%)	*form simplicity*	no
	B = 13%, D = 19%	negative (32%)		
 21 / urban	I = 22%	*extent* (22%)	*visual scope*	no
	G = 3%	*fascination* (3%)	*singularity*	
	J = 9%, K = 3%	*compatibility* (12%)	*form simplicity*	
	C = 28%, B = 19%, A = 16%	negative (63%)		
 22 / urban	K = 22%, F = 3%, J = 3%	*compatibility* (28%)	*clarity of joint*	no
	C = 31%, D = 25%, B = 9%, A = 7%	negative (72%)		
 23 / urban	J = 3%, K = 9%	*compatibility* (12%)	*motion awareness*	no
	I = 3%	*extent* (3%)	*visual scope*	
	B = 34%, A = 28%, C= 17%, D = 6%	negative (85%)		
 25 / urban	K = 53%, J = 19%	*compatibility* (72%)	*form simplicity*	no
	D = 16%, B = 9%, C = 3%	negative (28%)		

Note: [1]According to numbers in the survey; [2]A Dangerous / Frightening / Scary, B Incomprehensible / Unpleasant / Disturbing, C Very disturbing / Repellent / Depressing, D Boring, E Calming / Pleasant, F Understandable / Coherent / Legible, G Attractive / Fascinating / Invigorating, H Dreamy / Romantic, I Mysterious, J Acceptable / Not disturbing, K Does not arouse special feelings / Neutral.

The Kaplans (1989) describe four key components that an environment must contain to trigger restorativeness:

- *Fascination* – arouses interest and triggers involuntary attention that regenerates. Kaplan (1995, 2001) suggests that views of natural scenery can offer brief views with elements of fascination, which is likely to reduce the mental fatigue of the observer. The nature has an inexhaustible source of fascinating scenes that are fascinating for the observer. Natural scenery often contains elements that have characteristics of *soft fascination* such as clouds, sunsets, snow patterns, the motion of the leaves in the breeze. These elements readily hold the attention, but in an undramatic fashion (Kaplan, 1995).
- *Being away* – offers a feeling which may be of an objective or subjective nature, e.g. a person can be mentally detached from the current location and thus disconnected from everyday life and worries. As described by Kaplan (1995), the component of being away frees a person from stressful mental activities. The presence of natural elements in scenery such as coasts, mountains, streams, forests, lakes, and meadows allow the observer to enjoy mental absence. The characteristics of the scene, which have a relaxing effect on the observer, automatically trigger a restorative effect. This group also includes archetypal views that trigger memory and allow mental escape.
- *Extent* – represents the connection between an individual and the environment, for example a view of vast expanses of unspoiled nature boosts imagination. However, Kaplan (1995) argues that a sense of extent is not necessarily defined by the vastness of the environment. It can be achieved also with paths depicted in miniature so that a smaller environment looks larger. We can also identify this component in scenes that trigger mysteriousness. Mysterious views hide information, but at the same time offer a feeling of being in a whole different world. Kaplan (1995) describes environmental characteristics that include historical artifacts which connect the observer with the past and thus with the broader context of the environment.
- *Compatibility* – includes characteristics in the environment that correspond to the wishes and goals of the individual. Compatibility depends on both physical and non-physical attributes. It involves how well the content of the environment supports the needs and inclinations of the user (Tenngart Ivarsson & Hagerhall, 2008). Kaplan (1995) established that nature is largely compatible with man. For many people, functioning in the natural setting seems to require less effort than functioning in more man-made settings, even though they have much greater familiarity with the latter (Cawte, 1967).

1.1.2. Visual qualities of urban environment

According to Lynch (1960) urban space is determined by spatial relationship between the built structure and the observer. Visual qualities such as *legibility*, *imageability*, *structure* and *identity* are key characteristics for a quality urban environment. We hypothesized that these qualities have the potential for restorativeness. If the cityscape is legible, its components can easily form a coherent picture that not only provides people with a sense of security, but also gives them emotional satisfaction and the intensity of experiencing an urban space. An essential characteristic that determines the identity and structure of the urban environment is imageability (shapes, colours, composition of elements). These qualities make it easier for the observer to create a recognizable and useful mental image of an urban environment.

The measurements used to evaluate urban views include Lynch's visual qualities that may have restorative potential:

- *Singularity* – uniqueness of urban space, which offers the observer satisfaction in the contrasts of surfaces, shapes, intensities, complexity, size of elements, and locations. These are the characteristics that emphasize the urban space, make it recognizable, and exceptional.
- *Form simplicity* – clarity and simplicity of visual form in a geometric sense (e.g. the clarity of a grid system, a rectangle, a dome) are characteristics that allow the observer a quick, clear, and legible perception of urban space.
- *Continuity* – continuity of edges or surfaces (e.g. a street channel, skyline); nearness of parts (e.g. a cluster of buildings), repetition of rhythmic interval (e.g. a street-corner pattern); analogy, harmony of surface or shape (e.g. a common building material, repetitive facade patterns) are characteristics that define the identity of urban space.
- *Dominance* – one element dominates over others (e.g. by size, intensity level). These characteristics enable the simplification of the urban image by visually excluding and subordinating individual elements.
- *Clarity of joint* – high visibility of joints and seams (e.g. a major intersection, a sea-front). Clear spatial interconnection between a building and the site are characteristics that define city structure and ensure a legible image of the urban environment.
- *Visual scope* – transparency (e.g. glass, buildings on stilts); overlaps (e.g. structures appear behind others); vistas and panoramas which increase the depth of vision (e.g. broad open spaces, high views); articulating elements (e.g. foci, penetrating objects) are characteristics which increase the range of the view both physically and symbolically.
- *Motion awareness* – clarity of slopes, curves, and interpenetrations in urban space are characteristics which contribute to the visual assessment of the dis-

tance and give the experience of perspectives that identify the space.

1.1.3. Negative characteristics of window views

According to the literature review we identified views that can trigger negative responses (Aries et al., 2010). Some scenes in nature have beneficial effects, while others can cause neutral or unwanted effects (Martens et al., 2011). The findings show that people are uncomfortable with incoherent and complex views in both natural and urban environments. Such environments are difficult to understand and navigate. For example, a dense, intricate forest is illegible and appears threatening to most people (van Esch et al., 2019). Similarly, incoherent urban environments common in big cities can cause poor orientation in space, lack of legibility, imageability, and identity of space. Negative characteristics can outweigh restorative characteristics of the scene to such an extent that they provoke unpleasant feelings in an observer.

2. Results

The analysis of subjective responses to the displayed window view in the survey shows that a particular response depends on the content and visual quality of the scene.

The results demonstrate that natural views containing key components of ART have a larger potential for restorativeness than urban views. This agrees with previous empirical evidence that mainly suggests a much stronger stress – reducing capacity and restorativeness of natural views compared to urban views. However, some urban views containing ART components could have a similar restorative effect.

Our findings show that the evaluation method of urban views according to Lynch's theory may coincide with the evaluation method according to Kaplan's theory. For example, the quality of *visual scope* according to Lynch contains characteristics that increase the range and width of the view, which coincides with the ART component *extent*. The quality of *continuity* according to Lynch contains characteristics that emphasize continuity of edges, harmony of shapes and surfaces which coincides with the ART component of *being away*. The qualities such as *singularity* and *dominance* according to Lynch contain characteristics that express uniqueness of the urban environment, which coincides with the ART component *fascination*. Other qualities according to Lynch, such as *form simplicity*, *clarity of joint* and *motion awareness* contain characteristics that affect how a man-made environment is compatible with human needs, which coincides with the ART component of *compatibility*.

The findings also show that scenes which are distracting, boring, or even intimidating reduce visual preferences and therefore restorativness of the natural and urban environment according to ART and Lynch. The results of the survey responses show that the reaction to window views were consistent with the analysis of window views qualities.

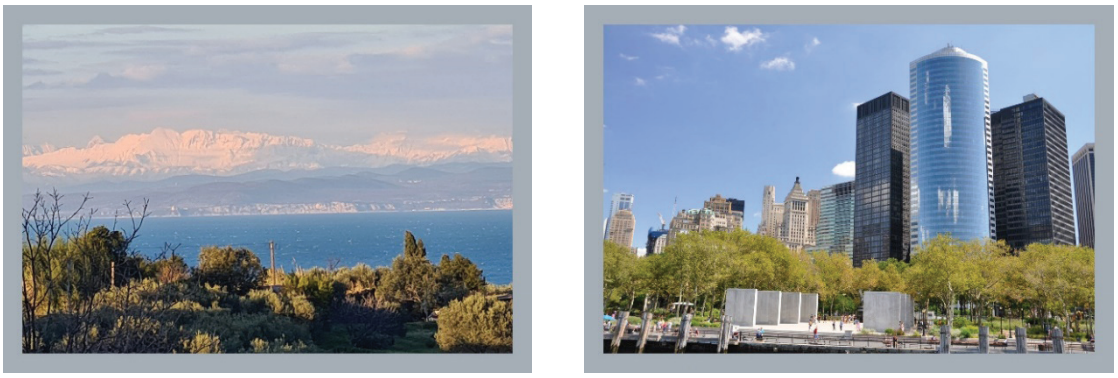
More detailed results are presented in three groups: (1) window views without negative characteristics, (2) window views with minor negative characteristics and (3) window views with predominant negative characteristics.

2.1. Natural and urban window views without negative characteristics

The analysis of the survey shows views without negative characteristics (Table 1). Respondents chose positive responses from E to K and no negative responses (A, B, C, D).

In natural views, mostly of distant, unspoiled, and picturesque nature, key components of *being away*, *fascination*, *extent* prevail. The characteristics of *being away* trigger a soothing, dreamy feeling. Respondents perceived them in views of natural coastal locations (view 2), mountains (view 3, 10) and forests (view 13). The characteristics of *fascination* are mainly recognized as elements of *soft fascination* which is not intrusive but allows mental escape and retains the attention of the observer. Respondents perceived them in views with sunset (view 12), clouds (views 2, 3 and 10), and snowy landscape (view 3, 10). The characteristics of *extent* enable the conceptual transformation of what is seen (in physical form) into the imaginary (the perception of an individual). Respondents perceived them in views that connects an individual with the scene (e.g. a path through a bamboo forest, view 13). The characteristics of *compatibility* are present in all natural views but at a lower percentage (views 2, 3, 10, 12, 13). Our findings show that natural views have a restorative potential (Figure 1a). They are free of negative characteristics and include key components of *being away*, *fascination*, *extent,* and *compatibility*.

In urban views *compatibility* prevails (view 20, 31, 33). *Fascination* and *extent* are present in a high view (clustered urban structure, view 20). *Being away* is evident in a distant view (city panorama, view 31). Responses were further verified by Lynch's criteria. Visual qualities of *form simplicity*, *singularity,* and *continuity* are common to all three urban views, where elements of urban structure are dominant, vivid, and simple in form. *Visual scope* is present in high views (view 20), while *clarity of joint* can be identified only in the scene of urban panorama (view 33). Urban views are enriched by landscape elements such as vegetation (views 31, 33) and the presence of water (view 31). The results show a high percentage of *compatibility* in urban window views. The presence of natural elements (e.g. water, vegetation) has a positive influence on view quality. However, low percentages of other key components of ART as well as the absence of some Lynch's visual qualities reduce restorative potential (Figure 1b). Although urban views are free of negative characteristics, the restorative potential cannot be entirely confirmed.



a) b)

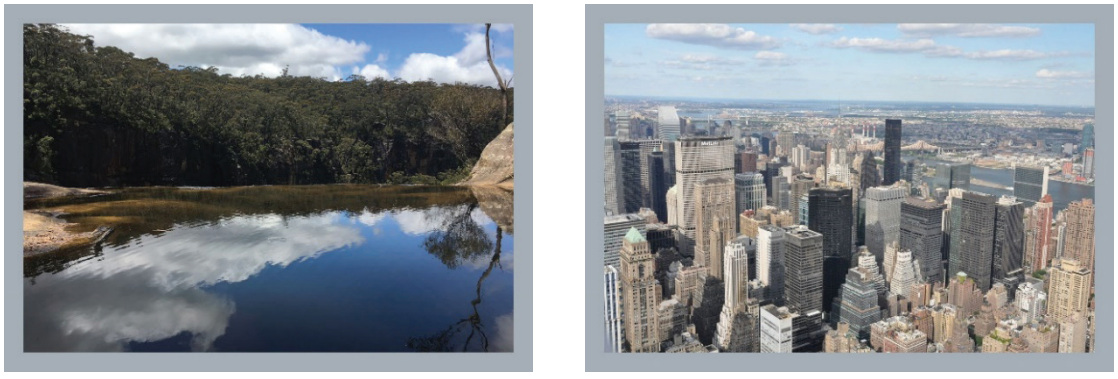
Figure 1. Examples of natural and urban view without negative characteristics: a) View 3 shows a dense vegetation in the foreground and snow-capped mountains in a distance with clearly visible boundary between the sea and land. *Fascination* and *being away* prevail; b) View 33 is a panoramic view on urban structure with natural elements (trees in a park) in the foreground and sky above. *Compatibility* and Lynch's visual qualities *form simplicity* and *clarity of joint* prevail

2.2. Natural and urban window views with minor negative characteristics

The analysis of the survey shows views with minor negative characteristics (Tables 2, 3). Respondents chose positive responses from E to K and negative responses (A, B, C, D).

The percentage of negative responses is relatively low. However, it may reduce the restorative potential. Our findings show that nature is not always restorative. For example, a view of the large tree (view 5) contains *compatibility*, *being away* and *extent*, but a close view can also cause a boring, unpleasant, or even threatening responses. Another example is an intact lake (view 4) where *being away* prevails. Calming, dreamy feelings may arise (triggered by water, clouds, and forest) but a complex scenery may cause incomprehensible or even terrifying response. View of dense tropical forest (view 11) includes a high percentage of *extent* and triggers a sense of mystery. However, the scene also appears illegible and boring to some respondents. Our findings show that restorativeness in natural view may decrease due to the presence of negative characteristics. This is most evident in views with one visible layer or complex sceneries (Figure 2a).

In urban views the percentage of negative responses is relatively low but can reduce the view quality. Our finding show that urban views include key components of ART *compatibility* is recognizable in views with the presence of natural elements such as green facades (views 17, 18), greenery, parks (views 1, 32) and waterways (views 27, 30). *Being away* is present mainly in scenes with distinct landscape characteristics (urban park, view 1). *Fascination* prevails in the high views (high view of the metropolis, view 26) or picturesqueness of the scene (green facade, view 18). Our findings show the overall absence of *extent* that indicates broader context of the environment and is evident only in views 17 (green facade), 26 (panoramic city view) and 28 (seashore in the city). The results show



a) b)

Figure 2. Examples of natural and urban view with minor negative characteristics: a) View 4 includes natural elements such as forest, clouds, and water. *Being away* prevail. Negative characteristics such as closed view and absence of illegibility is evident; b) View 26 is a high view of the metropolis where *fascination* and Lynch's visual quality *singularity* prevail. Absence of *being away,* and Lynch's visual quality *clarity of joint* as well as absence of natural elements is evident

that negative responses are linked to the absence of Lynch's visual qualities. The absence of *visual scope* (transparency, overlaps, open views) is recognizable in scenes which trigger uncomfortable and disturbing responses. Such an example is a close view of the green façade (view 18) where only one layer is visible. Obvious absence of *singularity* is evident in the scenes where the contrasts of surfaces and colours are not prominent (blurred path along the river sidewalk, view 28) or by monotonous composition that can create a boring feeling (residential neighbourhood, view 29). Urban views can become incomprehensible by the absence of *clarity of joint*, if the connections between urban areas, paths and intersections are not clearly recognizable, as in high view of the city panorama (view 26) and a distant view of the city structure (view 24). Negative characteristics such as lack of picturesqueness or illegibility of space reduce the level of restorativeness of the urban view (Figure 2b).

2.3. Natural and urban window views with predominant negative characteristics

The analysis of the survey shows views for which the respondents expressed mostly negative reactions (responses A, B, C, D). Pronounced negative characteristics prevent restorativeness of the view (Table 4).

Responses to natural views in this group are quite scattered. Some include *compatibility*, *fascination*, *extent* and *being away*. However predominant negative responses prevail. Due to the close view and illegible image, the natural scenery can be intimidating, although *compatibility*, *fascination* and *extent* are present (close view of mountains, view 15). Due to the absence of picturesqueness and difficult orientation in space, the scene can be boring and incomprehensible, although *compatibility*, *extent* or *being away* are present (ploughed field, view 8, or impassable forest, view 9). In natural views restorative potential is not recognizable mostly because of predominant negative characteristics and the absence or minimal percentage of ART components (Figure 3a).

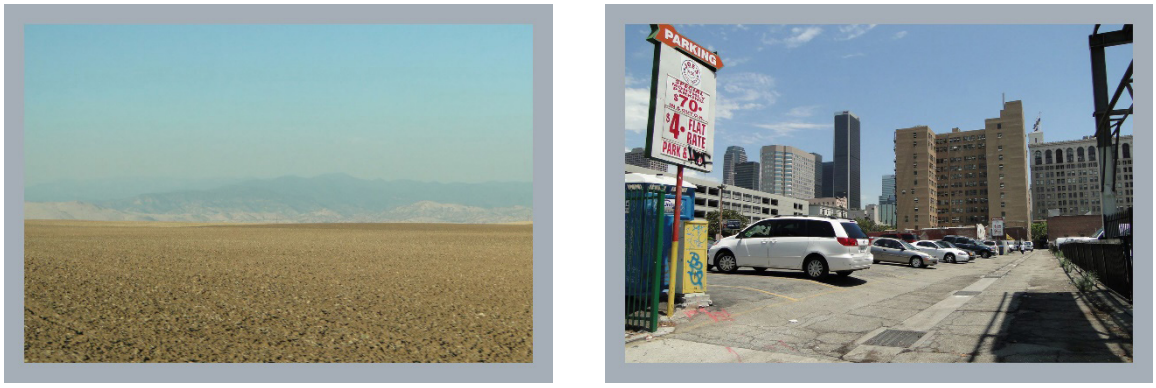
In urban views negative responses prevail. Our findings show that *being away* is not present in any view. Low percentage of other components such as *extent* and *fascination* are evident. Most of views do not contain three visible layers. The absence of natural elements and Lynch's visual qualities is evident. Views without *visual scope* and *singularity* seem boring and uncomfortable (views of nearby objects 19, 22, 25). The absence of *dominance* and *continuity* in a highly disordered environment can have a very repulsive or depressing effect on the observer (close view of the ruin, view 21 or parking lot, view 22). The absence of *clarity of joint* disables the legible image of the urban space (densely built structure, view 25 or an abandoned house in the woods, view 23). There is no restorativness in urban views because of predominant negative characteristics, absence or a minimal percentage of ART components and Lynch's visual qualities (Figure 3b).

Conclusions

Visual qualities of the window view will be crucial for the well-being of the inhabitants. The United Nations predicts that the world's population will grow to around 8.5 billion by 2030 (Vratanar, 2021). Most people are projected to live in densely populated urban areas, away from natural environment, where restorativeness will only be provided with an adequate window view.

It is generally accepted that the restorativeness of urban environment is still considered inferior compared to natural environment. The restorative potential of the natural view cannot be easily compared to the urban view because of different phenomena of the environment. The nature can inherently possess restorativeness, while the priority of man-made environments is to respond to human needs and is defined by decision makers.

The results of the study demonstrate that natural views containing key components according to Kaplan's theory (ART) have a larger restorative potential than urban views. However, urban views containing ART components



a) b)

Figure 3. Examples of natural and urban views with pronounced negative characteristics: a) View 8 is a view of a ploughed field without vegetation and absence of picturesqueness. The absence of *fascination* as well as a low percentage of *compatibility* is evident; b) View 22 is a view of the parking lot without *fascination*, *being away* and *extent*. The absence of Lynch's visual qualities *singularity, dominance*, *continuity,* and *visual scope* is evident

could be restorative, too. To establish restorative potential of urban environments an additional evaluation method is proposed. The findings of the study show that the restorative potential of urban views can be evaluated with the presence or absence of Lynch's visual qualities that enable enjoyable urban designs and could therefore possess characteristics of restorativness. Furthermore, a combined evaluation method according to both ART and Lynch's theories could bridge the gap between evaluating restorativness in urban environments. The absence of natural and urban visual qualities can reduce the restorativness of window view.

Future research should be undertaken to further explore visual qualities that could enable and enrich the restorative potential in urban environments. New evaluation methods are needed to transcend the renowned Kaplans Attention Restoration Theory into more approachable design mechanisms for planners, designers, and decision makers. Increasing the restorative potential in the early design stage can promote higher quality of life for the future city inhabitants.

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