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Preference and perceived naturalness in visual perception of naturalistic landscapes

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ABSTRACT

In landscape design legacy, diverse naturalistic landscape design types develop from a range of design approaches in application of the idea of nature. Naturalistic landscapes are important and valuable experiential landscapes. It is argued in the article, that naturalistic landscapes are not a single perceptual category and that the level of abstraction of natural condition affects not only preference for them, but also perceived naturalness. In addition, also other identifiable variables exist (namely Maintenance, Plant species diversity, Familiarity, Mystery, Coherence, Legibility, and Complexity), that to some extent account for these preferences and perceived naturalness. In the study, preference and perceived naturalness judgements were obtained for a selection of natural, naturalistic and geometrically designed landscape scenes. The results show, that naturalistic landscapes are more preferred than geometrical, and partly also more preferred than natural and that they consist of different visually perceived types. The most preferred are 'Landscape style' and 'Wild garden' scenes, less preferred are 'Natural' and 'Biotope' scenes, the least preferred are 'Geometrical' scenes. In addition, 'Natural' and 'Biotope' scenes are also perceived as the most natural. Preference is predicted mostly by Coherence, whereas perceived naturalness is predicted by several predictors, namely Preference, Maintenance, Familiarity, and Mystery. Hierarchy of score grouping for preference is as follows: form, content, structure, and spatial order. Slight difference is observed for perceived naturalness. In regard to perceived naturalness, the landscape scenes are grouped by content, form, structure and spatial order. Four distinctive groups of participants were clustered in regard to preference for landscape scenes, and three groups in regard to perceived naturalness.

Keywords: visual landscape perception, naturalistic landscape, preference, perceived naturalness, experiential landscape

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IZVLEČEK

VŠEČNOST IN NARAVNI VTIS V VIDNI ZAZNAVI NATURALISTIČNIH KRAJIN

V krajinskooblikovni tvornosti je mogoče razpoznati raznolike tipe naturalističnih krajin, ki nastajajo v različnih oblikovalskih pristopih kot opredmetenje idej o naravi. Naturalistične krajine so pomembne in vredne doživljajske krajine. V članku je predpostavljeno, da naturalistične krajine niso enoznačna vidnozaznavna kategorija in da stopnja odmika od naravnih stanj vpliva tako na všečnost kot na naravni vtis krajinskih prizorišč. Nanju vplivajo še druge prostorske zaznavne spremenljivke (vzdrževanost, pestrost rastlinskih vrst, domačnost, skrivnostnost, skladnost, berljivost, sestavljenost). V študiji so bile zbrane ocene všečnosti in naravnega vtisa za izbrana naravna, naturalistična in geometrijsko oblikovana krajinska prizorišča. Rezultati so pokazali, da so naturalistične krajine bolj všečne od geometrijskih in deloma bolj všečne od naravnih krajin in da jih gradijo različni vidnozaznavni tipi. Bolj so všečna prizorišča 'krajinskega stila' in prizorišča tipa 'divji vrt', manj všečna so 'naravna' in 'biotopska', najmanj pa 'geometrijska' krajinska prizorišča. Obenem pa so 'naravna' in 'biotopska' prizorišča zaznana kot najbolj naravna. Všečnost napoveduje zlasti spremenljivka skladnost, naravni vtis pa napoveduje več spremenljivk; všečnost, vzdrževanost, domačnost in skrivnostnost. Hierarhija združevanja ocenah všečnosti sledi od forme in vsebine prizorišča do njegovih strukturnih značilnosti in prostorske organizacije, združevanje ocen naravnega vtisa pa od vsebine in forme do strukture in prostorskega reda opazovanega prizorišča. Razpoznane so bile tudi štiri različne skupine udeležencev ankete glede na ocene všečnosti in tri skupine glede na ocene naravni vtis.

Ključne besede: vidna zaznava krajine, naturalistične krajine, všečnost, preferenca, naravni vtis, doživljajska krajina

1 INTRODUCTION

In experiencing nature, visual quality of observed landscape plays an important role. The value of quality experiential landscape lays in subtle interrelation between human and natural environment. Production of a quality experiential landscape as a contemporary landscape design attitude may as well be a good design approach in the context of globalising world, in which processes of simplification of visual landscape patterns and diminishment of landscape diversity are rapid and likely irreversible. Nature, particularly vegetation, plays in many aspects a crucial role in everyday life of people. The need to experience beautiful and preferred landscapes, which would be perceived also as natural, seems to be more and more important in the contemporary quick pace of life. In order to design such landscapes, specific design criteria should be adopted; some should also be derived from preference and perceived naturalness characteristics of landscapes. In this article some answers to several questions, which arise in this respect, are given. What is the nature that people have in mind? Are there, apart from mere presence of vegetation in the landscape scene, also other factors influencing the positive effects of nature on people? Are natural landscape scenes more preferred to designed naturalistic landscapes and do different responses to different types of naturalistic landscapes also exist? Does perceived naturalness directly corresponds to factual naturalness of landscape? Or is it more likely, that perceived naturalness relates closely to preferences and is as such an aesthetic response to them? If so, how does the perceived naturalness relate to different types of

naturalistic landscapes. The expressed need for quality experiential landscape, of which natural elements consist a great part, is in fact the need for nature, which is, so to speak, a cultural construct. As a mental representation, it is formed on the basis of various sources, primarily from experience and values that people hold about the environment. Preferences and perceived naturalness of a landscape scene seem valuable concepts in researching these relations. For landscape architect, the importance of perceived naturalness and preference lays in the adoption of suitable design strategies when designing naturalistic landscapes of high experiential value for people.

2 PREVIOUS RESEARCH

2.1 Naturalism in landscape design

As Ogrin (1988: 86) points out, it has been repeatedly declared that mimesis, as an imitation of nature, is the basic principle of landscape design. However, translations of ideas and principles that are extracted from nature into designed landscape are not direct. On the contrary, two particular approaches may be in general recognised: abstraction of natural forms and abstraction of natural processes (Ogrin, 1988). This is also true for naturalistic landscapes, which resemble natural landscape to some degree, yet they are generated by use of particular design approach and syntax. From the 18th century onwards, with development of English landscape style, conceptions of nature were imposed on the landscape in a naturalistic manner by abstracting natural forms and structures. The naturalness was expressed through organic forms and irregular spatial organisation in a highly abstracted form. Later, naturalisation continued with 'picturesque' landscape style by introduction of different landscape elements. It also developed in the direction of 'gardenesque' style with introduction of non-native plants. In nineteenth century, an important contribution in naturalistic landscape design came in developing landscape parks in towns on one hand and evolution of garden styles, namely 'wild garden' and 'flower garden' style, on the other. Development of ecological science as well as environmental movements in the 20th century strongly influenced naturalism in landscape design. Natural processes became the basis for naturalistic design only later in the 20th century. On one hand, they served as a basis for their abstraction and on the other, they were directly implemented in, for example, urban wild gardens or created wetland biotopes.

2.2 Experiencing nature, preference, and perceived naturalness

Contact with nature is a basic human need and a valuable visual environment plays an important role in this interaction (Kaplan in Kaplan, 1989; Hartig, 1993; Ulrich, 1986; Balling in Falk, 1982; Purcell, 1992). Kaplan and Kaplan (1989, 1998) point out the importance of experiencing everyday nature, termed also as a 'nearby nature'. Their investigation of people's perceptions and preferences for natural and naturalistic settings, gives particular attention to the issues of different independent spatial variables that influence landscape preference. These are mystery, coherence, complexity and legibility (Kaplan and Kaplan, 1989). However, little is known about preferences for different naturalistic landscape design types, in regard to preference for natural landscape types or geometrical design types. Although the role of specific natural elements in the landscape and their visual characteristics in terms of spatial

information is well researched (Kaplan and Kaplan, 1989, 1998; Purcell, 1992), little is known of preference relation to perceived naturalness and how the two influence the experiential value of landscape. It has been also shown, that natural environment is not a homogenous category (Herzog, 1984: 10). In environmental preference research, different landscape categories are used, however these categories of nature are too general and they are not suitable to address specific naturalistic design approaches. A lot of attention is also put to investigating attitudes toward natural vs. urban landscapes, and different types of recreational landscapes (Kaplan and Kaplan, 1989; Gobster, 1996). Less focus however, is given to perceptual qualities of different vegetation types, such as shrubs and herbaceous flowering plants vegetation as Ulrich (1986: 41) points out. The role of different types of vegetation on preference and also perceived naturalness is still to be thoroughly investigated.

3 METHOD

3.1 Participants

A questionnaire was designed to test the visual preference judgements and judgements of perceived naturalness for different types of naturalistic landscapes. The questionnaire was delivered to 550 households, of which 214 (38.9%) were filled in and returned by mail. Among participants, there were 39.9% man and 59.3% women, with average age of 44.3 years and an age range from 14 to 84 years.

3.2 Material

On the basis of thorough examination of landscape design legacy, six *Naturalistic landscape* design types were developed. Description of these styles is presented in Table 1. In addition, two landscape type groups as reference groups were defined, namely *Natural landscapes* and *Geometrical landscapes*.

Table 1. Description of landscape types

Landscape type group	Landscape type	Landscape Character Criteria for selecting representative landscape scenes
Natural landscapes	Natural landscape	Free plant growth, multi-layered vegetation, woodland planting, course ground surface, partly or entirely vegetated water edge
Naturalistic landscapes	Landscape style	Open lawn, solitary trees or tree clumps, irregular water edge (if the water is present)
	Picturesque	High structural complexity, high number of landscape elements, groupings of plants, flowering plants
	Wild garden	Groupings of plants, rockery, according to W. Robinson design principles
	Parkland	Open lawn, solitary trees, tree clumps, solitary and groupings of scrubs, irregular arrangement, curving water edge (if water is present)
	Abstract	Large homogenous surfaces (lawn, flowering field or ground cover planting, trees)
	Biotope	High similarity to natural systems, presence of human influence in management
Geometrical landscapes	Geometrical landscape	Orthogonal landscape design, regular flower beds, regular tree arrangement

Twenty-one representative landscape scenes of different landscape types were selected according to the criteria. They were presented as photographs in a questionnaire, three per A4 page in random order, accompanied by a list of variables. Selected landscape scenes from different landscape types are presented in Figures 1 to 8. The number beneath each scene indicates the number of a photograph in the questionnaire.



Landscape scene 3



Landscape scene 4



Landscape scene 11

Figure 1: Representatives of NATURAL LANDSCAPE landscape type (Landscape scenes 3, 4, and 11)



Landscape scene 6



Landscape scene 14

Figure 2: Representatives of LANDSCAPE STYLE landscape type (Landscape scenes 6 and 14)



Landscape scene 15



Landscape scene 16

Figure 3: Representatives of PICTURESQUE landscape type (Landscape scenes 15 and 16)



Landscape scene 7



Landscape scene 10

Figure 4: Representatives of WILD GARDEN landscape type (Landscape scenes 7 and 10)



Landscape scene 1



Landscape scene 8



Landscape scene 18



Landscape scene 21

Figure 5: Landscape scenes 1, 8, 18, and 21 are representatives of PARKLAND landscape type



Landscape scene 2



Landscape scene 13

Figure 6: Representatives of ABSTRACT landscape type (Landscape scenes 2 and 13)



Landscape scene 12



Landscape scene 19

Figure 7: Representatives of BIOTOPE landscape type (Landscape scenes 12 and 19)



Landscape scene 5



Landscape scene 9



Landscape scene 17



Landscape scene 20

Figure 8: Landscape scenes 5, 9, 17, and 20 are representatives of GEOMETRICAL landscape type

3.3 Procedure

Preference judgements and judgements of perceived naturalness were made on a 5-point scale by each participant for all landscape scenes. Prior to judging the landscape scenes, the participants had to read the instructions and definitions of each variable. These were the indicators of degree of preference and perceived naturalness for the scene. *Preference* is a particular affectionate response to the observed landscape scenes. *Perceived naturalness*, on the other hand, is a visual character of landscape scene, recognised by the observer as a degree of similarity to nature. It is judged by the observer and is not necessarily in direct relation to factual natural condition of observed landscape. To explain preference and perceived naturalness, seven relevant predictor variables were also judged. They relate to two general cognitive processes: making sense and involvement (Herzog, 1989:10) in human-environment interaction. In the process of sense making, degree of order in the observed environment is established. Three variables were selected, namely *Coherence*, *Legibility* and degree of *Maintenance*. In the involvement processes, *Complexity* as a number of landscape elements in the landscape scene, and *Mystery* as promise of further information were judged. Combination of the two processes, as Herzog suggests (1989:10), is involved in judging the *Familiarity*. Additional variable *Perceived species diversity* was introduced, to address the influence of plant species knowledge on preference and perceived naturalness scoring.

Printed questionnaires were delivered to households in different neighbourhoods in two towns in Slovenia. In the introductory note, the participants were asked to give their opinion on a series of landscape scenes, presented in the continuation. They recorded their judgements by encircling the adequate number for each variable for each landscape scene. The filled in questionnaires were returned to the researchers by mail. The questionnaire was in Slovenian language.

4 RESULTS

4.1 Landscape preference judgements and perceived naturalness of landscape scenes

Participants scored all 21-landscape scenes in terms of preference and perceived naturalness. The results are presented in Figure 9.

The range of preference judgement means for given landscape scenes are from 2.45 to 4.44. In general, higher preference was expressed for those landscape scenes where larger open areas are visible, such as lawn, flowering meadow or water. Natural landscapes (3, 4, 11) received high preference scores, as well as waterscapes with visible water surface did as expected (6, 12, 15, 21). Participants scored *Landscape Style* and *Parkland* landscape type scenes the highest, with lower preference expressed for *Biotope* and *Natural* type, as oppose to higher preference expressed for *Wild garden* landscape type scenes. As expected, geometrical scenes received the lowest scores, particularly when the scene was extremely simple in complexity (17 and 20).

The range of perceived naturalness judgement means for landscape scenes was from 1.78 to 4.85. Higher scores were obtained for *Natural* type and *Biotope* type landscapes. There are two other landscape scenes, that scored very high in perceived naturalness (No. 6 and No. 12), which are designed landscapes from Tivoli pond, Ljubljana, and one of the ponds in Mestni park, Maribor. *Geometrical landscapes* received lowest scores.

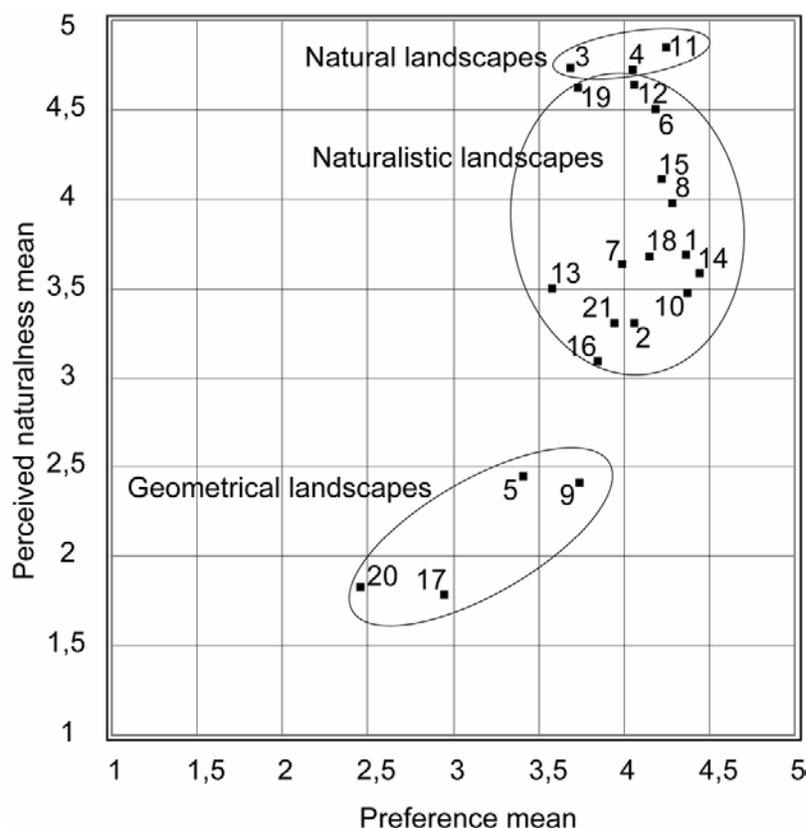


Figure 9: Preference and perceived naturalness scoring. Landscape scenes from three landscape type groups are encircled, namely *Natural landscapes*, *Naturalistic landscapes* and *Geometrical landscapes*

As shown in Figure 9, the scenes that scored high in preference (Mean scoring 4 and higher) were also in general those, which scored high in perceived naturalness judgement (Mean 3.5 and higher). Most of *Natural* type and *Biotope* type scenes scored high in preference rating and perceived naturalness rating. However there are some exceptions: scenes 19 and 3 show water biotope, whose edges are to a great extent vegetated with wetland plants. These scored high in perceived naturalness and lower in preference. On the other hand, two other designed water landscape scenes, namely 6 and 12, scored very high in preference and also in perceived naturalness. Although these landscape scenes all represent water landscapes, the two groups differ in three visual aspects: the size of visible water surface, the type of water vegetation (shrubs versus wetland plants) and the visual character of trees present.

4.2 Variance of preference and perceived naturalness scoring

The variance of preference and perceived naturalness scoring, which was computed for each landscape scene, is listed in Table 2. The range of variance of preference scoring is from 0.55 to 1.89, which is rather large. However, there is a great consensus on preference for landscape scenes with high preference mean in the low end side of variance table, in which scoring for the most preferred landscape scenes (1, 10, and 14) express the lowest variance. The range of variance of perceived

naturalness is even larger, from 0.19 to 1.84. It can be noticed that there is a great consensus in judgement of perceived naturalness for scenes of *Natural* landscape type and *Biotope* landscape design type (11, 3, 19, 4).

Table 2: Preference (a.) and perceived naturalness (b.) means and variances for all 21-landscape scenes, sorted in ascending order of variance

a.			b.		
Landscape scene	Preference Mean	Preference Variance	Landscape scene	Perceived naturalness Mean	Perceived naturalness Variance
1	4,36	0,55	11	4,85	0,19
10	4,38	0,58	3	4,72	0,32
14	4,44	0,63	19	4,62	0,39
8	4,28	0,69	12	4,63	0,40
18	4,15	0,79	4	4,72	0,42
21	3,94	0,79	6	4,50	0,59
6	4,19	0,84	8	3,97	0,89
11	4,25	0,85	17	1,78	1,05
15	4,23	0,91	21	3,30	1,06
7	3,99	0,96	15	4,11	1,12
2	4,06	1,03	20	1,83	1,20
4	4,06	1,07	18	3,68	1,21
12	4,06	1,11	13	3,49	1,22
13	3,59	1,13	1	3,68	1,23
3	3,69	1,31	10	3,47	1,25
5	3,41	1,39	14	3,58	1,35
19	3,73	1,41	5	2,44	1,42
16	3,85	1,52	7	3,63	1,47
20	2,46	1,61	2	3,30	1,58
9	3,74	1,64	9	2,41	1,83
17	2,95	1,89	16	3,09	1,84

In Figure 10 three representative examples of landscape scenes with low variance in preference scoring are presented, and in Figure 11 three representatives of landscape scenes with high variance in preference scoring are shown.



Figure 10: Examples of landscape scenes with low (1, 10, 14) variance in preference scoring



Figure 11: Examples of landscape scenes with high variance (20, 9, 17) in preference scoring

Figure 12 shows three representative examples of landscape scenes with low variance in perceived naturalness scoring, and figure 13 shows three representatives of landscape scenes with high variance in perceived naturalness scoring.



Figure 12: Examples of landscape scenes with low (11, 3, 19) variance in perceived naturalness scoring



Figure 13: Examples of landscape scenes with high variance (2, 9, 16) in perceived naturalness scoring

Since more than half of judgements of presented landscape scenes yielded variance, that was higher than 1, preference data was used to cluster the participants. Cluster analysis, in which Ward's method was employed, yielded four distinctive clusters. In order to define preference distinction between these four groups of participants, a K-Mean analysis was performed. In Table 3, a resulting sequence of landscape scenes for each cluster is presented in a descending order of landscape preference scoring means.

Table 3: Sequences of landscape scenes, sorted in each cluster by preference judgement mean

Cluster	Landscape scenes sequence	Participant group characteristics
Cluster 1 PREFERENCE FOR PARKLAND	14-1-18- 8-10-11-4-6-21- 7-2-15-12-3-16-5-13-19- 9-17-20	Preference for managed open space, with lawn and trees, legible; Dislike of overgrown natural and geometrical landscapes
Cluster 2 PREFERENCE FOR PICTURESQUE	14-10-15-8-1-7-12-2-19- 6-16-9-11-18-21-5-13-4- 3-17-20	Preference for structural diversity, picturesque scenery, a number of landscape elements present Dislike of natural and geometrical
Cluster 3 PREFERENCE FOR NATURAL	11-12-4-6-19-15-3-8-10- 1-14-21-7-18-13-16-2-9- 5-17-20	Preference for natural scenes over any else Dislike of picturesque, colourful and geometrical
Cluster 4 PREFERENCE FOR ABSTRACT	14-10-2-1-18-8- 15-9-6- 16-11-21-7-17-12-4-13-5- 3-20-19	Preference for abstracted, simplified scenes, with large surfaces of lawn, water, flowering beds Dislike of overgrown natural and geometrical

Also perceived naturalness data was cluster analysed. As seen in Figure 14, Ward's method of cluster analysis yielded three clusters and data was further analysed by K-Means analysis. Sequence of landscape scenes of these clusters are sorted by descending perceived naturalness scoring means.

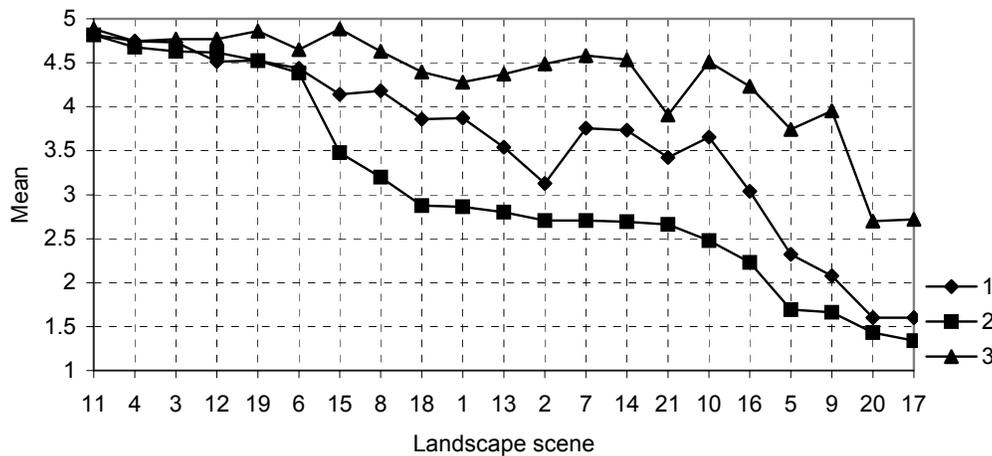


Figure 14: Sequences of landscape scenes, sorted in three clusters according to perceived naturalness scoring mean

As seen in Figure 14 and Table 4, the participants group in three clusters according to how they see naturalness of the observed scene. Their attitude ranges from 'almost all scenes seem to be natural' to 'only some scenes seem to be natural'.

Table 4: Sequences of landscape scenes, sorted in each cluster by perceived naturalness scoring mean

Cluster	Landscape scenes sequence	Participant group characteristics
Cluster 1 RATHER ALL ARE NATURAL	11-4-3-19-12-6-8-15-1- 18-7-14-10-13-21-2-16- 5-9-17-20	Except for Geometrical and Abstract type, the landscape scenes seem rather natural
Cluster 2 ONLY FEW ARE NATURAL	11-4-3-12-19-6-15-8-18- 1-13-2-7-14-21-10-16-5- 9-20-17	Except for Natural and Biotope type, the landscape scenes don't seem natural
Cluster 3 ALMOST ALL ARE NATURAL	15-11-19-3-12-4-6-8-7- 14-10-2-18-13-1-16-9- 21-5-17-20	Except for the Geometrical, landscape scenes all seem natural

4.3 Prediction of preference and perceived naturalness

As Kaplan and Kaplan (1989: 62) point out, regression analysis is a more appropriate procedure to investigate the effect of predictors on preference judgements. The combined effectiveness of a series of predictors in explaining preference is summarised in a statistic, called R^2 . In Table 5 the regression analysis of preference data is presented. R^2 for landscape scenes show, that *Coherence* is the most powerful predictor of preference for these scenes. Much less powerful are *Perceived naturalness* and *Familiarity*. *Legibility*, *Maintenance*, *Mystery* and *Complexity*, on the other hand, are not found as significant preference predictors.

In general, perceived naturalness is predicted by more than two variables for each landscape scene. However, these account for lower R^2 , as is presented in Table 6. This suggests, perceived naturalness is more complex concept and that other predictors determine perceived naturalness, which were not included in the variable selection. *Preference* is a very strong predictor of perceived naturalness, whereas perceived *Plant species diversity* is a significant predictor only for perceived naturalness of one landscape scene. Strong predictor of Perceived naturalness are also perceived *Maintenance* (negative coefficient for *Natural* and *Biotope* type), *Familiarity* (primarily for *Naturalistic* type), *Mystery*, whereas *Complexity* accounts as a significant predictor only for several landscape scenes.

Table 5: Prediction of preference by independent variables. Significant coefficients are bold and underlined

Landscape scene	N	R	R ²	β -coefficients for each variable							
				Perceived naturalness	Maintenance	Plant species diversity	Familiarity	Mystery	Coherence	Legibility	Complexity
1	187	0.825	0.54	0.034	0.003	<u>-0.475</u>	0.011	0.084	0.16	0.175	<u>0.6346</u>
2	191	0.771	0.424	0.297	0.078	-0.377	0.216	0.045	<u>0.232</u>	-0.41	0.3488
3	187	0.752	0.373	-0.2	-0.104	0.03	0.186	-0.143	<u>0.604</u>	0.212	0.0731
4	192	0.814	0.52	-0.08	-0.163	0.114	0.214	0.148	<u>0.666</u>	0.248	-0.114
5	190	0.838	0.57	0.192	0.035	0.0671	0.341	<u>0.357</u>	<u>0.46</u>	-0.27	-0.237
6	187	0.881	0.681	0.319	<u>0.42</u>	-0.144	-0.04	-0.006	0.213	0.065	0.3651
7	187	0.842	0.58	0.269	0.135	-0.006	0.11	-0.167	<u>0.411</u>	0.094	0.2847
8	191	0.626	0.135	-0.2	0.059	-0.03	0.181	0.041	0.372	-0.07	0.2803
9	191	0.652	0.183	0.099	0.007	-0.018	0.167	0.185	<u>0.555</u>	-0.11	-0.057
10	189	0.773	0.427	0.121	-0.152	-0.266	-0.01	0.23	-0.024	0.362	0.3633
11	189	0.628	0.125	-0.48	-0.259	-0.207	0.244	0.413	0.34	0.121	0.1782
12	191	0.809	0.809	0.272	0.129	-0.315	-0.37	0.09	<u>0.742</u>	-0.14	0.2776
13	192	0.821	0.537	-0.21	-0.08	0.1113	-0.07	-0.111	<u>1.008</u>	-0.15	0.1487
14	199	0.826	0.541	0.111	0.125	0.04	-0.09	0.281	0.552	-0.05	0.0944
15	189	0.865	0.642	-0.19	0.13	-0.179	0.074	<u>0.577</u>	<u>0.445</u>	0.192	0.2758
16	190	0.646	0.172	0.238	-0.106	0.323	0.101	-0.252	0.183	0.25	-0.027
17	189	0.745	0.536	<u>0.151</u>	0.044	0.0063	<u>0.239</u>	0.007	<u>0.193</u>	0.093	0.3702
18	188	0.716	0.491	<u>0.398</u>	0.039	-0.115	0.119	0.092	<u>0.195</u>	0.08	0.1955
19	187	7E+05	0.493	<u>0.286</u>	0.072	0.0778	<u>0.131</u>	0.026	<u>0.196</u>	0.053	0.2859
20	191	0.699	0.466	<u>0.238</u>	0.053	0.0562	<u>0.31</u>	-0.033	<u>0.127</u>	0.099	0.1597
21	190	0.61	0.345	<u>0.257</u>	0.153	-0.114	<u>0.182</u>	-0.011	<u>0.23</u>	-0.04	<u>0.203</u>

Table 6: Prediction of perceived naturalness by independent variables. Statistically significant coefficients are highlighted and underlined

Landscape scene	N	R	R ²	β-coefficients for each variable							
				Preference	Maintenance	Plant species diversity	Familiarity	Mystery	Coherence	Legibility	Complexity
1	187	0.669	0.424	<u>0.330</u>	<u>-0.172</u>	-0.059	<u>0.353</u>	0.05	-0.024	-0.026	<u>0.255</u>
2	191	0.681	0.440	<u>0.213</u>	<u>-0.14</u>	0.054	<u>0.139</u>	<u>0.146</u>	0.042	0.077	<u>0.289</u>
3	187	0.535	0.254	<u>0.179</u>	<u>-0.207</u>	0.018	-0.072	<u>0.157</u>	<u>0.177</u>	0.101	0.15
4	192	0.452	0.169	<u>0.350</u>	-0.121	0.109	-0.016	0.094	<u>0.088</u>	0.05	-0.046
5	190	0.678	0.435	<u>0.269</u>	-0.044	-0.045	<u>0.261</u>	<u>0.243</u>	0.043	-0.02	0.127
6	187	0.607	0.356	<u>0.187</u>	-0.056	0.062	0.106	<u>0.235</u>	<u>0.254</u>	0.033	0.073
7	187	0.666	0.340	<u>0.230</u>	<u>-0.374</u>	<u>0.18</u>	<u>0.289</u>	<u>0.215</u>	0.051	-0.065	0.011
8	191	0.583	0.418	<u>0.239</u>	-0.034	0.022	<u>0.134</u>	<u>0.177</u>	0.101	0.103	<u>0.161</u>
9	191	0.629	0.311	<u>0.183</u>	-0.049	-0.051	<u>0.213</u>	<u>0.305</u>	0.106	-0.048	0.074
10	189	0.579	0.306	<u>0.168</u>	<u>-0.186</u>	0.004	<u>0.254</u>	0.121	0.116	-0.063	<u>0.178</u>
11	189	0.389	0.114	<u>0.321</u>	-0.076	0.092	0.000	0.051	0.09	-0.077	-0.014
12	191	0.536	0.256	<u>0.364</u>	<u>-0.238</u>	0.061	-0.064	-0.04	0.096	0.101	0.108
13	192	0.636	0.378	<u>0.307</u>	<u>-0.368</u>	0.119	<u>0.155</u>	0.068	<u>0.193</u>	0.07	0.03
14	199	0.631	0.371	<u>0.208</u>	0.023	-0.043	<u>0.288</u>	<u>0.136</u>	0.108	-0.123	0.146
15	189	0.522	0.239	<u>0.270</u>	<u>-0.177</u>	0.1	0.097	<u>0.261</u>	-0.12	<u>0.167</u>	-0.005
16	190	0.746	0.537	<u>0.154</u>	<u>-0.37</u>	0.061	<u>0.298</u>	0.104	<u>0.233</u>	<u>0.156</u>	-0.066
17	189	0.627	0.366	<u>0.199</u>	-0.05	0.053	<u>0.282</u>	<u>0.184</u>	-0.048	0.055	0.129
18	188	0.705	0.474	<u>0.401</u>	-0.06	-0.028	<u>0.254</u>	0.067	-0.004	-0.09	<u>0.237</u>
19	187	0.509	0.226	<u>0.426</u>	<u>-0.208</u>	-0.017	-0.038	0.021	0.061	0.02	0.082
20	191	0.747	0.539	<u>0.212</u>	-0.067	0.096	0.134	<u>0.186</u>	0.023	-0.02	<u>0.316</u>
21	190	0.533	0.252	<u>0.286</u>	-0.089	0.047	0.124	<u>0.214</u>	-0.057	-0.063	0.175

4.4 Similarities in preference and perceived naturalness scoring

To explore similarities in preference and perceived naturalness scoring, cluster analysis (Ward's method) was performed. Figure 15 shows generalised results of clustering of preference and perceived naturalness scoring. Higher levels of resulting dendrogram for preference scoring present categorisation of groups of scenes by form (organic vs. geometrical) and content (natural vs. designed for group 'organic form'). On the third and fourth level, landscape scenes are clustered by structure and spatial order.

1. Level FORM	2. Level CONTENT	3.level STRUCTURE	4. Level SPATIAL ORDER Contrast of elements arrangement	
Organic form	Natural	Water, overgrown		
		Water, open		
		Wood		
	Designed	Structurally simple		Water / trees
				Grass / trees
		Flowering surface / trees		
Structurally complex	Shrubs			
	Water / shrubs			
Geometry/colour		Flowerbeds		
		Flowering		
		Flowering organic		

Figure 15: Simplified model of levels in preference scoring clustering. Cluster analysis: Ward method

Similarly, perceived naturalness data was cluster analysed and generalised resulting dendrogram is presented in Figure 16. Landscape scenes group on higher levels primarily by content (natural vs. designed elements) and only secondly by form (organic form vs. geometrical form for 'designed' group). On the third and fourth level however, landscape scenes are similarly to the case of preference, clustered by structure and spatial order.

1. Level CONTENT	2. Level FORM	3.level STRUCTURE	4. Level SPATIAL ORDER Contrast of elements arrangement
Natural		Water, open	
		Overgrown	
Designed	Organic form	Structurally Very complex	- Rockery, scrubs
			- Water, water plants, vegetated water edge
		Structurally complex	- Lawn, scrubs
	- Lawn, tree		
	Structurally simple	- Water, shrubs	
- Shrubs, trees			
Geometrical form			- Lawn, trees
			Non-flowering
			Flowering

Figure 16: Simplified model of levels in naturalness scoring clustering. Cluster analysis: Ward method

5 DISCUSSION AND CONCLUSIONS

In the study, a general consensus on higher preference for landscapes that are more natural in character, was revealed, as also numerous authors point out in their research (Herzog, 1984; Kaplan and Kaplan, 1989; Ulrich, 1983; Wohlwill, 1976). As expected, recognised geometry in landscape scenes was less preferred. However, the results clearly demonstrate that there is also a great difference in preference for different naturalistic landscape design types. Although a higher preference for water is usually expressed (Steinitz, 1990), there are several points to make in regard to the results of the study. Landscape scenes which contain open water surface and water edge, which is either grassed or vegetated with shrubs, scored higher in preference than landscape scenes with less water visible, and containing wetland type vegetation. Wetland situation seem to be less preferred. Content analysis of landscape scenes also shows, that in general, *Landscape style*, *Wild garden* and *Picturesque* landscape design type scenes are preferred. The aesthetic mode expressed by participants could be explained in terms of 'landscape scenery aesthetics' category and not the 'new sublime aesthetics' (Nohl, 2001) or 'ecological aesthetics' one (Berleant, 1992, 1997; Nohl, 2001; Thorne and Huang, 1991). In addition, higher preference is expressed for structurally more complex scenes, and lower preference for simplified and abstracted ones.

Also some group differences were found in regard to preference and perceived naturalness. Four different groups of participants were clustered in regard to preference and three in regard to perceived naturalness. As far as preference is concerned, these results can be explained by difference in aesthetic attitude (preference for parkland, preference for picturesque, preference for natural and, preference for abstract). In regard to perceived naturalness, the groups of participants are unanimous in selection of 'natural' and 'biotope' types as most natural, and in judgement of 'geometrical' as not natural. However, they differ in attitude to naturalistic landscape types. Their attitude was as follows: 'Several are natural', 'Only few are natural', and 'Almost all are natural', which clearly shows the influence of knowledge and values which people hold.

Findings regarding prediction of preference cannot be entirely confirmed by the model of spatial information (Kaplan, Kaplan, 1989; Ulrich, 1977; 1986). In this preference model, several informational variables, such as mystery, coherence, legibility and complexity were used and investigated. Ulrich (1986) and Kaplan and Kaplan (1989) found in general a higher preference expressed for landscape scenes holding specific spatial information, particularly those, which express high levels of complexity and coherence, as well as mystery. However, we may report that only perceived *Coherence* is a powerful predictor of preference, whereas *Mystery*, *Complexity* and let alone *Legibility* do not seem to have much influence on preference. In general, the scenes, that scored highest in preference, were those that contained water and trees, the texture of groundcover was however less important as oppose to findings of Ulrich (1986). The diversity of landscape elements in the scene, as well as colour also seem to play an important role in determining preference, as long as their spatial organisation was organic and naturalistic. Preference and maintenance were found to be the most powerful predictors of perceived naturalness. However, the results show, that perceived naturalness is a more complex concept in

visual landscape perception and that there are other, unknown predictors that account for it.

As found by several researchers (Ulrich, 1986; Kaplan and Kaplan 1989; Peron et al., 1998) also this study demonstrated a large effect of diverse landscape scene types on preference. In addition to that, two more points should be outlined. Not only that natural and naturalistic landscape scenes are more preferred to geometric designs, also different responses to different types of naturalistic design itself were observed. The differences are found on the higher hierarchical level of form and content of a landscape scene, and on lower hierarchical level (structural and compositional character of the setting). In addition to that also the type and quality of landscape elements that are present in the landscape scene play an important role in preference differences.

The findings give some clues for designing naturalistic landscapes, in regard to the organisation of landscape experience. The aim of such efforts is to produce valuable experiential landscape. In landscape design particular care should be given to introduction of geometrical design patterns, since they were found to be least preferred. It is not suggested that they shouldn't be used, however an attention should be given to what extent and in what spatial context should geometric patterns be adopted. It may be concluded, that findings clearly show diverse preference and perceived naturalness responses to different naturalistic landscape design types and they should thus be considered in landscape design process. In addition, perceived naturalness, as a concept in visual landscape perception appears to be rather complex, and thus interesting for further research, particularly in the context of designing naturalistic landscapes.

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