Journal of Environmental Psychology (1996) **16**, 17–31
0272-4944/96/010017+15$18.00/0

Journal of ENVIRONMENTAL PSYCHOLOGY

DEMOGRAPHIC DIFFERENCES IN THE VISUAL PREFERENCES FOR AGRARIAN LANDSCAPES IN WESTERN NORWAY

EINAR STRUMSE

Research Center for Health Promotion, University of Bergen, Øistens gt. 3, N-5007 Bergen, Norway

Abstract

This study examines the relationship between a number of demographic variables and the visual preferences for a sample of colour slides depicting traditional and agrarian landscape scenes from Western Norway among 198 Norwegian students. In order to attain this purpose, eight demographic measures, tapping familiarity, subculture and expertise, were developed. Serving as criterion variables, sumscores were constructed on the basis of a nonmetric factorial analysis (SSA-III), identifying seven perceptual dimensions in the visual preferences for agrarian landscapes. The results suggest areas of unanimity as well as areas of divergence with respect to the visual perception of agrarian landscapes. Thus, an almost unanimous consensus with respect to (a) the high preferences for traditional human-influenced settings and nature scenes, and (b) the relative dislike for dominating human influence and many of the effects of modern farming practices was found. In contrast, important divergencies were found for landscape categories in the moderate preference range, with the highest occurrence of group differences for a category of scenes depicting farming activities. The most potent demographic predictors of preference across landscape categories were present population density, gender, organization membership and expertise. In addition, effects of age and present geographical region of residence were observed. The findings support evidence from earlier analyses of the landscapes in question, indicating strong preferences for traditional agrarian settings.

Introduction

Agrarian landscapes are threatened by the continuing expansion of urban areas, the spreading of industrial agriculture and an increasing marginalization and disuse of old agricultural land. In this situation, Norway occupies a special position due to a topography generally not suited for mechanized agriculture (Kaland, 1993). This is the case especially in Western Norway, where peasants often chose to maintain traditional practices. Here, traditional agrarian landscapes of exceptional recreational and aesthetical value, and an ecological diversity not present in the natural landscape, can still be found (Austad *et al.*, 1991). However, with the last generation of farmers still knowledgeable of traditional techniques rapidly disappearing, these landscapes are also threatened by disuse (Austad, 1993). Thus, their preservation for the future depends, at least in part, on national policy decisions. Such decisions will probably not be made without support from both landscape experts and the general public.

There is good reason to expect that support to landscape preservation varies between segments of the population. This variation may, at least in part, be associated with underlying divergencies in the perception of the landscapes in question. The study of visual preferences represents one way of subjecting environmental perception to systematic inquiry. Moreover, an examination of the relationships between demographic variables and visual landscape preferences might provide valuable information for decision-makers in the field of landscape planning and management. For example, the identification of *similarities* in landscape preferences across groups would assist the development of general guidelines for landscape design, whereas the demonstration of group *differences* would help to sort out cases or conditions in which the preferences

of specific groups should be mapped. In contrast, the costs of *not* taking demographic variation into account might be that well-meant efforts, to either preserve or develop an area, will end up mired in conflicts between opposing groups (*cf.* Kaplan & Kaplan, 1983).

An examination of the role of demographics in visual landscape preferences also brings to the surface the more general issue of the universality of human nature vs cultural variability (see, e.g. Cosmides *et al.*, 1992). Theoretical explanations of variations in visual landscape preferences have commonly been taken to support either a constructivist (*cf.* Moore, 1979; Lyons, 1983) or a functionalist–evolutionary position (Appleton, 1975; Kaplan & Kaplan, 1983, 1989). Somewhat simplified, differences that can be attributed to the backgrounds of individuals or groups, i.e. to demographic characteristics, would lend support to the constructivist assumption and, consequently, to the notion of cultural variability in landscape preferences. In contrast, differences produced by the landscapes in question (i.e. in the absence of individual or group differences) would indicate the appropriateness of a functionalist–evolutionary interpretation, thus supporting the notion of cross-cultural, universal patterns in visual preference. However, from the position of evolutionary psychology, cultural variability is not a challenge to claims of universality. Rather, the focus of this emerging field is to identify the psychological mechanisms that come between theories of selection pressures on the one hand and socio-cultural behaviour on the other (Cosmides *et al.*, 1992).

In an attempt to overcome the conflict between biological and cultural explanations as it is reflected in the field of landscape aesthetics, Bourassa (1990) suggests a tripartite theory, making a distinction between biological, cultural and personal modes of aesthetic experience. A particularly interesting feature of this contribution is the proposal that natural landscapes should be experienced primarily through a biological mode, thus implying universal patterns of preference. On the other hand, urban landscapes (and, we would add, other strongly human-influenced landscapes) would probably be experienced through the cultural mode and thus be subjected to variability. The proposed framework seems useful because it urges researchers to make explicit the distinctions between the three modes of aesthetic experience, and to clarify the way in which they apply them to their own research.

Kaplan and Kaplan (1989) summarized studies of group differences in landscape preferences according to three main themes:

(1) familiarity, or experience, related to geographical circumstances of residence and the effect of direct exposure to an environment;

(2) cultural and ethnic variation, including the question of age and other bases for belonging to a 'subculture';

(3) the effects of formal knowledge and expertise.

Evidence for the importance of familiarity can be found in a number of studies. Landscape exposure as a child, childhood residence and place of residence (Zube *et al.*, 1974; Daniel & Boster, 1976; Lyons, 1983; Kellert, 1978) have all been reported to influence landscape preferences. Moreover, in an analysis of perceptual differences between residents of and visitors to a specific area, Kaplan (1977) found that long-time residents exhibited greater differentiation of landscape features. However, urban/rural experience seems in most cases not to influence landscape preferences (Gallagher, 1977; Kaplan, 1977, 1985; Miller, 1984; Keane, 1990). Generally, the relationship between preference and familiarity has been a positive one (*cf.* Hammitt, 1978, 1987; Keyes, 1984), but negative relationships have also been found (Penning-Rowsell *et al.*, 1977). Thus, familiarity does affect preference, but it is not always clear what the effect will be (Kaplan & Kaplan, 1989).

The potential effect of subculture is demonstrated by findings suggesting that, in some cases, samples sharing the same landscape show substantial differences in preference (Daniel & Boster, 1976; Kaplan & Herbert, 1987; Porter, 1987). Some studies have found that preference tend to decrease with increasing age (Balling & Falk, 1982; Lyons, 1983), and vast preference differences have been found between teens and people involved in teaching about the environment (Medina, 1983).

An effect of gender has repeatedly been found in studies of environmental perceptions (Kellert, 1978; Macia, 1979; Lyons, 1983; Dearden, 1984), but this effect seems far from unambiguous. For example in a recent review of the more general research literature on gender and environmental concern, Stern *et al.* (1993) found that while some studies reported women to be more concerned about the environment, others reported the opposite findings. When differences *are* found, women seem to be more negative towards intrusions into natural environment than are men (Levine & Langenau, 1979; Kardell & Mård, 1989). There also seems to be some support for gender differences along evolutionary lines, with

a tendency for males to prefer more challenging environments (Woodcock, 1982; Bernaldez & Abello, 1989) and a greater facility by females to remember spatial configurations of objects (Silverman & Eals, 1992).

Membership in environmental groups has been shown to influence landscape preferences, members being more in favour of wilderness scenes (Dearden, 1984) and showing lower preferences for manipulated landscapes and higher preferences for nature scenes (Kaplan & Herbert, 1987).

A distinction between expert evaluations and the preferences of the general public has commonly been made in studies of visual preference. Concluding from the results of a number of studies (Kaplan, 1973; Anderson, 1978; Buhyoff *et al*., 1978; Medina, 1983), Kaplan and Kaplan (1989) note that experts seem to weigh the role of informational aspects of a given setting differently from lay groups. Furthermore, these studies also suggest that expert judgements do not correspond well to the public's and that experts tend to be unaware of the difference. In Scandinavia, Hultman (1983) found that Swedish forest managers exhibited preferences close to those environmentalists, whereas Savolainen and Kellomäki (1984) found no differences attributable to expertise.

Clearly, demographic characteristics *can* be a source of variation of environmental preference. However, it should be kept in mind that consensus, rather than divergence, seems to be the rule (*cf*. Dearden, 1984). A series of studies support this argument. First, the *content* of scenes has consistently emerged as a major contributor to preference. Here, the most preferred scenes have repeatedly been shown to be those in which human influence does not dominate the natural elements or where nature dominates, whereas the least preferred scenes often represent intrusions into the natural environment (Gallagher, 1977; Anderson, 1978; Hammitt, 1978; Herbert, 1981; Ellsworth, 1982; Herzog *et al*., 1982; Hudspeth, 1982; Miller, 1984; Kaplan, 1985; Strumse, 1994*a*).

However, not all nature scenes are highly preferred. Consequently, similarities in preference cannot be explained sufficiently on the basis of content alone. According to Kaplan and Kaplan (1989), additional important factors are environmental attributes enhancing the processes of understanding and exploration. Also spatial information, indicating how well one could function in the space represented, seems important. An earlier examination of preference predictors for the agrarian landscapes employed in the present study (Strumse, 1994*b*) seemed, in large part, to conform with these findings.

The purpose of the present study was to examine to what extent differences in visual preferences for agrarian landscapes in Western Norway can be explained by demographic factors. In order to attain this goal, scenes from traditional and modern agrarian landscapes were sampled. Modern scenes were included for two major reasons: (1) to assure a degree of representativeness in the sample of scenes, and (2) to make possible a comparison of the effects on visual preference of changing agricultural techniques (i.e. traditional vs modern). The study focused on the following questions:

(1) Will consensus among demographic groups in terms of visual preferences be found for any given category of landscape?

(2) Will subcultural variables, such as age, gender and organization membership, influence preferences for agrarian landscapes in Western Norway?

(3) Will familiarity with types of landscape in question result in higher preferences for them?

(4) How does landscape expertise influence the visual preferences for Western Norwegian agrarian landscapes?

Method

Subjects were 198 volunteer male (n=72) and female (n=126) Norwegian university and college students, taken from landscape-related disciplines (n=94) and introductory courses in psychology (n=104). The rationale for this composition of the sample was to make it consist of equally large groups of landscape 'experts' and 'nonexperts'. The mean age of participants was 25.1 years (S.D.=5.96, minimum=19 years, maximum=50 years). The study was carried out in several sessions in Bergen, Oslo, Trondheim, Sogndal, and Bøi Telemark between May and October 1993.

Visual stimuli

Sixty colour slides, drawn from an initial collection of 76 slides, were used. In so far as this was compatible with the composition of a fairly balanced sample of settings, a major concern was that the settings chosen should represent areas well documented with respect to earlier research (geography and ecology) as this would add to the usefulness of the results. A more detailed description of the sampling procedure can be found in Strumse

(1994*a*, *b*). The areas chosen for the sampling of scenes were:

(1) traditional agrarian landscapes from various locations in Sogn og Fjordane county. Considerable geographical and botanical ecological data exist on some of these areas (Austad & Kaland, 1991; Austad *et al*., 1991);

(2) well-documented modern agrarian landscapes, mostly from the surroundings of the lake Kalandsvatnet (Sandahl, 1989; Lundberg, 1990; Østerbø, 1990) just outside Bergen, the second largest city of Norway, but other areas (Sogndal, Aurland, Laerdal and Vik) were also included. These landscapes have undoubtedly lost some of the values that characterize the traditional landscapes but are nevertheless important as they provide outdoor recreation opportunities to the urban population.

The questionnaire

The visual preference ratings and the demographic measures investigated in the present study were parts of a larger questionnaire designed to explore a wide range of potential predictors of visual preferences. The questionnaire included:

(1) a visual preference rating sheet, with 5-point Likert type rating scales intended for visual preference ratings;

(2) eight items designed to measure the following demographic characteristics: age, gender, organization membership, geographical region during childhood, present geographical region, population density during childhood, present population density and expertise (i.e. type of university or college study currently being undertaken).

In the questionnaire, some of these measures were dichotomies (gender and organization membership), whereas others were polytomies. However, because of the relatively small sample (n= 198) in the present study, and in order to simplify the use of statistical techniques, all variables were dichotomized. For the variable 'age', dichotomization was based on the fact that 1970 was the median for this variable. For all other originally nondichotomous variables, the guiding principle for dichotomization was to end up with intuitively meaningful categorizations, for example urban vs rural, and Western Norwegians vs others. It should be noted that in answering the two items measuring, respectively, geographical region and population density during childhood, subjects were asked to think of the place they lived most of the time before their sixteenth birthday.

Procedure

Projected in random order on a screen, 60 slides intended for the analysis of preference ratings and 10 'filler slides', five at the beginning and five at the end of each sessions in order to avoid start and end effects, were rated by the participants. The slides were rated on a scale ranging from 1 to 5 according to how much it was liked (1=does not like at all, 2= likes a little, 3=likes somewhat, 4=likes quite a bit and 5=likes very much). Each slide was exposed for 10 seconds with a random interstimulus interval ranging from 1 to 9 seconds, the latter in order to avoid response set (see e.g. Polit & Hungler, 1991). Immediately following the visual preference ratings, subjects filled in the questionnaire, including the items designed for the measurement of demographic variables.

SPSS/PC+ V5.0 was used for descriptive statistics, one-way analyses of variance and multiple classification analyses (MCA).

Results

An analysis considering the influence of demography on the preferences for each of the 60 scenes included in the present study would be neither practical nor very interesting. Instead, landscape category sumscores were created on the basis of perceptual dimensions derived from the preference ratings of the scenes in the current data set. Such dimensions were identified through the application of a nonmetric factor analytic procedure, the SSA-III, or the Guttman–Lingoes Smallest Space Analysis (Lingoes, 1972), with normalized varimax rotation. The benefits of the SSA-III procedure compared with metric factor analysis, is that it increases the stability of the solution (Kaplan & Kaplan, 1989) and decreases the number of dimensions (Herzog, 1992). Following established criteria (*cf*. Kaplan & Kaplan, 1989, for example) a seven-dimensional solution including ratings for 50 of the scenes gave a readily interpretable result, with no dimension including fewer than three items (Table 1). Thus sumscores were computed by summing up the items measuring preferences for the scenes included in each landscape category. In this process, missing values were substituted by item means, and outliers were recorded to $\pm 2_{S.D.}$ from the mean of its sumscore (*cf*. Aarø, 1986). A more detailed description of the analysis of these dimensions has been given elsewhere (Strumse, 1994*a*).

In the following presentation of results, mean

preference ratings at 3·7 and above were considered as 'high', mean ratings between 3·0 and 3·7 as 'moderate', and means below 3·0 as 'low'. These cut-off points were chosen as they have repeatedly been employed in visual preference studies based on the general finding that ratings at 4·0 or above and at 2·0 or lower are highly unusual (*cf.* Kaplan & Kaplan, 1989). In addition, these characterizations of mean preference levels enhance both the review of the results and the subsequent interpretation of divergencies between group means and the overall mean preference for a given category.

The two most preferred categories, both at high mean rating levels, depicted traditional scenes (Table 1). However, whereas the Flowers category was dominated by 'nature' scenes, the Old Structures category was characterized by human influence. The moderately preferred Farming category was, in contrast to all other categories, dominated by activity, but contained both traditional and modern scenes. Also at a moderate level, but distinctly lower than the Farming scenes, was the Green, Grassy Fields category, depicting vegetation from predominantly modern agrarian landscapes. The New Dominating Structures and the Spruce Plantations categories, although very different in content, were at essentially the same preference level, i.e. they were generally not preferred. Least preferred of all was the Modern Farming Elements category. For a thorough analysis of these preference levels, see Strumse (1994*a*).

One-way (bivariate) analyses of variance were performed separately for each demographic variable (independent) on each landscape category sumscore (dependent). Moreover, to assess further the effectiveness among demographic variables as predictors of differences in preference for each landscape category, a special kind of multiple regression, the Multiple Classification Analysis (MCA) (Andrews *et al.*, 1973) was employed. MCA is designed to handle categorical predictors.

A first look at the bivariate analyses (Table 2) revealed that for two of the landscape categories, no significant group differences were found. Thus, for the Old Structures category, across all groups, the mean ratings were consistently high, between 4·35 and 4·48 (see examples of the settings in Fig. 1). The Spruce Plantations category, however, was rated consistently low, between 1·78 and 1·96 (Fig. 2). No further analysis was done for these two categories. For the remaining landscape categories, between one and five demographic variables yielded significant results. However, two familiarity variables, geographical region during childhood and population density during childhood, proved insignificant across all landscape categories. These results

TABLE 1
*Sumscores computed on the basis of preference-derived (*n=*198) categories in Western Norwegian agrarian landscapes: descriptive statistics*

Label	Description	No. of items	Mean	S.D.	Minimum	Maximum
Farming	Persons doing manual labour or using machines, products of such activities, or reflections of activities associated with farming	12	3·63	0·62	1·83	4·92
Old structures	Old buildings or mechanical equipment embedded in a nature setting, but also a nature scene, the ground covered with stone	9	4·43	0·42	3·49	5·00
Green, grassy fields	Modern mowed fields or meadows	9	3·14	0·57	1·93	4·67
Modern farming elements	Silos, drainpipes and forest machines	6	1·66	0·51	1·00	2·80
New dominating structures	Modern buildings and constructions	7	1·95	0·51	1·00	3·04
Flowers	Flowers and colourful meadows, high in biological diversity	4	4·34	0·54	3·09	5·00
Spruce plantations	Relatively dense spruce plantations	3	1·86	0·81	1·00	3·58

TABLE 2
Mean preference ratings for seven landscape categories by demography: one-way analyses of variance (S.D.s in parentheses)

Groups	(*n*)	Landscape category						
		Farming	Old Structures	Green, Grassy Fields	Modern Farming	New Dominating	Flowers	Spruce Plantations
Familiarity								
Geographical region during childhood								
Western Norway	(95)	3·62 (0·63)	4·42 (0·42)	3·10 (0·60)	1·71 (0·55)	2·01 (0·50)	4·37 (0·52)	1·88 (0.81)
Other	(103)	3·64 (0·60)	4·45 (0·43)	3·17 (0·54)	1·60 (0·46)	1·90 (0·51)	4·32 (0·56)	1·84 (0·82)
Present geographical region								
Western Norway	(146)	3·56** (0·63)	4·42 (0·42)	3·16 (0·60)	1·67 (0·53)	1·98 (0·51)	4·34 (0·55)	1·85 (0·80)
Other	(52)	3·83 (0·52)	4·46 (0·44)	3·09 (0·49)	1·63 (0·45)	1·89 (0·49)	4·34 (0·51)	1·88 (0·84)
Population density during childhood								
Urban	(85)	3·66 (0·58)	4·49 (0·43)	3·18 (0·55)	1·65 (0·51)	2·01 (0·48)	4·37 (0·56)	1·83 (0·80)
Rural	(113)	3·60 (0·64)	4·39 (0·42)	3·11 (0·59)	1·66 (0·51)	1·91 (0·52)	4·32 (0·52)	1·88 (0·82)
Present population density								
Urban	(136)	3·52*** (0·60)	4·42 (0·43)	3·19 (0·54)	1·72** (0·52)	2·01* (0·51)	4·33 (0·54)	1·89 (0·79)
Rural	(62)	3·87 (0·60)	4·47 (0·41)	3·03 (0·62)	1·51 (0·46)	1·82 (0·47)	4·37 (0·55)	1·78 (0·85)
Subculture								
Age (year of birth)								
Before 1970	(92)	3·82*** (0·53)	4·47 (0·45)	3·12 (0·54)	1·72 (0·53)	2·02 (0·50)	4·37 (0·54)	1·85 (0·84)
After 1970	(106)	3·46 (0·64)	4·40 (0·40)	3·15 (0·60)	1·60 (0·49)	1·89 (0·50)	4·32 (0·54)	1·87 (0·79)
Gender								
Men	(72)	3·56 (0·61)	4·36 (0·48)	2·99** (0·52)	1·71 (0·51)	2·01 (0·51)	4·20** (0·55)	1·96 (0·80)
Women	(126)	3·67 (0·62)	4·48 (0·38)	3·22 (0·58)	1·63 (0·51)	1·92 (0·50)	4·43 (0·52)	1·80 (0·82)
Organization membership								
Yes	(153)	3·70** (0·62)	4·45 (0·41)	3·15 (0·55)	1·66 (0·50)	1·95 (0·51)	4·40** (0·52)	1·84 (0·80)
No	(45)	3·38 (0·52)	4·36 (0·46)	3·09 (0·62)	1·64 (0·53)	1·97 (0·51)	4·15 (0·57)	1·92 (0·86)
Expertise								
Expert	(94)	3·84*** (0·54)	4·48 (0·43)	3·02** (0·57)	1·64 (0·49)	1·96 (0·51)	4·40 (0·51)	1·82 (0·82)
Nonexpert	(104)	3·44 (0·62)	4·39 (0·42)	3·24 (0·55)	1·67 (0·53)	1·95 (0·50)	4·29 (0·56)	1·89 (0·80)

*$p<0·05$; **$p<0·01$; ***$p<0·001$.

FIGURE 1. No group differences were found for the scenes included in the Old Structures category, which received consistently high preferences (overall mean=4·43).

FIGURE 2. The preferences for scenes like this one from the Space Plantations category, were consistently low (mean=1·85).

are somewhat surprising as landscape exposure as a child has repeatedly been found to influence preferences. All other demographic variables yielded significant results for one or more of the landscape categories. With an exception for the Farming category, the MCAs did not provide additional information, as they only confirmed the bivariate results. For this landscape category, additional analyses of variance were performed to explore the nature of these divergencies. In the following sections, results of the bivariate and multivariate analyses (MCA) will be presented in greater detail.

The Farming category yielded the highest degree of diverging preferences in bivariate analyses, with significant results for five of the eight demographic variables (Table 2, first column from the left). Moreover, all observed differences went beyond the overall, moderate preference level of the category. First, among measures of familiarity, present geographical region (p<0·01) and present population density (p<0·001), yielded clear differences in preference. Thus, while subjects presently living in Western Norway were found at a moderate preference level (mean=3·56), those living in other regions had *high* preferences (mean=3·83) for these scenes. Likewise, in contrast to urban residents (mean=3·52), subjects living in rural areas were found to have high preferences (mean=3·87) for the Farming scenes. Among subcultural variables, age and organization membership both yielded highly significant results (both at p<0·001). Here, those born before 1970 (mean= 3·82) and members (mean=3·70) were highly in favour of the Farming scenes, whereas younger subjects (mean=3·46) and nonmembers (mean=3·83) were found within the moderate preference range. Expertise also yielded clear group differences (p< 0·001), with high preferences (mean=3·84) in the expert group and moderate preferences (mean= 3·44) among nonexperts.

The MCA for the Farming category (Table 3) yielded a significant (p<0·001) over all multiple R square of 0·195, with age as the most powerful predictor variable (β=0·21, p<0·01). Not significant in bivariate analysis, gender obtained a highly significant result in MCA (β=0.18, p<0·01). Present population density also proved to be a significant predictor, with a β of 0·16 (p<0.05). However, in contrast to the bivariate results, both present geographical region and expertise turned out to be insignificant in the MCA. Thus further analyses had to be made.

In bivariate analysis of expertise, controlling for present population density, it was found that expertise remained significant only for experts and nonexperts living in *urban* areas (Table 4, upper section). With the rural nonexpert group being too small (n=9), the difference between experts and nonexperts living in rural areas could not be tested statistically. Further bivariate analysis also indi-

TABLE 3.
The Farming category sumscore by demographic variables: Multiple Classification Analysis

Variable	*n*	Unadjusted deviation	η	Adjusted deviation	β
Geographical region during childhood					
Western Norway	95	–0·01		0·02	
Other regions	103	0·01		–0·01	
			0·02		0·02†
Present geographical region					
Western Norway	146	–0·07		–0·02	
Other regions	52	0·20		0·06	
			0·20		0·06†
Population density during childhood					
Urban	85	0·03		0·02	
Rural	113	–0·03		–0·02	
			0·05		0·03†
Present population density					
Urban	136	–0·11		–0·07	
Rural	62	0·24		0·15	
			0·26		0·16*
Age (year of birth)					
Before 1970	92	0·19		0·14	
After 1970	106	–0·17		–0·12	
			0·29		0·21**
Gender					
Men	72	–0·07		–0·15	
Women	126	0·04		0·08	
			0·09		0·18**
Organization membership					
Yes	153	0·07		0·04	
No	45	–0·25		–0·14	
			0·22		0·12†
Expertise					
Experts	94	0·21		0·07	
Nonexperts	104	–0·19		–0·06	
			0·33		0·11
Multiple *R* squared					0·195***
Multiple *R*					0·442

Grand mean=3·629. *p<0·05; **p<0·01; ***p<0·001; †not significant.

cated that expertise seemed to remove the effect of present geographical region. Also here, the differences between two of the subgroups, nonexperts living in Western Norway and nonexperts living in other regions, could not be subjected to statistical analysis, as the latter group consisted of only one individual (see Table 4, middle section). On the other hand, when controlling for present population density, the effect of present geographical region found in bivariate analysis, was reproduced, but only for urban residents (Table 4, lower section). Photographic samples of the Farming scenes are found in Fig. 3.

For the Green, Grassy Fields category (see Table 2, third column from the left), significant bivariate results were found for gender and expertise (both at p<0·01): women were, well in keeping with the overall preferences for this category, moderate (mean= 3·22) in their liking of these scenes, whereas men (mean=2·99) were found in the low preference

TABLE 4

Further bivariate analyses for the Farming category: expertise controlled for present population density, present geographical region controlled for expertise, and present geographical region controlled for present population density: one-way analyses of variance

Variable	*n*	Mean	S.D.
Expertise controlled for present population density			
Urban experts	41	3·81***	0·49
Urban nonexperts	95	3·40	0·60
Rural experts	53	3·87‡	0·59
Rural nonexperts	9	3·85	0·71
Present geographical region controlled for expertise			
Western Norwegian experts	43	3·84†	0·59
Experts from other regions	51	3·85	0·51
Western Norwegian nonexperts	103	3·44‡	0·62
Nonexperts from other regions	1	3·00	–
Present geographical region controlled for present population density			
Urban Western Norwegians	115	3·48**	0·61
Urban, other regions	21	3·73	0·50
Rural Western Norwegians	31	3·83†	0·67
Rural, other regions	31	3·90	0·53

*$p<0·05$; **$p<0·01$; ***$p<0·001$; †not significant; ‡due to an insufficient group size, statistics could either not be calculated, or results would be unreliable.

FIGURE 3. Although at an overall moderate preference level, the Farming scenes were highly preferred by the older age group in the sample (mean=3·82), rural residents (mean=3·87), urban residents not living in Western Norway (mean=3·73), urban experts (mean=3·81) and organization members (mean=3·70).

range. While both were moderate in their preferences for this category, experts (mean=3·02) were found at a significantly lower level than nonexperts (mean=3·24). One of the scenes included in this category is depicted in Fig. 4.

The bivariate results for the Modern Farming Elements category (see Table 2, middle column) indicated that only *familiarity* seemed important here, with present population density yielding a significant ($p<0·01$) result. Here, urban residents (mean=1·72) were more in favour of the category than were those living in rural areas (mean=1·52), but both groups were still found within the low preference range (Fig. 5, left photo).

For the New Dominating Structures category (see Table 2, third column from the right), the results of bivariate analyses were similar to those found for the Modern Farming Elements, only somewhat weaker, with $p<0{\cdot}05$ for present population density. While both groups were found in the low preference range, subjects presently living in urban areas (mean=2·01) were somewhat more in favour of the category than were rural residents (mean=1·82). One of the Modern Farming Elements scenes is depicted in Fig. 5, right-hand photo.

Preferences for the Flowers category (see Table 2, second column from the right) proved in bivariate analyses to be significantly affected by two subcultural variables: gender and organization membership (both at $p<0{\cdot}01$). However, all group means were within the overall high preference range. With this reservation, women (mean=4·43) and members (mean=4·40) were more in favour of the Flowers category than were, respectively, men (mean=4·20) and nonmembers (mean=4·15). Settings from the Flowers category are depicted in Fig. 6.

FIGURE 4. The scenes included in the Green, Grassy Fields category were more preferred by women (mean=3·22) and nonexperts (mean=3·24) than by men (mean=2·99) and experts (mean=3·02).

A brief summary of the findings presented above, sharpening the focus upon demography by considering each demographic variable separately across landscape categories, might add to their clarity. Among the familiarity variables, two of these, geographical region during childhood and population density during childhood, did not affect the visual preferences for any of the landscape categories. In contrast, the parallel circumstances *presently* did seem to affect landscape preferences. Thus, subjects presently living in urban areas scored higher than rural residents in their visual preferences for the New Dominating Structures and Modern Farming Elements categories, whereas they were lower in their preferences for the Farming category. In the latter case, further analysis revealed that high preference was only found among urban landscape experts, and that Western Norwegian urban residents were lower in their visual preferences for Farming scenes than were urban residents living elsewhere.

Among subcultural variables, age was a strong predictor of visual preference for the Farming category, with older subjects found at the higher level of preference. Furthermore, gender affected the visual preferences for the Farming, Green, Grassy Fields and Flowers categories, women in all cases being more in favour of these scenes. In addition, organization members exhibited higher preferences than did nonmembers for the Farming and Green, Grassy Fields categories.

Finally, knowledge, in this case landscape expertise, led to higher preferences among experts com-

FIGURE 5. Urban residents were somewhat more (mean=1·72) in favour of scenes containing Modern Farming Elements and New Dominating Structures than were rural residents (mean=1·51).

FIGURE 6. For the Flowers category, gender and organization membership produced clear differences in preference. Women (mean=4·43) and members (mean=4·40) were significantly (in both cases at $p<0·01$) higher in their visual preferences for these scores than were men (mean=4·20) and nonmembers (mean= 4·15).

pared with nonexperts for the Farming scenes, whereas nonexperts were higher in their preferences for the Green, Grassy Fields category.

Discussion

The finding that no significant group differences were found for the Old Structures and Spruce Plantations categories, suggests that preferences for these landscapes could be explained, first, on the basis of their content, and second, according to the presence or absence in them of preference-promoting environmental attributes (Strumse, 1994*a*, *b*). Specifically, the high preferences for the Old Structures category seem to be related to those scenes containing human influence in balance with the natural elements (Strumse, 1994*a*). For the Spruce Plantations category, however, dense vegetation, resulting in a blocked view, seemed responsible for the low preference levels (*cf*. Strumse, 1994*a*).

The role of preference-promoting environmental features will here be interpreted within a functionalist–evolutionary framework (*cf*. Kaplan & Kaplan, 1989; Kaplan, 1992). Thus, for the Old Structures category, preference seems associated with high degrees in it of one informational variable, Mystery (Strumse, 1994*b*), which promotes exploration by promising new information if one could enter into the setting. Mystery has reliably proved itself to predict visual preferences and is assumed to be, together with factors promoting understanding, a salient characteristic of environments preferred by humans (Kaplan & Kaplan, 1989). Presumably, through evolutionary time, the ability to respond with preference to environments exhibiting such attributes has been selected for, as they facilitate the efficient processing of environmental information. However, for the Spruce Plantations category, Mystery seems to have an opposite, perhaps even fear-inducing effect, which might be due to its combination with dense vegetation, making the prediction of what might happen next difficult (Strumse, 1994*b*).

The results for the Flowers and Green, Grassy Fields categories could be understood as a relatively clear example of the complementarity of constructivist and evolutionary perspectives. While the impression of consensus dominated, significant group differences were found in the preferences for both categories. Unanimity seemed to be explained by these scenes representing environments providing safe conditions for understanding and exploration (*cf*. Kaplan & Kaplan, 1989). Nevertheless, the subcultural factors gender and organization membership, and one knowledge-related factor, expertise, seemed capable of producing divergencies.

The observed differences produced by gender support the notion that this is a 'subcultural' variable capable of accounting for important differences with respect to landscape preferences, here expressing itself by women taking a more positive stance towards nature than men. It is also possible, however, to interpret the gender differences in evolutionary terms. For the Flowers category, the differences seem compatible with findings indicating women to be superior in their perception and memory of complex arrays of vegetation, whereas men are better on mental rotation, map-reading and maze learning (Silverman & Eals, 1992). This is hypothesized to be so because, during hominid evolution, men predominantly hunted and women predominantly foraged (Tooby & DeVore, 1987). Moreover, a higher preference in women could be due to the fact that categories such as Flowers and Green, Grassy Fields, which are open and well-defined settings (Strumse, 1994*b*), would most probably induce feelings of security, which is perhaps more important to women than to men.

The finding that experts exhibited somewhat lower preferences than nonexperts for the Green, Grassy Fields category suggests that training within landscape disciplines leads to a more critical (or negative) attitude towards scenes of less than optimal ecological quality, in this case manifesting itself in a somewhat uniform, schematic layout of space and a low biological diversity (Strumse, 1994*b*). However, organization members were

somewhat more in favour of the highly preferred Flowers category than were nonmembers. This makes sense, as membership could be regarded as an indication of interest in a broad spectrum of issues, including environmental protection. This applies well to the Flowers category, containing as it does aesthetically valuable traditional meadows with high biological diversity (Strumse, 1994*a*).

For both the Modern Farming Elements and the New Dominating Structures categories, present population density resulted in one small group difference, with urban residents slightly more in favour of these scenes. These findings suggest a slightly negative relationship between familiarity and preference. Apart from these minor divergencies, for these settings too the overall (low) preference pattern seemed readily explained both by their content and by the degree to which preference-enhancing environmental attributes are present in them (Strumse, 1994*a*, *b*).

So far, a relatively unambiguous consensus in landscape preferences, favouring a functionalist–evolutionary position, has been demonstrated for the categories discussed. However, the comparatively large divergencies among groups found for the moderately preferred Farming category constituted a sharp contrast to this overall picture and the strongest support for the constructivist position in the present study. In the final analysis, the strongest predictors of differences in visual preferences for the Farming scenes were, in descending order, age, gender and present population density. However, expertise and present geographical region also exerted important influences on visual preference for this category of scenes.

Results indicating that preferences for the Farming category increase with increasing age could perhaps be understood as a result of the rarifying of direct experience of farming practices in our age of rapidly increasing urbanization. Furthermore, the impact of expertise may be understood as resulting from a higher level of knowledge about agrarian practices in experts than in nonexperts. Finally, subjects with higher preferences for the Farming category, who were indeed rural residents, and thus supposedly more familiar with such scenes than other groups, could be hypothesized to identify more closely than others with the persons depicted and the activities they performed. Such identification could, in turn, be understood as part of subjects' geographical (or place) identity (*cf.* Proshansky *et al.*, 1983; Feldman, 1990; Williams & Roggenbuck, 1989). This, however, also raises the question of whether the Farming category can be compared directly, or at all, with the other categories employed in this study, precisely because farming *activity*, rather than landscape type, emerged as the common perceptual theme for this category. On the other hand, the inclusion of this category could be justified because such activities are intimately connected with the shaping and maintenance of agrarian landscapes, and that both visitors to and residents in such landscapes are likely to encounter such situations.

The present study has demonstrated an almost unanimous consensus with respect to (a) the high preferences for traditional human-influenced settings and nature scenes, and (b) the relative dislike for dominating human influence and many of the effects of modern farming practices. This lends support, at least indirectly, to the relevance of a functionalist–evolutionary interpretation of visual landscape preferences, and, at the same time, it confirms the impression of strong support for the protection of traditional agrarian landscapes, reported in earlier analyses (Strumse, 1994*a*, *b*). However, in spite of this strong tendency towards consensus, diverging preferences for agrarian landscapes in Western Norway do exist. The observed group differences suggest the importance of taking into account the preferences of those affected by the management of particular landscapes, especially the moderately preferred landscapes, where divergencies are more pronounced. Particularly important group differences seem to be associated with gender, organization membership, present population density, expertise and, to a lesser extent, age and present geographical region. On the other hand, in this study at least, geographical region and population density during childhood did not seem to influence landscape preferences in adults.

Conclusion

The present study permitted an estimation of the impact of demographic variables on visual preferences for a given sample of agrarian landscapes. For highly preferred traditional, as well as for less-preferred modern landscapes, the impression of consensus is overwhelming, leading to the conclusion that, for these landscapes, group differences are relatively small compared with the effects produced by the landscapes themselves. Nevertheless, some clear effects of demography, notably for moderately preferred landscapes, were identified. This reinforces the argument that group differences in landscape preferences should not be neglected by

planners, managers and other landscape experts. A further accentuation of this recommendation comes from the fact that one of the more important variables in producing such differences is expertise itself. It might be argued that visual preference results obtained for colour slides limits their generalizability into real world settings. However, several studies have pointed out that the use of photographic representations yields valid and reliable results (*cf* Levine, 1977; Ulrich, 1979; Shuttleworth, 1980; Savolainen & Kellomäki, 1984; Zube *et al*., 1987).

Some important weaknesses of the study should be noted. First, virtually all nonexperts were living in urban areas, resulting in a near-absence of rural nonexperts. Also, the age span in the sample was smaller than desirable, suggesting that differences due to age could have been underestimated. Furthermore, using students, the effect of direct experience with the landscapes in question could not be examined. These specific weaknesses reflect the more general objection that the cultural and demographic homogeneity of the sample reduces the probability that group differences will be found. Thus, a more heterogenous sample would certainly make it easier to find support for the constructivist position. In an eventual follow-up, these considerations should be kept in mind.

Acknowledgements

This study was made possible by a research grant from the Norwegian Research Council, as part of a research programme on cultural landscapes. The author wishes to express his thanks to Leif Edvard Aarø at the University of Bergen for excellent advice in methodological and statistical matters, to Leif Hauge at the Sogn og Fjordane College for taking all the photos employed in this study, and to Rachel and Stephen Kaplan at the University of Michigan for helping with the analysis of the preference ratings.

Notes

Correspondence should be addressed to: Einar Strumse, Research Center for Health Promotion, Øisteins gt. 3, N-5007 Bergen, Norway; Tel. +47 55 21 33 06; E-mail: einar-.strumse@psych.uib.no.

References

Anderson, E. (1978). Visual resource assessment: local perceptions of familiar natural environments. Unpublished doctoral dissertation, University of Michigan, Ann Arbor.

Andrews, F. M., Morgan, J. N., Sonquist, J. A. & Klem, L. (1973). *Multiple Classification Analysis. A Report on a Computer Program for Multiple Regression Using Categorical Predictors*, 2nd Edn. Ann Arbor, MI: Institute for Social Research, University of Michigan.

Appleton, J. (1975). *The Experience of Landscape*. London: John Wiley & Sons.

Austad, I. (1993). Verdier i det tradisjonelle kulturlandskapet. In E. Framstad & S. Rysstad, Eds, *Jordbrukets kulturlandskap*. Forskerkonferansen 1992 26–27. oktober—Sundvolden Hotell. Ås: Norges Forskningsråd, Forskningsprogram om kulturlandskapet.

Austad, I. & Kaland, P. E. (1991). *Endring i biologisk mangfold i tradisjonelle kulturmarkstyper på Vestlandet ved gjengroing, tilplanting og skjótseltiltak. Forskningsprosjekt i tilknytning til NMF/NLVF's forskningsprogram om kulturlandskapet*. Sogn og Fjordane distriktshøgskule og Botanisk institutt, Universitetet i Bergen.

Austad, I., Skogen, A., Hauge, L., Helle, T. & Timberlid, A. (1991). Human influenced vegetation types and landscape elements in the cultural landscapes of inner Sogn, western Norway. *Norsk. geogr. Tidsskr.*, **45,** 35–58.

Balling, J. D. & Falk, J. H. (1982). Development of visual preference for natural environments. *Environment and Behavior*, **14,** 5–28.

Bernaldez, F. G. & Abello, R. P. (1989). Environmental challenge and environmental preference: age and sex effects. *Journal of Environmental Management*, **28,** 53–70.

Bourassa, S. C. (1990). A paradigm for landscape aesthetics. *Environment and Behavior*, **22**(6), 787–812.

Buhyoff, G. J., Wellman, J. D., Harvey, H. & Fraser, R. A. (1978). Landscape architects' interpretations of people's landscape preferences. *Journal of Environmental Management*, **6,** 255–262.

Cosmides, L., Tooby, J. & Barkow, J. (1992). Introduction: Evolutionary psychology and conceptual integration. In J. Barkow, L. Cosmides & J. Tooby, Eds, *The Adapted Mind. Evolutionary Psychology and the Generation of Culture*. New York: Oxford University Press, pp. 3–15.

Daniel, T. C. & Boster, R. S. (1976). *Measuring Landscape Aesthetics: The SBE Method*. Boulder, CO: USDA. USDA Forest Service Research Paper RM-167.

Dearden, P. (1984). Factors influencing landscape preferences: an empirical investigation. *Landscape Planning*, **11,** 293–306.

Ellsworth, J. C. (1982). Visual assessment of rivers and marshes: an examination of the relationship visual units, perceptual variables, and preference. Unpublished Master's thesis, Utah State University, Logan.

Feldman, R. M. (1990). Settlement-identity. Psychological bonds with home places in a mobile society. *Environment and Behavior*, **22**(2), 183–229.

Gallagher, T. J. (1977). Visual preference for alternative natural landscapes. Unpublished doctoral dissertation, University of Michigan, Ann Arbor.

Hammitt, W. E. (1978). Visual and user preference for a bog environment. Unpublished doctoral dissertation, University of Michigan, Ann Arbor.

Hammitt, W. E. (1987). Visual recognition capacity during outdoor recreation experiences. *Environment and Behavior*, **14,** 478–493.

Herbert, E. J. (1981). Visual resource analysis: prediction and preference in Oakland County, Michigan. Unpublished Master's thesis, University of Michigan, Ann Arbor.

Herzog, T. R. (1992). A cognitive analysis of preferences for urban spaces. *Journal of Environmental Psychology*, **12,** 237–248.

Herzog, T. R., Kaplan, S. & Kaplan, R. (1982). The prediction of preference for unfamiliar urban landscapes. *Population and Environment: Behavioral and Social Issues*, **5,** 43–59.

Hudspeth, T. R. (1982). Visual preference as a tool for citizen participation: a case study of urban waterfront revitalization in Burlington, Vermont. Unpublished doctoral dissertation, University of Michigan, Ann Arbor.

Hultman, S. G. (1983). *Allmänhetens bedömning av skogsmiljöers lämplighet för friluftsliv. 2. En riksdäckande enkät*. Rapport 28. Sveriges lantbruksuniversitet.

Kaland, P. E. (1993). Forskning på tradisjonelle kulturmarkstyper. In E. Framstad, E. & S. Rysstad, Eds, *Jordbrukets kulturlandskap*. Forskerkonferansen 1992 26–27. oktober—Sundvolden Hotell. Ås: Norges Forskningsråd, Forskningsprogram om kulturlandskapet.

Kaplan, R. (1973). Predictors of environmental preference: designers and 'clients'. In W. F. E. Preiser, Ed., *Environmental Design Research*. Stroudsburgh, PA: Dowden, Hutchinson & Ross.

Kaplan, R. (1977). Preference and everyday nature: method and application. In D. Stokols, Ed., *Perspectives on Environment and Behavior: Theory, Research, and Applications*. New York: Plenum.

Kaplan, R. (1985). Nature at the doorstep: residential satisfaction and the nearby environment. *Journal of Architectural and Planning Research*, **2,** 115–127.

Kaplan, R. & Herbert, E. J. (1987). Cultural and subcultural comparisons in preference for natural settings. *Landscape and Urban Planning*, **14,** 281–293.

Kaplan, R. & Kaplan, S. (1983). *Cognition and Environment. Functioning in an Uncertain World*. Ann Arbor, MI: Ulrichs Bookstore.

Kaplan, R. & Kaplan, S. (1989). *The Experience of Nature. A Psychological Perspective*. Cambridge: Cambridge University Press.

Kaplan, S. (1992). Environmental preference in a knowledge-seeking, knowledge-using organism. In J. H. Barkow, L. Cosmides & J. Tooby, Eds, *The Adapted Mind. Evolutionary Psychology and the Generation of Culture*. New York: Oxford University Press, pp. 581–598.

Kardell, L. & Mård, H. (1989). *Några gruppers attituder till stubbrytning 1976 och 1988*. Rapport 41. Avdelningen för landskapsvård. Sveriges Lantbruksuniversitet.

Keane, T. D. (1990). The role of familiarity in landscape aesthetics: a study of tallgrass prairie landscapes. A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy (Landscape Architecture) in The University of Michigan.

Kellert, S. R. (1978). Perceptions of animals in American society. *41st North American Wildlife Conference Proceedings*, pp. 533–546.

Keyes, B. E. (1984). Visual preferences of a forest trail environment. Unpublished Master's thesis, University of Tennessee, Knoxville.

Levin, J. (1977). Riverside preference: on-site and photographic reactions. Unpublished master's thesis, University of Michigan, Ann Arbor.

Lingoes, J. C. (1972). A general survey of the Guttman–-Lingoes nonmetric program series. In R. N. Shephard, A. K. Romney & S. B. Nerlove, Eds, *Multidimensional scaling, Vol. 1*. New York: Seminar.

Lundberg, A. (1990). *Vegetasjon og kulturlandskap ved Kalandsvatnet i Fana* Bergen: Institutt for geografi, Norges Handelshøyskole og Universitetet i Bergen (Geografi i Bergen, nr. 140).

Lyons, E. (1983). Demographic correlates of landscape preference. *Environment and Behavior*, **15,** 487–511.

Macia (1979). Visual perception of landscape: sex and personality differences. In G. H. Elsner & R. C. Smardon, Eds, *Our National Landscape*. USDA Forest Service General Technical Report PSW-35. Berkeley, CA: USDA.

Medina, A. Q. (1983). A visual assessment of children's and environmental educators' urban residential preference patterns. Unpublished doctoral dissertation, University of Michigan, Ann Arbor.

Miller, P. A. (1984). Visual preference and implications for coastal management: a perceptual study of the British Columbia shoreline. Unpublished doctoral dissertation, University of Michigan, Ann Arbor.

Moore, G. T. (1979). Knowing about environmental knowing: the current state of theory and research on environmental cognition. *Environment and Behavior*, **11,** 33–70.

Østerbø, V. (1990). *Kulturlandskapet kring Kalandsvatnet, Fana, Bergen kommune*. Bergen: Universitetet i Bergen, Institutt for geografi.

Penning-Rowsell, E., Gullett, G. H., Searle, G. H. & Witham, S. A. (1977). *Public Evaluation of Landscape Quality*. Planning Research Group Report 13. Enfield: Middlesex Polytechnic.

Polit, D. F. & Hungler, B. P. (1991). *Nursing Research. Principles and Methods*, 4th Edn. Philadelphia: J. B. Lippincott.

Porter, M. V. (1987). The role of spatial quality and familiarity in determining countryside landscape preference. Unpublished Master's thesis. University of Washington, Seattle.

Proshansky, H. M., Fabian, A. K. & Kaminoff, R. (1983). Place-identity: physical world socialization of the self. *Journal of Environmental Psychology*, **3,** 57–83.

Sandahl, T. J. (1989). *Kalandsvatnet—Fanaelva En utredning av områdets egnethet for allment friluftsliv, basert på areal- og landskapsvurderinger, samt fysisk/biologiske registreringer langs strandkantene i vassdraget*. Bergen: Bergen kommune. Kommunalavdeling fritid, kultur og kirke. Fritidsavdelingen.

Savolainen, R. & Kellomäki, S. (1984). Scenic value of the forest as assessed in the field and the laboratory. In O. Saastomoinen, S. G. Hultman, N. E. Koch & L. Mattsson, Eds, *Multiple-use Forestry in the Scandinavian Countries*. Helsinki: Finnish Forest Research Institute.

Shuttleworth, S. (1980). The use of photographs as an environmental presentation medium in landscape studies. *Journal of Environmental Management,* **11,** 61–76.

Silverman, I. & Eals, M. (1992). Sex differences in spatial abilities: evolutionary theory and data. In J. H. Barkow, L. Cosmides & J. Tooby, Eds, *The Adapted Mind. Evolutionary Psychology and the Generation of Culture.* New York: Oxford University Press, pp. 533–553.

Stern, R. C., Dietz, T. & Yaloff, L. (1993). Value orientations, gender, and environmental concern. *Environment and Behavior,* **25**(3), 322–348.

Strumse, E. (1994*a*). Perceptual dimensions in the visual preferences for agrarian landscapes in western Norway. *Journal of Environmental Psychology,* **14,** 281–292.

Strumse, E. (1994*b*). Environmental attributes and the prediction of visual preferences for agrarian landscapes in western Norway. *Journal of Environmental Psychology,* **14,** 293–303.

Tooby, J. & DeVore, I. (1987). The reconstruction of hominid behavioral evolution through strategic modeling. In W. Kinzey, Ed., *Primate Models of Human Behavior*. New York: SUNY Press.

Ulrich, R. S. (1979). Visual landscapes and psychological well-being. *Landscape Research,* **4,** 17–23.

Williams, D. R. & Roggenbuck, J. W. (1989). *Measuring Place Attachment: Some Preliminary Results*. Paper presented at the session on outdoor planning and management. NRPA symposium on leisure research, San Antonio, Texas, October.

Woodcock, D. M. (1982). A functionalist approach to environmental preference. Doctoral dissertation, University of Michigan.

Zube, E. H., Pitt, D. G. & Anderson, T. W. (1974). Perception and Measurement of Scenic Resources in the Connecticut River Valley. Amherst: University of Massachusetts.

Zube, E. H., Sell, J. L. & Taylor, J. G. (1982). Landscape perception: research, application and theory. *Landscape Planning,* **9,** 1–33.

Zube, E. H., Simcox, D. E. & Law, C. S. (1987). Perceptual landscape simulations: history and prospect. *Landscape Journal,* **6,** 62–80.