

only three were exclusively of man-made structures. The cultural features depicted most were the Glacier House Hotel and the large Stoney Creek railway bridge. Only 9 per cent of the postcards included people, and these were tourists on or near a glacier, on horseback, or climbing. Most of the photographs were taken in the middle of the day during summer, there being few sunsets and only one winter view. Given the extreme topographic relief in the park, more vertical than horizontal views might have been anticipated, but, in fact, the opposite was the case. Seventy per cent of the cards were multicoloured, with some being artistically enhanced to suggest vegetation in burnt areas, or moonlight. Areas not depicted in the cards included the sections of the railway corridor in the lower Beaver and Illecillewaet valleys and most of the rather inaccessible backcountry away from the railway; even the popular Nakimu Caves area received scant attention. There were no views of the large trestle bridges over Mountain and Surprise creeks, few of trains, and none of the park's abundant wildlife. People pictures were rare, and none show tourists at the hotel or station or in activities like picnicking, caving, or skiing. Only 32 per cent of the cards had messages, and less than half of these referred to park scenery.

It is relatively simple to analyse postcards but quite difficult to interpret the results. However, if one accepts that such views should reflect the tourists' perception and appreciation of landscape, then some conclusions are possible. Tourists in Glacier Park between 1903 and 1925 seem to have concentrated in the railway corridor, especially around Glacier House Hotel and the adjacent trails. Both male and female tourists, mainly in summer, undertook activities such as glacier exploration, horseback riding, and climbing. They were impressed by the mountains, valleys, and glaciers, particularly by Mt Sir Donald, the Great Glacier, and the Illecillewaet Valley. Landscapes lacking human artefacts were deemed appealing, but landscapes blending man and nature, such as the hotel setting and the railway bridges in the valley, also had appeal. The signs of logging, forest fires, and railway operations, evident in the views, appear not to have prevented appreciation of the scenery.

Such conclusions are tentative and must be judged in the light of the methodological problems arising in this experimental study. The problems include the question of how closely the sample of cards represents the total

population (card numbers and publishers' catalogues may help); whether cards were bought or had merely survived as unpopular publishers' stock (the presence of messages is a help here); how representative the people were who bought cards; whether people bought cards as status symbols, attractive souvenirs in themselves, or as representations of scenery found pleasing; how influential the photographers were in defining what was beautiful and which cards would be produced (a comparison of cards of different companies might help here); problems of analysis, of dating cards, of defining what is a unique view, of categorizing natural and cultural elements; and, finally, the difficulty of knowing if the production, quantity, and content of the views reflected the tourist behaviour and landscape preferences of the period.

It was encouraging to find that the conclusions concurred substantially with those reached by the author using such literary evidence as guide books, CP guides, travel accounts, and the annual reports of the park superintendents (e.g. see Marsh 1971). Such comparisons will constitute a necessary means of validating the results of photograph analysis. The value of the method might also be investigated by an analysis of current postcards, the people who produce them and who buy them, and the relation between the cards produced and bought and the present landscape appreciation.

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PERSONAL CONSTRUCT THEORY: A BASIS FOR EVALUATION OF LANDSCAPE AESTHETICS

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Evaluation and modelling of landscape aesthetics have been subject to much criticism because of their lack of a theoretical basis. The personal construct theory developed by Kelly (1955) provides a theoretical

framework for evaluating complex environmental stimuli such as landscapes. Kelly (1955) proposed that a person's present perception of his or her environment is based on the complex interaction of past experience in the memory. New experiences are evaluated or 'construed' using the order made out of previous experience as a basis. Personal constructs are the criteria used by a person to describe the conceptual structure derived from past experience and to interpret new experiences in terms of existing conceptual structures. Constructs are bipolar concepts that categorize the perceived similarities and differences among environmental stimuli.

Application of this approach can be seen in the work of Zube, Pitt, and Anderson (1975) for direct evaluation of landscape preference. The technique has also been used to determine the applicability of theoretical models of landscape preference, such as those of Appleton (1975) and Kaplan and Kaplan (1982).

Application of the personal construct technique requires development of a repertory grid or range of stimuli used to elicit responses from individuals. The repertory grid is a matrix showing the disparities among aspects of the environmental stimuli. In the repertory grid technique, each individual discriminates among environmental stimuli. This construing process is based on the individual's personal constructs of his or her environment. The discrimination process can be achieved by the sorting, ranking, or rating of environmental stimuli (Harrison and Sarre 1976; O'Hare and Gordon 1976). Ratings of similarity or preferences are compiled in the matrix. The repertory grid for an individual can be combined with the grids from other individuals to form an aggregated 'supergrid' (Harrison and Sarre 1976). The supergrid represents the aggregated personal constructs of several subjects. Those constructs that are consistently important among the individuals will have the greatest influence on the composition of the supergrid.

O'Hare and Gordon (1976) have found strong differences in preference for landscape paintings between persons trained and untrained in art appreciation. This suggests that 'groups' of people with similar personal constructs of landscape preference may exist. Ward and Russel (1981) refer to the cognitive set as defining the mental universe of concepts represented by personal constructs. The cognitive set is the conceptual structure in a person's mind within which environmental stimuli are assessed. Ward and Russel state that a particular

landscape can be assessed in terms of the regional landscape by relating the cognitive set of the study subjects to the regional landscape.

In the present study, personal construct theory is used to identify the components of landscapes that are perceived and preferred. A rural townscape in southern Ontario (Wingham) was evaluated by the residents for preference.

METHODS

Evaluation of landscapes by large numbers of respondents is frequently carried out using photographic surrogates. Shuttleworth (1980) has suggested that colour photos with a lateral and foreground context are the optimal types of photos for landscape stimulation. In this study, a set of 40 colour photos meeting Shuttleworth's criteria was assembled to form the repertory grid (Harrison and Sarre 1976). This grid was used to obtain responses from a group of individuals who were familiar with the particular landscape. The Wingham townscape was evaluated for preference by having 40 respondents rate each photo for preference on a scale of 1 to 5 (i.e. not preferred to most preferred). To aid further in analysis, word associations were requested from each respondent as the photo set was rated for preference. The results can be regarded as similarity judgments. Similarity is measured by the frequency with which photos receive the same rating on the preference scale. The responses of each individual form a vector matrix that corresponds to the cognitive set of preferences of each respondent. The resulting matrices were analysed using the non-metric alternating least squares multi-dimensional scaling algorithm (MDS) (Young, Takane, and Lewyjkj 1979) available in the Statistical Analysis System.

MDS takes the disparities among elements of the supergrid and uses them to create an n -dimensional space. The configuration of this space is such that distances among the point elements of the space (landscape scenes) correspond to the disparities among the elements as recorded in the repertory supergrid. The dimensions of the n -dimensional space correspond to the aggregate personal constructs used in the differentiation of environmental stimuli (Harrison and Sarre 1976). The area of the space occupied by the landscape elements corresponds to the cognitive set common to the subjects (Ward and Russel 1981).

In this study, initial interpretation of the cognitive set

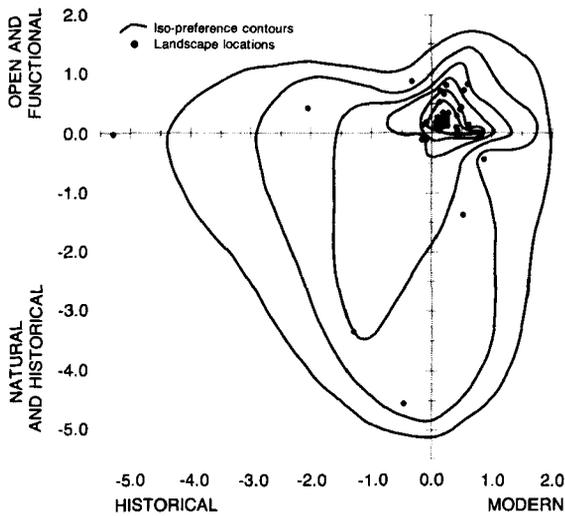


Figure 1
Preference for dimensional ranges

was carried out by inspecting the photos as they were configured by the scaling. Photos that had extremely large co-ordinate values in one dimension of the space relative to others were used to typify the scale.

RESULTS

The optimal solution of the perceptual space was two dimensional and provided a high degree of explanation ($R^2 = 0.96$). The results are shown in Figure 1. The content of the photos had been assessed verbally by the respondents and is summarized in Table 1. The ‘+’ represents a strong positive association in a given dimension, ‘-’ a strong negative association, and ‘0’ a non-determinant association.

Based on the analysis of photo context and configuration of the perceptual space the following personal constructs were identified. The personal constructs influencing preference in the Wingham townscape are: first dimension – an aspect of structural development, labelled modern versus historical; and second dimension – an aspect of the landscaping of the area, labelled open and functional versus natural and historical. Most of the photos in the Wingham data set were located close to the centre of the configuration because the photos were generally similar, with few striking landscape scenes. However, the relation between average preference and the co-ordinate values of the photos (Figure 2) in the derived spatial configuration

Table 1
Interpretation of Two-Dimensional Solution for Landscape Preference: Wingham, Ontario

Group	Resident district (+Old -New)	Income of residents (+Upper -Low)	Pine trees (+Prevalent -None)	Deciduous trees (+Prevalent -None)	View (-Open +Closed)	Ground cover (+Shrubs -Fields)	Business district (+Old -New)	Sky colour (+blue -White)	Blight (+Prevalent -None)	Public structures (+Prevalent -None)	Canadian flags (+Prevalent -None)	Brightness of scene (+Light -Dark)	Water bodies (+Prevalent -None)
Not preferred	0	0	0	+	+	0	0	0	0	+	-	0	-
Dim. 1+	-	+	0	+	-	0	-	+	1	0	0	-	-
Dim. 1-	+	+	0	0	+	0	+	+	-	+	0	0	-
Dim. 2+	-	0	0	+	+	-	0	+	1	-	-	+	0
Dim. 2-	+	+	+	+	+	+	0	0	1	-	-	+	0

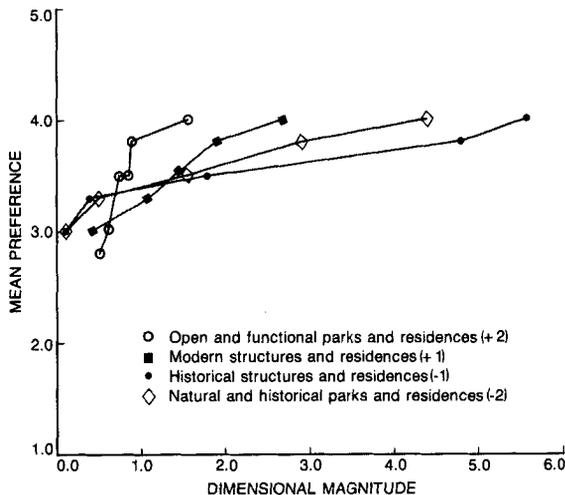


Figure 2
Wingham landscape preference space

shows a strong trend. This indicates that preference for functional open parks is more likely to vary due to small differences in the scene than is the preference for residences.

DISCUSSION AND CONCLUSION

The personal constructs interpreted from the assessment of the photos for preference show some very strong relationships. The natural versus structural environment construct is influential in determining both perception and preference. This construct is embodied in much aesthetics research (Leopold 1969; USDA 1978). The high level of agreement between individuals, as expressed by the high R^2 , suggests that there is an identifiable cognitive set for such general stimuli as landscape. More extensive testing of data sets designed around single personal constructs, e.g. natural versus man-made, modern versus historical, could result in definition of scales for measurement of these aspects of visual quality.

This study illustrates the use of the personal construct theory for visual evaluation of landscape. The method provides a systematic means of evaluation that relates the constructs used by individuals to a cognitive set which characterizes group responses to landscape. Further systematic research is required to provide confirmation of the generality of the constructs identified here and to determine the nature of interactions between these constructs.

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ON THE PERSISTENCE OF ERROR IN SCHOLARLY COMMUNICATION: THE CASE OF LANDSCAPE AESTHETICS

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Kuhn (1962) and some other science theorists give the impression that modern science reacts correctly to critical analysis and that errors of concept and method are systematically discarded as a consequence of informed scientific communication. However, many erroneous paradigms have persisted for long periods of time and have achieved academic respectability. In some cases, published errors define the frontiers of research. This suggests that there must be good reasons why people produce errors, why errors survive review prior to publication, why they are used in teaching, and why they often are referenced favourably in subsequent publications. I believe that the persistence of errors is a con-