20^{TH} / 21^{ST} CENTURIES' LANDSCAPE QUALITY RESEARCH

CONTENTS

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INTRODUCTION

In this chapter the characteristics of research of landscape quality are examined. It traces the emergence of landscape as an area of research, examines the scope of research and the growth of landscape studies over the past 50 plus years. It then examines the use of photographs to represent the landscape, and the influence of the characteristics of survey participants on their ratings.

EMERGENCE OF LANDSCAPE QUALITY AS AN AREA OF INQUIRY

During the last few decades of the 20th century and into the new millennium extensive research of landscapes has been conducted. This entirely new field of research scarcely existed before 1970. Inklings of it emerged with the early attempts to map landscape quality by Fines and Linton in 1968 and by Shafer *et al* in 1969. An early reference was a paper by David Lowenthal in 1962, titled *Not every prospect pleases: criterion for scenic beauty*.

The other pre-1970 event was the launch, by John "Brinck" Jackson (1901 – 1996), of the journal *Landscape* in 1951 which presented landscapes as a serious issue for academics and the public. "The older I grow and the longer I look at landscapes and seek to understand them, the more convinced I am that their beauty is not simply an aspect but their very essence and that that beauty derives from the human presence." (Jackson, 1999).

By the late 1970s landscape was becoming a serious issue of enquiry by academics with several hundred papers published. This upsurge probably occurred because of a convergence of various factors; psychologists were investigating influences, positive and negative, on the human psyche and the landscape presented itself as a likely candidate; many of the researchers were of the post-war baby boomer generation who were more appreciative of their environment than previous generations; the researchers often lived and worked amidst attractive landscapes and wanted to understand them more; many of the researchers were young, at the beginning of their academic careers and landscape quality offered a new and exciting field that corresponded closely with their world view and environmental sensitivity; and finally the development of statistical tools together with the availability of computers and, later, the Internet, facilitated research. For a host of reasons, an explosion of research commenced in the mid-1970s and has scarcely abated.

OVERVIEW OF LANDSCAPE QUALITY STUDIES

- Scope of landscape quality references
- Growth of landscape studies
- Country of origin of studies
- Publication journals
- Principal researchers

Scope of Landscape Quality References

The definition of what counts as landscape quality research is somewhat ambiguous. In the context of this book, at its core is the quantitative measurement and mapping of landscape quality. However the knowledge required covers a wide field including:

- theoretical constructs of what generates preferences for landscape quality;
- techniques for measuring landscape quality preferences;
- human and landscape factors involved in influencing these preferences;
- the mode of presentation of the landscape (e.g. field vs photos vs computer visualisations);
- change in landscapes and the impact of developments on the landscape;
- landscape management and policies affecting landscapes;
- pricing the view of landscapes;
- restorative qualities for human health and well-being.

While the compilation here concentrates on studies that measure preferences, it includes some studies which have placed a value on the landscape based on professional expertise. Cultural landscape studies are excluded.

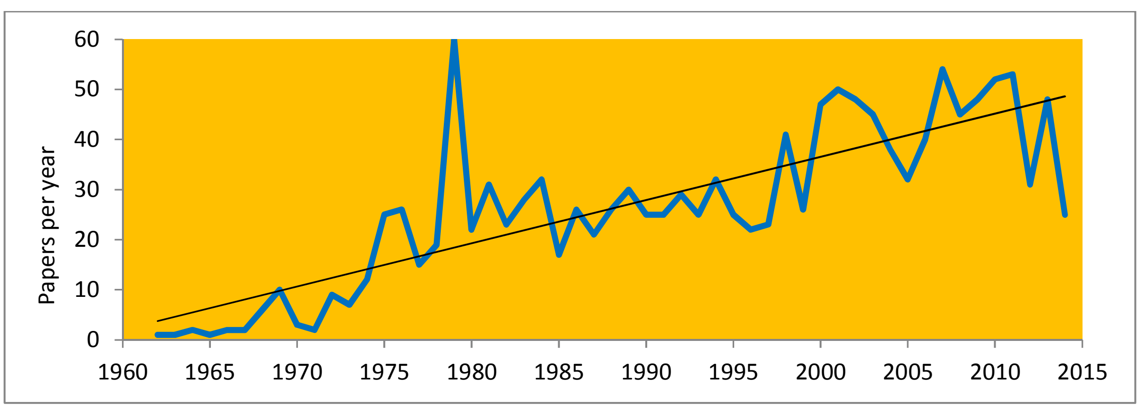
The edges of the field adopted here are therefore somewhat fuzzy, for example, among the studies of the restorative qualities of landscape have been the effect of landscape posters in offices (which are included) and the restorative qualities of home gardens and lawns (excluded).

A comprehensive search of relevant literature was carried out, building on those compiled in my PhD thesis, updated and supplemented through searching issues of relevant journals and using Google Scholar to help identify likely references. The references were of two main types, those in journals, and those that comprised reports, theses, books and conference compilations. The latter in particular is unlikely to be complete.

A sum total of 1106 journal references and 288 references from books, theses etc were identified, overall a total of 1388 references. However this is unlikely to be a complete set of relevant references, for example there are likely to be many local studies of landscape which have gone unreported. Some such references from Australia have been included.

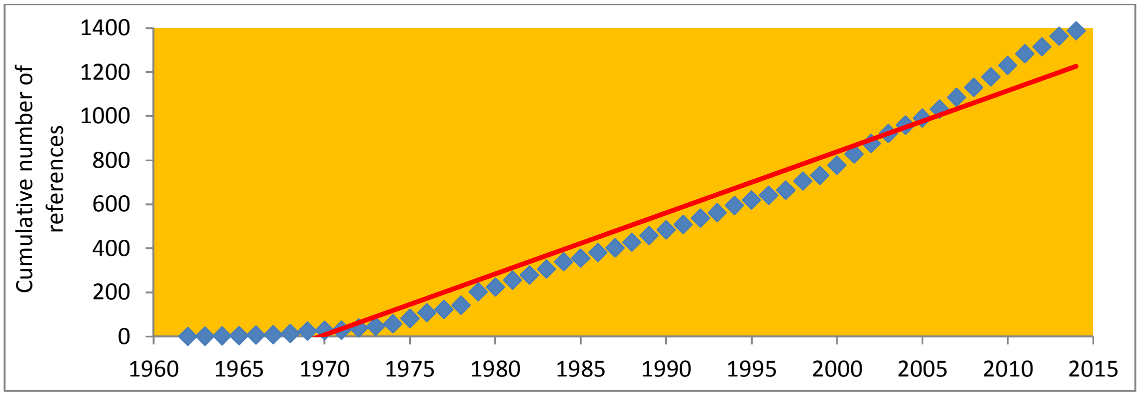
Growth of Landscape Studies

Landscape studies over the 53 years, 1962 – 2014, have increased on average by nearly 26 annually but this has increased over the past decade to over 50 per year (Figure 1). Much of this upsurge in recent decades has been studies of the health and restorative benefits of nature and landscape. The growth has been remarkably even across the five and half decades (Figure 2).



Trend line y = 0.86x – 1687, R^2 = 0.67.
Peak in 1979 due to National Landscape Conference (Elsner & Smardon, 1979)

Figure 1 Papers per year, 1962 - 2014



Trend line: y = 27.7x – 54557, R^2 = 0.96

Figure 2 Cumulative growth of landscape studies, 1962 – 2014

Country of origin of studies

Table 1 and Figure 3 indicate the country of origin of the authors of the 1388 papers and reports. The majority of them were from the United States (645 studies, 43% of total), while other significant sources were the UK (201, 13.4%), Scandinavia (156, 10.4%), Australia and New Zealand (153, 10.2%) and other European countries (207, 13.8%). Spain, the Netherlands and Switzerland accounted for 110 studies (7.3%). An emerging field is China with nearly 30 studies, most of which occurred since 2000.

Table 1 Country of origin of authors of landscape studies, 1962 – 2014

Country	Studies	Country	Studies	Country	Studies
US	645	Belgium	15	Hungary	2
England	164	Israel	10	Ireland	2
Australia	118	Wales	9	Argentina	1
Sweden	77	France	8	Austria	1
Netherlands	51	Korea	8	India	1
Canada	47	Turkey	8	Nth Ireland	1
Norway	45	Taiwan	7	South Africa	1
Spain	38	Czech	6	Ghana	1
NZ	35	Estonia	6	Brazil	1
Finland	30	Greece	6	Ukraine	1
China	29	Portugal	6	UK	1
Scotland	26	Croatia	4	Russia	1
Switzerland	21	Poland	4	Philippines	1
Japan	19	Thailand	4	Nigeria	1
Germany	18	Denmark	4	Singapore	1
Italy	17	Hong Kong	3	Lebanon	1

Note: Records number of countries of origin of authors involved in papers, so a paper may have multiple authors from several countries, each of which is recorded.

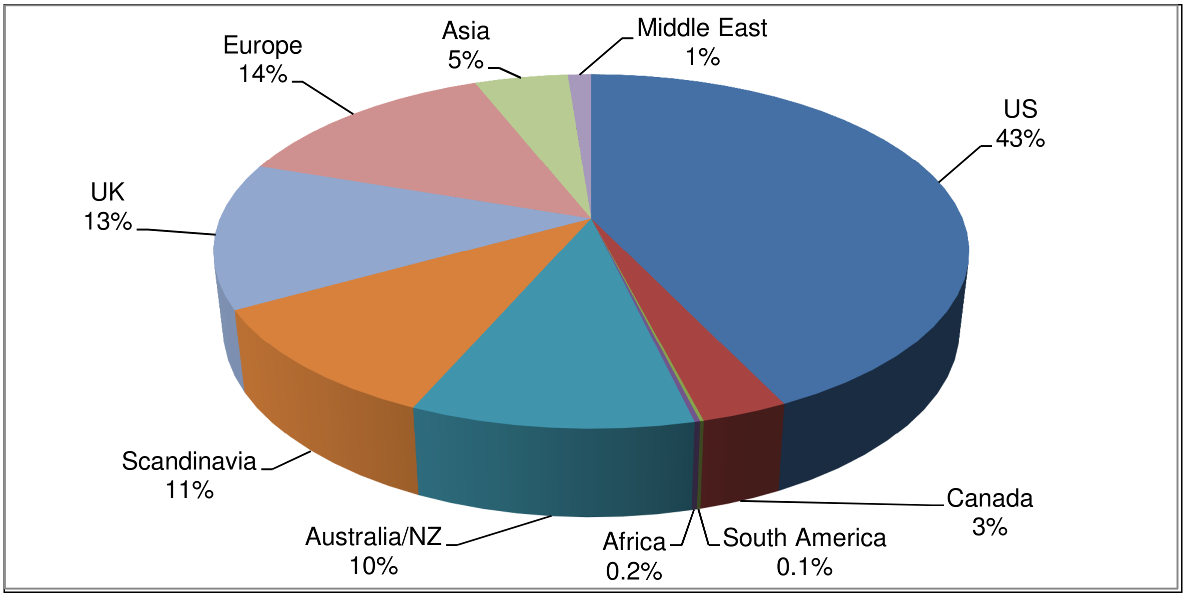
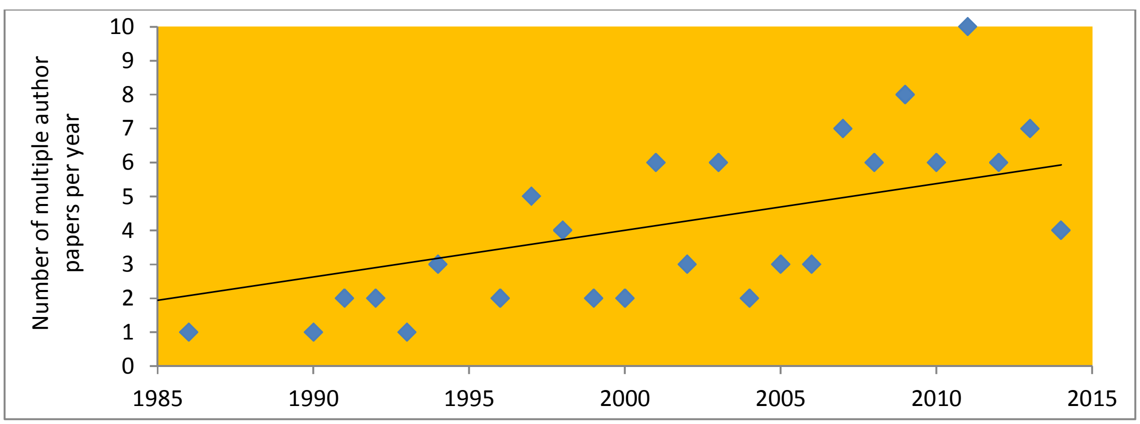


Figure 3 Country of origin of authors of landscape studies, 1962 – 2014

Some countries have surprisingly few studies, for example, Austria with its outstanding landscapes produced only one, however there are likely to be studies in languages other than English, the language in which the search was conducted.

Two trends are evident in the studies, firstly many studies now involve authors from several countries collaborating in the study, and secondly, the number of countries involved in landscape studies is growing.

Figure 4 shows the growth in the number of studies involving authors from more than one country. Over the period, 104 studies involved authors from several countries. While in the early 1960s there were only two such studies, both involving authors from the United States and England, in the 1990s the number took off and now up to ten countries are involved each year. The growth parallels the availability of the Internet and email communications which have greatly facilitated cross-country interaction.



Trend line: y = 0.23x – 456, R^2 = 0.66. Two studies in 1964 and 1965 omitted.

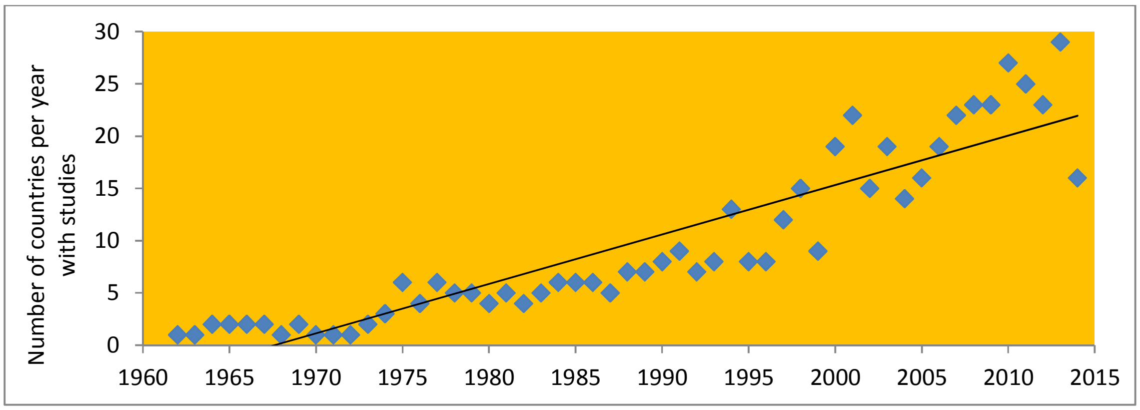
Figure 4 Number of studies per year with authors from multiple countries, 1985 – 2014

Table 2 shows the main countries that cooperate with other countries in preparing landscape studies, Sweden being the outstanding country for working with other nations in undertaking studies.

Table 2 Main countries cooperating in landscape studies

Country	Number of studies
Sweden	49
US	32
Norway	26
Netherlands	18
Australia	16
England	14
Scotland	11
Switzerland	10

Figure 5 shows the number of countries per year in which landscape studies have been contributed for publication. Whereas until the mid-1980s, studies were largely confined to a handful of countries, in the 1990s this expanded with the availability of internet communications and now papers are contributed from authors in between 25 - 30 countries annually.



Trend line: y = 0.47x - 931, R^2 = 0.83

Figure 5 Number of countries per year with landscape studies, 1962 – 2014

Fields of Study

The areas of landscape study were discussed at the beginning of this paper and the number of landscape papers in each of the categories is summarised by Table 3. Papers on theory including testing totalled a sizeable 175 studies (12.7%). The core fields of measurement techniques and the influence of observer and landscape factors on preferences totalled 557 papers or 40.5% of the total. Actual surveys of regional landscapes accounted for only 13.3% but comprised a reasonable 183 projects. The positive effect of natural landscapes on human health and restoration is an emerging field and was the subject of 94 papers. Studies of landscape change and visual impact totalled 120 (8.7%).

Table 3 Frequency of fields of landscape study

Field of study	Papers	%
Theory	175	12.71
Measurement techniques	221	16.05
Observer factors	149	10.82
Landscape factors	187	13.58
Presentation mode	35	2.54
Regional studies	183	13.29

Landscape change & impact	120	8.71
Landscape management	30	2.18
Restoration & health	94	6.83
Pricing of landscapes	60	4.36
Future directions, sustainability	32	2.32
Policy, law & conventions	48	3.49
Overview papers	43	3.12
	1377	100.00

The overall trend in studies has been to move from the general to the specific, from the theory to the practical, from conceptual development to application. The early years was marked by searching - for the right method for assessing landscape quality, for underlying theoretical constructs, and for understanding the concepts involved in landscape quality assessment. The titles of early papers reflect this:

- *Aesthetic appreciation of nature* (Hepburn, 1963)
- *Ideas and Attitudes - A Scenery Classification System* (Sargent, 1966)
- *How to rate & rank landscape* (Hart & Graham, 1967)
- *An attempt at assessing preferences for natural landscapes* (Calvin, *et al*, 1972)
- *Quantitative evaluation of landscapes: an application of signal detection analysis to forest management alternatives* (Daniel, *et a*l, 1973)
- *Landscape evaluation: the theoretical vacuum* (Appleton, 1975)

Theories gradually emerged, concepts were clarified, techniques were developed, refined and applied, and specialisations emerged.

Table 4 and Figure 6 illustrate the emergence and development of six areas of landscape research since the 1960s:

- Theory – theory including the constructs by Appleton, Kaplan, Ulrich and Orians;
- Measurement techniques - the issues involved in measuring landscape aesthetics;
- Human factors which may influence preferences including culture, age, gender and education;
- Landscape factors which may influence preferences including trees, water, land forms and naturalness;
- Restoration and health – research of the positive effect that exposure to nature has on human health and restoration from stress;
- Pricing - studies of the positive effect that a view of landscapes has on property prices.

Table 4 Frequency of studies by decade

	Theory	Measurement techniques	Human factors	Landscape factors	Health & restoration	Pricing	Total
1960-69	0	11	6	4	0	0	21
1970-79	10	49	29	26	2	2	118
1980-89	35	62	37	35	4	6	179
1990-99	43	36	23	29	15	22	168
2000-2009	72	49	31	54	45	21	272
2010-2014	15	14	16	33	28	7	113
Total	175	221	142	181	94	58	871

Note: +3 of unknown year

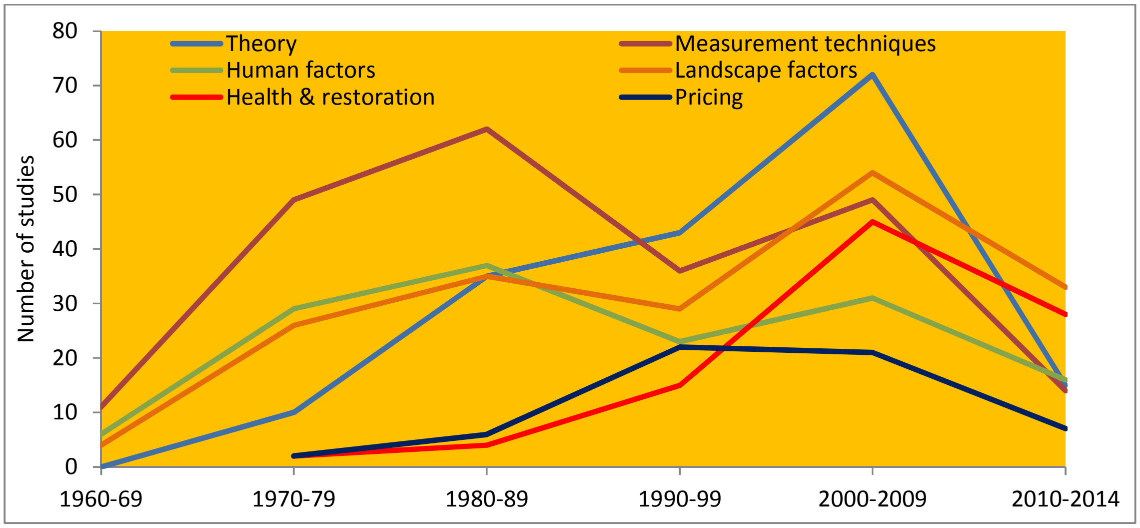


Figure 6 Frequency of studies by decade

While studies of measurement techniques and the human and landscape factors have been ongoing over the past five and a half decades, and theory strengthened in the 2000s, studies of the health and restorative effects of landscape, and the effect of landscape views on property prices only really took off in the 1990s. Health and restoration studies have become the most rapidly growing area over the past decade.

Publication Journals

Table 5 summarises the main journals responsible for over two-thirds of the journal papers. *Landscape and Urban Planning* (together its predecessor, *Landscape Planning*) accounts for nearly a quarter of all papers.

Table 5 Main journals publishing landscape papers

Journal	Studies	Journal	Studies
Landscape & Urban Planning*	263	Trans Inst of British Geographers	11
Landscape Research	123	Perceptual & Motor Skills	10
Journal of Environmental Psychology	88	British Jnl of Aesthetics	10
Environment & Behavior	77	Environmental Management	9
Journal of Environmental Management	40	Regional Studies	9
Landscape Journal	32	Leisure Sciences	9
Journal of Leisure Research	21	Environment & Planning B	8
Forest Science	18	Landscape Architecture	8

* Includes Landscape Planning

Principal Researchers

The earliest landscape studies were conducted in the late 1960s with only a handful of researchers in the US and UK. Contrast this with today with dozens of researchers in many countries. While some researchers have spent part of their careers carrying out landscape research and then moved on to other fields, a considerable number of researchers have maintained their involvement and produced studies year after year.

Table 6 lists 37 of the foremost researchers in terms of the number of papers and books they have published on landscape studies. These account for about 50% of the total number of studies.

Table 6 Principal landscape researchers

Name	Location	Papers & books	Period
Ian D. Bishop	Retired 2009. Formerly Director of the Centre for GIS and Modelling, then Head of the Dept. of Geomatics. University of Melbourne, Australia.	47	1985 - 2012
Gregory J. Buhyoff	Retired. Formerly Professor of Forestry in the College of Natural Resources at Virginia Tech. US.	29	1978 - 2003
J. Frederich Coeterier	DLO Winand Staring Centre for Integrated Land, Soil, and Water Research, Wageningen. Netherlands	6	1976 - 1996
Terry C. Daniel	Retired 2012, formerly Professor of Psychology, University of Arizona, Tuczon, Arizona, US.	38	1975-2013
Phillip Dearden	Professor of Geography, University of Victoria, British Columbia, Canada.	9	1980 - 1987
Wenche E. Dramstad	Norwegian Forest and Landscape Institute, Ås, Norway	4	2002-2011
Rebecca M. Ford	School of Resource Management, University of Melbourne, Victoria, Australia.	5	2006-9
Guy D. Garrod & Kenneth G. Willis	Centre for Research in Environmental Appraisal & Management, University of Newcastle, England.	11	1991 - 94
Paul H. Gobster	Research Social Scientist, Northern Research Station, Forest Service, US.	25	1989 - 2012
Caroline M. Hagerhall	Dept. of Landscape Architecture and Spatial Planning, Norwegian University of Life Sciences, Norway	7	2000 - 2013
Ke-Tsung Han	Associate Professor, Dept. of Landscape Architecture, National Chin-Yi Institute of Technology, Taiwan	6	2001 – 2010
Terry Hartig	Professor at Institute for Housing and Urban Research and Professor at Dept. of Psychology, Uppsala University, Sweden	48	1991 - 2012
Thomas R. Herzog	Dept. of Psychology, Grand Valley State University, US.	24	1976 – 2009
Brian J. Hudson	Adjunct Professor, School of Urban Development, Queensland University of Technology, Brisbane.	5	1992 - 2006
R. Bruce Hull IV	Professor of Leadership for Sustainability, Dept. of Forest Resources and Environmental Conservation, Virginia Tech, US	24	1981 - 2005
Stephen & Rachel Kaplan	Respectively Professor of Environmental Psychology and Professor of Psychology, School of Natural Resources, University of Michigan, US. - Many joint papers.	SK 29 RK 33	1972 – 2011
Kalevi M. Korpela	Professor of Psychology, School of Social Sciences and Humanities, University of Tampere, Finland.	15	1992 – 2010
Richard J. Lamb	Formerly Senior Lecturer, Dept of Architecture, Sydney University, Sydney, Australia. Now Principal of Richard Lamb & Assocs.	6 with A.T. Purcell	1984 - 1998
Eckart Lange	Formerly Institute of National, Regional and Local Planning, Swiss Federal Institute of Technology, Zurich. Now Dept. of Landscape, University of Sheffield, England.	11	1994 - 2011
Joan I. Nassauer	Professor of Landscape Architecture in the School of Natural Resources and Environment, University of Michigan, US.	15	1980 – 2010
Åsa Ode	Dept. of Landscape Planning, Swedish University of Agricultural Sciences, Sweden.	8	2006 – 2010
James F. Palmer	Director, Landscape Architecture, SUNY College of Environmental Science and Forestry, State University of New York, Syracuse, US	13	1977 – 2004
Russ Parsons	Environmental Psychophysiology Laboratory, Dept. of Landscape Architecture, University of Illinois, US	10	1988 – 2002
Edward C. Penning-Rowsell	Reader in Geography and Planning, Middlesex Polytechnic, Enfield, England.	11	1973 - 1989
A. Terry Purcell	Psychologist, Dept. of Architectural and Design Science in the Faculty of Architecture at Sydney University, Sydney, Australia.	10	1984 - 2004
Robert G. Ribe	Institute for a Sustainable Environment and Dept. of Landscape Architecture, University of Oregon, Eugene, US.	20	1982 – 2013
Herbert W. Schroeder	Retired, formerly an environmental psychologist with the Forest Service at the North Central Forest Experiment Station, Chicago, US.	20	1979 – 2007
Elwood L. Shafer	Professor of Tourism and Environmental Management,	6	1969 –

	Pennsylvania State University, Pennsylvania, US.		1977
Henk Staats	Dept. of Social and Organizational Psychology, Centre for Energy and Environmental Research, Leiden University, Netherlands	12	1990 – 2013
Arthur E. Stamps	Institute of Environmental Quality, San Francisco, US.	19	1990 – 2010
Carl Steinitz	Dept of Landscape Architecture, Harvard University, US.	5	1970 – 2003
Simon Swaffield	Professor of Landscape Architecture, Lincoln University, Canterbury, New Zealand.	18	1993 – 2007
Mari S. Tveit	Professor, Landscape Architecture (environmental psychology), Dept. of Landscape Architecture and Spatial Planning, Norwegian University of Life Sciences, Ås, Norway.	9	2001 - 2010
Roger S. Ulrich	Director of the Centre for Health Systems and Design, Professor, College of Architecture, Texas A & M University, US.	30	1977 - 2010
Agnes Van den Berg	Wageningen University and Research Centre, Wageningen, The Netherlands.	9	1998 - 2010
J. Douglas Wellman	Associate Professor of Forestry, School of Forestry, Virginia Polytechnic Institute, US. Often published with Buhyoff	11	1978 - 1985
Joachim F. Wohlwill (1928 – 1987)	Formerly Professor, Dept. of Individual and Family Studies, Penn State, US.	7	1976 - 1982
Ervin H. Zube (1931 – 2002)	Formerly of the School of Renewable Natural Resources, University of Arizona, US.	39	1973 - 1998

The majority of the researchers, 89%, are in universities (Table 7).

Table 7 Location of principal researchers

	University	Government	Other
Number	33	3	1*
Percentage	89%	8%	3%

*Arthur Stamps, Institute of Environmental Quality, San Francisco

Figure 7 illustrates the number of papers and books that each of the principal researchers has published. While some researchers are just at the beginning of their careers, others are well established, and some have retired or passed away. Their number of papers reflects these factors.

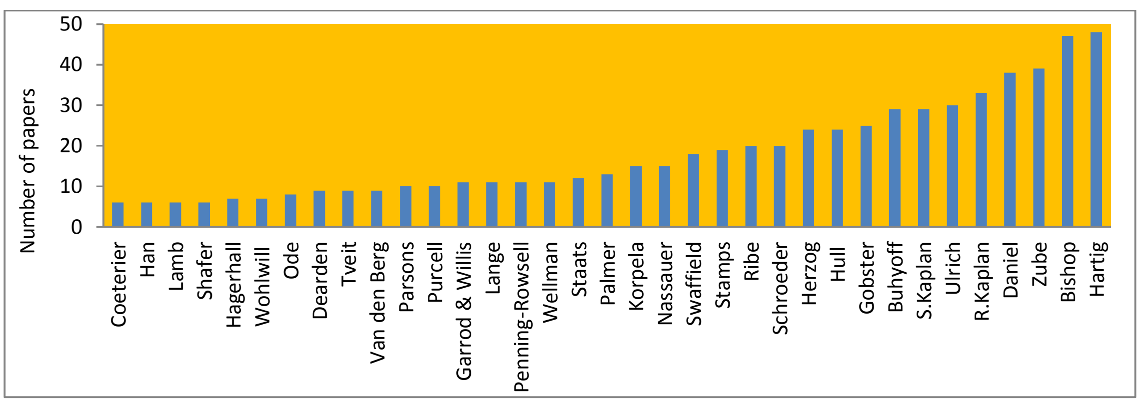


Figure 7 Number of papers by main authors

Figure 8 illustrates the period of landscape research covered by each of the researchers, arranged from the late 1960s and going through to the 2010s. An impression from Figure 8 is that most of the researchers have focussed on landscape related research for much of their careers. Among the most consistent and productive have been Terry Hartig - 48 papers over 21 years, Ian Bishop - 47 papers over 27 years, Ervin Zube - 39 papers over 25 years, Terry Daniel - 38 papers over 38 years, Stephen and Rachel Kaplan - 45 papers over 40 years, Roger Ulrich - 30 papers over 34 years, and Gregory Buhyoff - 29 papers over 25 years.

Producing figures on the number of papers per year for each researcher is somewhat problematic as the list of papers is not necessarily complete and many researchers have moved on to other areas of research. However a good average is one paper per year. A few researchers, such as Terry Hartig, have produced over two a year. Twelve of the researchers published over one landscape paper a year.

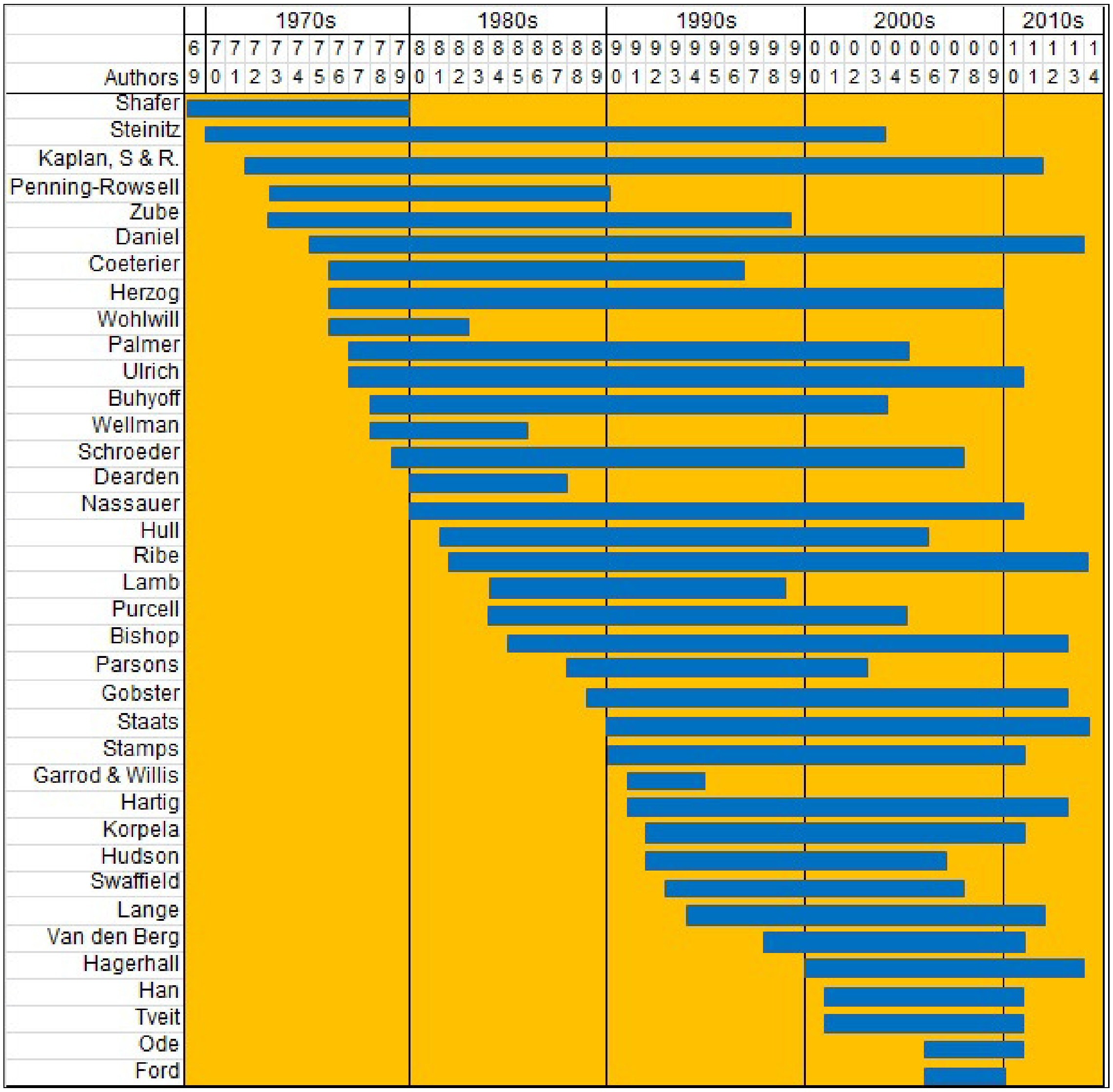


Figure 8 Years of papers by main authors, 1969 - 2014

Theoretical Basis of Studies

Porteous' pithy observation (1982) that landscape preference studies are "rampantly empirical" is borne out by an analysis of the theoretical basis of surveys. Of 1377 papers and reports surveyed, only 175 (12.7%) were considered to deal with theory. The remainder were classed as empirical. Table 8 indicates the theoretical base of these papers. Chapter 17 described these theories.

Table 8 Theoretical basis of papers

Theoretical Basis	Number of papers
Prospect & refuge theory, Jay Appleton	21
Information processing theory and Affective Restoration Theory - Stephen and Rachel Kaplan	51
Habitat theory (savannah) - Gordon Orians	13
Affective theory - Roger Urlich	70
General	20
Total	175

Research Instruments

The basic methodological approach involves measuring the relationship between the landscape as perceived, the independent variable, by human observers stating their preferences for the landscape, usually by use of some rating scale (e.g. 1 – 10) or by other physiological and psychological measures. The landscape is known as the independent variable because it remains constant and invariable regardless of who views it, rates it, measures it or examines it. Human observers on the other hand are not constant but their preferences and reactions to a landscape can vary widely influenced by a range of personal, interpersonal, cultural and other factors. Figure 9 summarises the three elements of the method.

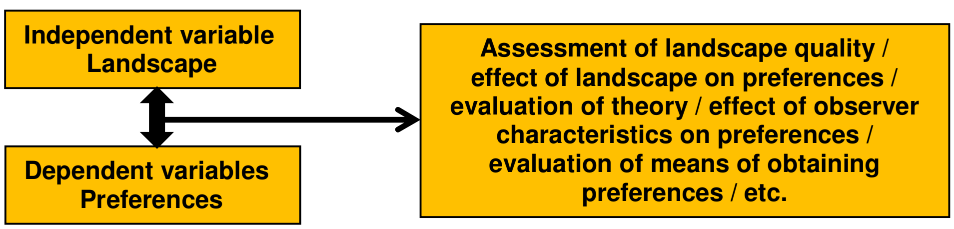


Figure 9 Landscape assessment components

Most of the research instruments are used to evaluate the dependent variables, measuring the preferences of observers and how they vary with the quality of the landscape. This is achieved through statistical measures including correlation, multiple regression and factor analysis. Other studies compare the preferences of one population sample with another, no independent variable is used.

In measuring anything, including landscape quality, numbers are used. However numbers come in a variety of capabilities - according to Stevens (1946) there are four types of numbers:

Nominal, the weakest form, merely take the form of labels or categories, such as the numbers on the backs of football players for identification. Numbers can be used for classes - eg males = 1, females = 2. Such classes or numbers have no order (i.e. they are random) and have no sense of relativity (i.e. one is better than another).

Ordinal implies a relative ranking, e.g. one mineral is harder than another, an odour is more pleasant than another, this landscape is more appealing than that one. While relativity is apparent, the intervals between classes are not necessarily equal, nor is there a baseline - ie zero point.

Interval measures are quantitative in the usual sense of the word. It provides a ranking between classes and an equal spacing between them, however a zero point is arbitrarily assigned. The temperature scale is an interval scale - the units are of equal size and the zero on the Celsius scale is based on the freezing point of water, it does not denote the absence of temperature in the way that 0° Kelvin does (ie absolute zero). An interval scale enables precision about the differences in magnitude of objects; one

> can state that one is twice that of the other. Interval scales are commonly used in psychology. Much landscape research assumes that ordinal numbers are interval measures.
>
> Ratio measures are the strongest form of numbers. They are sometimes known as *cardinal* numbers. Relativity between objects is defined, the intervals between units are equal, and an absolute zero point is included which means the complete absence of the characteristic being measured. Ratio measures have all the properties of interval measures plus an absolute basepoint. Measures of weight and distance are examples.

Most landscape research assumes that the data is interval whereas in fact they are mostly ordinal. According to Schroeder (1984), "The simplest scaling methods treat the noninterval scale problem by ignoring it, they assume that rating data already possess interval properties and analyse them accordingly."

A range of research instruments for measuring landscape preferences have been developed, ranging from simple to the sophisticated.

The sophisticated research methods produce interval-type data and these include the Law of Comparative Judgement (LCJ) method and the Scenic Beauty Estimation (SBE) method, developed from psychophysics.

Psychophysics originated in the 19th century through the work of a German physicist, Gustav Fechner (1801 - 87), who defined it as "an exact science of the functional relations of dependency between body and mind" (Torgenson, 1958), or the measurement of sensations and perception (Lindzey, *et al*, 1988) - in other words, it measures how the brain interprets information provided by the senses.

A basic assumption of psychophysics is that people are reasonably consistent in making judgements or choices among options. In regard to landscapes, people are unlikely to switch their preferences markedly during a test. Although some variability is acknowledged, it is assumed to display a normal distribution with the true value being represented by the mean (Hull, Buhyoff & Daniel, 1984).

According to the Macaulay Institute:

> Of all landscape assessments, (psychophysical) methods have been subjected to the most rigorous and extensive evaluation. They have been shown to be very sensitive to subtle landscape variations and psychophysical functions have proven very robust to changes in landscapes and in observers. Relying on ordinal or interval scales of measurement, psychophysical methods have consistently been able to provide different landscape-quality assessments for landscapes that vary only subtly. (Macaulay Land Use Research Institute, Review of Existing Methods of Landscape Assessment and Evaluation on line)

Law of Comparative Judgement

During the 1920s, Louis Thurstone (1887 - 1955) developed psychophysical scaling laws that enabled the accurate measurement of those psychological attributes resulting from stimuli but which had no physical manifestation. His Law of Comparative Judgement (Thurstone, 1927) is one of the key foundations for research into landscape quality and has been used widely across a range of disciplines, including psychology, engineering, marketing, and ergonomics (Hull, 1986).

The problem that Thurstone addressed was that individuals making judgements about the same feature would give similar but not identical responses at different times. Furthermore while some individuals are consistent in their reliability, others may be very inconsistent. If respondents use, say, a 10-point scale and are asked to rate some feature, they may regard the interval differences between 5 and 6 as different than between 8 and 9. Thus, while the researcher may treat each unit as equal, the respondents may not. Scaling methods provide a means of transforming the raw responses into accurate and reliable scale values that reflect the perceived properties of the features.

Thurstone defined five cases in the Law of Comparative Judgement (LCJ) but we will concern ourselves only with the third case which involves several observers, each judging each pair of scenes several times. This is widely used in landscape research with photographs of scenes providing the stimuli and assumes that each photograph may be judged independently of others. Two photographs are shown side by side. The observer judges between the two and chose one on the basis of whatever criteria is defined - such as the preference of one over the other. Each photograph is compared successively with every other photograph. No single photograph appears twice in succession and the aim should be to space them as far apart as possible. No two photos should be judged equal.

A limitation of the method is that the number of paired comparisons grows rapidly with the number of photographs. With *n* stimuli, there are *n(n-1)/2* pairs of stimuli required. It is generally impractical to go beyond about 15 pairs (Guildford, 1954). This would require 105 paired comparisons which are about as many as one could reasonably expect a survey participant to undertake. Increasing the number of photographs by one (to 16) increases the paired comparisons to 120, a sizeable increase for only one extra photograph. An experiment requiring observers to make 120 comparative judgements could suffer from observer fatigue (Hull, Buhyoff & Daniel, 1984). While most of the studies using the LCJ method had less than 15 pairs of photographs, one used 29 pairs, requiring 406 paired comparisons (Whitemore *et al*, 1995). Figure 10 indicates the number of paired comparisons that need to be made for *n* photographs.

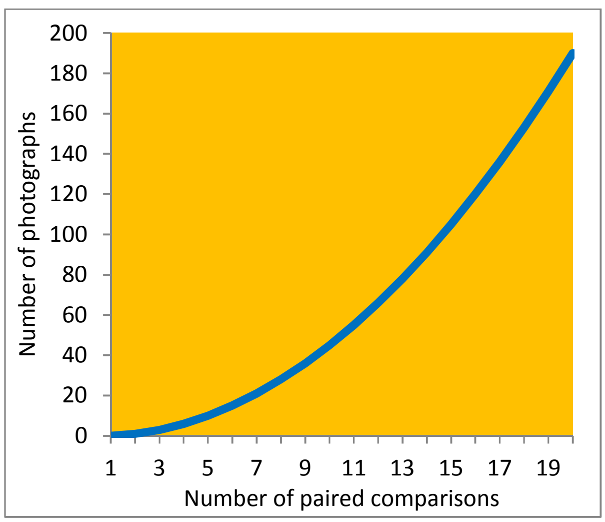


Figure 10 Numbers of Photographs for Paired Comparisons - LCJ Method

The LCJ method requires a large number of comparisons of each stimulus to provide sufficient data for analysis, so a balance has to be struck between exceeding the patience of the observers and providing sufficient data for analysis.

Through a series of mathematical steps and data transformations, the LCJ method provides interval scaling between preferences. This enables the results to be analysed using standard statistical methods. A key researcher who has used the LCJ method extensively is Greg Buhyoff who has used the method in twelve of his studies.

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Scenic Beauty Estimation

The second psychophysical method is the Scenic Beauty Estimation (SBE) method that was developed by Terry Daniel, a psychologist at the University of Arizona, and Ron Boster, a forester with the US Forest Service. The SBE method transforms ordinal ratings to an interval scale SBEs.

SBE method has its origins in both the Law of Categorical Judgement and the Theory of Signal Detection. The Theory of Signal Detection has close parallels with Thurstone's law (Green & Swets, 1966) and grew out of research to detect a weak message over a noisy telephone (Lindzey *et al*, 1988, 116). The theory is based on the research finding that the cognitive state of the person doing the detecting - their biases and expectations - influences the results they attain. Providing rewards or punishments for the detection changes the cognitive state and one's willingness to make false alarms or misses. However, one's true sensitivity remains the same. Signal Detection Theory allows the researcher to separate spurious and real influences so as to determine the observer's true sensitivity, provided the observer is neither cautious nor reckless.

Applying SBE to landscapes, an observer may form a negative judgement about Landscape A that they do not like it. Landscape B however exceeds the implicit criterion the observer sets and results in a positive judgement - "I like it". If, however, the observer's standards were raised for some reason, their judgement:

> "would be negative for both landscapes, **even though their perceived beauty has not changed**. Thus, scenic beauty judgements depend jointly on the perceived properties of the landscape and the judgemental criteria of the observer" (Daniel & Boster, 1976, authors' emphasis).

Ideally, if each observer rated a landscape out of a possible top score of 10, a rating of, say, 7 would be the equivalent across observers. However, this would be unusual because each observer's criterion is unique, and the same landscape will be rated differently by different observers, making the scoring difficult to interpret. For example, one observer may rate a landscape as 3 out of 10, applying very high aesthetic criterion, while another having low aesthetic standards may score it as 8.

These and other problems of observer differences are solved through the SBE method, in which a measure of landscape beauty "independent of observer judgemental criteria" is derived.

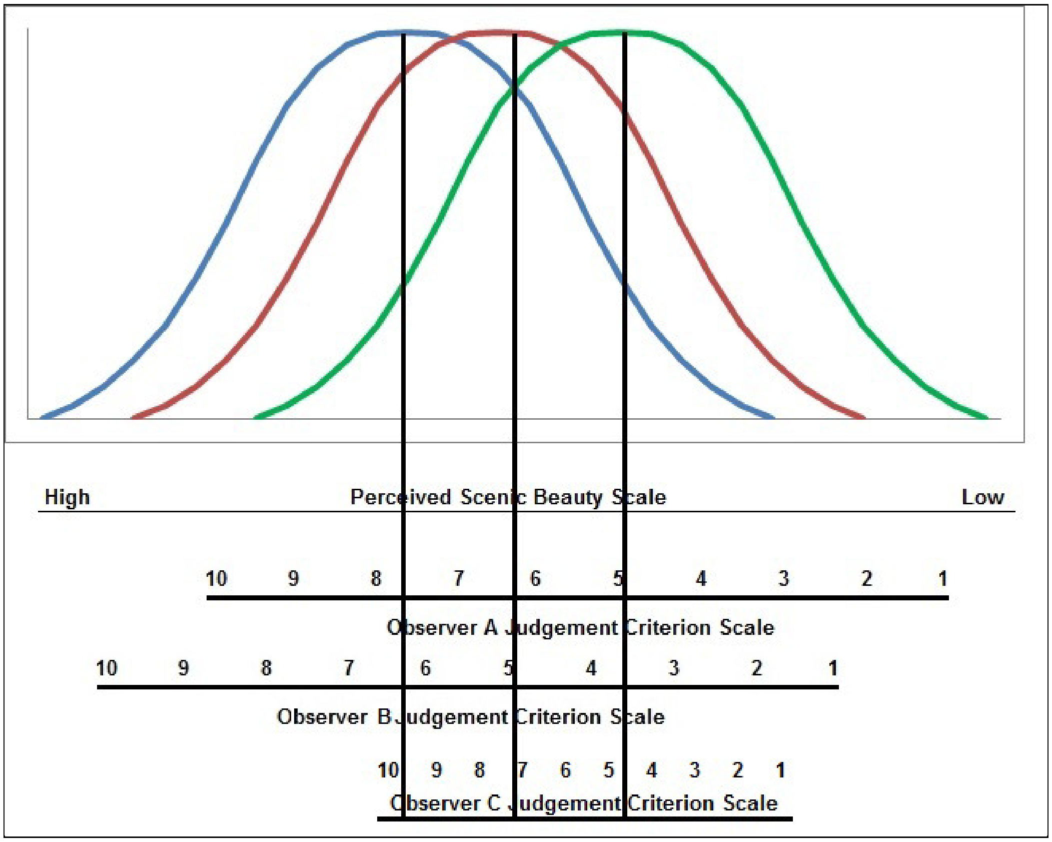
The SBE method involves three stages taking colour photographs of the landscape, presenting these to participants for evaluation and evaluating their judgements. Daniel and Boster developed the method in ponderosa forest on flat topography but it has been used across many landscapes.

Like the LCJ method, the SBE method assumes that all individuals will categorise each slide in essentially the same location on their respective scenic beauty continuum and that differences among individuals are normally distributed. These categories can then represent a basis from which measurements of scenic beauty can be made. Each category is indicated by a distribution, reflecting both individual differences and variability in perceptual and judgemental processes. The mean of the distribution is assumed to represent the true category.

Hypothetical results of a survey are presented in Figure 11. The three graphs indicate the scenic beauty scales assigned the average ratings given by the three observers to each of the landscapes are as follows:

Observer		**Landscape**	
	1	**2**	**3**
A	7	6	5
B	5	4	3
C	9	7	4

While the order of these is the same, the scores given for each landscape differ between observers even though the perceived scenic beauty values are identical for all observers. Table 9 summarises the derivation of the SBE score using the "by slide" or "by stimulus" method of Daniel and Boster. This method uses multiple observers to rate the scenes and from this a distribution of ratings for each scene is obtained. The rating distributions are converted to frequencies for each rating category (e.g. 1 - 10) and Z values derived. Daniel and Boster's alternative method is "by observer", which uses few observers rating multiple scenes of a given landscape.



Source: Daniel & Boster, 1976

Figure 11 SBE model - hypothetical example of three observers

Table 9 Derivation of Scenic Beauty Estimation (SBE) for Three Scenes

Scale	Stimulus 1	cf	cp	Z	Stimulus 2	cf	cp	Z	Stimulus 3	cf	cp	Z
1	1	3	1.00			3	1			3	1.00	
2		2	0.67	0.44	1	3	1	0.95		3	1.00	0.95
3	1	2	0.67	0.44		2	0.67	0.44		3	1.00	0.95
4		1	0.33	-0.44	1	2	0.67	0.44	1	3	1.00	0.95
5		1	0.33	-0.44		1	0.33	-0.44		2	0.67	0.44
6	1	1	0.33	-0.44		1	0.33	-0.44	1	2	0.67	0.44
7		0	0.17	-0.95	1	1	0.33	-0.44		1	0.33	-0.44
8		0	0.17	-0.95		0	0.17	-0.95		1	0.33	-0.44
9		0	0.17	-0.95		0	0.17	-0.95	1	1	0.33	-0.44
10		0	0.17	-0.95		0	0.17	-0.95		0	0.17	-0.95
Mean Z				-0.471				-0.26				0.162
Mean of MeanZs	-0.189											
Mean Zn-Mean Zall				-0.281				-0.070				0.352
SBE				-28				-7				35

Source: Brown & Daniel (1990) Note: Stimuli 1, 2, 3 are individual scenes and indicates the scores by three observers on the scale 1 - 10. cf = cumulative frequencies, cp = cumulative probabilities and Z is Standard Normal Distribution (Z tables).

Daniel and Boster used the SBE method in relation to forest management and applications included deriving aesthetic contour maps for National Forest areas, examining the effects of timber harvesting on scenic beauty, and identifying the factors that affect the SBE scores. The amount and distribution of felled timber and stumps had a negative effect, while tree density, tree diameter and crown-canopy cover each contributed positively. It has also been used to estimate the scenic effect of beetle damage on trees, the forest factors that contribute to scenic beauty, the changes to scenic beauty over time with forest maturation, tradeoffs between scenic beauty and timber value, effect of distance on scenic beauty, Cultural differences in scenic beauty estimates, effect of scene composition on scenic beauty estimates, and alternative options for the landscape and their impact on scenic beauty.

Because the LCJ and SBE methods both produce interval scale metrics, they do not define absolute scenic values (i.e. no benchmark zero point is available), only relative differences. Thus, the scores derived from different studies of different landscapes cannot be compared as a SBE score of say 60 in one area bears no relation to the same score in another area. However, Hull considers it possible to compare two sets of landscapes that share some scenes (Hull, 1987).

While there may be some appeal in the sophistication of the LCJ and SBE methods, it has been suggested that these complex methods do not produce any real gain over simpler methods. Schroeder (1984) tested both complex and simple methods for rating landscape quality and concluded that there was no discernible difference – “even the most sophisticated of scaling methods seems to produce results that are equivalent to a simple mean rating.” He commented that rating scales that are “often maligned as ‘merely ordinal’, may actually approximate interval scale data more closely than many people suspect.” Thus a simple rating scale, such as 1 (low) to 10 (high) as used by the author suffices. Such scales are far more intuitively acceptable than the negative to positive integers that result from the SBE method.

Schroeder also makes the point in view of his research that small samples may be adequate as they produce acceptable intergroup reliability. Typically researchers have a rule-of-thumb of 15 – 25 raters whereas Schroeder considers that 9 to 15 would be adequate. Prior to Internet-based surveys, the cost of the survey largely related to the number in the sample so this was a significant consideration but is less so now.

The following are research instruments that are generally simpler to use than the LCJ and SBE.

Rating of Photographs

Rating of photographs is the single most prevalent method and its attraction lies in its simplicity and effectiveness. Typically, photographs are presented as prints, as slides, or more commonly now, digital images are presented via the Internet and respondents rate each scene. The advantage of the Internet is that randomisation can be built into the order so that each viewer sees them in a different order. This overcomes issue of a rating of a scene being influenced by the previous scene. It also offsets the problem of fatigue affecting the ratings as the survey can be delayed for a period. Surveys should commence with a few scenes to “prime” the viewer of the range of images to be presented, thereby cueing their brain regarding their rating.

Online survey companies such as Survey Monkey® are available with easy-to-use tools to construct the survey, input the images, and collect and even analyse the results. Other instruments include: Question Pro, eSurvey Pro, Zoomerang, Survey Gizmo, Free online survey, Fluid surveys, Qualtrics, Survey Expression, Goodle Consumer Surveys, and Smart-

Survey. According to Roth (2006), the "scenic quality categories of visual variety, beauty, visual naturalness as well as overall scenic quality can be validly recorded on the Internet."

Rating scales vary among studies. Some use an odd number, say 1 – 9 so that the mid-point is an integer (5) whereas for the 1 – 10 scale the mid-point is 5.5. Some surveys use a 5 or 7 points. However the scale needs to provide sufficient discrimination between scenes and scales of 5 and possibly 7 points fail in this. On the other hand a 1 – 100 scale provides too much discrimination and it can be difficult for a viewer to discriminate say between 65 and 66. The scale should not include the zero, 0, as there is logically no scene of zero rating. Even scenes of a flat plain without any land form, land cover, land use, water or any other feature have been found to rate 3 – 4 on a 1 – 10 scale.

Frome gibber plain. Rating 3.8

Sturts Stony desert Rating 3.63

Examples of a flat landscape without land cover, land use or water, yet rate nearly 4

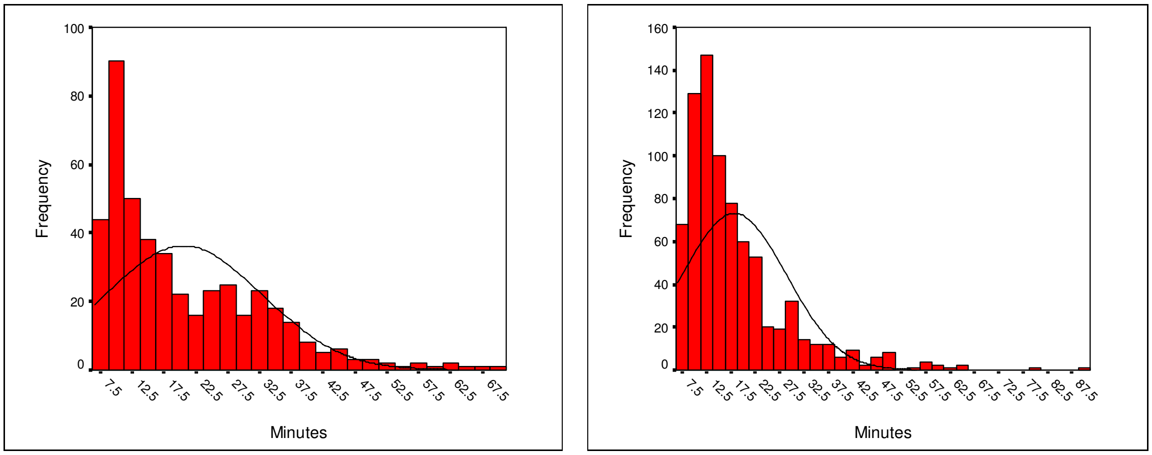
The author's experience is that the 1 – 10 scale works very well; it provides sufficient discrimination and is most easily used by viewers. Most scales go from worst (1) to best (10) as the reverse (best 1 – worst 10) can be confusing for participants and they may revert to the worst-best scenario after a few scenes which makes data analysis difficult.

Rating scales are used in landscape surveys to rate the aesthetic quality of the landscape as well as many other attributes including Kaplan's variables of coherence, complexity, legibility and mystery; tranquillity, naturalness and familiarity. My surveys also assess the visual significance of components in the scenes including land form, vegetation, land uses, water, diversity and naturalness.

The number of photographs used in studies varies from 6 to 180 with the majority in the 40 – 60 range. However with Internet surveys, longer surveys can be used as the person can pause the survey when fatigued and return to it later. Table 10 indicates the average time taken to complete three of my surveys and shows very little difference between dial-up and broadband Internet connections. Figure 12 shows the duration for the Barossa survey.

Table 10 Effect of Internet connections on survey times

Survey		Dial-up		Broadband	
	Scenes	Average time (min)	Time per scene (sec)	Average time (min)	Time per scene (sec)
Coast, Lothian, 2005a	166	19.7	7.1	19.8	7.2
Barossa, Lothian, 2005b	150	20.6	8.2	18.2	7.2
Flinders Ranges, Lothian, 2009	147	13.5	5.5	12.2	5.0



Dial up Broadband

Source: Lothian, 2005b. Note: Mean duration, dial-up 20.6 minutes, broadband 18.2 min.

Figure 12 Duration of surveys – Dial up and Broadband

While rating of scenes enables comparisons of their ratings from a common base, rankings only provide an ordinal hierarchy of scenes which is difficult to analyse.

Paired Photographs

A group of photographs are allocated into pairs and the preference for each photograph in each pair is recorded. This differs from the LCJ method in that each photograph is different, so the sample is not limited to a relatively small number of photographs. Studies have used up to 120 photographs in 60 pairs. The method is particularly popular in Spain - 11 out of the 16 studies using this method were undertaken in Spain by researchers such as Abello, Bernaldez, De Lucio, Marcia and Rodenas.

Q-Sort of Photographs

The Q-sort procedure was originally developed for personality assessment (the prefix 'Q' has no special significance). Based on psychological research, which indicates that the human senses are not capable of discriminating sensory perceptions into more than nine categories (Pitt & Zube, 1979), participants are asked to sort a set of photographs into five or seven piles. Even numbers of piles are avoided so as to permit a central group.

The Q-sort allows a large number of stimuli to be evaluated. An advantage it has over a rating form is that the participant can shift items back and forth as they proceed (Cronbach, 1970). Thus, the photographs in a given pile at the end of the sorting can be regarded as approximately equivalent. Forcing the participant to allocate a pre-set number of photographs to each pile is regarded as being preferable to an unforced choice.

Swaffield and Fairweather in New Zealand has used Q sort in several studies.

Visitor Employed Photographs (Participant Photography)

As the name suggests, this technique uses the selection of photographs taken by visitors as an indicator of landscape preferences. The method involves loaning park visitors an inexpensive and easily operated camera, and asking them to take photographs of given subjects. This may as broad as "anything they wish" (Cherem & Driver, 1983), preferred scenes, anything of interest, or may be used to provide material for use in framing a questionnaire (Hammitt, 1979).

Gabriel Cherem developed the method in the early 1970s as a means of eliciting the public's view of aesthetic objects. Cherem and Driver (1983) evaluated the method in landscape research, trialing it in three studies. They provided cameras to hikers on a trail (of 512 cameras loaned, only 6 were not returned) and from the hundreds of photographs taken, identified 'consensus photographs' (i.e. scenes photographed by 10% or more of the participants). They acknowledge that the 10% figure is arbitrary and could be set higher or lower, but it serves to provide a "concrete representation of a scene which offers some common degree of perceptual interest."

Hull and Revell (1989) used the participant photography method in a study in Bali of cross-cultural landscape preferences among the Balinese and Western tourists. Based on the photographs taken, consensus scenes were identified based on 10% of the responses from each culture.

In an evaluation of the method, Chenoweth (1984) concluded that it is a tool that "deserves serious consideration along with other tools for understanding people's reaction to the landscape ..."

Semantic Differential

The semantic differential (SD) is the first of the descriptive methods used in landscape research. Charles Osgood developed the SD technique in the mid-1950s as an objective method of measuring perception, meaning and attitudes. It has been used for assessing the reactions of observers to different types of environmental stimuli, including the architecture of buildings; rooms and interiors; snow, rain, fog and other meteorological phenomena; beach scenes; and roadside scenery.

The SD technique is based on the following prerequisites (Osgood & Suci, 1955):

- Judgement can be made in terms of a continuum, definable by polar terms (i.e. opposites such as like - dislike);
- The many different ways in which meanings can vary can be represented by a single dimension (e.g. scenic quality as a term covering a landscape's aesthetic qualities);
- A limited number of continua can be used to define a quality within which the meaning can be specified.

The SD technique involves participants scoring photographs on a series of bipolar semantic scales, each of which has, say, a 7-point gauge. The scales might be expressed in terms of: common/unusual, pleasant/untidy, obvious/mysterious, artificial/natural, weak/powerful and barren/fertile.

The SD technique is a mature methodology that has been used extensively in landscape preference assessment.

Adjective Checklist

The second descriptive method is the adjective checklist that has been used for the evaluation of landscapes. In 1972, Kenneth Craik developed a Landscape Adjective Check List (LACL) based on descriptions of 50 natural landscape scenes by students. He asked students to list 10 adjective descriptors of each scene and, while not all were able to achieve this, adjectives that were used six or more times comprised a list of 1196 distinct items. The LACL comprised 240 adjectives. He proposed that the list be used to:

- derive impressions of landscapes quickly from large samples in the field
- statistically compared descriptions of the same landscapes
- record impressions of landscape
- assess change in landscapes
- evaluate the effectiveness of photographs, sketches and other surrogates of landscapes

Craik (1975) used the list in a field assessment of landscape in Marin County, California and identified 104 adjectives that were used by 10% or more of the participants. It identified the following attributes of the area: clean, hilly, tree-studded, grassy, pleasant, beautiful, natural, green, peaceful, and sunny. Factor analysis was then used to identify four descriptive landscape factors: serene/gentle, dry/barren, beautiful/ picturesque, and blooming/cultivated.

Kane (1976, 1981) in a study of South Australian landscape for the National Trust, developed and applied a bipolar list of 21 adjectives, of which 14 were significant to South Australians as descriptive of their landscape. The adjective pairs included wet/dry, cold/warm, private/public, unstimulating/ stimulating, and disordered/ order. Responses were transformed into a landscape rating score through application of a weighting factor derived from an earlier evaluation of 40 adjective pairs, and a selection of those which related most to beautiful/ugly and like/dislike. The scoring of adjective pairs was undertaken by ten respondents and applied to 46 scenes throughout South Australia. Checklist scores ranged from a high of 80 down to 29.
The adjective checklist method has not been widely used but can provide an effective and quick method of assessing impressions of a landscape.

Physiological tests

While psychophysical tests and other preference rating methods assume that human cognitive and affective responses to landscapes can be expressed and measured, physiological tests aim to measure these responses more directly. Physiological effects are autonomic (i.e. self-governing) responses of the human body to environmental stimuli – the subject cannot intentionally create them.

Roger Urlich who has postulated a landscape theory based on its affective effects has carried out a range of studies using physiological tests. In Ulrich, 1981 he used alpha wave amplitude and heart rate to compare reactions to photographs of scenes of natural and urban environments. In Urlich *et al* (1991), he used a battery of tests: electrocardiogram, pulse transit time (correlates with systolic blood pressure), spontaneous skin conductance responding, and frontalis muscle tension - to assess the rate of recovery from stress from a stressful movie during exposure to videos of natural and urban scenes. There have been many other studies by researchers using physiological tests.

Physiological tests are complex and require specialist equipment and expertise in their administration.

Interviews and Questionnaires

Interviews and questionnaires play an important role in landscape research and are often used in association with other methods. Many are field administered surveys - about 50%. They require a large number of respondents and therefore are expensive in cost and resources required - one survey of 242 averaged only 4 interviews a day - 60 days total.

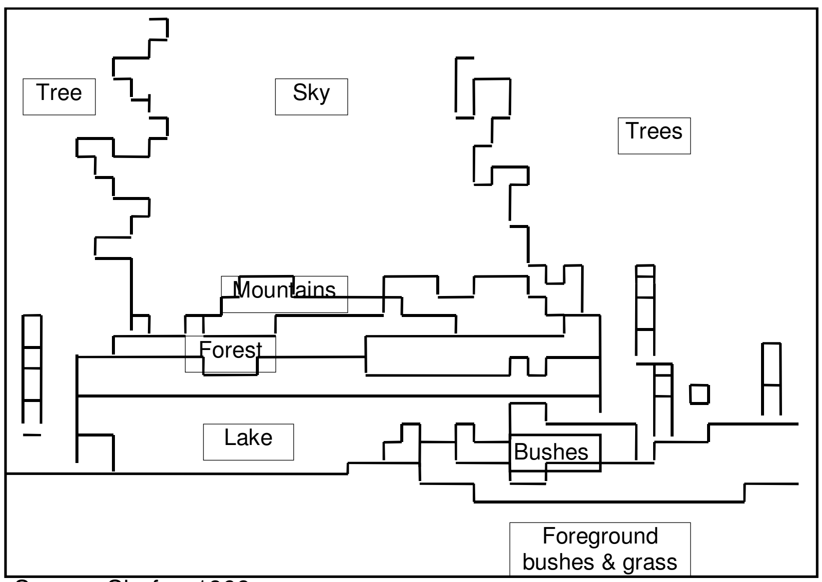
Measurement of Features on Photographs

The final method examined is the only one that provides an objective measure of the composition of landscapes as depicted in photographs. It is therefore the only measure that has been developed of the independent variable (i.e. the landscape).

In 1969, Elwood Shafer, a researcher in the US Forest Service, published a unique approach to measuring landscape preferences by measuring areas and perimeters of features on 8” x 10” black and white photographs. The photographs were of scenes across the US and included forests, mountains, meadows, water and various combinations. A total of 100 photographs were used. A 1/4” clear plastic grid was overlaid on each photograph and the areas of landscape zones were then outlined by pen and measured. The 10 landscape zones were:

- sky
- vegetation in the foreground, mid-distance and distance
- non-vegetation (e.g. exposed ground, mountains, snowfields, grasslands) in the foreground, mid-distance and distance
- water - streams, waterfall and lakes

Figure 13 indicates the landscape zones identified in a scene of a lake and distant mountains, framed by trees. Each polygon is identified as set (S_n) that identifies the total squares it contains. Each set is identified by computer, using variables that describe its boundary; the interior number of squares; the area; and the horizontal end-squares. The tonal variations provided by sky, land and water are measured by a photometer and are included in the analysis. Each photograph is described by a total of 46 variables. This was subsequently reduced to 26 zones by removing redundancies.



Source: Shafer, 1969

Figure 13 Example of landscape zones designated on photograph

The photographic evaluations that describe the elements in the landscape provide the independent variables in the research method. The rating of landscape quality provides the dependent variable and was assessed by asking participants rank the landscape on a 1 - 5 scale. Factor analysis identified nine independent factors and the model derived used ten terms and explained 65% of the variation in landscape preference. Using the model, the predicted scores of the 100 photographs ranged from 84 to 236 which approximated that derived from participants (Table 11).

Table 11 Shafer's Predictive Model of Landscape Preferences

$$Y = 184.8 - 0.5436 X_1 - 0.0929 X_2 + 0.002069 (X_1 . X_3) + 0.0005538 (X_1 . X_4) - 0.002596 (X_3 . X_5) + 0.001634 (X_2 . X_6) - 0.008441 (X_4 . X_6) - 0.0004131 (X_4 . X_5) + 0.0006666 X_1^2 + 0.0001327 X_5^2$$

where: Y = preference

X_1 = perimeter of near vegetation	X_4 = area of near vegetation
X_2 = perimeter of middle distant vegetation	X_5 = area of any kind of water

X_3 = perimeter of distant vegetation	X_6 = area of distant non-vegetation

Note: negative items contribute positively, while positive items contribute negatively (i.e. the lower the score the better the landscape).

Factors which had a positive influence on the landscape's aesthetic appeal were the:

- perimeters of near and middle distant vegetation
- perimeter of distant vegetation multiplied by the area of water
- area of middle distance vegetation multiplied by the area of distant non-vegetation
- area of middle distant vegetation multiplied by the area of water.

The resultant scores are ordinal numbers that enable ranking of photographs.

Shafer has applied the method to several further studies. From an analysis he suggested that farmland scenes could be improved by

- eliminating tree cover in the middle distance and replacing it with fields or pasture
- establishing a lake
- permitting vegetation to encroach in the distant zone

For each of these he was able to predict the change to the score that would result (e.g. establishing a lake would improve the score from 155 to 119 – the lower is better).

Shafer's model was criticised as "lacking intuitive appeal since some of the multiplicative independent variables, although mathematically proper, seem illogical (e.g. area of water X area of intermediate veg)" (Buhyoff & Leuschner, 1978). Whittow (1976) suggested that the method was like the "well-known analogy of the computer attempting to describe Shakespeare", but he also recognised its worth. The philosopher, Alan Carlson (1977), issued a lengthy critique of the method in which he identifies three key assumptions in the model:

1) the aesthetic quality of the landscape is meaningfully correlated with certain preferences for that landscape
2) the relevant preferences are those of the general public
3) the presence of the formalist theme

Of these, the third is possibly the most telling. Carlson notes that the methodology is "completely formalist" as the methodology measures only formal aspects of photographs - the shapes of the zones, not their contents, or the relationships between the shapes and lines. Formalism derives from the artistic tradition and identifies certain formal aspects of a scene such as shapes, lines, colour, patterns, and the formal qualities which they produce such as balance, proportion, unity and diversity.

Bourassa (1991) also identified the formalist basis of Shafer's approach and is critical of its lack of theoretical origin, stating that the "choice of variables is completely without justification (and) do not even seem to make sense intuitively". Bourassa considered the results quite "spurious" as there is no causal link between the independent variables (i.e. the landscape's formal qualities) and the dependent variable (i.e. preference scores). In another critique, Weinstein is also critical of Shafer's use of regression analysis:

> "With enough independent variables a regression equation can be derived that will correlate perfectly with *any* dependent variable, no matter how meaningless and inappropriate the predictors actually are" (Weinstein, 1976).

Despite its critics, Shafer's approach has been used widely, simply because as it provides an objective basis for measuring the independent variable in landscape research.

Research Instruments - Conclusions

The diversity of instruments used in the evaluation of landscape preferences is notable. Although the field of landscape research is relatively new, it has been characterised by considerable innovation and imagination in the application and modification of existing techniques and the development of new ones.

REPRESENTING THE LANDSCAPE

Use of photographs as a surrogate

Most of the research instruments use photographs to represent the landscape as an alternative to taking participants out into the field. Photographs are a surrogate of the landscape and the rating scale used to assess preferences is also a surrogate of these preferences. One of the earliest areas of inquiry in landscape research was the adequacy of photographs as surrogates. A photograph clearly differs from a field observation as summarised by Table 12.

Table 12 Landscape assessment: field observations vs photographs

Field observation	Photograph
Range of scenes, showing context.	Single scene without context.
Observer is part of the scene.	Observer is separate from the scene.
Scenes can be viewed over long time.	Scenes can be viewed quickly.
Scenes often observed while in motion.	Scenes observed from a static position.
Cone of vision of 130° with peripheral vision extending to 208° from one viewpoint.	Photographs are 65° for wide angle lens.
Field observations are frameless.	Photographs are framed - sample of the scene.
Narrow range of scenes within a region.	Scenes from many regions can be used.
Difficult to compare one scene with another and to establish their relative quality.	Easy to compare widely separated scenes and to establish their relative quality.
Cannot easily compare seasonal changes.	Easy to compare seasonal changes.
Cannot assess changes to landscape.	Using Photoshop®, changes easily assessed.
Expensive in time and effort.	Cheap in time and effort.
Content is seen as trees, grass, clouds etc.	Content (black & white) tends to be formalist – emphasises line, form, texture, balance.
Scenes observed day and night and in a diversity of states under differing lighting, weather and seasonal conditions.	Scenes generally taken 10 am to 4 pm, avoid strong side lighting, reduce shadows, maximum light penetration and avoid ephemeral effects.
Observer aware of other senses – sounds, wind, water, odours, heat and cold of water and wind, touch of leaves, taste of berries; these are multi-sensory stimuli.	Observer of photo relies on vision but can infer other senses from previous experience.
Observer has generally chosen to visit area which implies a preference for the area. Their ratings may be higher as a consequence.	Observer may not have visited the scene and can view them from a neutral stance. Their ratings may better represent the disinterested view.
Observers often go to new areas, not previously visited.	The ubiquity of landscape photographs means observers will not find scenes unique.
Viewing scenes in the field avoids composition. In 19th c. people sought to compose scenes in field.	Landscape photographs tend to follow rules of composition, similar to picturesque.

Overall the advantages of using photographs easily outweigh those of field observations. Photographs offer rapid, comparatively inexpensive means of assessing landscapes, allowing scenes widely separated in space and time (seasonal) and also changes in landscapes to be assessed. Ratings better represent the disinterested view.

Some of the early studies transported raters into the field: Dearden (1980) transported 12 observers on by mini-bus through the area over two days, Robinson *et al* (1976) used field methods in surveying the Manchester region of England and Briggs & France (1981) transported observers through the study area in South Yorkshire. Bernáldez *et al* (1988) transported subjects in a coach and invited them, at certain times, to mark on a form their preference of the landscape on the right or left; at the same time photographs of both scenes were taken. To overcome the transport issue, Brush and Shafer (1975) interviewed campers in the area being assessed.

Given the differences between photographs and field observations, it is not surprising that Carlson (1977) stated "It goes without saying that photographs are not landscapes and landscapes are not photographs" Do photographs provide a valid for landscape assessment? Is the assessment of photographs similar to that of field observations?

There have been many studies of this issue: Coughlin and Goldstein, 1970; Zube *et al*, 1975; Daniel & Boster, 1976; Dunn, 1976; Shuttleworth, 1980, Kellomaki & Savolainen, 1984; Stewart *et al,* 1984; Trent et al, 1987; Bernáldez *et al*, 1988, Brown *et al*, 1988; Hull & Stewart, 1992; Kroh & Gimblett, 1992; Sevenant & Antrop, 2011.

A definitive and widely quoted study on the use of photographs as a surrogate of field observations was undertaken by Shuttleworth (1980). He used the same group to assess landscapes in both the field and as photographs and randomised the assessments. He found no significant differences between groups in responses to landscapes in the field and to the photographs. However, he did detect distinctly more differences between responses to black and white photographs and field views than between colour photographs and field views. Shuttleworth concluded that the results "indicated that there were very few differences of significance between the reactions to and perceptions of the landscapes either when viewed in the field or as photographs" with any differences being explainable by content. He concluded that photographs can be used, providing they are in colour and are wide-angled to provide a lateral and foreground context.

Stamps (1990) used meta-analysis of 1300 papers representing over 150 environments and 2400 respondents to determine a correlation of 0.86 between field and photograph assessments. Photographs have become the preferred means of representing the landscape.

The following are ten rules for using photographs. Some have been derived from the literature and others are from my own practical experience.

1. Photograph in colour. Black and white photographs emphasise the formalist qualities - line, texture, shadow, form, etc. but lose the life-giving quality that colour conveys. Shuttleworth (1980) found that black and white photographs gave more extreme ratings and had lower correlations with field assessments than colour.
2. Photograph at 50 mm focal length. Photographs at 35 mm will render objects as very small (Sevenant & Antrop, 2011). For digital cameras the equivalent of 50 mm is 35 mm (the focal length of digital cameras is multiplied by 1.5 to equate to conventional cameras).
3. Photograph in horizontal landscape format, not the vertical portrait format (Nassauer, 1983).
4. Extend photographs where possible to the horizon and avoid close-up confined views. Include sky to help convey its landscape character.
5. Avoid photographic composition of a scene to frame a view or to lead the viewer into a scene. Such composition enhances its appearance and thereby its rating. Although Law & Zube (1983)

found that framing the scene had no influence on ratings, Svobodova *et al* (2014) found that compositions based on the Golden Section and the Rule of Thirds (the image is divided into three horizontal sections and three vertical sections creating points of interest at their intersections), together with the position of the horizon in the photograph significantly influenced ratings of the scene. Placing positive elements at the intersection points significantly increased the ratings of the landscape but placing negative elements on these points made negative ratings even more negative. Moreover placing the horizon in the lower third of the photo (thus increasing the dominance of the sky) reduced the ratings of the scene but having the landscape fill at least half the scene increased the rating.

6. Aim for good lateral and foreground context to scenes, of a single landscape unit, and of typical representative scenes, not unusual (i.e. rare) scenes. However significant features such as waterfalls, cliffs and water bodies should be included.
7. Minimise extraneous features such as people[1], sheep or cattle, wildlife, fences, roads, vehicles, electricity poles and wires, and excavations or other eyesores, each of which can influence preferences either positively or negatively. Where necessary, remove such objects from photographs digitally.
8. Aim for sunny cloud-free conditions to standardise scenes against a blue sky. Where cloud exists, aim to have the scene sunlit. Heavy cloud dampens the colour saturation while spectacular cloud formations enhance the scene. The rating of a sunlight scene with extensive cloud cover averaged 1.2 lower (1 – 10 scale) than cloudless scenes (Lothian, 2000).
9. Avoid transitory effects of special atmospheric lighting such as sunsets the strong side lighting of morning and evening.
10. Photograph at eye level. Photographs can include vistas from hills and mountain tops of valleys and vistas below but these should include foreground to provide context as otherwise the scene can appear as though it was taken from an aircraft.

In summary, photographs or advanced computer graphics be used to represent the landscape, standardized (colour, 50 mm, landscape format, cloud free conditions, avoid extraneous and transitory features, avoid composition, photograph from ground level) so as to minimize variations in the photographs other than in the landscapes they represent. Use digital manipulation sparingly to remove unnecessary features, not to enhance the scene.

Overall the ratings should reflect the quality of the scene, not the quality of the photograph. Scott & Canter (1997) showed the importance of asking participants to rate the scene, not the photograph. Standardizing photographs as far as possible through the application of these criteria will assist in ensuring this is achieved.

Meitner (2004) compared ratings of individual photographs of the Grand Canyon with 360° panoramas separated into four separate images (orthogonal) which could be scrolled through by the participant before rating them as a set. An additional method was portraying the 360° panorama on the inside of a cylinder which was rotated at a fixed rate and then rated as the entire scene (non-interactive). The cylinder could also be rotated by the participant (interactive). Correlations between the different presentation methods were lowest were for the individual photographs but higher for the other methods (Table 13). The results indicate that using such methods may provide advantages in presenting landscapes, but at the cost of considerable complexity of methods.

1. In a study of urban familiar places, Herzog *et al*, 1976 included a scene with an "inadvertent speck" which turned out on closer examination to be a young woman in a miniskirt. They wrote: "A typical reaction from male subjects was "Wow! Look at that chick in the miniskirt!" The scene loaded 0.51 on the Entertainment dimension and 0.37 on the Commercial dimension. Clearly, the decision to exclude people from the scenes was a wise one."!

Table 13 Correlations between viewing methods

	Individual slides	Orthogonal	Non-interactive	Interactive
Individual slides	1.00			
Orthogonal	0.59	1.00		
Non-interactive	0.61	0.80	1.00	
Interactive	0.53	0.78	0.81	1.00

Source: Meitner, 2004

In some instances it may be necessary to draw from existing collections of photographs. Caution is needed in particular to avoid selecting photographs which are well composed, have appealing lighting or clouds, or have people or other extraneous features. My experience is that about 95% of such collections are rejected as not meeting the criteria.

With Photoshop® and similar programs, photographs can be digitally altered, for example to remove extraneous objects. While this can be used to remove electricity poles and the like, such manipulation risks the photograph ceasing to accurately represent the landscape and should therefore be used minimally to edit out unnecessary objects and not to change colours or remove intrinsic features of the landscape.

Barroso *et al* (2012) added features to photographs to assess their influence on preferences by various groups of participants. This ensured that the "variations shown to respondents are adequately controlled in the study and landscape features are easily recognized by the respondents." Several of my own studies covering the visual impact of wind farms, coastal developments and riverside developments have similarly manipulated the photographs digitally to insert or delete features (Lothian, 2005, 2008, 2009). Prior to digital photography, studies photographed a feature in one landscape and then selected a similar landscape without the feature (e.g. Hull & McCarthy, 1988) but the results were never perfect whereas with digital technology, the same scene can be used.

Computer graphics and Geographical Information Systems

Bishop (2000, 2003) believes that advanced computer graphics is replacing photographs as a means of visual presentation and if this occurs the foregoing criteria remains relevant. Bishop (2011) examined the application of computer game technology – "virtual reality games and their use as collaborative virtual environments" (see also Orland, 2001 regarding the use of Virtual Reality technology). Bishop has written much on the use of computer technology in landscape research (Bishop & Karadaglis, 1996, 1997; Bishop & Stock, 2002, 2006, Ghadirian & Bishop, 2008). Kellomäki & Pukkala (1989) used computer graphics comprising tree symbols whose species and size distributions corresponded to those of a forest. Bergen *et al* (1995) reported reasonable correlation between the mean ratings of photographs and images but low correlations at the individual level. Daniel & Meitner (2001) compared ratings of four images: full colour, grayscale, 4 bit colour, and black & white sketch. They found the ratings of the grayscale correlated reasonably well with the full colour, 0.69, however the 4 bit colour less so, 0.43, and the B/W sketch very poorly, 0.04.

This is an emerging field and with the advances in computer and imaging technologies, the results are far better than in the early years. Further information can be gained from the following more recent publications: de Vries *et al*, 2007, Lange, 2001. Lange (2011) provided a review of the development of the Journal, *Landscape & Urban Planning's* articles on landscape visualization over the period, 1974 – 2010. Lange & Schmidt (2000) used digital 3-d virtual landscape images of proposed dams and urban development options in ecological planning. Paar (2006) found from a survey in 2000 of over 1000 consultancies and authorities in Germany that while 28% of consultants used 3D visualisation software, those who did not cited inadequate computers, lack of technical expertise and cost as their reasons. “Ease of learning” and “interoperability” were regarded as key issues.

Yu *et al* (2005) has applied sophisticated Geographical Information Systems and three-dimensional landscape modelling which enables the manipulation of large amounts of physical data. Smith *et al* (2009) has similarly employed GIS with scenario software to examine multiple options for forest management in Tasmania, and Brown & Brabyn (2012) used GIS in New Zealand to examine the relationship between multiple landscape values and the character of the physical landscape. Pukkala, T. & S. Kellomäki (1988) used computer simulation of forest logging as an aid in management. Legge-Smith *et al* (2012) used a web based interface, Scenario Chooser, to present a range of hypothetical future forested landscapes to the public with the aim of eliciting the most/least preferred forest management scenarios.

Further studies are found in: Bergen *et al*, 1995, Orland *et al*, 2001, Germino, *et al*, 2001 and Lim *et al*, 2006.

Influence of Labels on Preferences

Several studies have examined the influence that labelled photographs have on preferences and found that they can unduly influence preferences. Anderson (1981) found that labelling scenes as wilderness or a national park raised ratings while economic uses (forest, grazing) lowered them. Hodgson & Thayer (1980) labelled identical scenes with differing labels: lake - reservoir, forest growth - tree farm, pond - irrigation and stream bank - road cut. They also found that the labels implying human influence lowered ratings to 78% of the natural labels, a sizeable difference.

One group of students were told about harvesting practices of a forest including the term *clearcut,* while another group was not informed about this (Vodak *et al*, 1985). The ratings of both groups were however very similar. In contrast, a similar study (Simpson, *et al*, 1976) where one group was informed about the forestry management practices and a second group was not produced marked differences in responses for the clearcut, thinned and natural scenes. In another study Yeiser & Shilling (1978) used a conservation group and forestry students as subjects plus a control group of non-forestry students and showed them scenes of forest management practices with selected stimulus terms displayed – cull tree, site preparation and charred slash piles. Using galvanic skin response to measure the intensity of emotion among viewers (as used in lie detector tests) surprisingly they found the control group displayed greater concern than the conservation group. It could be that the conservation group had greater knowledge of forestry practices which lessened their reaction.

Overall, these studies indicate that, for whatever reason, appellations given to scenes *do* affect the responses significantly. They indicate the importance of not colouring responses by suggesting or including anything that will constrain or direct the respondent towards a particular response.

Viewing Time

In a significant paper, *Feeling and thinking: preferences need no inferences*, Robert B. Zanonc (1980) argued against the prevailing doctrine in cognitive psychology that affect is post-cognitive. He provided experimental evidence that discriminations (i.e. like-dislike) can be made in the complete absence of recognition memory. Ulrich also cited evidence in support of affect being precognitive (Ulrich, 1986, Ulrich *et al*, 1991). Ulrich *et al*, (1991) proposed that:

> immediate, unconsciously triggered and initiated emotional responses - not 'controlled' cognitive responses - play a central role in the initial level of responding to nature, and have major influences on attention, subsequent conscious processing, physiological responding and behaviour.

He also suggested that an:

> evolutionary perspective implies that adaptive response to unthreatening natural settings should include quick-onset positive affects and sustained intake and perceptual sensitivity.

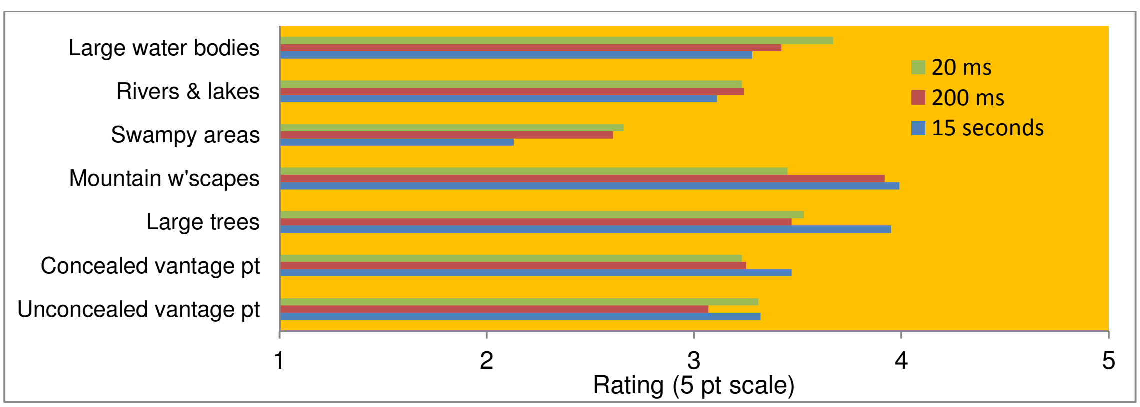
These views are antithetical to the information processing approach which holds that, although preferences are generated extremely rapidly, they are nevertheless the result of cognitive processing. Lazarus (1982) suggested that Zajonc made the mistake of equating cognition with reality. Lazarus argued that this process occurs outside of conscious awareness and is virtually automatic. He:

> regards emotion as a result of an anticipated, experienced, or imagined outcome of an adaptionally relevant transaction between organism and environment (and therefore) cognitive processes are always crucial in the elicitation of an emotion.

Lazarus considers that this approach "in no way threatens the basic premises of the evolutionary-adaptional perspective"

Twenty years later Zajonc (2000) revisited the subject and stated: "behavioral, neuroanatomical, and neurophysiological evidence has been found—evidence that is clear and robust— that substantiates many of the suppositions that derive from the original conjecture that 'preferences need no inferences.' "

Herzog has examined this issue in several studies. Herzog (1984, 1985) included scenes which respondents viewed for 20 milliseconds (i.e. 1/50 sec) or 200 milliseconds (i.e. 1/5 second) and compared the responses with 15 seconds. Although there were differences in their ratings, the differences were slight (Figure 14). Nor is the difference in one direction - some are lower and some are higher. The findings are probably insufficient to prove Zanonc correct but it is difficult to comprehend complex cognitive processes being undertaken in as short a space as 20 ms.



Source: Herzog, 1984 and 1985

Figure 14 Effect of Viewing Times on Preferences

Wade (1982) examined whether landscape preferences were affected by respondents being given as much time as they desired to view scenes. He found no relationship between preferences and viewing time.

In a study which Korpela *et al* (2002) believed provided support for the “rapid and automatic affective evaluations of environmental scenes”, they timed the interval between a stimulus of urban or nature pictures and a presentation of a vocal expression of joy, anger or emotional neutrality. The reaction times were all less than 0.7 second.

To better ensure that participants rely on their affective faculties the viewing time should be short as longer times encourage analysis of the scene and thereby use of the cognitive faculty. In the past when slides were shown, fixed viewing times were used, generally between 5 and 10 seconds. Now that Internet based surveys are used, the participant can spend as little or long as they wish although the instructions are to rate the scenes quickly based on their first impressions and not to analyse or think too much about them. This is intended to replicate the manner in which they view scenery, rapidly coming to like it or not. Table 10 showed the average time taken was between 5 and 8 seconds which is the time the participants have chosen to spend on each scene.

INFLUENCE OF THE OBSERVER ON PREFERENCES

There are two components to surveys of landscape quality – the landscape and the observer. How does the observer’s background influence their landscape preferences? Familiarity normally breeds contempt, according to the common saying. Does this apply to landscapes? Should experts be used to rate landscapes? What about the influence of an observer’s culture on their preferences? These are some of the issues that this section examines. It covers the following:

- Use of students in surveys
- Demographic data collected by surveys
- Influence of respondent characteristics
- Influence of cultural background of participants
- Do expert participants give different ratings than lay participants?
- Influence of familiarity on ratings
- Children’s perceptions of landscapes
- Influence of personality
- Perceptions by different groups
- Reliability of ratings over time

Use of students in surveys

Because many of the surveys were academic studies in universities, generally tertiary students were used. Of 314 participants in a range of surveys, 143 were university students or staff, 46.6% of the total (Lothian, 2000). Only 37% were from the general community, park visitors or residents. In a study of river environments in Slovenia and Croatia, Stober *et al* (2012) found no significance difference between students and experts in their assessment of the river landscapes. From a meta-analysis of 107 studies, Stamps (1999) found a high correlation of 0.83 between students and other respondents and 0.86 where the students served as representatives. However Tveit (2009) found distinct differences in the rating of visual scale between students and the public.

With concern about “nature deficit disorder” influencing children and students (Louv, 2005), their lack of familiarity with natural landscapes and even fear towards the outdoors could influence their preferences (Aaron & Witt, 2011).

Demographic data collected by surveys

Of 227 surveys examined in a survey, 63% sought no demographic data on their participants, a surprisingly high proportion (Lothian, 2000). Age, gender, education, employment and socio-economic status were the most frequently sought. My surveys generally ask age, gender, education and whether born in Australia as these are attributes for which national statistical data is available. My survey of the Lake District (2013) included birthplace (instead of whether born in Australia), postcode (to identify which part of the UK they resided), their familiarity with the region, and whether they lived in or near the Lake district.

Influence of respondent characteristics

Table 14 summarises 17 studies that examined the influence of respondent characteristics – age, gender, education, socio-economic factors - on their preferences. Most of these surveys used the information to check that their sample was representative of the population - they were not generally used to assess the results of the survey.

Table 14 Influence of demographic characteristics (chronological order0

Reference	Characteristics	Findings	Quantitative
Chapman, 1974	Community, professionals	Education corr with concerns but no signif differences due to age, gender, occupation or resident origin.	χ_2 & Spearman's - figures not given Note: χ_2 = Chi square
Banerjee, 1977	Community -age, gender, income	Age produced sig. diffs in perception, greater than gender or income. Viewers <25 years most critical of artificial changes and more appreciative of natural elements of landscape.	Not given
Bernaldez & Parra, 1979	Gender, occupation	Preference of male students was for natural landscapes, by females for humanised landscapes	Not given by p<0.01
Brush, 1979	Landowners, students - age, educ	Prefs not affected by age, education and whether landowner or forest student.	ANOVA, p<0.5; rankings of sites similar.
Penning-Rowsell, 1982	Age, gender, socio-economic	Preferences weakly related to age but unrelated to gender	Age χ_2 signif at 0.1. Gender X2 =3.87, p not signif at 0.05
Woodcock, 1982	Gender	Prospect & mystery ranked equal. . Females more sensitive to lack of cover/ diffs in mystery in savannah.	Summary only available - no figures given.
Cherem & Driver, 1983	Age, gender, education, socio-eco	Study 1. no meaningful differences, age slight difference. Study 2. no meaningful diffs.	χ_2 tests, figures not given.
Lyons, 1983	Age	Preferences influenced by age, gender & residence. Preferences for savannah & desert declined sharply from young children to adulthood. Preferences highest for familiar biomes.	Significance tests but figures not given.
Zube, Pitt & Evans, 1983	Age	Preferences of older adults (> 65 years) differ from other adults, Young children's preference for water higher than other age groups	Pearson correlations
Dearden, 1984	Age, sex, income, education, occupation.	Variables had no significant influence on preferences.	Correlations with rural residence: age .064, sex -.008, income .106, education .031, occupation -.048
Tips & Savasdisara 1986d	Asian sample, age, gender, income, religion	Preferences similar regardless of age, gender, income, religion.	Age 0.88 – 0.96 Male : female 0.984 Socio-eco 0.81 – 0.94 Religion (Buddhist, Christian, Hindu, Islam)
Tips &	Asian sample,	Preferences close across all groups; urbanity	

Savasdisara 1986a	rural/fringe/urban backgrounds	had minor influence on preferences.	
Pomeroy *et al*, 1989	Age, gender, education, occupation.	Residents have similar preferences regardless of age, gender, income levels	Not given - statement may be general observation
Lamb & Purcell, 1990	Age, gender, education, origins	None of the factors explained the naturalness scores	Figures not given
Hull & Stewart 1995	Age, gender, education, socio-economic	Males more likely to view ground, topo. & ephemeral objects. Other factors no significant relationship	χ_2 - figures not given
Strumse, 1996	Age, gender, educ., childhood location, current residence	Females more positive re nature than males. High prefs for traditional farming & nature scenes.	Traditional farming scenes (5 pt scale), females 3.67, males 3.56, age >25 3.82, < 25 3.46, tertiary educ 3.84, non-tertiary educ 3.44.
Stamps, 1999	Meta-analysis of demographics	All demographic groups highly correlated. Gender highly correlated	All demographics corr. 0.82 Gender corr 0.84
Brush *et al,* 2000	Age, gender, occupation, childhood experience	Little influence on ratings. Only participant knowledge of land management affected ratings.	
Regan & Horn, 2005	Age, gender, occupation, residence	Gender no influence. Age possibly influenced pref for green nature.	Green nature mentioned 48.2% adults, 28.1% by children (6-17 years).
Kearney & Bradley, 2011	Age, gender, education, current residence, residence as child	Factors had no influence on forest preferences.	Figures not given

In their study of the influence of socio-economic influences on landscape preferences, Tips & Savasdisara found high correlations among the groups for age, gender and socio-economic status (see Table 14) and also high correlations among most religions (Table 15), with none of the differences being statistically significant.

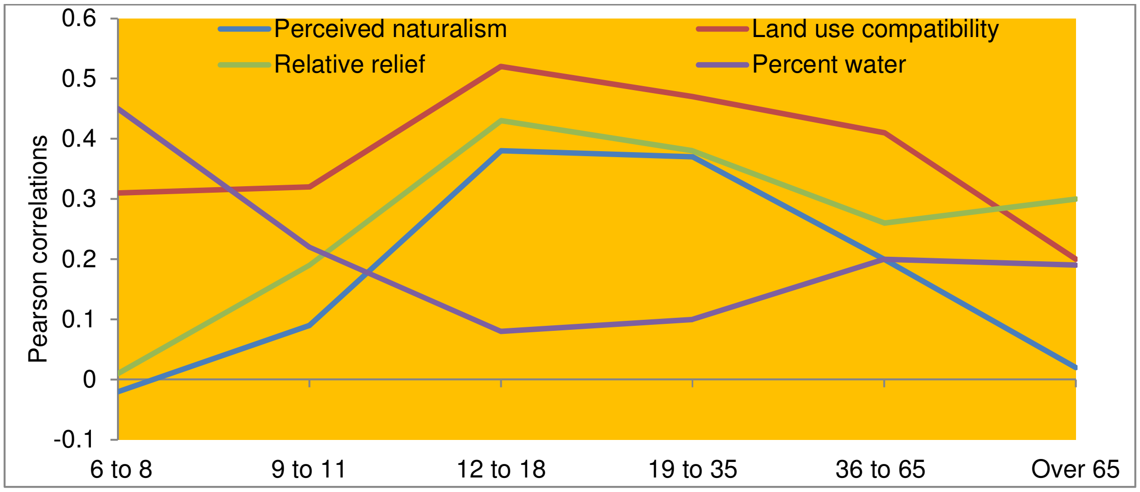
Table 15 Spearman rank correlations by religion (Thailand)

	Christian	Buddhist	Islamic
Buddhist	0.94		
Islamic	0.78	0.86	
Hindu	0.96	0.94	0.75

Source: Tips & Savasdisara, 1986. The influence of the socio-economic background of subjects on their landscape preference evaluation. *Landscape & Urban Plg*, 13, 225-230.

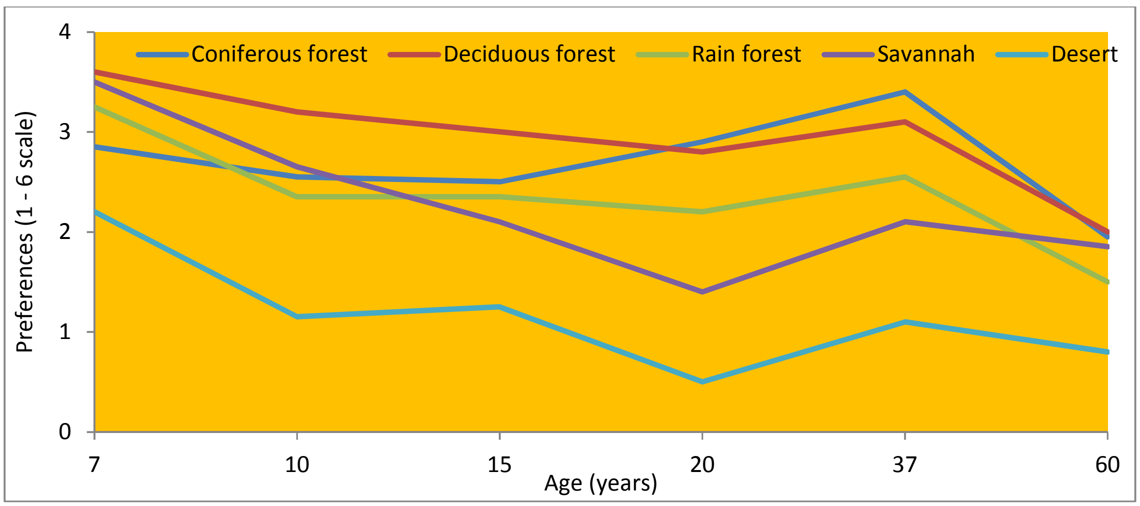
Of the demographic factors, only age, and to a lesser extent, gender, exhibited an influence on preferences. Eleven studies showed no difference for age and five studies showed a slight or weak influence. Banerjee (1977) showed significant influence of age - respondents aged over 25 were more critical of artificial changes to the coastal landscape and more appreciative of natural elements.

In their lifespan analysis of landscape assessment, Zube *et al* (1983) found that the preferences of young children (6 - 11 years) differed from adults (Figure 15) being very strongly correlated with the presence of water compared with other age groups. Preferences for other age groups rose with age to middle age and then declined in older age.



Source: Zube, Pitt & Evans, 1983

Figure 15 Correlations of age groups with scenic ratings of landscape dimensions



Source: Lyons, 1983

Figure 16 Preferences of biomes by age group

Lyons (1983) asked children and adults to rate five vegetation biomes on the basis of a place or live or visit (Figure 16). For most biomes, the ratings of the youngest children (grade 3) were higher than in subsequent ages, the exception being for coniferous forest the preference for which rose in middle age. Preferences for the biomes changed over the life span, being lowest in the elderly. Males and females showed similar preferences.

Stamps (1999) analysed 107 studies involving 19,000 respondents and over 3,000 environments. He found a correlation of 0.82 between different demographic groups. The correlation for different ethnic groups was 0.87, political affiliation 0.86, gender 0.84, and age (<=12 vs. age > 12) 0.61.

Gender played no influence in twelve studies but did have an influence in four studies:

- A preference of males for natural landscapes and by females for humanised landscapes (Bernaldez & Parra, 1979)
- Females were more sensitive to lack of cover in savannah (Woodcock, 1982)
- Males more likely to view ground, topography & ephemeral objects (Hull & Stewart, 1995)

- Females were more positive regarding nature than males (Strumse, 1996)

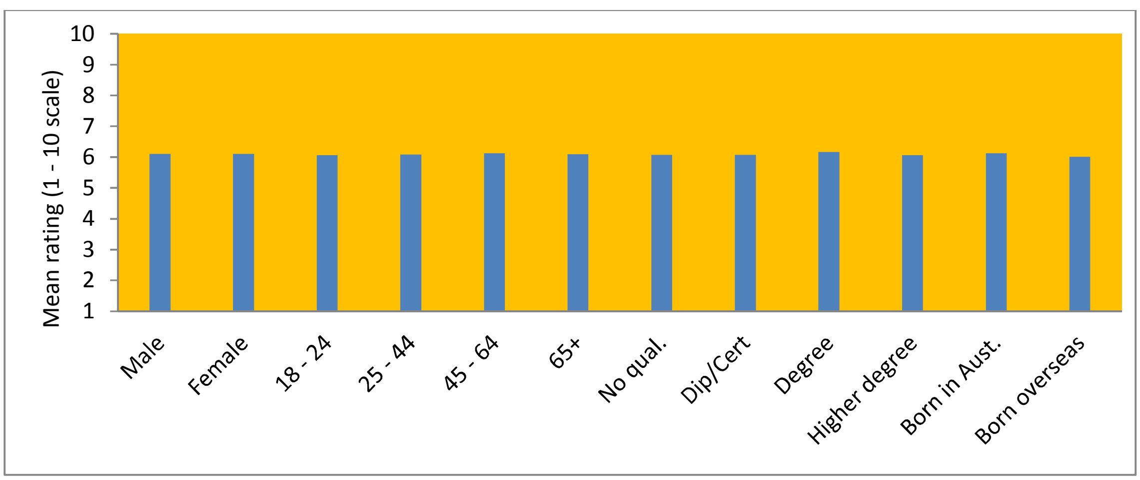
The apparent contradiction between the first and last studies regarding females and natural landscapes may be explained by the first study indicating that females preferred humanized landscapes over natural landscapes if given the choice, but this does not mean that the females disliked the natural landscape.

Preferences were unaffected by education, socio-economic status, religion, occupation, childhood residence or current residence.

To reinforce this, Table 16 and Figures 17a and 17b summarises the means for a range of respondent characteristics in six studies that I have undertaken.

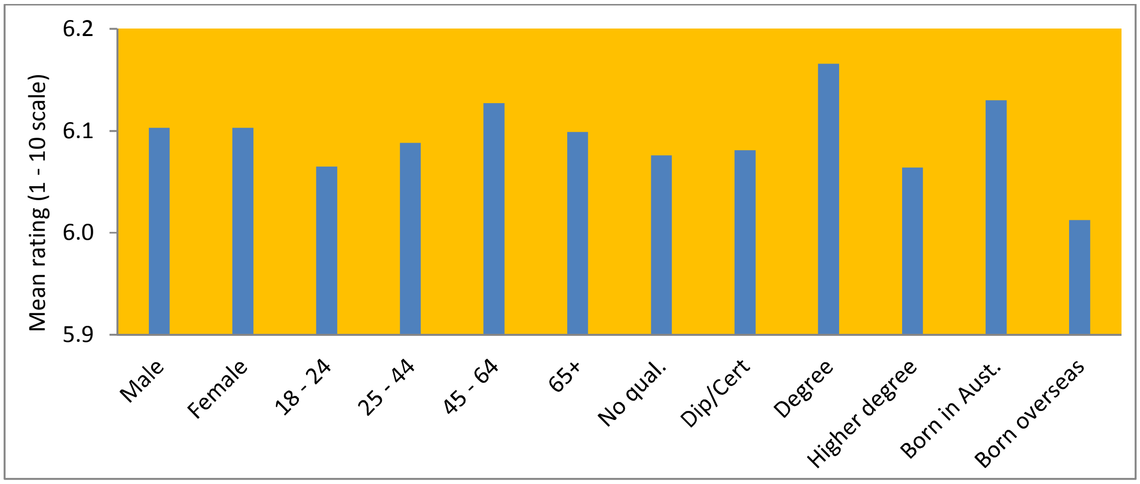
Table 16 Respondent characteristics from Scenic Solutions landscape surveys

	South Aust. coast	Barossa Valley	River Murray	Flinders Ranges	Lake District (UK)	Mean
Male	6.45	5.57	6.02	6.35	6.13	6.10
Female	6.56	5.55	6.05	6.26	6.10	6.10
18 - 24	6.36	5.57	6.03	6.07	6.3	6.07
25 - 44	6.56	5.50	6.07	6.19	6.12	6.09
45 - 64	6.49	5.60	6.01	6.37	6.17	6.13
65+	6.53	5.60	6.07	6.31	5.99	6.10
No qual.	6.49	5.46	6.04	6.16	6.23	6.08
Dip/Cert	6.44	5.53	6.02	6.26	6.155	6.08
Degree	6.54	5.68	6.09	6.36	6.16	6.17
Higher degree	6.56	5.49	5.97	6.32	5.98	6.06
Born in Australia	6.50	5.61	6.07	6.34		6.13
Born overseas	6.52	5.36	6.08	6.09		6.01



Source: Lothian, 2005 a & b, 2006, 2009, 2013

Figure 17a Respondent characteristics from Scenic Solutions landscape surveys



Source: Lothian, 2005 a & b, 2006, 2009, 2013. Scale exaggerated.

Figure 17b Respondent characteristics from Scenic Solutions landscape surveys

Overall, providing children are not used as subjects, the basic respondent characteristics of age, gender, education, employment and socio-economic status appear to have a nil or negligible influence on preferences. This again supports the evolutionary view that landscape preferences are innate and therefore fairly uniform across all humans.

Influence of cultural background of participants

Cultural differences are often regarded as ensuring that there will be wide disagreement across races, nations and cultures in respect of landscape aesthetics. In fact the opposite is true, the similarities are far greater than the differences. In the 19 studies summarised on Table 17, all but a couple indicate close similarities in the preferences between different cultures. Three of the studies indicate differences; in several studies these differences were with sub groups of the study.

Table 17 Studies of cultural influence

Reference	Participants	Findings	Quantification
Sonnenfeld, 1967	Eskimos & Americans	Preferences for landscapes most <u>similar</u> to participant's home-type landscape	not given
Sonnenfeld, 1969	Eskimos & Americans	Both differences and similarities in responses	not given
Shafer & Tooby, 1973	Scottish & Americans	Preferences <u>closely</u> correlated between two cultures	Correlation 0.91 between Scots & Americans
Zube & Mills, 1976	Australians Americans	<u>Close</u> agreement between cultures in responses	Correlation 0.87 between Aust's & Americans
Zube & Pitt, 1981	Virgin Islands Americans Yugoslavians	<u>Close</u> agreement between American and Yugoslavian cultures but <u>low</u> agreement with Virgin Islanders	Americans/Yugoslavians: 0.96 Virgin Is/American: 0.57, Virgin Is/Yugoslavians: 0.64
Buhyoff, *et al*, 1983	US, Dutch, Swedes, Danish	Moderate agreement between cultures. Not as strong as within US. US/Swedes & Dutch/ Danish <u>close</u>, possibly reflecting familiarity with test landscapes	Corr bet US/Swedes 0.89, Danish/Dutch 0.84
Tips & Savasdisara, 1986a	Asians & Western tourists	Asian preferences <u>close</u> agreement to Western. Consistency across different Asian cultures.	Corr with Western tourists Nepal 0.8, Taiwan 0.92, Sri Lanka 0.94, Thai 0.955, Indonesia 0.9, Bangladesh 0.74
Kaplan, R & Herbert, 1987	Australian & American	Australians ranked scenes higher than Americans. <u>Close</u> agreement	Mean prefs: Aust 3.28, American 3.11 (5 pt scale)
Hull & Revell, 1989	Balinese Western	5 out of 15 consensus photos taken by 10% of each - indicating cross-cultural	Pearson's 0.64, Spearman's 0.56 between Balinese & Western

	tourists	close similarities Moderate correlation in scenic beauty	tourists scenic beauty
Yang & Kaplan, 1990.	Koreans, Western tourists	Fairly close preferences for four different landscapes.	Japan water Kor 3.5, West 3.94 Informal Kor 3.3, West 3.25 Western formal Kor 2.75 West 3.13 Korea rock Kor 2.46, West 3.12
Yang & Brown, 1992	Korean, Western tourists	Preference for Japanese style over Korean and Western. Westerners had highest prefs. Similarities greater than differences between Koreans & West.	Scores (5 pt) Korean l/s style: Kor 2.63, West 3.23 Japan l/s style: Kor 3.08, West 3.67 West l/s style: Kor 2.89, West 3.14
Purcell *et al*, 1994	Italians & Australians	Extensive close similarities between cultures with differences in prefs of places in which to live and work. Quantification: I = Italians, A = Australians	Scores (7 pt): lakes I 5.8, A 5.7; hills I 4.5, A 3.6; forests I 5.3, A 5.5, l/s I 4.4, A 3.8; country I 3.8, A 3.4; canal I 3.5, A 3.4, city edge I 2.1, A 2.8
Yu, 1995	Chinese & US	Chinese landscape archs & horts, Uni and school students, workers & farmers, Harvard design graduates Rated scenes in Chinese national park Close similarities for older students, differences for junior students	Similar corrs between: experts & uni & school students 0.83 – 0.91; experts & middle school students 0.65 – 0.78, experts & junior school students 0.48 – 0.58.
Newell, 1997	US, Ireland, Senegal	More similarity in place preferences than differences. However the differences appear substantial for coast, waters, woods & forests, and pastoral landscapes.	% of respondents: Americans, Irish, Senegal: Coast: US 4.4%, Ire'l 21.1%, Sen'l 15.7%. Waters: US 8.8%, Ire'd 2.5%, Sen'l 2%. Woods & forests: US 17.6%, Ire'd 7.8%, Sen'l 3.9%. Pastoral: US 0%, Ire'l 14.4%, Sen'l 5.9%.
Buijs *et al*, 2009	Dutch & Islamic immigrants	Dutch support wilderness image, immigrants the functional image. Immigrants have lower preferences for non-urban landscapes, esp marshes & dunes. Differences	51% Dutch but only 25% immigrants support wilderness image. Natural l/s Dutch 7.5, Immig. 6.3, Managed l/s Dutch 6.6, Immig.6.5.
Herzog et al, 2000	Australian & American	Preference for Australian landscapes. Very high level of agreement.	Corr 0.91 Preferences: Vegetation: Aust 3.18, US 2.78 Rivers: Aust 4.00, US 3.8 Overall: Aust 3.01, US 2.76
Beza, 2010	Australian tourists & Sherpas	Australians tended to rate beautiful landscapes slightly higher than Sherpas, & ugly landscapes worse.	Corr 0.91. 80% photos within +/- 1.0 rating difference.
Diaz *et al*, 2010	Canary Island & tourists	Close parallels in appreciation of island landscape.	
Lothian, 2013	British and Australians	Ratings by (mainly) Australians & British very similar	Mean ratings British 6.11, Aust 6.15 Corr 0.93

Similarities were found between:

- Balinese and Western tourists
- Koreans and Western tourists
- Asian and Western tourists
- Italians and Australians
- Sherpas and Australians
- Americans, Virgin Islanders and Yugoslavians
- Americans, Dutch, Swedes and Danes
- Americans and Australians
- Americans and Chinese
- Americans and Scottish
- Canary Islanders and tourists
- British and Australians

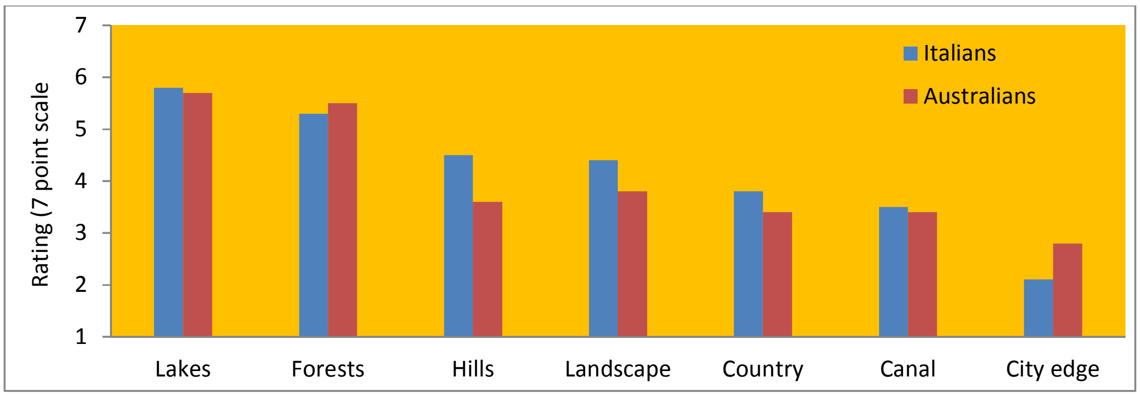
Differences were found between:

- Chinese and American: differences for junior students but similar for older age groups;
- Americans, Irish and Senegalese: differences for coast, waters, woods & forests, and pastoral landscapes;

- Dutch and Islamic immigrants: differences regarding wilderness images and non -urban landscapes, especially marshes & dunes.

Hull and Revell (1989) examined two distinctly different cultures, Balinese and Western tourists, yet they concluded that despite the “enormous differences which exist between the Balinese and western culture”, the results suggested “that there was perhaps more similarity than difference between the two groups in their scenic evaluations” of the Balinese landscape.

Based on the study by Purcell *et al* (1994), Figure 18 compares the responses by Italian and Australian students to photographs of landscapes from both countries. Preferences for natural vistas were generally higher amongst the Italian participants than amongst the Australian participants but the differences were only slight.



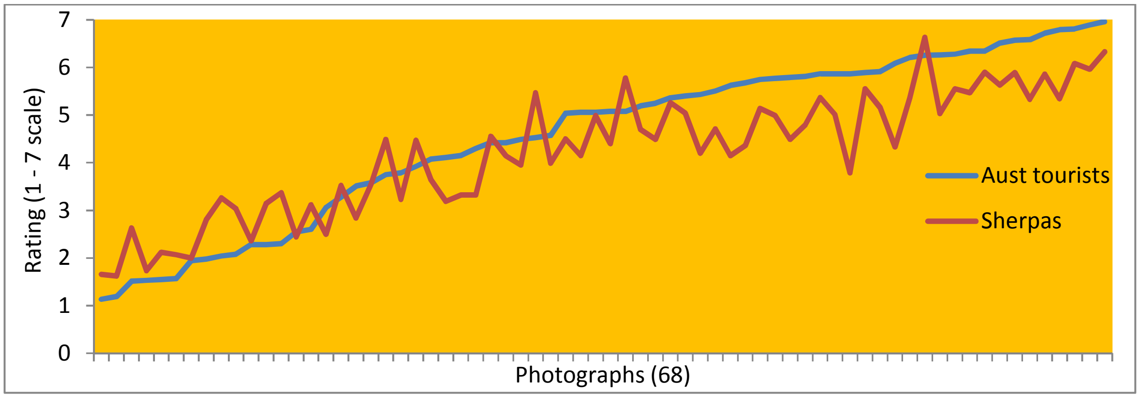
Source: Purcell *et al*, 1994.

Figure 18 Comparison of Italian and Australian Landscape Preferences

Stamps (1999) carried out a meta-analysis of 107 studies involving over 19,000 respondents and over 3000 scenes. He found an overall correlation of 0.85 for cross-cultural studies involving respondents from different cultural backgrounds. The correlation for ethnic affiliation was even higher, 0.87.

In the Netherlands, Buijs *et al* (2009) investigated the concepts of nature held by native Dutch and contrasted these with Islamic immigrants. While the Dutch related strongly to the wilderness image of nature (i.e. ecocentric values and the independence of nature), the immigrants related to the functional image (i.e. anthropocentric values and intensive management). The immigrants had lower preferences for non-urban landscapes, especially wild and unmanaged landscapes such as marshes and dunes. Age, gender and education had little influence.

Beza (2010) asked Australian tourists and Sherpas on the Mt Everest trek in Nepal to rate photographs of the landscapes and of rubbish and garbage along the route. While there was a close correlation in their ratings of the 68 scenes ($r^2 = 0.91$), the Australians tended to rate the high quality landscapes about 0.9 higher and the poorer quality landscapes about 0.6 lower (Figure 19). Overall, 80% of the ratings by Australians and Sherpas were within 1.0 of each other’s ratings.



Source: Beza, 2010. Note: Graph shows the ratings for the same photograph by the two groups

Figure 19 Rating of Nepal landscapes by Australian tourists and Sherpas

Based on the premise that "culture and landscape interact in a feedback loop in which culture structures landscapes and landscapes inculcate culture", Nassauer (1995) defined four principles regarding culture and landscape:

- Human landscape perception, cognition, and values directly affect the landscape and are affected by the landscape.
- Cultural conventions powerfully influence landscape pattern in both inhabited and apparently natural landscapes.
- Cultural concepts of nature are different from scientific concepts of ecological function.
- The appearance of landscapes communicates cultural values.

Overall, these studies indicate that the influence of culture is not as great as might be expected. Acculturation with Western values may be a partial explanation, but is not adequate. It lends support to the evolutionary view that landscape aesthetics are innate and therefore fairly uniform across all peoples. The differences that occur reflect strong local cultural influences.

Do expert participants give different ratings than lay participants?

A key issue is whether participants should have some form of expertise in landscape (e.g. botanist, geologist, geographer, planner) or whether they should be lay people drawn from the community who are not selected for their expertise. In an early seminal study, Fines (1968) initially used respondents with no design training, but then rejected their ratings in preference to a smaller group with considerable training and experience. His justification of this was twofold: firstly, "such people (i.e. those with training) are most likely to seek and to obtain the greatest enjoyment from landscape" and secondly, the majority may someday aspire to similar values - a justification which appears quaint and elitist by contemporary standards.

Similarly, Carlson (1977) argued that the general public's judgements of landscape should not provide the basis for their rating and the judgements of more environmentally sensitive people should be used. This would prevent the landscape's aesthetic qualities being rendered to the lowest common denominator.

The assumption underlying the approach of both Fines and Carlson was that the landscape ratings of the majority would differ from that of the trained minority. Does the evidence support this assumption?

Table 18 lists 19 studies that have examined the differences in preferences between "experts" and lay people. There were ten studies which yielded similar preferences between expert and lay, and ten that yielded different preferences (several studies included sub-studies). That there are equal numbers of studies that find similarities and differences between expert and lay observers suggests that care should be taken in assuming that experts will provide similar ratings of landscape as the community.

Table18 Studies of preferences by experts and lay (chronological order)

Author	Groups	Findings
Craik, 1972	Landscape architects, foresters, university panels	Similar correlation between expert and non-experts Corr: L/s archs/uni 0.66, for'rs/uni 0.67, l/s archs/ for'rs/ uni 0.72
Zube, 1973	Env. Professionals, wives, teachers, secretaries	Similar correlation across groups 0.74
Beckett, 1974	Biology staff, students & friends	Ratings appear to be influenced by agricultural knowledge – increased with knowledge, decreased without.
Anderson, E, 1978	Students, professionals, residents	Significant differences between groups. Correlations: prof/residents 0.65, prof/students 0.61, student/prof 0.94
Buhyoff, *et al*, 1978	L/s architects - with & w/o experience, client group	Similar L/s archs able to approximate their client's prefs. Their own prefs quite different.
Anderson & Schroeder, 1983	Psychology & landscape arch students, community.	Different L/s archs lowest inter-group correlation with other groups. L/s archs inter-group corr 0.70 - 0.74 cf 0.86 - 0.90 for other groups.
Kellomaki & Savolainen, 1984	Foresters & city dwellers	Similar means: forest students: 55.1-56.1, city dwls: 54-55.9. Corr: forester 0.789, city 0.789
Miller, 1984	Uni staff & landscape arch students	Prefs of landscape architects differed significantly from other professional groups
Brown, S. 1985	Community, landscape architects, planners	Different L's archs results failed to correlate (<40%) with community. Planners did better.
Vodak, *et al*, 1985	Landowners & students	Similar Student corr with landowner 0.93
Mosely, 1989	Staff & students, natural resource managers, river users	Similar preferences of various groups.
Jensen, 1993	Landscape managers & students & politicians.	Experts differed in 1/3 of issues. Experts believed public want more natural/unmanaged forests whereas public wanted more facilities.
Sullivan, 1994	Planners, farmers, residents	Similar prefs for images of rural-urban fringe. Slight difference with apartments. Farmers 2.5, residents 2.8, planners 3.1.
Yu, 1995	Chinese landscape archs & horts, Uni and school students, workers & farmers, Harvard design graduates	Similar corrs between: Experts/uni & upper school students 0.83 –0.91; Experts/middle school students 0.65 – 0.78, Experts/junior school students 0.48 – 0.58.
Stamps, 1999	Meta-analysis of studies	Experts vs others corr 0.60; fairly low
Morgan, 1999	Coastal managers, students, public	Mean scores: managers 10.55, students 10.71, public 8.82. Public differed from experts.
Herzog et al, 2000	Australian Aboriginals, landscape students, school students, community, Env Dept staff	Similar Aboriginal students 3.25, l's arch students 3.03, school students 2.72 Difference between DENR staff & other adults re willows (regarded as a weed).
Acar & Sakici, 2008	Educated and less-educated Turks	Educated slightly higher prefs for urban rocky habitats than less-educated. $\chi^2 = 53.6$
Tveit, 2009	Students (future ls archs) & public.	Student responses differed from public.
Stober et al, 2012	Students and river experts	Similar re area/river management. Different re change to river landscapes and trust in authorities. No significant difference in aesthetic values.

Paradoxically the one professional group whose preferences appear to differ from that of the community is landscape architects. More surveys found that their preferences differed (Anderson & Schroeder, 1983; Brown, 1985; Buhyoff *et al*, 1978; Miller, 1984, Tveit, 2009) than studies that found similarities (Craik, 1972, Schomaker, 1978 and Yu, 1995). From his meta-analysis of 107 studies, Stamps (1999) found a correlation of only 0.60 between expert and lay. While the preferences of natural resource managers and planners generally corresponded reasonably well with those of the community, the views of landscape architects were often at significant variance with the community. Yeiser & Shilling (1978) found with students that just the connotation of the terms used affected those with no professional knowledge of the terminology.

Influence of familiarity on ratings

The common adage that familiarity breeds contempt does not seem to apply to landscapes. A number of studies, including my own, have found that the more familiar a person is with a landscape, the higher their preferences for it.

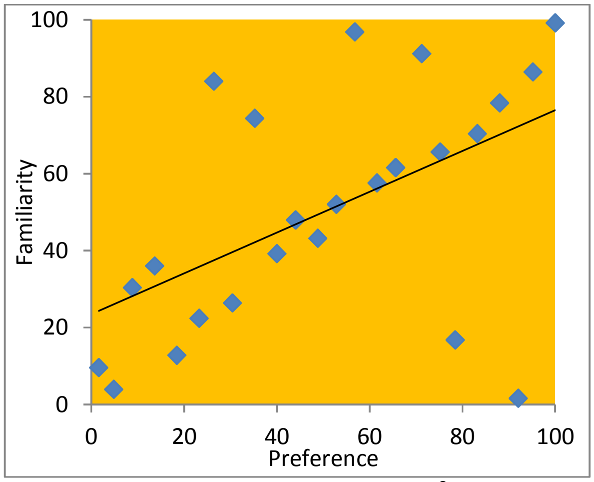
To study the effect of familiarity on landscape preferences, Wellman & Buhyoff (1980) asked subjects from Virginia and Utah to evaluate mountainous scenes from the Rocky Mountains and Appalachians. They found no regional familiarity effect which may be because photographs of both regions are common and people from across the US are familiar with them.

Adevi and Grahn (2012) in Sweden examined the relationship between landscape preferences and childhood landscapes, where they grew up. This shows the influence of familiarity. They found that people feel more at home in the type of landscape they grew up in and often settled in a similar landscape: Of those born in the:

- coast, 73% settled in a coastal area;
- forested landscapes, 63% settled in forested areas;
- hills and lakes areas, 54% settled in hills and lakes areas;
- agricultural areas, 52% settled in agricultural areas.

They identified eight “perceived dimensions of experiences in (these) landscapes”, the factors being: species richness, serene, prospect, social, culture, nature, refuge, and space. For example, those who grew up on the coast have a preference for prospect – vast expanses and views without many people, many species and comprising basically the sea, beach, cliffs and rocks. The authors stated that such qualities are “tied to innate reflexes related to certain basic needs that are associated with people’s feeling of safety and security.” They also found that the “larger the town a person grows up in, and the more densely built and lacking in green areas this town is, the lower the person’s identification with the childhood landscape.” Familiarity obviously has a major influence on one’s choice of a place to live.

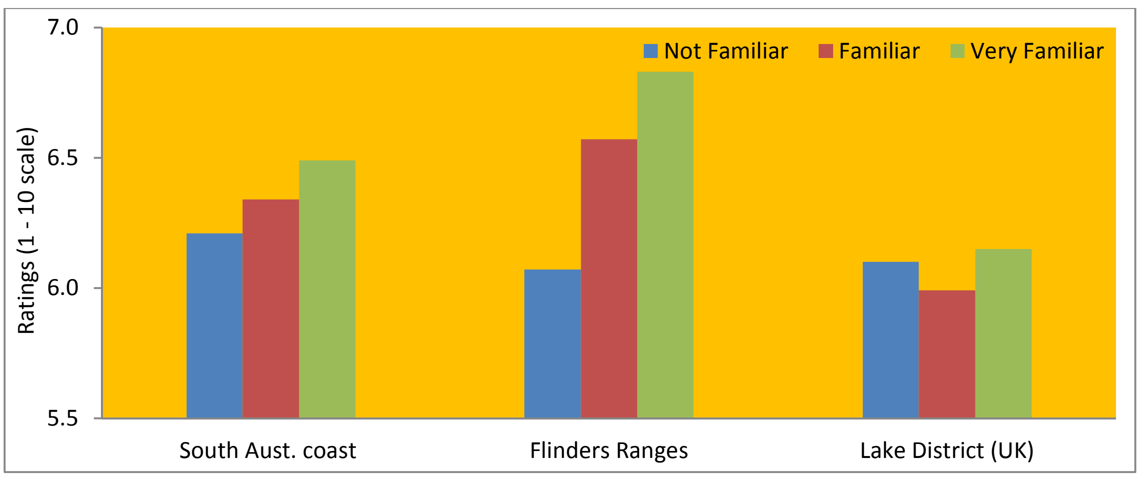
Hammitt (1979) showed photographs of wetlands to visitors before and after their visit and found that generally familiarity increased ratings (Figure 20). However he also noted that the opposite can occur, a highly familiar scene may rate low preferences – “familiarity per se,” Hammitt says, “is insufficient basis for appreciation. One can be very familiar with non-preferred aspects of an environment.”



Source: Hammitt, 1979 Trend line: y = 0.53x + 23.52, R^2 = 0.28. Arbitrary scale

Figure 20 Relationship between familiarity and preference

In several of my studies I have asked participants to indicate their level of familiarity with the region: not familiar, familiar, very familiar. Figure 21 summarises the influence of familiarity on the ratings of the landscape. In the coast and Flinders Ranges studies, familiarity had a clearly positive effect on ratings. Being very familiar with the coast increased mean ratings by 4.5% and for the Flinders Ranges by a large 12.5%. However, conversely in the study of the Lake District in England, being familiar with the area was found to actually reduce ratings by nearly 2% while being very familiar with it increased them by less than 1%.



Source: Lothian, 2005, 2009, 2013

Figure 21 Influence of familiarity on mean ratings

Perceptions of children

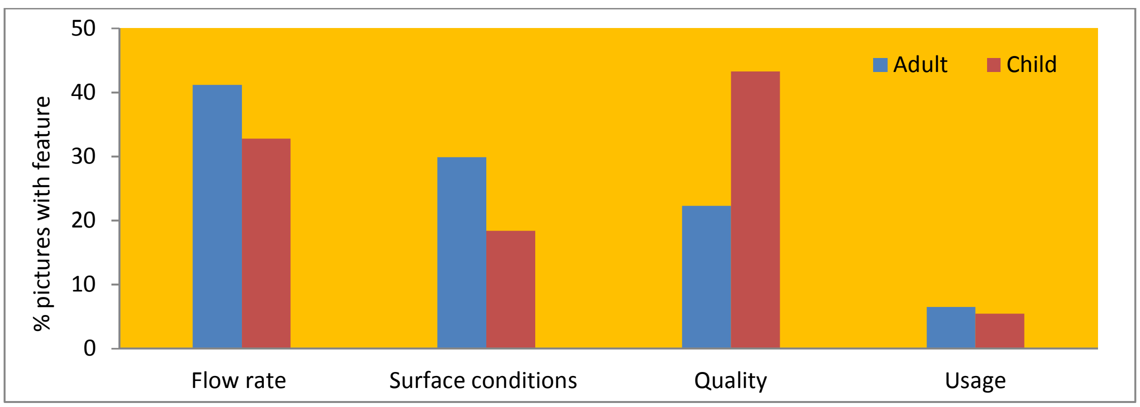
"Water is a special part of the play world of the child." observed Kates and Katz (1977) in a delightful study of children's play in a day centre and their understanding of the hydrological cycle. They describe the many games involving water – making volcanoes with water spurting up through sandcastle and using water to put out an imaginary fire. Asked where the water from the tap came through elicited many wonderful descriptions involving clouds, pipes, rivers, trucks bringing water from the sea, and rivers under every house that bring the water. Asked where the soapy water goes from the bath, one said it goes back into the river to clean it!

As mentioned earlier, Zube *et al* (1983) found that the preferences of young children (6 - 11 years) differed from adults (Figure 12) being very strongly correlated with the presence of water compared with other age groups. Differences in the landscape preferences of children and adults can indicate the influence of acculturation (socialisation) on these preferences and the extent to which preferences are inherent or are learnt. This reinforces the finding by Balling & Falk (1982) and Lyons (1983) that the preferences for savanna by children aged 8 - 11 years differed significantly from older children and adults (see Figure 13).

Bernaldez *et al* (1987) examined the landscape preferences of children on the Canary Islands. Two age groups were used, 11 and 16 years old. Pairs of photographs were used and the children asked to indicate their preference. Younger children differed from the older children: they disliked darker scenes with less detail and they disliked harshness in scenes. The authors linked this with the common fear of darkness among children. The shift in the 11 and 16 years olds in this regard indicates the older children are less influenced by this fear and are more inclined to find it stimulating.

In a study in California of teenager's valuing of outdoor areas, Owens (1988) found that 70% valued such areas where they could be with nature, 66% where they could get away from other people or be with their friends (30%). Valued outdoor places were places where they could go and view and not be seen. Natural parks and undeveloped agricultural land were their most popular areas, their beauty being their defining characteristic. The teenagers benefited by their proximity to Mt Diablo, a nearby State Park.

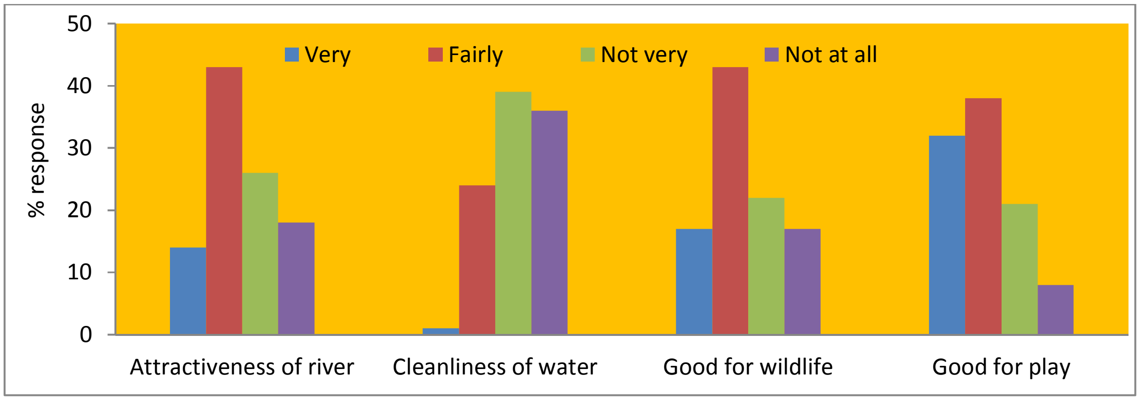
Yamashita (2002) gave cameras to adults and 5th & 6th grade (11 years) children to photograph a river environment in Japan. He found that while the adult's photographs emphasised the flow rate and surface conditions of the water, the children's photographs were more of water quality and flow rate (Figure 22). The children's photographs also had more water surface than those of the adults.



Source: Yamashita, 2002

Figure 22 Features photographed by adults and children

Tunstall *et al* (2004) gave cameras to 150 children age 9 – 11 in London and took them to two rivers to take photographs and to record what they thought about them. Over 500 photos were taken. The children focussed more on the river environment rather than the rivers themselves which accounted for only 16% of the photos and comments. This may be because the rivers were regarded somewhat negatively, being littered and polluted, with 52% making critical comments and only 29% were positive. Some showed "an aesthetic appreciation of the broader river landscape and wide open spaces in choosing to represent 'views' of the rivers or flood-plain meadows." They particularly appreciated the trees and plants near the river, partly because they offered opportunities for play. Parts of the river were seen to be dangerous because of steep slippery banks, and the children wanted cleaner, safer, more accessible rivers and varied, adventurous and manipulable play opportunities. Figure 23 summarises their evaluation of the rivers.



Source: Tunstall *et al*, 2004

Figure 23 Evaluation of two London rivers by children

In a study of agricultural landscapes on the Veneto Plain in Italy, Tempesta (2010) found that children rated the scenes higher than students or adults: mean children 7.83, students 6.17, adults 6.88.

In a South African study, Adams and Savahl (2013) found that children "perceived the natural environment through the lens of safety as natural areas in their community are characterised by crime, violence, and pollution."

An assessment of the influence of nature on children's self-discipline in high rise apartments in Chicago (Faber Taylor *et al*, 2002) found that the more natural the view was from the girl's home, her self-discipline improved by about 20%, however for boys no relationship was detected.

In a meta-analysis of studies involving children, Stamps (1999) found an overall correlation of only 0.61 between children (<12 years) and people over 12 years.

The few studies that have included children indicate that their landscape preferences differ significantly from adults. In their high preference for water and savannah there are suggestions of an evolutionary influence. Children were particularly perceptive about water cleanliness. Generally they are positive about nature and natural landscapes.

Influence of personality

Spanish researchers have examined the influence of personality on preferences. The research design involved use of paired photographs of scenes together with a personality test to identify personality types. Factor analysis was used to identify the differences. Maciá (1979) separated the results for male and female. For men, he found:

- men with mature personalities who dealt with reality prefer humanised landscapes
- men who score high in emotional control prefer pleasant landscapes
- extroverted men prefer landscapes with diffuse forms and rounded trees

For women, Maciá found:

- women with a sensitive, insecure personality prefer natural, unaltered landscapes
- women with astute, worldly personalities prefer dry, cold landscapes
- extroverted women prefer landscapes with diffuse forms and rounded trees

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Maciá concluded that personality structure conditions landscape choice, and gender can influence preference, either directly or be influenced by personality factors. It is worth noting that the previous finding by Bernaldez & Parra (1979) that males preferred natural landscapes while females preferred humanised landscapes is reversed here.

Abello & Bernaldez (1986) found that individuals having low emotional stability prefer landscapes exhibiting “recurrent patterns” and “structural rhythms or patterns”. They favour environmental regularity and avoid vegetation spontaneity and vigour. They reject “hostile, cold, wintry scenes with defoliated vegetation, although the same scenes are more legible and generally appreciated”.

These results provide tantalising indications of the influence of personality upon landscape preferences.

Influence of environmental attitudes

In southern Norway, Kaltenborn & Bjerke (2002) examined the influence of environmental value orientations – anthropocentric, ecocentric and apathetic – on landscape preferences. Their survey found close positive correlations between the ecocentric orientation and preference for wildlands with water, and for cultural landscapes. The anthropocentric orientation linked with a preference for farm landscapes. In contrast, environmental apathy was negatively linked with wildlands and cultural landscapes.

Perceptions by different groups

Do different groups in the community rate the landscape differently? Several studies have examined suggested they do.

Zube (1974) asked a group of 30 environmental designers (landscape architects, planners, architects) to participate in a field-based study and a group of 30 resource managers (foresters, wildlife managers, hydrologists etc.) to participate in an office-based study. The study involved using a semantic differential scale of 25 items (e.g. simple - complex, hard – soft, unity – variety) to describe the landscape, write a free description of the landscape, and rank scenes of aerial photographs of landscapes. He found a reasonable level of agreement between the two groups in their evaluation and description of scenic resources. Correlations between the groups in their semantic descriptions of landscapes averaged 0.80 – 0.88. Descriptions of land form, landscape materials or features, and land use consistently dominated in their free descriptions of landscapes.

Dearden (1984) asked planners, Sierra Club members and the community to evaluate scenes of peri-urban, rural and wilderness. While finding no difference on the basis of age, gender, income, education or occupation, he found that wilderness scenes were evaluated very differently by Sierra Club members compared with the other groups. He also found that those living in low density housing felt more positively about the rural and wilderness scenes than respondents from high-density housing.

Brush (1979) asked private owners of commercial forest land in Massachusetts about the scenic attractiveness of woodlands and compared their ratings with students with and without forestry training. He found that the landowners preferred large, enclosed spaces and spaces created by thinning stands of trees than dense overstocked stands.

A study was made of the ability of physical, artistic, and psychological descriptor dimensions to predict aesthetic preferences for rural river, forest, and agricultural landscape scenes.

Some descriptors were effective in predicting preference across a range of landscape types, while others were effective within a particular landscape type.

In central alpine Switzerland, Hunziker (1995) investigated the perception by tourists and residents of reafforestation of abandoned farmlands. He found that most people prefer "partially reafforested landscapes with a high diversity. Partial ingrowth of forest into an agricultural landscape is even assessed as an improvement of its visual quality. However, if the resulting forest patches become too big and homogeneous, a negative feedback can be expected."

In Holland, Van den Berg *et al* (1998) asked three groups, farmers, residents (nonfarmers) and visiting cyclists, to rate agrarian landscapes and computer simulations of nature development plans. Interestingly, they found that the "beauty ratings of residents and visitors were positively related to typical characteristics of nature development plans (wetness, roughness and noncultivatedness), while farmers' beauty ratings were negatively related to these characteristics."

Gómez-Limón et al (1999) found in a study in central Spain where change of use has resulted in widespread revegetation of the landscape, that the livestock farmers preferred open landscapes in contrast with recreationists and environmental managers who preferred denser vegetation.

Brush *et al* (2000) examined whether different groups view the landscape differently. They had dairy farmers, professional foresters, and logging contractors, groups that earn their living from the land, together with lake association members and tourists, view videos of driving along Wisconsin highways and rate the enjoyability of driving through each landscape type. They found significant differences among the groups, but only their reported knowledge regarding land management had a significant impact on their preferences.

Williams and Carey (2002) asked urban and rural groups in Australia to rate various vegetation associations. They found close similarity in their ratings, the difference averaging just 3.4%.

Dramstad *et al* (2006) asked locals and non-local students to evaluate scenes of the Norwegian landscape, including preferences, and found nearly identical mean preference scores: locals 3.2, students 3.25.

In Flanders, Rogge *et al*, (2007) compared the perception of rural landscapes among farmers, landscape experts and the general public. They found the groups looked at landscapes in different ways, "attaching importance to different landscape features and funding different functions appropriate for the considered landscape." In regard to landscape preferences, the following factors were important to each group:

- Farmers: openness and maintenance of the landscape
- Experts: vegetation and openness of the landscape
- General public: appearance of vegetation, the openness and maintenance of the landscapes

In Japan, Natori and Chenoweth (2008) asked farmers and naturalists to rate rice paddies and woodland landscapes. For the rice paddy landscapes, perceptions of stewardship and openness were much more important to the farmers, while to the naturalist, naturalness and biodiversity were more important. No difference was found in the two group's perception of the woodlands.

From these few studies it is evident that people with a stake in the land, particularly employment that is derived from the land, see landscape beauty in terms of productivity rather than aesthetics. A farmer told me that he rated the landscapes of farmland according to how high the crops were! It is not that these people are blind to the aesthetics but rather that their priority and focus is on making a living from the land. The surveys involved land in which they derived a living; had landscapes elsewhere been used they would probably have rated them as aesthetic objects.

Reliability of ratings over time

The reliability of observer responses has been assessed by examining the extent to which they change over time.

Coughlin & Goldstein (1970) examined the consistency of ratings one month after the initial rating. They found a reasonably good correlation of 0.73 between the two ratings.

Hull & Buhyoff (1984) reassessed preferences after the elapse of more than twelve months. Individual observer reliability averaged nearly 80% while group consensus values were very reliable ($r = 0.956$). The authors recommended that group data be used in preference to individual responses.

The reliability of preferences was tested by Cook & Cable (1995) in rating of shelterbelts in the Great Plains of Kansas where some respondents repeated the rating. They found the ratings of both sessions highly correlated (0.90).

In Denmark, Jensen (1999) reviewed surveys in 1976 - 78 of the public who had recreated in the forests and compared them with surveys in 1993 – 95. He found that the forest preferences were generally stable over this period although some changes were noted.

In a study in Massachusetts, Palmer (2004) found that because of land use change from forestry to residential, the overall landscape quality had decreased. Although the landscape had changed, he found that “the landscape scenic norms were relatively unchanged”, with a “preference for natural appearing landscapes with a mosaic of open and forested land.” The model of using spatial landscape metrics retained its predictive efficacy after 20 years.

These few studies suggest a reasonable constancy of landscape preferences over time.

SUMMARY – OBSERVER INFLUENCES ON LANDSCAPE PREFERENCES

This section examined the influence of the observer upon their landscape preferences. It found that although many studies used tertiary students as their subjects, there is a high correlation (0.83) between their preferences and that of other respondents. Surprisingly, nearly two-thirds of studies collected no demographic data on their subjects. Of the demographic factors, only age, and to a lesser extent, gender, had an influence on preferences. Landscape preferences of young children differed from adults, they having particularly high preferences for water and savannah landscapes. Providing children are not used as subjects, the characteristics of age, gender, education, employment and socio-economic status had nil or negligible influence on preferences.

It is often believed that cultural differences will result in wide differences in landscape preferences, but in fact the similarities are far greater than the differences. Experts in landscape are sometimes used as subjects instead of lay people with no expertise but studies indicate that there can be differences between expert and lay (correlation only 0.60) and that care should be taken in assuming that experts will provide similar ratings as the community. In particular, while the preferences of natural resource managers and planners were reasonably close to those of the community, the ratings of landscape architects often varied significantly from those of the community.

While it is commonly believed that familiarity breeds contempt, in respect of landscapes a common finding is that the more familiar a person is with a landscape, the higher their preferences for it. A few studies have suggested that the subject's personality influences their landscape preferences but the evidence is thin. Surveys involving different groups in the community have found that those with a stake in the land, particularly employment that is derived from the land, see landscape beauty in terms of productivity rather than aesthetics. Finally, longitudinal studies have found remarkable constancy in people's landscape preferences in repeated viewings and also over time, even as long as 20 years.

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