

DIMENSIONS OF ENVIRONMENTAL PERCEPTION

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ABSTRACT

175 Ss were administered a 23 item semantic differential which was used to rate large city, small town, forest, desert, and beach. The ratings of each environment were factor analyzed. The factors obtained were compared across environments to determine common dimensions used to rate the environments. Four common dimensions were obtained: evaluative, spiritual, activity, and aesthetic appeal. The factor loadings of the rating scales were then analyzed to determine ideosyncratic applications of the dimensions to particular environments.

INTRODUCTION

Man's reactions to his environment are guided by his perceptions of it. Although there has been a considerable amount of research on man's perceptual processes, little has been done to investigate how he perceives his environment. In a cross-cultural study, Canter and Thorne (1972) compared the perceptions of first-year students of the undergraduate schools of architecture at the University of Strathclyde, Glasgow, Scotland, with a similar group of students at the University of Sydney, Australia. Using a semantic differential (Osgood, Suci, & Tannenbaum, 1957), ratings were obtained of sixteen colored slides of house types from Scotland, Australia, Italy, United States, and England. Familiarity with house types did not produce preferences for those types. The procedure did produce significantly different responses between the two groups for nine of the illustrations. Lowenthal and Riel (1972) also used the semantic differential to obtain descriptions of four urban settings by a variety of groups of people from the four urban environments. Out of 300 paired relationships, created by finding all correlations among the 25 ratings scales, only 59 were strongly correlated among all groups of observers in each of the four cities. Three interconnected networks of association were found which were common to ratings of all cities. These networks were obtained through cluster analysis rather than factor analysis. The first cluster was beautiful, ordered fresh, smooth, rich, vivid, pleasant, clean, likeable, and light. The second cluster was new, fresh, ordered, and rich. The third cluster was quiet, fresh, ordered, and clean. There was some overlap among the three clusters. Calvin, Dearing, and Curtin (1972) factor analyzed semantic differential ratings of 15 scenes on 20 scales by 139 subjects. Two factors were obtained: "natural scenic beauty" and "natural force." Natural scenic beauty consisted of the scales colorful, beautiful, natural, and primitive. Natural force consisted of turbulent, loud, rugged, and complex. They concluded that variations in landscapes might be reduced to two or three dimensions such as those they found, but additional studies using different scenes, subjects, and scales were necessary before it could be determined what those dimensions are.

The purpose of the present study is to determine the factors or dimensions used to rate five environments. This procedure will disclose whether the

dimensions found by Calvin et al. (1972) emerge using a different set of subjects, scales, and environments or whether a new set of dimensions is produced. It will also permit a comparison to be made of the dimensions utilized to perceive each of the five distinct environments. Since this is an exploratory study designed to find dimensions, no hypotheses will be made.

Orthogonal factors will be extracted for the following reasons: (a) Since Calvin et al. (1972) used orthogonal factors, a comparison between the dimensions found in this study and those found in their investigation requires orthogonal factors. (b) A principal purpose of the present study is to determine the comparability of factors used by people to perceive distinct environments. The factor matching across environments is facilitated if all sets of factors are orthogonal. (c) Finally, the theoretical choice between oblique and orthogonal factors is somewhat arbitrary. The investigator prefers the ease of interpretation generated by the independent "points of view" represented by orthogonal factors as a trade off against the possibly superior "goodness of fit" to the data which may be produced by oblique factors.

METHOD

SUBJECTS

Ss were 175 students at Brigham Young University who volunteered to participate in the experiment. Volunteers were obtained who varied in terms of size of home town.

MEASURING INSTRUMENTS

A 23 item semantic differential which was called the *Environment Rating Scale* was used to rate the following five environments: Large City (L), Small Town (S), Forest (F), Desert (D), and Beach (B). The environments were selected on an ad hoc basis as representing five rather distinct conceptual environments. The 23 bipolar adjectives were as follows: rational-irrational, sacred-profane, immoral-moral, awful-nice, worthless-valuable, unimportant-important, honest-dishonest, wholesome-unwholesome, natural-artificial, beautiful-ugly, motionless-moving, smooth-rough, noisy-quiet, dirty-clean, like-dislike, inadequate-adequate, suitable-unsuitable, acceptable-unacceptable, unpleasant-pleasant, uncomfortable-comfortable, bad-good, uninteresting-interesting, and depressing-stimulating. These scales were selected from those used by Canter and Thorne (1972) and Lowenthal and Riel (1972). The more favorable adjective was randomly assigned to either the right or left side to mitigate against the effects of a response bias. The bipolar adjectives were separated by a seven point scale. The least favorable adjective was scored "1" going up the most favorable adjective which was scored "7." The name of each environment appeared at the top of a page with the rating scales underneath.

PROCEDURE

Ss were administered the Environment Rating Scale in small groups. The order of the five environments was randomly assigned to each S.

DATA ANALYSIS

The data consisted of 23 ratings of each of the five environments by each of the 175 subjects. A principal components factor analysis (Harman, 1967) with a varimax rotation (Kaiser, 1958) was completed on the ratings for each of the five environments. This yielded a set of factors for each environment.

RESULTS

The factor analysis yielded four factors for Forest, Beach, and Small Town, and three factors for Desert and Large City. The factor pattern matrix containing the factor loadings of the 23 scales on each of the factors for each of the five environments is presented in Table 1. Arbitrarily, only loadings larger than .42 were considered significant and are reported. By presenting the loadings for all the environments on each factor together, the comparison of factors across environments was simplified. Omission of loadings lower than .42 also produced greater clarity.

The results of the factor analysis will be examined in terms of (a) matching factors that are common across the environments, (b) interpreting and labeling the factors that are identified, (c) analyzing differences in the pattern of factor loadings that exist from one environment to another.

MATCHING FACTORS THAT ARE COMMON ACROSS ENVIRONMENTS

Table 1 shows that there were slight differences in the scales that were included in each of the four factors from one environment to another. In other words, each environment produced a slightly different clustering of scales used by the Ss to describe it. However, there were "core" scales for each factor that were common across all of the environments. These core scales are grouped together in Table 1 for ease of interpretation. A core adjective was defined as one which was included in a factor for at least three of the five environments. Twenty of the 23 scales met that criterion. Of these, five were only shared by three environments; seven were only shared by four environments; and eight were shared by all five environments. A comparison of the factor loadings of the core scales across environments showed that the size of the loadings were fairly consistent. Table 2 gives intercorrelations among the similar factors obtained for each of the environments. In this factor matching procedure, correlations were found using all the factor loadings including those lower than .42. From the table it is apparent that there was good factor matching across the five environments. Thus, the pattern of factor loadings for the core scales on each factor tended to be highly similar for each of the five environments.

INTERPRETING AND LABELING THE FACTORS

Each of the four factors were named in terms of the core bipolar adjectives they shared. Factor I was an "evaluative" factor. The loading of good-bad on the factor was a "marker" which helped to identify it. Taken together the adjectives nice, good, clean, pleasant, adequate, stimulating, interesting, comfortable, valuable, and important established a pattern of how "good" the environment was. Factor II was a "spiritual" factor. The adjectives moral,

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Table 1

Factor Loadings of the Rating Scales on Four Factors for each of the Five Types of Environments

Rating Scales	Factors																						
	I					II					III					IV							
	F	B	S	D	L	F	B	S	D	L	F	B	S	D	L	F	B	S					
Nice - Awful	87	74	65	79	70																		
Good - Bad	83	71	67	77	71																		
Clean - Dirty	73	45	52	42	52					48								43					
Pleasant - Unpleasant	87	79	70	88	84											45	42						
Adequate - Inadequate	59	56		68	65						50		58										
Stimulating - Depressing	81	84		84	49					42			79										
Interesting - Uninteresting	86			76	85								67		71								
Comfortable - Uncomfortable	70	76	67	75	77																		
Valuable - Worthless	85	80	70	73	48					48							50						
Important - Unimportant	87	80	50	69						42	42						71						
Moral - Immoral	62									77	61	74	62										
Honest - Dishonest										69	66		80	78				63					
Sacred - Profane										69	72	73	72	70									
Wholesome - Unwholesome					45	53	45	56		67	63							56	57				
Rational - Irrational										52	63	49	42						55				
Quiet - Noisy	66		79															-72	-62	-64			
Moving - Motionless			63															42	70	66	70		
Natural - Artificial					46					44	49							-42	83	58	72		
Beautiful - Ugly					70	70													81	63	64		
Like - Dislike					81	81												49	46		55	64	54
Suitable - Unsuitable					75	80												80				75	63
Acceptable - Unacceptable					78	82												78	45			80	62
Smooth - Rough										59								59	-81	-49			

Note. Decimals have been omitted. All entries are to two decimal places. Factor loadings smaller than .42 have been omitted. A Factor IV was not found for Desert or Large City.

honest, sacred, and wholesome all connote a religious or spiritual dimension. The inclusion of rational-irrational in that set is difficult to understand. It may have resulted from a view that irrational is not spiritual, rather than from the belief that rational is spiritual. Factor III was an "activity" factor. Both moving-motionless and quiet-noisy have strong connotations of activity. The fact that only two scales loaded on the factor probably resulted from a failure to include more activity scales in the measuring instrument. The only other possible candidate for inclusion in that factor from the other scales was smooth-rough, and it was included in the factor for two of the environments. Factor IV was "aesthetic appeal." The core scales were natural-artificial, beautiful-ugly, and like-dislike.

Table 2

Correlations Among Factors That are Similar Across Environments
and Percentage of Variance Accounted for by Each Factor

Factor's Environments	Environments				Percentage of Variance Accounted For	
	Small Beach	Small Town	Large Desert	Large City		
I Forest	.85	.71	.50	.10	33	
Beach		.55	.74	.23	28	
Small Town			.42	.44	18	
Desert				.71	37	
Large City					30	M=29.2
II Forest	.48	.56	.53	.79	10	
Beach		.59	.80	.65	12	
Small Town			.73	.43	8	
Desert				.52	16	
Large City					17	M=12.6
III Forest	.44	.58	.42	.16	10	
Beach		.45	.73	.48	6	
Small Town			.62	.73	14	
Desert				.74	7	
Large City					11	M=9.6
IV Forest	.43	.58			9	
Beach		.75			18	
Small Town					17	M=14.7

Table 2 gives the percent of variance accounted for by each of the factors that emerged for each of the environments. Altogether, the factors accounted for a mean of 60.2 percent of the variance. For Desert and Large City, three instead of four factors accounted for approximately that much variance. Whereas, Ss used four dimensions to perceive Forest, Beach, and Small Town, only three were required for Desert and Large City. Desert and Large City were not viewed with the same complexity as the other environments.

The factors varied in terms of the degree that they came into play as Ss responded to an environment. Evaluation was the most important factor in rating all of the environments. Spirituality was second; Activity was third; and Aesthetic Appeal was fourth. Actually, Aesthetic Appeal accounted for second the most variance, but it did not apply to Desert and Large City. Evaluation was more important as a response variable for Forest, Beach, Desert, and Large City than it was for Small Town. Small Town tended to be appraised more than the other environments in terms of activity and less so in terms of utilization of the dimensions. Both were reacted to more than the others in terms of Spirituality. Neither appeared to be appraised in terms of Aesthetic Appeal.

Suitable, acceptable, and smooth did not load primarily on any of the four factors. Suitable and acceptable had similar patterns of loadings. Smooth had a pattern distinct from the others. These adjectives do not form additional factors. They are part of one or two of the basic four factors. However, the factor that they loaded on depended upon the environment being rated.

ANALYZING DIFFERENCES IN THE PATTERN OF FACTOR LOADINGS ACROSS ENVIRONMENTS

An examination of variations in the factors on which rating scales loaded from one environment to another provides an understanding of differences in the manner in which environments were rated or perceived; whereas, the forgoing analysis provided an understanding of what the ratings of the environments had in common. The following analysis considers three types of variations of factor loadings for a given factor from one environment to another: (a) displaced loadings, (b) shared loadings, and (c) missing loadings. For displaced loadings, a rating scale has a loading larger than .42 on a factor other than what is usual for the majority of environments. For shared loadings, instead of a rating scale loading primarily on the one factor that is usual for the majority of environments, it loads higher than .42 on that factor and on an additional factor as well. For missing loadings, a rating scale does not load higher than .42 on the factor that is usual for the majority of environments or on any of the other three factors either. These variations will be discussed in the order in which they were described.

In terms of displacements for Factor I, adequate, stimulating, and interesting loaded on "activity" for Small Town rather than on "evaluative." In other words, for ratings of Small Town, adequacy, stimulating, and interesting were associated with the scale moving on the activity factor. These three rating scales were not used to rate the "goodness" of the Small Town but rather they went with its activity level. Similarly, the importance of a Large City was

clustered with the activity factor. Ss did not rate a Large City important in terms of its "goodness," but in terms of its activity.

There were four displacements involving three environments for Factor II. First, the morality of Forest went with its "goodness" rather than its spirituality. It is not understood what this particular displacement means. Second, a part of the aesthetic appeal of a Small Town was its honesty and wholesomeness. These two scales did not load on the spirituality dimension for Small Town as they did for the other environments. Finally, for Beach rational went with aesthetic appeal rather than spirituality. An explanation of this result may be that in rating the Beach, Ss keyed on the irrationality side of the bipolar scale and concluded that an irrational beach may be dangerous and thus not appealing.

For Factor III there were three displacements. For both Forest and Small Town quiet was a part of the rating of how "good" they were rather than their activity. In other words, part of what makes a Small Town and a Forest good is the fact that they are quiet. Also, for Beach motion was a part of the good-bad rating rather than the activity rating. A Beach is good to the extent that it has a lot of motion.

There was a major displacement for Factor IV. Both Desert and Large City did not have a separate factor for aesthetic appeal. Apparently, these environments were not appraised in these terms. How much they were liked or described as beautiful went with how "good" they were rated. And for the Large City, natural went with how good it was rated. Since Large Cities are all artificial, discriminations on the scale, natural-artificial, were not meaningful.

Suitable and acceptable were used almost as synonyms. They did not align themselves with any one of the four factors. What factor made an environment suitable or acceptable depended upon the environment being rated. Thus, in a sense, all of their loadings were displacements. Both Desert and Large City were suitable or acceptable in terms of how highly they were evaluated. What made a Beach and Small Town suitable or acceptable was their aesthetic value. And a Forest was suitable or acceptable according to its activity.

For both Large City and Forest smooth-rough was associated with the spiritual factor. For both Beach and Desert smooth-rough loaded negatively on the activity dimension. A likely explanation is that the connotation of the adjective changed with the environment being rated. Using it to rate a Large City, Ss probably focused on the "rough" end of the continuum. And a rough city is probably seen as one which is unsafe and has undesirable elements. Applied to the Beach and Desert environments, Ss probably used the scale in terms of the textural connotations of "smooth." For example, Beaches that are moving are not smooth, and deserts which are motionless are also smooth. The connotation of the smooth-rough scale when applied to Forest is not understood.

Having examined factor loading displacements, an analysis will be made of shared factor loadings. Clean-dirty was part of the evaluative factor for all of the environments. It was also applied to the spirituality of a Large City and to the aesthetic appeal of a Small Town. A Large City may be viewed as dirty in the morally unclean sense. And part of the aesthetic appeal of a Small Town was its cleanliness. Both a Beach and a Small Town had as part of their

aesthetic appeal their pleasantness. People like those environments in part because they are pleasant. The adequacy of a Forest was viewed in terms of its activity as well as its evaluation. The Large City was stimulating in terms of spirituality as well as evaluation. And it was interesting in terms of activity as well as evaluation. The value of a Desert was its spirituality as well as its evaluation. Ss perceive the Desert as having spiritual values. Contrastingly, for a Large City, value was tied to activity as well as evaluation. Cities are valuable according to their degree of activity. Shared loadings also show that the importance of both the Small City and the Desert were related to their spirituality as well as their evaluation.

Shared factor loadings for the spirituality factor involved only the wholesome-unwholesome rating scale. For both Desert and Large City wholesome related not only to their spirituality, but also to evaluation. In other words, part of what makes both the Desert and Large City good is their degree of wholesomeness. However, for Beach wholesome related to aesthetic appeal as well as to spirituality. A Beach that is not wholesome is not as appealing. There were no shared loadings for the activity factor.

Natural-artificial was not associated with aesthetic appeal for Desert and Large City. For Desert, natural had connotations of both spirituality and inactivity. It is natural for Desert to be a spiritual and an inactive place. For the Large City natural related to both evaluation and spirituality. An "artificial" city was viewed as bad and lacking spirituality. Finally, liking of both Forest and Small Town was associated with their degree of activity as well as their aesthetic appeal.

Missing factor loadings refer to the absence of a factor loading above .42 for a rating scale on any of the factors. There were only two such occurrences. Most environments were viewed as interesting in terms of the evaluative dimension. For Beach interesting was not associated with any of the factors. Apparently, a Beach is judged interesting in terms of a factor other than one of the four extracted. Also, for Small Town, smooth-rough was not associated with any of the four factors generated.

It may be concluded that there are four basic dimensions which are utilized in the perception of the five environments. The dimensions have a great deal in common as compared across environments. Not surprisingly, there are characteristics of the dimensions that are ideosyncratic to the environments perceived. An examination of the variations in the factors across environments has shown that those ideosyncratic characteristics are meaningful.

DISCUSSION

The factor analytic results will first be discussed in terms of the factors obtained by Calvin et al. (1972). In this study it was found that four basic dimensions were used to rate the environments. These dimensions were "evaluative," "spiritual," "activity," and "aesthetic appeal." Calvin et al. (1972) found only two factors: "natural scenic beauty" and "natural force." The first contained high loadings by natural, beautiful, colorful, and primitive. This factor is highly similar to the "aesthetic appeal" factor which had high loadings by natural, beautiful, and like. This was the most prominent factor in Calvin's study,

accounting for 62% of the variance. In the present study it was the second most prominent factor in describing Beach and Small Town, fourth most important in describing Forest, and not important at all in describing either Desert or Large City. Turbulent, loud, rugged, and complex were adjectives loading on the Calvin et al. "natural force" factor. This factor is similar to the "activity" factor which included moving and noisy. It also contains rugged from the Osgood et al. (1957) potency factor. Whereas, this was Calvin's second most important factor accounting for 24% of the variance, it was the fourth most important factor in the present study (mean = 9.6% of variance).

Calvin et al. (1972) failed to extract the "evaluative" and "spiritual" factors — the first and third most important factors in the present study. This may be accounted for by the fact that they did not include the bipolar adjective scales which had high loadings on these two factors. In factor analytic studies the factors obtained depend upon the variables included. In this study the factors obtained were dependent upon both the adjectives included and the environments rated. Calvin et al. (1972) did not include as broad a sample of bipolar adjectives as the present study and, thus, failed to extract two rather important dimensions used to respond to environments. Furthermore, all of their environments were examples of forested areas.

The usual order of importance of the factors for the environments was as follows: evaluative, aesthetic appeal, spirituality, and activity. In other words, the most prominent reaction was in terms of how good the environment was. Judging from the adjectives on the evaluative factor, "goodness" may be interpreted in terms of how hospitable the environment is. The second consideration was in terms of aesthetics. The attractiveness of the environment in terms of its naturalness and beauty were considered. Third, a reaction was made in terms of "moral goodness." Key considerations were the honesty and wholesomeness of the environment. Finally, and least important, was degree of activity. There were three exceptions to this order of prominence by the factors, indicating that the relative importance of the factors varied somewhat depending upon the type of environment being rated. The first exception was the rating of Small Town. Activity and spirituality were inverted in order of importance. Not surprisingly, activity becomes a more salient dimension for assessing Small Town than for the other environments. The other two exceptions were Desert and Large City. All factors were involved in about the same degree for these two. Aesthetic appeal dropped out as a factor in rating both of these environments. Apparently, they are not adjudged in terms of their attractiveness. An explanation may be that people view them as necessary and given components in the environment which do not require appraisal in terms of their beauty. However, if specific Large Cities or Deserts were to be rated, it is likely that their comparative beauties could be appraised.

Some variation in the structure of the factors occurred from one environment to another. These variations were produced by two processes. First, associations among adjectives varied depending upon the environment. For example, activity in a Small Town related to how adequate, stimulating, and interesting it was. In a Large City activity was more likely related to the "hustle and bustle" of industry and business. This was evidenced by the loading of importance on the activity factor for Large City. Secondly, when applied to a particular

environment the actual meaning of the scale changed. An example of this was the loadings of the scale "rough-smooth." When applied to a Large City it had anti-social connotations, and when applied to a Beach and a Desert it had connotations of motion.

NOTES

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2. Requests for reprints should be sent to 1230-A SFLC, Brigham Young University, Provo, Utah 84602.

REFERENCES

1. Calvin, J. S., Dearing, J.A., & Curtis, M. E. An attempt at assessing preferences for natural landscapes. *Environment and Behavior*, 1972, 4, 447-470.
2. Canter, D., & Thorne, R. Attitudes to housing: a cross-cultural comparison. *Environment and Behavior*, 1972, 4, 3-23.
3. Harman, H. *Modern factor analysis*. Chicago: University of Chicago Press, 1967.
4. Kaiser, H. F. The varimax criterion for analytic rotation in factor analysis. *Psychometrika*, 1958, 23, 187-200.
5. Lowenthal, D. & Reil, M. The nature of perceived environments. *Environment and Behavior*, 1972, 4, 189-206.
6. Osgood, C. E., Suci, G. J., & Tannenbaum, P. H. *The measurement of meaning*. Urbana: University of Illinois Press, 1957.