AN INFORMAL MODEL

FOR THE PREDICTION OF PREFERENCE

Stephen Kaplan

In E. H. Zube, R. O. Brush, & J. G. Fabos (Eds.)
Landscape Assessment: Values, Perceptions, and Resources
Stroudsburg, PA: Dowden, Hutchinson & Ross. 1975. Pp.92-101

Supported by
Forest Service, USDA
Research Agreement 13-306

Department of Psychology

An Informal Model for the Prediction of Preference[1]

Stephen Kaplan

University of Michigan

Landscape assessment can be viewed as a procedure for identifying landscapes likely to be preferred by humans. In this process the choice of variables is the central problem. Clearly it is desirable to select variables that will predict preference. In addition to being effective predictors, such variables should make theoretical and intuitive sense as well. Theoretical sense makes one's efforts more coherent, better organized, and more widely generalizable. Intuitive sense is necessary if one wishes to share one's understanding with others. Variables that seem arbitrary or obscure are unlikely to be used by the experts whose effectiveness we hope to enhance.

It is difficult to specify how one goes about making intuitive sense. In part it is an attitude rather than a procedure, and in part it depends upon good fortune in uncovering variables that are both sensible and efficient. But in our work an important factor has been that of working with a broad theoretical framework which itself makes reasonably good intuitive sense.

This basic theoretical framework has its background in perception, and more particularly, in a functional approach to perception. Two basic themes emerge from such an approach. First, it is assumed that perception is oriented to getting along in the world, to making sense out of the environment. Second, the process of perception is highly inferential. A great deal of knowledge, of experience, of interpretation enters into what may seem to be the straightforward process of looking.

There are a number of implications of this approach that have proved helpful in the search for suitable variables in landscape assessment. First, information is central to the organism's survival. Thus considering the landscape in terms of the information it provides is likely to be helpful in discovering what underlies preference. Second, that information that aids in making sense out of the environment is likely to be particularly salient. Information that allows an individual to make more accurate inferences about his whereabouts should be highly valued. Likewise, the individual should also value the possibility of gaining new information about his environment. Thus, the third point is that the acquisition of knowledge should also be related to environmental preference. (S. Kaplan, 1973b).

One of the most central concerns of the perceptual process is the interpretation of space. For an understanding of why spatial information is so important, it is necessary to refer back to the conditions of human evolution. Comprehension of large areas was vital for early man to locate prey, to find desirable plant food in season, and to find his way home again (Flannery, 1965; Peters, 1973; Pfeiffer, 1969).

Like other perceptual processes, the perception of space is highly inferential. We construct our spatial world through the selection and analysis and interpretation of spatial information.[2] This inferential process takes a two-dimensional pattern of light falling on the retina and interprets it in three dimensions. (Thus the spatial interpretations participants make of two-dimensional photographs in our research and in other studies is hardly surprising. The perceptual apparatus is highly biased toward spatial interpretations and people in our society have extensive experience with photographs as representations of the three-dimensional world. To criticize photographs as artificial and inadequate in landscape research is to fail to appreciate the nature of human perceptual mechanisms.)

To date we have identified six variables that seem to have some role in the prediction of preference. We have tentatively grouped them into two categories, in terms of the information they seem to provide. One category, concerning the order or structure apparent in the scene, suggests factors that aid in making sense of or interpreting the environment. This is closely akin to the concept of legibility that Lynch (1960) has applied to the extended three-dimensional environment. The other category concerns the amount of information that appears to be available, or is likely to become available as one advances into the scene. This category thus applies to settings where there is the possibility of acquiring further knowledge about the environment. The next portion of the paper deals with the evolution of these six concepts and of the organizational scheme that has been growing up around them.

IN PURSUIT OF PREFERENCE: A FRAMEWORK

THE PROMISE OF FURTHER INFORMATION

The first study in the series was John Wendt's honors thesis concerning the identification of the separate urban and nature domains (Kaplan et al., 1972). Complexity was the primary predictive variable in that study (besides, of course, the domain distinction itself). Since the paper by R. Kaplan in this volume deals with several details of this study, I will not repeat these, but focus on the role that study played in the emergence of preference predictors. By ordering the slides in terms of preference it was clear that there were additional variables besides complexity that went into preference within the nature domain. Certain specific features, like the presence of water, were striking in their influence. Such primary landscape features, while not lending themselves to dimensionalization, are of undeniable importance. Another variable, however, seemed more continuous and less content-specific. It appeared in a variety of different settings. There was high preference for a photograph of a path that went straight for a while and then turned and disappeared from view. Another highly preferred item was a brightly lit field partially obscured by nearby foliage. The two examples have little in common in terms of either the two-dimensional pattern of stimulation or the three-dimensional settings they depicted. But both of them communicated a feeling of mystery.

In thinking about the concept of mystery, and particularly in trying to describe it clearly to subjects or judges, the idea of being able to enter

the scene in order to gain further information became increasingly compelling. In all cases that seemed appropriately characterized by "mystery," some information was suggested but hidden from view. The attraction to go deeper into the scene not surprisingly had its influence on the preference value of that scene.[3]

A number of comments are called for with respect to this concept. First, it clearly depends on the spatial interpretation of the visual array. One can hardly feel attracted to enter a visual array that lacks depth. Second, there does seem to be a functional interpretation for this concept. As I have suggested above, an organism, like man, whose survival is based on knowledge would have to like acquiring new information. Thus, a scene that promises new information would be preferred precisely because of this promise. Let me hasten to add that this tendency is by no means uniquely human -- it should be characteristic of any far-ranging animal whose resources and dangers are widely distributed in space. Thus, as we all know, the bear went over the mountain (to see what he could see).

While one might be tempted to argue that curiosity by any other name is just as familiar, in fact certain subtle additions have crept in. First, mystery concerns the promise of new or additional information, rather than new information per se. Second, by casting the concept in these terms, its kinship with the complexity variable becomes evident. Both concepts address themselves to the issue of information that could differentially characterize different portions of the array. A complex scene promises more information just as a mysterious one does, except that in the case of complexity the additional information requires more time and inspection, rather than a change in vantage point. It is evident that a scene can be relatively high in both these qualities, or in either one without the other.

LEGIBILITY IN SCENES OF THE ENVIRONMENT

The next step in the identification of possible predictors of preference came in the context of a different set of material. In addition to photographs of the outdoor environment, this set included graphics, that is, sketches by designers of the same sort of environments. Our intent was to find out if certain types of graphics were more effective than others; we ended up learning a good deal more than we intended.

We pretested this material by presenting it to a group of nondesigners; largely, as it turned out, psychologists and psychologists-to-be. We had expected them to be puzzled by some of the graphics - we were puzzled ourselves by some of them. But we had not anticipated the anger and hostility they provoked. Being confronted with something one could not make sense of turned out to be experienced as distinctly unpleasant. On reflecting on this experience, we came to the realization that being able to identify or categorize a visual form tended to enhance its preference value. The identifiability variable is as yet not well defined. Clearly in extreme cases its absence leads to considerable frustration. Proponents of ambiguity as a desirable feature of the designed environment take note! On the positive side, the variable is probably better understood in terms of familiarity, which in turn is not unrelated to a sense of place. Zajonc (1968) has shown that familiarity can have a powerful role in the prediction of preference in a

laboratory setting. And Thomas Herzog, a colleague of ours at Grand Valley State College, has demonstrated that familiarity enhances preference for scenes of the outdoor environment as well. The concept also appears to be related to the Acking and Sorte concept of "affection" which they describe as "an age concept in the environment, but also a feeling for the old and genuine" (1973: 472).

Another outcome of examining the graphics that had been ill-received was the discovery that some scenes failed to "hang together". They lacked organization; they were hard to grasp -- quite apart from how readily one could tell what they were pictures of. Antidotes to this difficulty included textures that provided continuity among disparate elements and elements that were identical or similar to each other. Grouping of elements together in space also helped with this property. Labeled "coherence," this concept has a kinship with gestalt principles of organization that cause elements to be perceived as groups. There is likewise a parallel with the information processing concept of "chunking." While initially introduced in the context of memory (Miller, 1956), this concept applies in the perceptual domain as well. The argument would be that anything that helps organize the many elements in a scene into a few major units (or "chunks") will aid in its perception, just as memory is aided by the formation of a few major units out of many different elements.

The concepts of identifiability and coherence arose out of experience with a particular set of stimuli. But they could hardly fail to have been influenced by Lynch's legibility concept. They clearly deal with order or structure and as such play an important functional role in orienting and in "knowing where one is." The differences between these two concepts are also instructive. The overall organization of the array, the order among the elements and the redundancy of the components, are readily apparent; in other words, coherence is perceived practically immediately. Identifiability, by contrast, depends upon inference. It is mediated rather than immediate; it requires a certain amount of classifying, of decision.

The same issue seems to apply to the complexity-mystery distinction as well. As we stopped to consider it, we realized that complexity, depending on the number of elements in the array, is immediately perceived. Mystery, like identifiability, requires an inferential process. At this point in our pursuit of the components of preference of physical environments we had four variables which fit into a two-by-two table. Two of them were aspects of legibility and two dealt with "information promised"; within each of these categories the two concepts differed in their immediacy.

Source of Information	Degree of Inference Required: Little	Degree of Inference Required: More
Present: Legibility	Coherence	Identifiability
Future: Information Promised	Complexity	Mystery

Figure 1

Of course such insights about possible predictors of preference lead one scurrying to the laboratory or the field or anywhere where one can check them out. One of the most interesting possibilities for research of this kind arose in an applied context, the prediction of preference for the roadside environment. This study is at least as interesting for the ways in which it forced on us an extension of our conceptual scheme as it is for the test it provided for our previous concepts.

MORE ON LEGIBILITY: GLEANINGS FROM THE ROADSIDE

This project is a collaborative effort with Roger Ulrich, a behavioral geographer now at the University of Delaware. His interest in demonstrating the limits of the rational man idea led him to study the choice between a fast expressway and an attractive parkway. This naturally led to a consideration of the factors underlying a choice clearly premised on aesthetic considerations. Although the data are not yet fully analyzed, certain preliminary findings are of sufficient interest to be worth describing briefly.

In the interest of sampling a wide range of roadside settings, this study began with a large number of photographs. Even a concerted effort at eliminating photographs with extraneous elements and redundant themes only brought the total down to some 140 prints. To reduce that number to a manageable size for obtaining ratings, we asked several people to sort the photographs into categories of their own choosing. The groupings were remarkably reliable across participants. The controlling variable in these sorts, which some of the participants were able to articulate but which all of them appeared to be relying upon, was the notion of spaciousness.

Given the obvious salience of this new variable, judges were asked to rate each of the photographs for spaciousness as well as for coherence and complexity. Then 53 photographs were selected to include a representative range of each of these three variables. (Subsequently a panel of judges also rated the scenes for mystery.) The subjects' task, then, was to indicate their degree of preference for each of the 53 roadside photographs.

In terms of their power in predicting preference, we found that a scene had to have a modicum of complexity, coherence, and spaciousness to be liked. Items rated low on these factors are not preferred. But it appears to make little difference whether there is a little or a lot of any of these. In other words, they form necessary conditions for preference. Mystery, by contrast, is effective throughout the entire range represented by these scenes. The more mystery the scene seemed to have, the better -- following a typical regression pattern.

There is, however, another consistency lurking among these photographs. Following our usual approach (cf. R. Kaplan, 1972), the results were subjected to dimensional analyses; these yielded eight content groupings. Inspection of the different groupings formed by these content domains points to the fineness of texture as a key distinguishing factor. Within each content domain the scenes seemed to be fairly uniform in fineness or coarseness of texture -- expanses of mowed grass vs. scruffy underbrush, for example. The dimensions were also quite uniform with respect to the spaciousness ratings: at one

extreme there are embankments or other obstructions limiting the sense of space, while at the other extreme there are scenes of relatively open spaces. In terms of the other predictive variables, coherence, mystery, and complexity, the dimensions showed no such consistency.

By combining texture and spaciousness, one can categorize the majority of the dimensions unambiguously. The high spacious-smooth texture dimensions have by far the highest preference ratings while the low spacious-coarse texture dimensions are clearly the lowest in preference.

Spaciousness is a welcome factor in this research; space is after all the hallmark of the outdoor environment and it is rather ironic that it emerged as a predictive variable as late as it did. Texture too seems congenial since it has a profound informational role as well as being so vital in defining space.[4] Note also that this study is based on black and white photographs of what are essentially natural settings. Color plays no role and contours range from soft to nonexistent. Thus texture plays a critical role in defining the masses within the space as well as the space itself.

These two factors were not discovered through use of the theoretical framework. They were discovered by getting a firm grasp of preference on the one hand and on dimensional structure on the other. But they are consistent with the proposed framework, and they extend it in an interesting way. Fineness of texture is a legibility component; the finer the texture, the more clearly the figures are distinguished from ground. It is also an immediately perceived factor. The combination of dealing with the order of the information and the low need for inference, places texture in the same cell in the two by two table (Fig. 1) as coherence. Since coherence was intended to include redundancy factors, it may be that texture is a more explicit, more concrete component of coherence. Indeed, when more components of coherence are identified, the larger and vaguer concept might well be dropped.

Where does spaciousness fit in our previous table? I would argue that spaciousness is rather an inferred than an immediate factor, but it is also clearly a component of legibility. In fact, spaciousness might be defined as the visible availability of options for locomotion, of places to go. This factor would thus take its place in the same cell of the table as identifiability. Indeed it could be considered as identifiability of a more specific kind, of running room, if you will. While it is one of the most fascinating concepts in the prediction of preferences that we have considered, spaciousness is also one of the least explored. At this point, both spaciousness and texture are included in the revised 2 x 2 table based on the tentative findings of a single study.[5]

Source of Information	Degree of Inference Required: Little	Degree of Inference Required: More
Present: Legibility	Coherence Texture	Identifiability Spaciousness
Future: Information Promised	Complexity	Mystery

Figure 2

SOME CIRCUMSTANTIAL EVIDENCE

The empirical basis of this table is undeniably slim. At the same time, there is circumstantial support from other sources. One indication of the reasonableness of these proposed factors comes from viewing them in terms of the information processing requirements that prevailed when our species evolved. Survival under those uncertain and dangerous conditions must have placed a high premium on the skills of recognition and prediction (S. Kaplan, 1972). Recognition, that is, comprehending where one is and what the objects are in one's immediate environment, although vital, is useless without prediction -- the capacity for anticipating what might happen next.[6]

As I indicated previously, an organism must not only be able to handle information; he must <u>like</u> to do so if he is to survive. Thus, humans would be expected to prefer an environment where both recognition and prediction can be achieved without undue effort. In other words, there must be sufficient structure to make sense, to comprehend, to recognize and sufficient uncertainty to make prediction nontrivial. Prediction in an environment where nothing happens does not enhance one's predictive facility. Likewise, predicting in an environment without order is equally futile. But an environment that promises further information is a clear challenge to prediction.

One of the most striking parallels to the proposed set of factors involves what is perhaps the most concerted attempt in human history to comprehend the aesthetic visual experiences characteristic of nature. The Japanese garden is more an imitation of the visual experience of nature, and of the most aesthetic instances at that, than it is an imitation of nature per se. In the literature of the Japanese garden can be found explicit mention of mystery and of means of enhancing spaciousness. The concern for careful control of texture, and particularly for the use of fine textures, is obvious. Coherence is dealt with in terms of grouping elements, of unifying textures, of repeated elements, and in the total banishment of anything potentially distracting. Identifiability is achieved through the use of elements that capture the essence of the objects they stand for. In fact, through the use of highly standardized, highly familiar forms the elements achieve that ultimate identifiability required of the symbolic. Interestingly enough, of all the proposed variables, complexity plays the smallest role. The Japanese garden could in fact be viewed as a challenge to complexity theory; in its planned austerity it represents a vivid example of a low complexity, high preference environment.

ALTERNATIVE APPROACHES: SOME LIMITATIONS

It has been the concern of this paper to provide a somewhat systematic framework in an area that has tended to go to extremes. By and large, the prediction of visual preference has been dominated by the unifactor theories on the one hand, and by lengthy lists of factors on the other. Let me comment on each of these.

The unifactor theory in this area has been primarily the optimal complexity theory (see, for example, Berlyne and Madsen, 1973). It is somewhat of a squeeze to explain all human visual preference on the basis of a single variable, and one might wonder how it has been pulled off as successfully as it has. I think I am beginning to understand how this has been possible.

The bulk of the laboratory work in this area has used nonsense forms of one kind or another. Nonsense forms are characteristically randomly generated. They thus contain no order -- by definition. Given that people are concerned with order, with legibility, one would assume that people would prefer that level of complexity upon which they could most readily impose order. I believe the laboratory research has shown us that an intermediate level of complexity most readily permits the imposition of order. This is by no means a trivial finding. It is also not in any broad sense an adequate theory of preference.

In the real world environment there is a great deal of order. Man builds in at least a somewhat orderly way and nature is profound in its patterns of redundancies. A good designer does not merely attempt to control complexity; he creates order. He uses texture, repeated elements, sequential dependencies, and undoubtedly other vehicles of legibility yet to be discovered. In this context, it is particularly disheartening to see designers looking to psychology for guidance and taking back with them the unifactor approach better suited to computer-generated random forms. Worse yet, they have translated complexity to ambiguity (Rapoport and Kantor, 1967). A further weakness in the discussion of these issues has been the tendency to talk in terms of a bipolar dimension, of unity vs. diversity. Given such a framework one clearly has to search for an optimal level. And given the recent emphasis on complexity, it is clear that legibility must suffer. But we find no evidence that the legibility and "information promised" components are negatively correlated. Rather it is fruitful to search for the ways to enhance each of these domains.

The primary alternative to a unifactor approach, exemplified by numerous textbooks, has been the list. One can think of many terms referring to "good" aspects of design. Granted they may overlap or partially overlap. Granted some may be subcategories of others. If one is in a list-making mood one can simply write them down. Lists, however, present problems, and not only because there is nothing to prevent them from growing indefinitely. They also foster arbitrariness or indecision, depending on one's temperament. The designer, who tends to be relatively decisive, chooses from the list whatever he feels like taking. The longer the list, the more optional it all appears. The scientist working in this area, wishing to avoid arbitrariness, is readily paralyzed because it is by no means obvious where one should begin.

The proposed approach is intended to allow enough richness to characterize the man-environment interface without skimping. On the other hand, it intends to provide the analytic tools to keep the concepts organized, related to each other, and within a systematic framework. They are constrained from growing into optional status. There may be a variety of ways of achieving legibility and a variety of ways of promising added information, but neither can be considered unimportant in a setting where human preferences are at issue. The results obtained to date suggest that the proposed framework is a useful one in pointing to the importance of both aspects of information in comprehending environmental preference. It does not however answer the question of which factors within these categories are salient for a particular type of environment. At the same time, our data indicate that not even complexity reliably participates in the prediction of preference. Further research is clearly called for to find the relationship between the kind of environment and salient dimensions.

SOME IMPLICATIONS

The proposed framework has a number of implications for thinking about preference, both for design and for assessment. Three of these are perhaps particularly salient.

First, it suggests that there is something to be gained by thinking of humans as profoundly concerned with information, as being motivated both to make sense of their world and to learn more about it. Correspondingly, the environment can be viewed as a source of information, both in terms of the two-dimensional configurations that meet the eye and the three-dimensional world that is then inferred.

Second, it encourages the study of and the concern with those factors that lead humans to infer the presence of depth or space. The designer in the Western tradition has tended to focus on the placing of objects in space as opposed to enhancing the experience of space per se. The ordinary (Western) human, however, seems to be quite sensitive to spaciousness in his judgment of preference (whether in spite of or in ignorance of his cultural heritage is not entirely clear). For the designer seriously in search of information on factors that enhance the sense of space, there are a variety of complementary sources. The literature on the Japanese garden is of great value, particularly if it is read in terms of salient cues rather than symbolism. The former appear to suffer far less in translation. The perception chapter of any introductory psychology textbook offers additional material, as do a number of books concerned with graphic art.

Third, there is in all landscape assessment studies the persisting concern for individual differences. Even when high agreement is found among a particular group of participants, there is always the worry that some other group might feel differently. And while in general the level of agreement found has been impressive, there remains the concern that those groups who might not agree are the very groups that have all too often been ignored when planning decisions are made. But perhaps the problem is miscast. Groups with less experience with natural environments, for example, may indeed have different preferences.[7] This would suggest a two-pronged policy. On the one hand it would be important to preserve landscapes appreciated by the less experienced. On the other hand, with increasing experience, these same people might prefer environments very much like those preferred by other experienced individuals, thus underlining the importance of preserving those landscapes appreciated by the more experienced segment of the population.

But the most fruitful approach to this problem would seem to be not one of ascertaining how different such group preferences are, but of identifying what the pattern of variables is that underlies preference for these various groups. It may well be, for example, that the same variables are appropriate for different groups, but that their importance or weighting differs. An initial study of group differences using some of the variables discussed here suggests that this is indeed the case; the difference between groups can be explained in terms of differing emphasis among the same set of variables (R. Kaplan, 1973a).

The designer in search of a guiding framework may find some useful clues in the foregoing discussion. Some mention, however, should be made of the designer who secretly harbors hopes for a Formula. Very briefly, he is unlikely to get it and would be unhappy with it if he did. Those who need to

be convinced that science is unlikely to provide that ultimate Formula are encouraged to read Weaver (1960) and Kuhn (1962). Those who think they would like to have that ultimate formula that eliminates difficult and messy decisions are encouraged to think about what their role would be once such a formula were known.

Fortunately for those who like a bit of uncertainty and challenge in their lives, Science is likely to continue producing generalizations and frameworks while Reality is likely to continue to be complicated and erratic. Thus considerable skill will continue to be required in the application of scientific knowledge. The framework proposed here in no way threatens to replace the designer. It is intended to sharpen his eye, to enhance his intuition, to provide a floor under his efforts. It is intended to multiply talent, not substitute for it.

Notes

[1]This work was supported in part by the Forrest Service, USDA. Portions of this paper were presented as part of a Symposium on Environmental Aesthetics: Outdoor Environment as a Source of Affect, American Psychological Association meeting, Montreal, 1973.

[2]The idea that our perception of the environment is not given or immediate but an achievement has been stressed in the writing of such functionalists as Brunswick (1943) and Ittelson (1962). Hilgard (1950) has a thoughtful paper on this topic. Neisser (1967, 1968) added the notion of construction, that is that our experience of the environment is a synthesis rather than the picture it seems to be. That this appraoch entails internal structures corresponding to objects frequently experienced in the environment has been pointed out by S. Kaplan (1973a), who also argues for the central role of these structures in the organism's cognitive map.

[3]R. Kaplan (1973a:272, 274) discusses the relationship of the "mystery" concept to Cullen's (1961) "here and there" and describes its use in other design contexts.

[4]For an excellent discussion of the role of textural gradients in depth perception, see Gibson (1946).

[5]It is not the case that these variables are unprecedented; parallels in the empirical literature exist, although they are hardly blatant. Thus, for example, spaciousness, texture, and order appear among the many variables considered in a stimulating study by Rabinowitz and Coughlin (1970). Wohlwill, too, has obtained independent evidence for one of these variables. In a recent symposium paper he described the predictive value of "depth", clearly a direct parallel to the spaciousness variable (1973).

[6]This predictive capacity had already been explicitly identified as an essential component of adaptive or intelligent behavior in 1943 by Kenneth J. W. Craik, a brilliant young British psychologist who met an untimely death two years later. Samuel (1959) depended on the same idea (which he called "look-ahead") in the construction of his famous computer checker player.

[7]Such a difference in environmental preference arising out of differences in experience has been reported by R. Kaplan (1973b) in the context of gardening activities.

References

ACKING, C.A. and G.J. SORTE (1973) "How do we verbalize what we see?" Landscape Architecture 64:470-475.

BRUNSWIK, E. (1943) "Organic achievement and environmental probability." Psychological Review 50:255-272.

BERLYNE, D. E. and K. B. MADSEN (eds.) (1973) Pleasure, Reward, Preference. New York: Academic.

CRAIK, K. J. W. (1943) The Nature of Explanation. Cambridge, Great Britain: University Press. (Paperback edition 1967).

CULLEN, G. (1961) Townscape. New York: Reinhold.

FLANNERY, K. V. (1965) "The ecology of early food production in mesopotamia." Science 147:1247-1256.

GIBSON, J. J. (1946) "Perception of distance and space in the open air." Reprinted in D. C. Beardslee and M. Wertheimer (eds.) Readings in Perception. Princeton, N. J.: Van Nostrand. 1958 (pp. 415-431).

HILGARD, E. R. (1950) "The role of learning in perception." pp. 95-120 in R. R. Blake and G. V. Ramsey (eds.) Perception: An Approach to Personality. New York: Ronald.

ITTELSON, W. H. (1962) "Perception and transactional psychology." pp. 660-704 in S. Koch (ed.) Psychology: A Study of a Science, Volume 4. New York: McGraw-Hill.

KAPLAN, R. (1973a) "Predictors of environmental preference: Designers and 'clients'." pp. 265-274 in W. F. E. Preiser (ed.) Environmental Design Research. Stroudsberg, Pa.: Dowden, Hutchinson, Ross.

KAPLAN, R. (1973b) "Some psychological benefits of gardening." Environment and Behavior 5:145-162.

KAPLAN, R. (1972) "The dimensions of the visual environment: Methodological considerations." In W. J. Mitchell (ed.) Environmental Design: Research and Practice. Proceedings of the Environmental Design Research Association Conference Three. Los Angeles.

KAPLAN, S. (1973a) "Cognitive maps in perception and thought." pp. 63-78 in R. M. Downs and D. Stea (eds.) Image and Environment: Cognitive Mapping and Spatial Behavior. Chicago: Aldine.

KAPLAN, S. (1973b) "Cognitive maps, human needs and the designed environment." pp. 275-283 in W. F. E. Preiser (ed.) Environmental Design Research. Stroudsberg, Pa.: Dowden, Hutchinson, Ross.

KAPLAN, S. (1972) "The challenge of environmental psychology: A proposal for a new functionalism." American Psychologist 27:140-143.

KAPLAN, S., R. KAPLAN, and J. S. WENDT (1972) "Rated preference and complexity for natural and urban visual material." Perception and Psychophysics 12:354-356.

KUHN, T. S. (1962) The Structure of Scientific Revolutions. Chicago: University of Chicago Press.

LYNCH, K. (1960) The Image of the City. Cambridge, Mass.: Harvard Press.

MILLER, G. (1956) "The magical number seven, plus or minus two: Some limits on our capacity for processing information." Psychological Review 63: 81-97.

NEISSER, U. (1968) "The processes of vision." Scientific American 219:204-214.

NEISSER, U. (1967) Cognitive Psychology. New York: Appleton-Century-Crofts.

PETERS, R. (1973) "Cognitive maps in wolves and men." In W. F. E. Preiser (ed.) Environmental Design Research, Volume 2. Stroudsberg, Pa.: Dowden, Hutchinson, Ross.

PFEIFFER, J. E. (1969) The Emergence of Man. New York: Harper.

RABINOWITZ, C. B. and R. E. COUGHLIN (1970) "Analysis of landscape characteristics relevant to preference." Philadelphia: Regional Science Research Institute Paper No. 38.

RAPOPORT, A. and R. E. KANTOR (1967) "Complexity and ambiguity in environmental design." Journal of the American Institute of Planners, 33:210-221.

SAMUEL, A. L. (1959) "Some studies in machine learning using the game of checkers." IBM Journal of Research and Development 3:211-229.

WEAVER, W. (1960) "The disparagement of statistical evidence." Science 132: 1859.

WOHLWILL, J. F. (1973) "Factors in the differential response to the natural and the man-made environments." Paper presented at the Symposium on Affective Response to the Outdoor Environment held at the American Psychological Association Meeting, Montreal.

ZAJONC, R. B. (1968) "Attitudinal effects of mere exposure." Journal of Personality and Social Psychology Monograph Supplement 9:No. 2.

Source of Information	Degree of Inference Required	
	Little	More
Present: Legibility	Coherence	Identifiability
Future: Information Promised	Complexity	Mystery

Figure 1

Source of Information	Degree of Inference Required	
	Little	More
Present: Legibility	Coherence Texture	Identifiability Spaciousness
Future: Information Promised	Complexity	Mystery

Figure 2