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COGNITIVE MAPS, HUMAN NEEDS AND THE DESIGNED ENVIRONMENT

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Abstract

An integrative framework is proposed which deals with those human needs underlying environmental preference through an extension of cognitive map theory. It is argued on evolutionary grounds that the basic human information processes which the cognitive map makes possible -- recognition, prediction, evaluation, and action -- must be human needs as well as human capacities. The environment which would support such needs is one that meets three essential requirements: It is (1) possible to make sense of, (2) novel, challenging, uncertain, and (3) permitting of choice. Both variety and coherence are shown to be essential for each of these requirements.

Designers look to behavioral scientists not only for information about how people experience the physical environment, but also about the sorts of human needs that the physical environment must satisfy. They would like an integrated conception of these issues to guide them in their decisions. The design professions are under frequent fire for the intuitive, rule-of-thumb, and sometimes even dehumanizing solutions they have offered. But at the same time, as has been stated repeatedly, that needed integrated framework is lacking. The practitioner thus has little choice then to act as he does, to draw conclusions from scattered empirical results, and to proceed with the faith that his intuitive expertise is better than nothing.

In the area of environmental perception and cognition, the cognitive map theory has been proposed as a model of how people experience and know the environment. The purpose of this paper is to extend the concept of cognitive maps to the area of environmental preference. In other words, the argument will be presented that the same informational processes that the cognitive map makes possible exist as essential human needs that require environmental support. The paper thus lays a groundwork for a theory of those human needs that are particularly pertinent to the designed environment, that is, those needs involved with the taking in and processing of environmental information.

Cognitive maps: Basic processes as human needs

The cognitive map is a construct that has been proposed to explain how individuals know their environment. It assumes that people store information about their environment in simplified form and in relation to other information they already have. It further assumes that this information is coded in a structure which people carry

around in their heads, and that this structure corresponds, at least to a reasonable degree, to the environment it represents (cf. Tolman, 1948; Lee, 1969; Downs & Stea, 1972). It is as if an individual carried around a map or model of the environment in his head. The map is far from a cartographer's map, however. It is schematic, sketchy, incomplete, distorted, and otherwise simplified and idiosyncratic. It is, after all, a product of experience, not of precise measurement.

There remains the question of the sorts of information that would necessarily be contained in a cognitive map, the basic information processing categories that comprise knowledge of the environment. Kaplan (1972a, b, c) has described four domains of knowledge that must be included in one's mental map: Recognition (knowing where you are, being able to identify the common objects of your environment); Prediction (knowing what might happen next, being familiar with what leads to what); Evaluation (knowing whether these next things are good or bad, being able to anticipate whether alternative actions have favorable or unfavorable probable outcomes); and Action (knowing what to do, being able to think of effective alternatives). Through these processes man structures his uncertain environment and makes it livable.

The extension of the cognitive map position to environmental preference involves the assertion that these basic information processing domains also represent powerful biases or, in other words, human needs. Viewed as human needs these four domains can be described as follows:

Recognition: This includes the bias towards making sense out of the perceived environment, and the bias towards interpreting new events in familiar terms. There is thus a bias towards simplification built in here.

Prediction: The enjoyment involved in guessing about possible outcomes in uncertain circumstances. The interest in extending one's knowledge of what leads to what.

Evaluation: The delight in dividing up the world into good guys and bad guys. The discomfort generated by ambivalence.

Action: The exercise of skill, to act in such a way as to have predictable results. The concern to make a difference. The possibility of exercising choice from among alternatives, of being decisive. The knowledge that the environment is responsive, at least to a degree, to actions one could take.

Thus the human animal not only performs these categories of processes with speed, facility, and decisiveness; at the same time, he cares and cares deeply about each of them. These biases play dual roles: they insure the extensive practice necessary for the skillful performance of these processes. In addition, as is argued in the next section, they insure that the individual will have extensive and reasonably systematic commerce with his environment.

Space, time, and uncertainty

It seems not unreasonable to look to the environment for the satisfaction of human process needs, since it was the environment that, in the first place, made these needs necessary. The evolutionary environment may have been different in many respects from the contemporary one, but it is that one that shaped man's genetic structure, and thus, to a substantial extent, his current needs. And in terms of the basic issues of space, time, and uncertainty the contemporary environment is by no means totally dissimilar. An analysis of that primal environment is thus an essential first step in understanding contemporary man-environment relationships.

Humans, like other animals, operate in a spatial world. This world is large relative to the size of the individual and the scope of his sensory capacity. Thus at any point in time he can only know what is going on in a small portion of this environment. At the same time, environments beyond his sensory capacity and the events occurring there are of potentially great interest to him. To behave only in the here and now, as if the more distant environment did not exist, would be folly indeed. Granted this is a luxury some animals can enjoy. They found their niche relatively early in the evolutionary sequence. They can sit on their favorite leaf and munch on it and give no thought to environments distant in time and space. But man was a late arrival in the evolutionary scheme of things; his niche is neither singular nor well defined. He lives on leftovers; he is either an opportunist or a failure. His niche is composed of the scraps and odd corners not worked by other species, or not at the moment, at any rate. Thus man evolved as a far-ranging organism, able to relate (and thus take advantage of) environments dispersed in space and thus never experienced all at one time. To behave effectively with respect to extended space, especially when different places are interesting at different times, for different reasons, and never for sure, requires an organized approach. To visit all spaces every day would be impossible, and even to visit a random sample every day would be highly inefficient. Rather it would be necessary to have an overall conception of the layout of the spatial environment, and of the distribution of the assets and the dangers. The capacity to read the signs or indicators of assets and dangers would increase efficiency still further.

It thus appears that a well structured memory, a cognitive map of the spatial environment, would be essential for survival under circumstances of this kind. A cognitive map is, however, an outcome of experience, and there is no assurance that random or unmotivated experience would lead to a cognitive map that is either extensive or well structured. The occasional allegation that "you can't get there from here" would be common indeed if people always travelled the easy paths and the direct routes. A cognitive map is only an approximation to continuity. With suitable effort it can be a rather good approximation. Without such effort it is likely to be highly incomplete, full of intransitivities and dead ends. Such a map is unsuitable when one is on the chase, or, for that matter, being chased.

If the quality of cognitive map were related to the probability of survival, then those who survived would have been those who loved to explore, who craved to know, whose restlessness and eagerness for new sights constantly led them to map-extending experiences. There are, granted, limits to the adaptiveness of exploration. If

man depended on knowledge for survival then being too far from well-known terrain could put him at a distinct disadvantage. Thus he would ideally station himself along the shifting fringe between the known and the unknown. As what was once fringe became known, the fringe would shift, carrying with it our knowledge-crazed organism. From this perspective one would expect humans to be both curious and fearful of the strange at the same time -- a condition Hebb (1966) referred to as "man's ambivalent nature."

The data on curiosity in both man and other animals are now extensive, and the concept is widely accepted. It is not, however, a particularly well-formed or discriminating concept. Man is not randomly curious as much as curious with respect to what he already knows something about, and with respect to what he might need to know something about. He is not only curious in the sense of enjoying to see new things (given, of course, that they are not too new); he also likes to see how things connect and what leads to what and what predicts what in a time sequence. He likes to know what is good and bad, what he likes and does not like. He likes to learn how to do things and to learn about how other people did things whether he would ever be faced with the circumstances they faced or not. In brief, man is a motivated, dedicated, addicted, if you will, builder of cognitive maps.

This then is a rather rough outline of a theory of human informational needs. It can perhaps be summarized most effectively in terms of the sources of pleasure in people's lives. Although eagerly sought, primary pleasures are of limited pertinence to the designer since only a small part of the designed environment is directly concerned with such joys as food, beverage, and sex. Besides, these are often only of limited duration. Most of the time, people are dependent on process rather than content for maintaining a reasonable level of pleasure -- or at least, absence of pain. The process that feels good is the process that is most adaptive from an evolutionary point of view, that is, going along making sense out of things, anticipating, acting appropriately, and exploring new things. These activities have in common a focus on knowledge, on the acquisition, maintainence, and use of an individual's cognitive map of the environment. The central argument of this paper is that an environment that enhances the cognitive-map related processes will be an environment most suitable to the human condition.

Coherence, variety, and choice

We come, then, to the issue of the properties of the environment that would allow the expression of these basic informational needs: an environment that we might characterize, following White (1959), as competence-supporting. Based on the previous discussion, three requirements for such an environment seem particularly vital. Two of these are so closely related to each other that they may even seem contradictory. In order to show their relationship and resolve the apparent contradiction, they are discussed as a pair. The third requirement, concerning choice, is then presented as a logical outcome of the circumstances satisfying the first two requirements.

1. It must be an environment one can make sense of. Making sense, finding order, uncovering rules and relationships are after all the very essence of environmental knowledge, of the cognitive map by which an individual relates himself to his world.

2. It must offer novelty, challenge, and uncertainty. As the unknown becomes known, the frontier tamed, the individual is driven to new ground to practice his powerful processes. There must always be new domains to be comprehended, new problems to be solved, new insights to be won.

It might at first appear on intuitive grounds that these two categories stand in direct conflict with each other. After all, is not what is sensible also dull? And does not uncertainty stand in the way of order, of sense? These are indeed widely held feelings and it is important to examine them with some care. In fact, the argument fails to stand up to a thorough analysis, and has been disputed empirically as well.

It is not the case that the environment that one can most readily make sense of is an environment that is neat, linear, and sterile. Granted that a housing development composed of row on row of identical white houses facilitates prediction in a limited fashion. Given any particular white house one can usually predict what will come next. But such an environment does not support the development of a cognitive map. To begin with, it is exceptionally difficult to ascertain where one is. If one cannot enter one's map, it is exceedingly difficult to use or develop it. Further, such an environment does not provide material for the identification of essential components of a cognitive map, the landmarks, differentiated regions, and the like that Lynch (1960) has shown to be vital to legibility. On the contrary, an environment that fulfills the requirements of an information-processing, cognitive-map developing person, far from being dull and overly tidy, must be rich and varied.

In addition to variety, the construction and use of cognitive maps is dependent on that complex of factors that go under the heading of legibility. Of particular interest in the present discussion is coherence, that factor which deals with the way a setting "hangs together." In other words, there must be a degree of pattern, of order, running through the variety. The arrangement of the components is not random, but follows some set of rules. Coherence both facilitates recognition and makes prediction possible. Consider, for example, an architectural style. Any given style is not distinguished from all others by a single feature but by a variety of different aspects. It is thus possible to recognize a style in many alternate ways. Likewise, a region of a city may be defined by certain styles. The variety from place to place defines a region, the coherence makes it more readily recognized.

Coherence can be achieved in a number of different ways. Besides the use of multiple features to aid differentiation, there is the repetition of a given element, allowing an individual viewing part of a scene to predict at least a portion of the content of the remaining area. A third aspect of coherence is the structural basis underlying the arrangement of elements. This permits prediction not through repetition but through the expression of some underlying rule. Some rules, like the layout patterns of different cities studied by Appleyard (1970), are strong on imagery,

thus making them easier to use and to remember. (Appleyard's research also shows how idiosyncratic this rule system can be, demonstrating how many viable solutions are available in comprehending a rich and varied environment.)

Thus the possibility of making sense out of an environment does not depend on extreme simplicity, but on coherence and variety. When we turn to the second proposed category of factors defining a competence - supporting environment, the necessity of offering novelty, challenge, and uncertainty, we find the rules are quite similar. Here too both coherence and variety are necessary for the requirement to be met. Coherence makes possible the definition of a region as being "somewhere else," as having a distinctive character from every other region. This means there exist different, and thus novel, patterns and relationships to explore when we have mastered the region at home. If the variety were random instead of coherent, it would defeat human competence-striving on two counts. First, the environment would be homogenized. One's home area would be as likely to have one of everything as anywhere else and thus there would be no point in going anywhere else in search of novelty or challenge. The other flaw in such an arrangement would be the ultimate lack of order, the absence of any underlying rule system. The joy of exploration, after all, comes from the gradual discovery and comprehension of order, from the growth of competence in the new setting. To lack a discoverable order is to insure eventual frustration and disappointment. Such an environment does not support effective human action, and thus could hardly be expected to enhance human satisfaction.

In other words, the kind of uncertainty most favored by humans is temporary. Uncertainty, as far as humans are concerned, exists to be resolved, and challenge, to be overcome. Thus this requirement of the humane environment depends on order and rules every bit as much as the first one does. There must, of course, be different rules and different arrangements in different places.

It is important to realize that these two basic requirements for environmental preference are not intended to be unitary dimensions. There may in fact be a number of different dimensions that contribute to the extent one can make sense out of a given environment. Likewise, the category of factors contributing to novelty, challenge and uncertainty is almost certain to be multidimensional. Thus this theoretical perspective constitutes less a solution than a direction, a framework for further analysis and further research.

A beginning in this direction has been made by Kaplan and Wendt (1972) in their study of preference for slides of outdoor environments. Their tentative framework, developed essentially on empirical grounds, includes two proposed dimensions for each of these categories. Their legibility category includes both coherence and identifiability, the extent to which a scene can be readily recognized for what it is. The variety or diversity category they called "information promised" to indicate that people's preference for uncertainty is a function of the possibility of learning something new, of extending the cognitive map. The two dimensions they included in this category were the familiar one of complexity and the unfamiliar one of mystery. By the latter they meant a setting that suggests that more information would be available if the observer were to take up a vantage point farther into the scene. The bend-in-the-road, the partially obscured field, and the other side of

the mountain are familiar examples of this dimension. In a subsequent study, R. Kaplan (1973) tested a portion of this dimensional scheme by asking subjects to rate "coherence" and "mystery" as well as preference. Although there were wide differences between groups of subjects as far as the influence of these two dimensions on preference was concerned, the composite prediction taking them both together was very substantial for all groups.

We turn finally to the last requirement of the competence-supporting environment:

3. It must permit choice. The bias to act, to be decisive, to make choices is a profound one. So profound, as a matter of fact, that people prefer an alternative they have chosen themselves to one chosen for them, even when the latter would otherwise be most preferred. People wish to be "origins," not "pawns" (deCharms, 1968). The possibility of choice is of course necessary on the practical grounds that different people prefer different levels of sense and of novelty at different times. But in addition to that, there is the powerful bias on the part of humans to make their own choices, a bias that is all too easy to ignore when doing "good" on the behalf of needy others.

The requirement of choice does not impose a further burden on the designer, since the foregoing analysis necessarily provides room for choice. The designer is not called on to make every neighborhood novel and challenging. People do not require a disneyland outside their doorstep. They desire that novelty be available, not inescapable. Thus the existence of differentiated patterns and differentiated regions meets all three environmental requirements. It allows for a sensible environment, the option of novelty, and the opportunity to choose.

Conclusion

It turns out, then, that the complex organism we are dealing with will not be satisfied with simple solutions for his designed environment. Lynch is certainly right that humans prefer clarity and coherence. Rapaport and Kantor (1967), Wohlwill (1970), Craik (1970), and others are also correct in their assertion that humans prefer some complexity in their environment. To the extent, however, that Rapaport and Kantor extend the complexity concept to include ambiguity, and advocate ambiguity in opposition to legibility, they diverge sharply from the position proposed here. The complexity emphasis that has so heavily influenced work in this area, may in the final analysis turn out to be a half-truth, albeit an attractive one. Complexity may be organized or it may be gibberish. The organization and the distribution of the elements are at least as important as their number. Design in terms of complexity alone could readily become a computer-generated or random number table-based activity. The requirement of order, of coherence as well as variety, the requirement that the result ultimately be comprehensible by humans, makes design necessarily not only a human but an artistic activity as well.

As we consider these informational needs it becomes increasingly obvious that curiosity is not a hobby, that such design dimensions as variety and coherence are not decorations. The designer must unavoidably deal with factors that touch deep and

ancient human concerns. His role, in terms of this framework, is neither to dazzle nor to create ambiguity, but to respect these concerns through designs that develop and enhance a sense of place.

It is hard to escape the conclusions that variety can only be appreciated in the context of order and that order is lifeless and useless without such variety. These considerations apply to an internal model of the environment, to a cognitive structure of how the world works, in very much the same way as they apply to the environment itself. Given the difficult task he faces, the designer in particular needs a map of the domain he is struggling with, a model of the processes with which he must contend. It is hoped that the theoretical approach presented here will help him build such a model for himself.

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Note

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