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WAY-FINDING IN THE NATURAL ENVIRONMENT[1]

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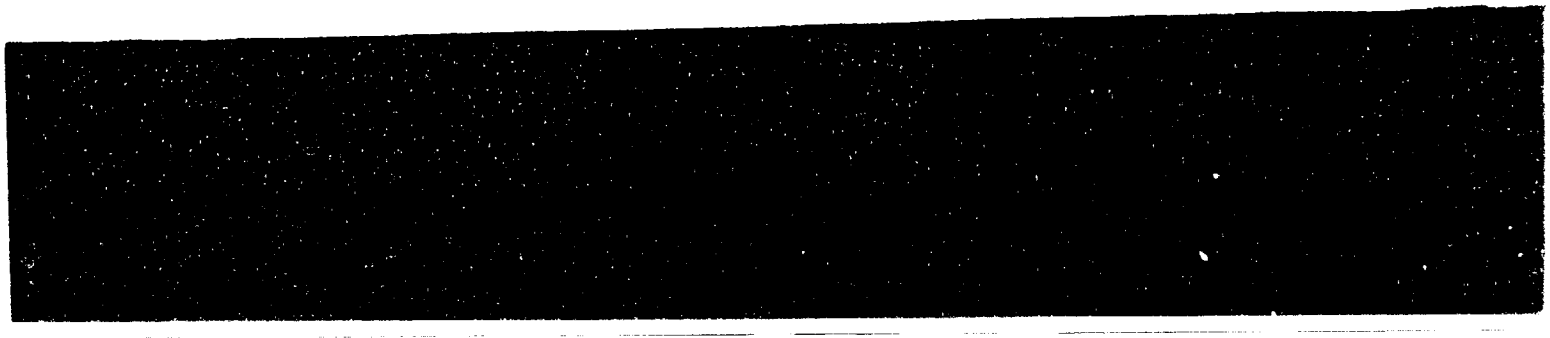
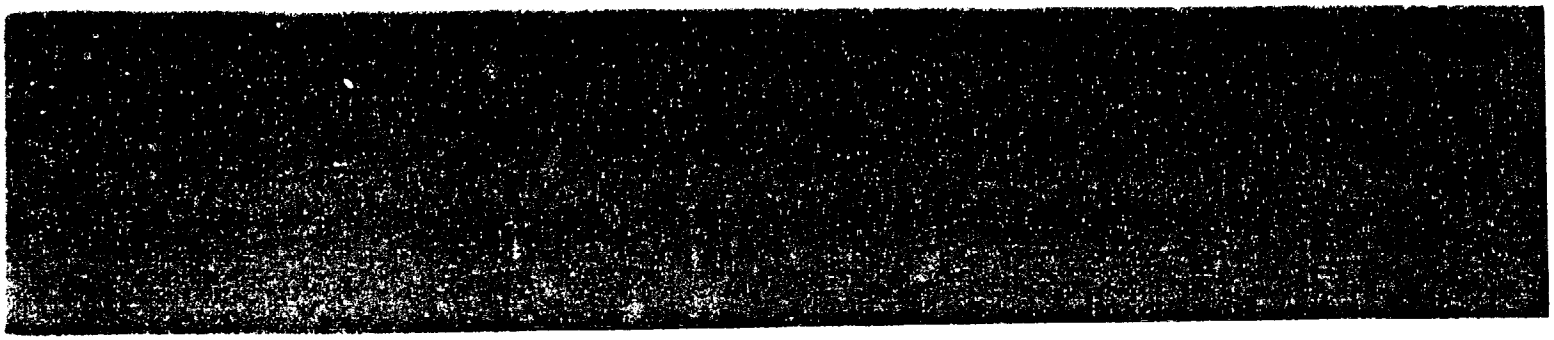
You may have heard it said that moss grows on the north side of trees; you may also know that that is not always true. And sometimes there is no moss at all.

People who have had extensive exposure to natural environments have gained generic information about such settings that enhances their love for and comfort with the woods, streams, and meadows. Familiarity with a variety of such settings leads to a sense of mastery. Having a feeling for different patterns of trail and undergrowth provides information that enables one to predict what other places will be like. For people thoroughly comfortable in such settings, it is often difficult to comprehend the lack of pleasure and even fear that the uninitiated feel in the same setting. Camp counselors, nature guides, and others in a position to introduce nature to the novice are frequently confronted with these fears, sometimes expressed verbally ("Are there bears?" "Where are the snakes?") and sometimes expressed by the hesitation of feet afraid to explore.

The "fear not, there are no snakes here" approach is often no more credible than other "fear not, I am here to help you" approaches. To the person coming to the Big City for the first time, that environment can be as bewildering as are woods and wide open spaces to the veteran of urban life. The fear of getting lost is profound. The same cognitive structures that we depend on for making our way through the environment permit the anticipation of future environments (S. Kaplan, 1973b). If such a lookahead is not well ordered, the effect is one of pain and discomfort. The effect is now; the anticipated event has not even begun to happen. This is quite adaptive. One need not even *be* lost; the mere anticipation of the possibility is potentially discomforting.

The purposes of the research project discussed here were to understand better the nature of the information that leads to comfort in the natural setting and to provide the novice with some of the information that will enhance his confidence—before he finds himself in that setting. We attempted to develop transition experiences that would reduce the novice's uninformed status and to provide these in a setting where the discomfort is not at issue. Such of course is the purpose of most education—developing knowledge toward future needs, techniques for dealing with new situations, ways to anticipate demands, and confidence in oneself as a consequence of prior successful problem solving. All these issues, of course, depend ultimately on the adequacy of the individual's internal





model of the environment, and it, in turn, must depend on experience.

From the perspective of the informational approach to cognitive mapping presented in Chapter 2, such transition experiences have to meet certain criteria. The "future" environment has to be presented in a way that facilitates envisioning it. One could verbally describe such a setting (e.g., hilly, lots of trees), but we felt that an approach that permits a grasp of the spatial aspects in one sweep, as it were, would be preferable. To the extent that the mental map one forms of an environment includes such spatial components, it is important to provide these components so that such a map can take shape. This suggests the presentation of a miniature, a simulation, that permits an overview of an area. By its very nature, a miniature must entail abstraction. It requires reduction in detail. On the other hand, such abstraction need not be at the expense of object constancy. A house must still be recognized as a house, despite loss of detail. There must also be some way to assure sufficient contact with the "future" environment so that a mental map can be developed. Such contact will be more successful if it has fascination or appeal, and this will be related to considering what the person feels he wants to know or needs to know about that environment.

Although these requirements are straightforward, their execution is illusive. In the process of carrying out a series of studies, we have grown increasingly aware of how uncharted this area is. In fact, we have not yet found a way to represent a "future" environment that fully meets our criteria. But that is not to say that progress has not been made. Quite to the contrary, this paper will describe our experiences with respect to different kinds of transition experiences, ways of presenting an as yet unknown environment, and assessments of the effectiveness of the procedures. Four studies will be described in the next few pages; subsequently, the discussion will return to the more general issues of effective transition experiences for natural environments.

Study I: Exploratory Study of Cognitive Mapping

The aim of the initial study was to determine the kinds of maps people will draw of a natural area after a brief hike. The salient features of the environment would presumably be determinable from these maps. To maximize comparability, the participants were taken over a predetermined route (in groups of two or three) in a relatively short time (about half an hour). The route covered a great variety of terrains and features, including a river, a pine grove, a large meadow, and steep hills. The setting was the arboretum, 138 acres of university-owned parkland in the middle of Ann Arbor, Michigan. Each of 32 college students (ages ranged from 18 to 45) who went on these summer outings produced a freely drawn sketch map representing the hike. Despite the fact that all went on the same route, these maps showed vast differences. They could, nonetheless, be grouped into three basic kinds: (1) two were pictorial, showing key features in elevation and obscuring geographical relationships; (2) the majority were linear, showing major landmarks and features strung out in sequence with a line representing the path connecting them; and (3) 12 were regional, showing areas defined by types of flora and topographic variation. It was generally true that the areas with fewest landmarks (e.g., a large meadow) were represented as disproportionately shorter than areas with more salient features. The maps made one vividly aware that they provided an indication of only a fraction of what must be in the person's mind about the hike.

Study II: Use of a Board Game as Prior Experience

Having some knowledge of the salient features of this particular natural setting, we approached the task of representing it visually to people who did not know it. A picture map was prepared to show particular features of the area and to provide a general orientation to the various regions and terrains. By applying an acetate overlay with a grid pattern to this map, we created a board game. The object of the game was to gain points, which could be won both by reaching each of three specific destinations and by landing on certain "surprise" squares. Information about the areas was transmitted by extensive encounter with the map, by attempting to reach certain destinations, by communicating terrain variations through different grid sizes, and through the sur-

prise squares, which were coupled with decks of cards depicting plants and animals likely to be found at those locations.

The participants in this study were junior high school students (ages between 12 and 15) who volunteered to come for a trip to a "wooded area." This is not irrelevant; it seems very likely that those who signed up were more likely to be comfortable in such settings. Certainly the ones who passed the sign-up desk in the schools' hallways with exclamations of "Me? The Woods?" were not among the volunteers. These participants, meeting in groups of two to eight, were randomly assigned to one of three conditions. A control group ($n=14$) explored a large section of the arboretum for a 30-minute period. A map group ($n=23$) studied the picture map for a few minutes just prior to setting out on their exploration. A game group ($n=24$) explored the same part of the arboretum, but they had met to play the board game the previous day.

At the end of their half-hour exploration, the participants returned and completed both a freely drawn sketch map and some open-ended questions. Briefly, the results did not show consistent differences between the three groups. The overall satisfaction with the experience was extremely high and, with only one exception, the students were unanimous in their willingness to do it again. Many of the areas in the arboretum were explored equally often by the different groups. There was no clear indication that the prior experience, either the game or seeing the map, had any effect on the unstructured sketch maps.

There were indications, however, that the game group's transition experience affected their behavior in the field. The boys especially explored more extensively.[2] They did not cover much more total distance on their outings, but they penetrated a greater range of areas. Whereas most of the participants chose the same initial direction for their hike, the boys in the game group showed great diversity in this respect. They showed an equal likelihood of starting in the direction opposite the one that seemed most natural (toward the big meadow). This suggests that the game experience had some bearing on their knowledge of the environment and permitted a greater degree of choice in their exploration.

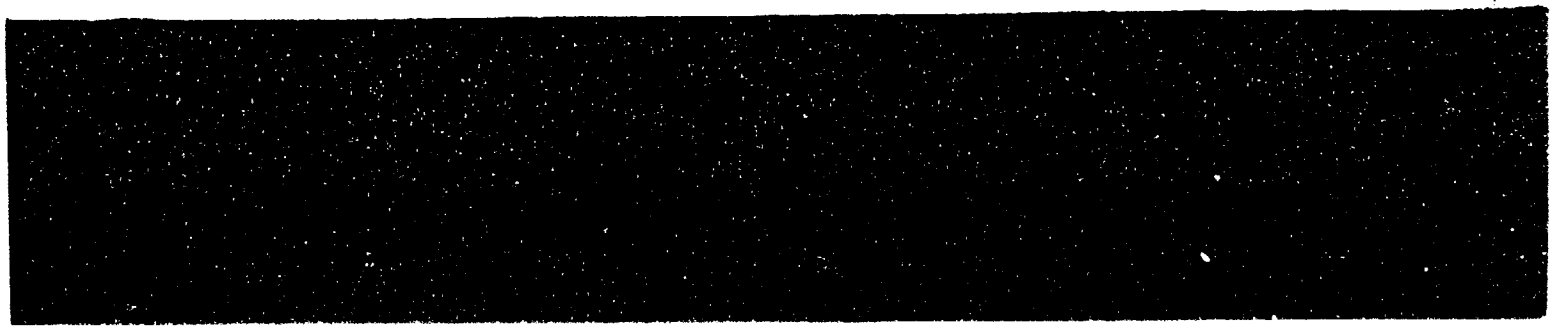
Several reasons precluded more clear-cut results. Although the arboretum is in fact an excellent setting in terms of the variety of regions and interfaces it offers and in terms of mystery and surprise, because surprisingly few people are acquainted with it despite its convenient location, it turns out to be a setting that requires no prior information. The large focal open field edged by wooded regions is immediately inviting and has a drawing power. This is the direction almost all the students chose to start their hikes. Not only is the arboretum unthreatening as a setting, the participants were self-selected; as a group they were clearly comfortable in the natural environment. The game itself and the map rendition presented problems that needed to be corrected in the next study.

Study III: Different Games as Prior Experience and a New Location[3]

The problem of having volunteer participants was solved by working through the school system where we had access to seventh graders in four separate classes in a "school within a school" ($n=85$). For each class we were permitted two class sessions one week apart, as well as school time for the field trips.

Procedure: maps. For two of the four classes, the games were based on maps of the arboretum; for the other two classes, the games were based on maps of a different park to which *all* the groups would later go. Both maps were drawn by a landscape architect who converted contour lines to cloud-like patterns resembling lacework. Unfortunately, the feeling of different heights, different vegetation, and variation in density were not communicated. Although we knew we had the wrong maps when we did the study, the timetable imposed by weather, the school year, and the commitment to the school system meant we had to use what we had. (Figure 1 shows the map for the park where the students went on the field trip.)

Games. Class periods were used for presenting the "map" material; two different game formats were used. Except for the use of the two different maps, each of the four classes followed the same procedure. A Kim-game format was used the acquaint the students with the form of the map: after 1 minute of concentration on the map, a number of orienting questions were asked (e.g., "did you see any water?"). Subsequent discussion included mention of some of



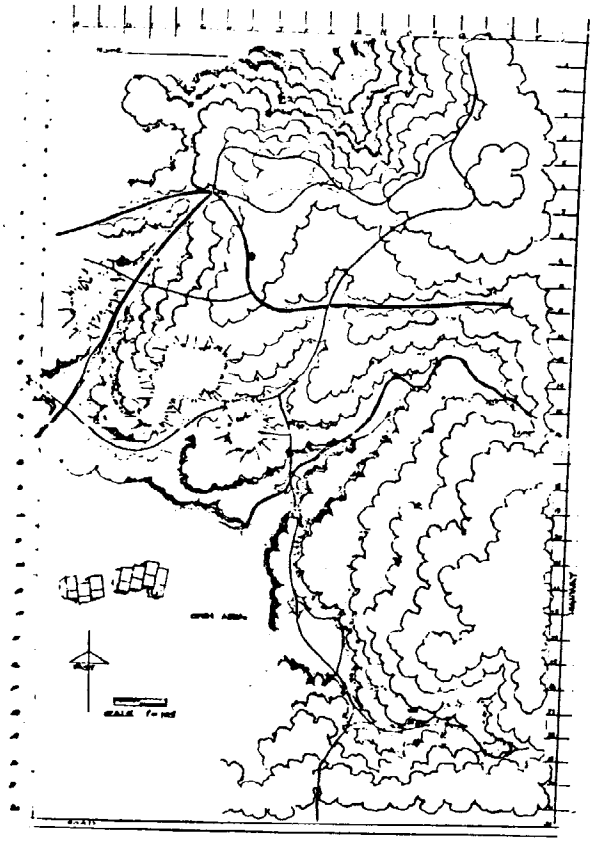


FIGURE 1
"Lacework" rendition of Ann Arbor Arboretum park contour map.

the main features of the map (elevation, boundaries, paths). This was done fairly rapidly and included the whole class (about 20 to 25 students).

A "Battleship" game format was used to transmit information about the path structure of the area. For this the students worked in pairs, each having an identical picture map except that the paths shown on the two maps were complementary. Each partner had to guess the location of the paths missing from his map. At the end of about 30 minutes, the partners would compare maps.

In the second classroom session, the aim was to transfer knowledge about the topography of the area. For this a "20-Question" game format was used with the students again working in pairs, each member having his own map. One member of the pair would "hide" at a particular location on the map and the other would have to determine where his partner was by using the supplied question cards. (See Table 1 for sample questions.)

Setting and field trips. The setting for the field trips this time was a 116-acre park at the edge of the city that has been left relatively wild save for some paths and the encroachment of a housing development at one boundary. It was picked because it is a more difficult natural area in terms of orientation, for getting a feel for the entire place—it is less "legible" in Lynch's (1960) terms. There are more hills and they are steeper. The woods are relatively dense. There are few places from which one can see a vista. In addition, the entrance point is particularly low in drawing power. It is blocked to discourage motorcycles and permits no immediate feeling for what is beyond.

The students were taken in groups of eight in a 12-passenger van to the starting point of the field trip. At the entrance they were given a brief orientation to the park by use of the same base map of the area that had been used for that setting previously. At that point, the groups who had seen this map previously were told that this was in fact the same place; the other groups were told that this area was different than the one they had seen in the map games. They were told they would have to report back to the starting point in 30 minutes; whistles were blown and the van's horn honked to signal them in. The field trips took place in early May (between 7 and 15 days after the second game session), when the trees were just starting to leaf out, and were all in the early morning, even when it was cold and drizzly.

Upon returning from their exploration of the park, the students were asked to draw a map of the park as well as to indicate some particular features on a map that was provided, and to answer a series of questions dealing with how they liked the experience, how confident they felt, and so on.

Results. Although the games were intended to be of some generic value, it was expected that the information gained from playing a game based on the actual area to be visited would be more useful. By and large, the results were opposite to our expecta-

TABLE 1
Examples of "20-Question" Items

Is it flat where you are standing?
Are the trees close to the path where you are standing?
Are you standing on a path?
Can you see a long way down the path from where you are standing?
Are you standing near the beginning of three short paths?
When you look directly up, can you see lots of open sky?
Are you standing east of the stream?
Are you near a 90° curve in the path?
When you look directly up, do you see lots of pine trees?
Does the land near you dip suddenly?

tion. The students who played games based on the *different* setting tended to feel more confident about their knowledge after the field trip than did the students whose games and outing were based on the *same* location (t = 2.40, df = 83, $p<.02$, especially true for the boys). The latter group expressed more discrepancy between their expectation and what they found; for the other group there was no basis for such discrepancies. By scoring the structured maps for how far each student ventured on his trip, one has an indication of the willingness to explore. Those whose games were based on the different park scored higher on "adventuresome" than did the other group (t=2.00, df=83, $p<.05$). Not surprisingly, the students whose games were based on the same park as the field trip were more accurate in indicating the location of such features as pine trees and hills on their structured maps (t = 2.52, df = 83, $p<.02$).

Discussion. The outcome of this study, although not in the intended direction, permits several conclusions vital to any project of this kind. First, there is clear evidence that prior experience did make a difference. The results leave no doubt that there was a relationship between the transition experience in the classroom and the reactions to the outing in a natural setting. Second, the results make clear that prior cognitive structuring for an unfamiliar outdoor setting must be done well or not at all. This research was premised on presenting information in a way that was readily imageable and easy to understand at first glance. Due to several unfortunate coincidences, it was necessary to go ahead with material the research staff agreed did not fill this criterion. Participants with information they knew to be irrelevant to the park at hand appeared to have no difficulty ignoring it. By contrast, material that is relevant but misleading has a clearly damaging effect. It is now clear that the resulting cognitive incongruity and confusion can actually detract from an experience in a natural area.

Study IV: Contour Maps and Aerial Photographs

Procedure. The last in this series of studies had many similarities with the one preceding it. We returned to the same junior high school and four new seventh grades classes (n=106). It was October; fall colors were evident, but the leaves were mostly still on the trees. The Kim-game format was again used for orientation; "Battleships" and "20-Questions" were again used, with minimal changes. The field-trip procedure remained largely unchanged. The weather was again unpredictable (ranging from 35° F and dry to 50° F and very muddy in a matter of two days). The questionnaire completed after drawing the maps was improved, based on the results from the spring study.

Once again the park was not identified during the game sessions, but this time all the students had maps of the park where the field trips would take place. The major difference between this study and the preceding one was in the base maps used for the games. Two of the classes had contour maps; while the other two classes had oblique photo-based maps.

The contour maps, identifying elevation differences of 10 feet, showed that the park varied from about 890 to 960 feet. By using halftones, the path system and stream bed were shown against the contour lines.

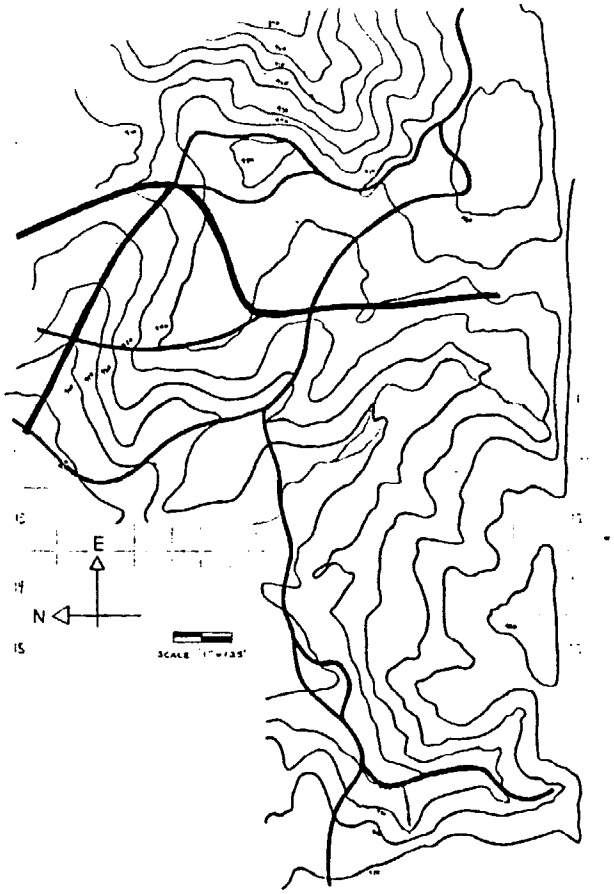


FIGURE 2
Contour map of the arboretum.

the grid system, needed for playing both games, was designated with light gray lines (see Figure 2). Contour maps are highly abstract and not immediately graspable. Before playing the first game, the students using these maps for their games were instructed in "reading" such maps. To play "20-Questions," they had to understand the topography and path system, and so the contour maps were discussed further at the start of the second game session. At this time, a few additional features of the park (e.g., where the pine trees and open field are) were also introduced.

Contour maps and many other maps are based on information "available" from directly above the depicted region, a vew that is rarely encountered. A view that would seem to enhance the immediate grasp of an area approximates the view from the window of a low-flying airplane; it is at an oblique angle to the region viewed and at a height that permits a single glance of the region. It was precisely such pictures that we tried to obtain for the photo-based maps. They were taken from the cockpit of a low-flying plane, at an oblique angle, and tried to include the entire park. In fact, given the height the plane had to fly, the pictures included much more than the park, which comprised only a small portion of the photograph, showing little other than the open field and the dense tree cover (although taken in early spring before the trees were leafed out). I think only a bird can actually meet all our height-and-angle criteria! In any event, we "doctored" one of these photographs to show the path system and stream bed, superimposed the grid system, and used it as the "game board" for two of the classes (see Figure 3). Once again, the students were instructed in "reading" the information and in understanding the oblique view. To play "20-Questions," they had to be told about the topography since this is not evident from the "map," but the pine trees and open field were, of course, self-evident.[4]

Results: Group differences. In terms of attitude toward the outing, the students who had played games with the photomap were significantly more positive than those who had used the contour maps ($t=2.85$, df$=104$, $p<.005$). This measure entailed a combination of two items, "How did you like going to the park?" and "How much would you like to take another trip like this one, but to another park?", with the mean rating for both map conditions falling between 4 and 5 on a 5-point scale. A third item, "Do you think you might come back to this park?", although uncorrelated with the other two items for the sample as a whole, showed the same pattern: the photomap students indicated a more positive outlook ($p<.01$); the means on this item were closer to the neutral point.

On the other hand, the answers to questions dealing with confidence with respect to way-finding were in the opposite direction: the students who had played games based on contour maps expressed a higher degree of confidence (means 3.0 and 2.7 on a 4-point

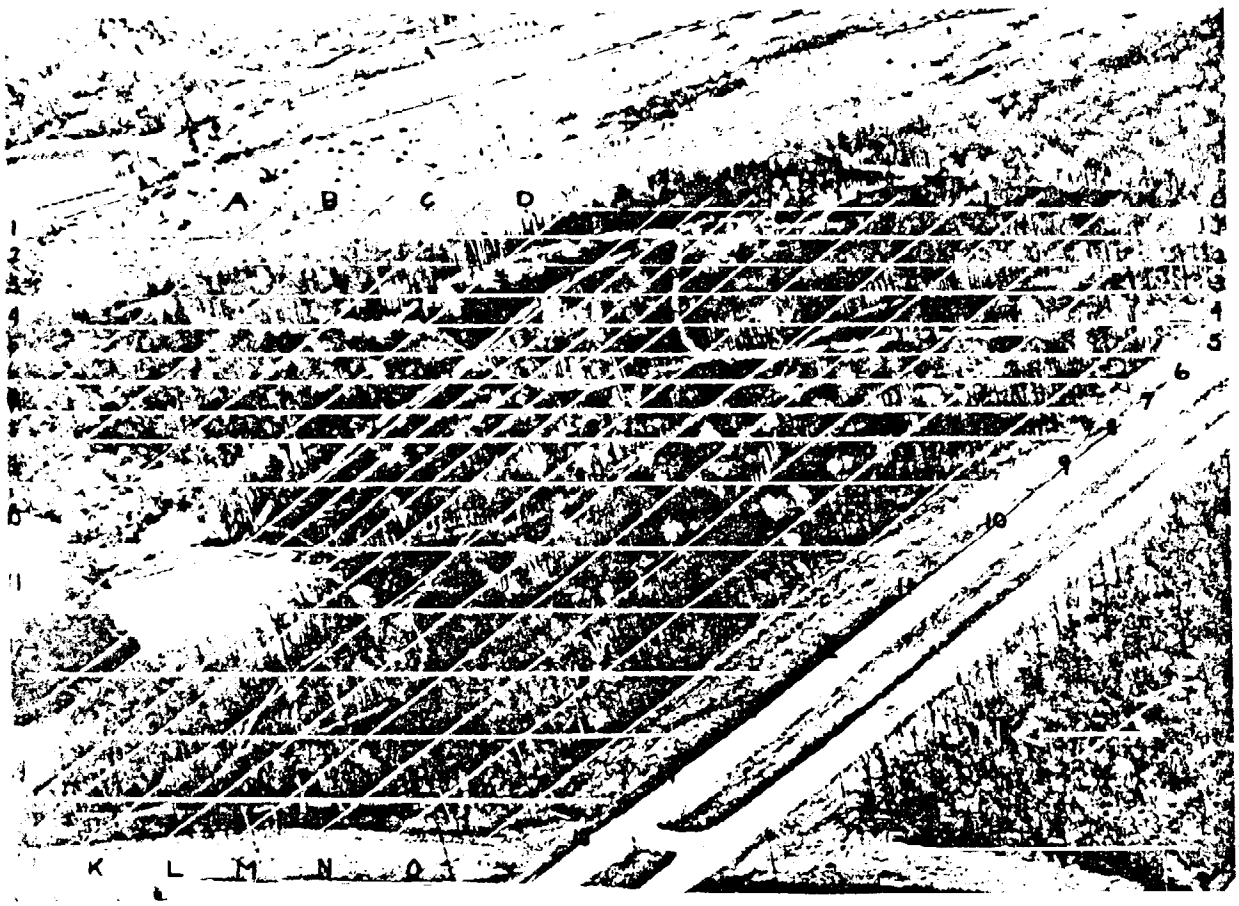


FIGURE 3
Aerial "map" of the arboretum.

scale; $t=2.10$, df$=104$, $p<.05$). This measure reflects a combination of three questions: "How hard was it to find your way back to the beginning?", "At times, did you feel uncertain of where you were?", and "If you brought a friend here for the first time, do you think he would need somebody to help him find his way?"—scored so that a higher number reflected greater confidence. Using this same measure, the boys showed considerably greater comfort with finding their way around than did the girls (means 3.1 and 2.7; $t=2.53$, df$=104$, $p<.01$).

The different map conditions had no bearing on the students' ratings of the helpfulness of the games in finding their way around the park. Nor did the map conditions affect the students' reply to a question dealing with desired knowledge prior to going to a different place. Over 60 percent of the students in both groups felt it would be useful to know about "where the paths are," "if it was a woods," and "if there was water." They cared least (fewer than 40 percent) to know "what kind of trees grew there" and "what's there" (information often offered before school field trips). Both map formats led to a similar pattern of expectations about the size and number

of trees, the size of the park, and the hilliness. The responses to these items indicated that the students generally found these slightly more or bigger than expected.

The variables from the questionnaire, structured map, and sketch map were analyzed using the two different dimensional approaches we have used extensively in other settings (see R. Kaplan, 1972, 1975). Based on these, three dimensions were formed: one dimension dealt with the principal features on the structured map and two separate ones dealt with the sketch map, one reflecting detail information and the other, accuracy and area covered. These three dimensions yielded no differences between the photomap and contour map conditions.

One of the two-dimensional approaches, the ICLUST hierarchical cluster analysis (Kulik, Revelle, and Kulik, 1970), also led to an additional dimension. It included three items from the questionnaire (related to knowing the park well enough to be a friend's guide, the likelihood of coming back to this park, and the expectation that there would be more paths), one item from the structured map (accuracy of indicating compass directions), and one from both map sources (the number of different parts of the park that were visited). High scorers on this dimension also included relatively more nature features than miscellaneous aspects (e.g., presence of people, houses, highway) on their sketch maps. A sense of orientation seemed to be the basis for the grouping of these measures.

Although the dimension is not particularly coherent (alpha coefficient of internal consistency = .45), and the results from it are tentative and only suggestive, we explored the relationship of this orientation dimension to the other variables. We found two things: the contour-map group scored higher on this composite orientation measure than did the photomap group ($t = 2.09$, df = 104, $p < .05$). Among the girls, this result was much more striking than with the boys. Second, the 15 students who indicated that they had made any prior trips to this park scored higher on this measure than did the vast majority (91) who had never been there before ($t = 2.17$, df = .04, $p < .05$). Prior trips made no difference with respect to any other variables. (Two students from each map group had made quite a few prior trips to the park; they found the games less helpful, and expressed greater confidence with respect to finding their way about.)

Discussion. The most striking finding of this study is the divergence of the attitude and confidence measures. The photomap condition showed a substantial difference in the predicted direction: these students were more favorable both to the experience and to the thought of future trips. At the same time, the contour-map condition seems to have generated somewhat greater confidence in way-finding ability in the park. Explanations of this unexpected divergence are necessarily after the fact, but they suggest areas of knowledge that should receive further attention in future studies.

The photomap seems to communicate an overall spatial feeling. One can quickly sense from it such information as the rough size of the area, what sorts of things form the boundaries, the balance between open area and dense woods. These seem to provide a nonspecific sense of familiarity for the place as a whole. The role of familiarity or sense of place in environmental preference has been demonstrated in other contexts (S. Kaplan, 1975; Herzog, Kaplan, and Kaplan, 1975). It is not unlikely that the photomap influenced attitude through its effect on familiarity, but this hypothesis has not yet been tested directly.

The contour map, by contrast, focuses specifically on features of the park itself: where the hills are and how steep they are, areas that are relatively flat, and so on. These issues are more directly pertinent to finding one's way in the park, and the greater way-finding confidence on the part of the contour-map group supports this. The interesting aspect of this finding, however, is that the greater confidence was independent of attitude. A sense of confidence and comfort in the natural environment would seem to entail a variety of informational inputs. Generic knowledge, to be sure, involves a great deal more than way-finding or orientation.

Mention should also be made of the problems created by operating on a cooperative basis in a school setting. In our concern to provide the students with a good educational experience, we probably managed to obscure intrinsic differences in the

map formats. Both groups were provided with so much additional information that map differences may have been mitigated. The addition of considerable verbal imagery to supplement the visual squiggles of the contour map reduced the possibility of evaluating the "immediacy" of such maps. Likewise, there was no control group in the usual sense; all students had relevant prior information. The outing itself was structured so as to be an enjoyable experience. The students went out in small groups and had the freedom to roam and explore—not usual components of school field trips. The very high overall positive attitude suggests the effectiveness of these factors. That significant results were obtained despite these moderating factors is an indication of their robustness.

Key Areas of Methodological Development

As with any research in a new area, this series of studies has required the development of many tools as well as solution to a number of interrelated problems. In particular, four major areas have required considerable attention. These involve considerations of the natural setting to be studied, the basic representation of that setting (e.g., map rendition), the kind of involvement with the "map" (e.g., games), and the measures used to assess the effectiveness of the procedures.

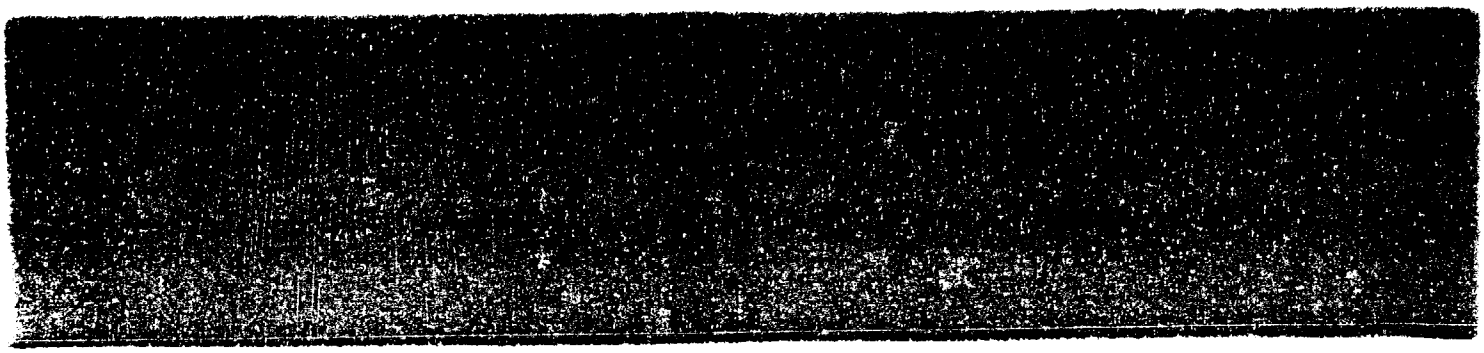
Choice of natural setting. The ultimate goal of this research is to apply the techniques to more remote, more extensive areas. Places where there is a more realistic consideration of losing one's way are better candidates for needing prior knowledge. When the student knows that he has but half an hour, it is unlikely he will feel overly distraught and uncomfortable. Yet the frequency with which issues pertaining to getting lost were mentioned is astounding. There was hardly a carload heading for the park in which such concerns were not voiced, and upon the students' return to the van after the half-hour's exploration a great many of the comments dealt with this concern. Several people remarked on leaving "trail markers" to help them retrace their steps; some returned to the van well before the whistle blew. In answer to the question, "How is this park different from what you expected?", one student wrote, "I was kind of skair!"

It could be argued that such fears are the province of the young, that we become less fearful as we get older. It is perhaps equally likely that we become increasingly inhibited about expressing these fears! In fact, it is striking how common a worry is the fear of getting lost.

Thus, to be effective for such research, a site must present a challenge. If it is too readily comprehensible, there is little need for prior knowledge. A place that is quite open, providing vistas, permits more orienting cues and would therefore depend less on prior "vicarious" experience. Variations in topography and vegetation and relatively dense woods, as well as intricate path networks or relative lack of paths, probably enhance the usefulness of prior information.

Representation of the setting. This is the single most difficult problem and the most central issue in the area of transition experiences. Most of the difficulties we have encountered in our studies are clearly attributable to this problem. We have searched in vain for maps that give the impression we seek. The closest we have found is the shaded relief map, but it turns out to be extremely costly to create on the scale of a park. It would require indicating single trees and thousands of them. What we are seeking is a map rendition that does not overly distort and yet provides a more intuitive feeling of depth (or height). Its immediacy is of great importance. We want a two-dimensional representation that communicates the "feel" of the place. None of the base "maps" we have used so far has achieved our desired goals.

Involvement with the "map." We have now explored a variety of game formats. The intention in all of them is to require active involvement with the base map and to communicate information about various aspects of the setting. The game-board method we explored in the second study was, in a sense, too much fun. One could play it and win points with minimal regard for the base map. The "Battleships" and "20-Questions" games have both been effective in their aims. The students clearly enjoy playing the games and welcome the experimenters back the second week. Since they are based on familiar games, the



rules associated with the games were easily understood and the games proceeded smoothly. The material for the games proved extremely inexpensive and the basic games were flexible enough to be modified to fit any natural area. As such, they hold great promise for use in a classroom setting.

Given a group setting, a game approach holds promise as a means of assuring sufficient involvement with the representation of the environment that is being used in the transition experience. Our studies using games all involved young teen-agers as the participants, but we have had no difficulty in engaging adults in these games as well—although never on a systematic basis. However, such games may not be appropriate in nongroup settings, where prior knowledge may nonetheless be important. We have not explored this area of research, but it would seem that there are a variety of approaches to assure such involvement, provided the base "map" is effective. Relying on a casual perusal of the map is unlikely to do the job. It is striking how much more information one obtains from a painting by using a format such as that Kenneth Clark used in his "Civilization" series, where many views are provided of what turns out to be a single painting. One's attention needs to be guided; without background or generic knowledge, one does not yet know what questions to ask.

Dependent measures. In the end, the knowledge we gain through these studies must come from the dependent variables we use. We are trying to get on paper an approximation of what people have in their minds about material that is not well coded verbally and is complex and diffuse.[5] We have made substantial progress along these lines, but this area still presents some frustrations. Although 12-year-olds are not known for their eagerness to complete questionnaires, this has presented no problems.

The importance of a range of measures cannot be overemphasized. In each study in this series it would have been all too easy to come to erroneous conclusions had only some of the measures been included. The multidimensionality of the effects of different kinds of maps is most strikingly evident in the fourth study, in which way-finding confidence and attitude appear to be barely overlapping domains. The possibility that an informational dimension other than way-finding underlies this attitude effect remains to be studied. It is clear, however, that the knowledge revealed in a map-drawing task taps still different domains.

Questionnaire data, especially if based on choices provided for the participant, are comforting and concrete. Map data are quite the opposite. The unstructured map task seems to be valuable, but it is also fraught with problems. These are not based so much on interrater reliability, which is not difficult to accomplish, as on the inferences one is making. What does a map that utilizes much of the blank page reflect? How can one tell how far the person actually went? How can one interpret the map if the person in fact explored off the paths most of the time?

Intrinsic in the map-drawing task are the very problems that make this area of research so difficult. The map should be an indication of the salient aspects of the environment. What *are* the salient features of a natural environment?

Knowledge and the Natural Environment

Maps of built environments (e.g., street maps) provide extremely abstract material and little general orientation to that environment. They have, however, the inherent advantage that knowledge of street patterns is important and in itself useful. The salient features of many natural environments are not as clearly identified. A map showing only the paths in a natural area the size of a large city is far less effective than the comparable city map, showing only streets. Problems of scale also enter. A method that is appropriate for representing several hundred square miles is less satisfactory for one square mile. Thus, atlases provide useful, readily communicable topographic material for vast areas, and yet these same methods present difficulties when applied on a small scale.

Knowledge of an area is based on much more than the information provided in a map. In the built environment, three kinds of information seem to be particularly salient: (1) the unusual, striking, or distinctly different components—landmarks in the tra-

ditional sense; (2) less striking landmarks whose distinctiveness is inferred from a background of regional information (such as "single-family residential" or "relatively new development tract"), against which they "stand out" (see Chapter 2); (3) "functional" landmarks, the collection of distinctive features at those nodes which serve as subgoals along one's path—places where one changes direction, for example. Some of these subgoals assume properties of "personal" landmarks, which are not shared by the public at large, but are just as distinctive and salient in a personal cognitive map (e.g., a friend's house, the place with the great garden, etc.).

What are the analogues in the natural environment, especially for one not well traveled in such bewilderment? The tension between landmark and background can be acute. The awesome, windswept conifer may well be coded as a landmark, a good feature to remember—until, alas, one passes the third or fourth or fifth awesome, windswept conifer. Landmarks have a way of becoming backdrop as elements repeat. With little prior experience, the unique aspects are difficult to discriminate, to code, to recall. Thus, it often turns out to be the nonnatural components in the natural environment that serve as the clearest landmarks. Human artifacts become particularly salient. The characteristic of a region as a whole may be one of the easiest aspects to recognize—forest, a clearing, or tall grasses. If a park can be characterized in terms of separable regions, it should be most easily knowable.[6] The problem of landmarks in the natural environment is thus an integral part of the issue of discriminating unique features against their background. To remember a particular place one has to discriminate it from other similar places.

Paths too can be problematic in natural areas; they are vital but often discouraging. They have a way of disappearing, of parting, or suddenly changing direction. They are demanding. Roots may be protruding; caterpillars may be crossing. The novice nature hiker probably spends more time looking down than does the novice "street walker." Because of the inherent complexities in the path systems of difficult natural areas, the recognition of salient features at points of choice is both vital and frustrating to the novice. It is at these points that the relative inability to distinguish among seemingly similar features is particu painful. Without being able to distinguish featur points of choice, way-finding and route-retracin come problematic. In the built environment points are often multiply coded. We have learne distinguish the angle of the intersection, as we subtleties of buildings, not to mention helpful st signs. To remember that the path intersection four flowers and some tall grasses against some r is quite demanding, especially as one must remen an increasing number of intersections.

We are still a long way from knowing what ger knowledge of natural environments entails. Confi way-finding and orientation in such settings car enhanced, at least to a limited degree, by prior posure to relevant information. There are prob limits to the extent that this can be achieved base specific information alone. A critical componen these skills must be the capacity to identify dist tive aspects of the environment. Landmarks are to cognitive map development; their identificatio enhanced when one is sufficiently well acquair with the setting to know what is distinctive.

The fear born of "not feeling at home" in the ural environment is a function not merely of a lac prior experience with that particular setting, but lack of cognitive structure for such settings as a wh Lee (1972) notes the close ties between such fear ness and the notion of "sense of place."As he a indicates, this often expresses itself in a social sen one feels one "belongs" where social norms are pre table. It is equally true with respect to the phys environment itself. Thus, generic knowledge is quired to use experience of the outdoor setting eff tively. The importance of a sense of place and preference for the familiar may well relate to the c tral role of feeling comfortable with the environm so that the distinctive elements can be differentiate

NOTES

1. The studies reported here involved quite a few search assistants, graduate students, and oth attracted to doing research while enjoying lo parks. In particular, Roger Peters, John Mer Ann S. Devlin, and Hillorie Applebaum play

key roles in the formulations of the studies, development of games and maps, and the various phases of data collection. Janet Frey is responsible for making sense out of a vast collection of maps that were drawn by the students in the third and fourth studies. Mrs. Toby Butcher's continued eagerness and cooperation made it possible for us to do both the third and fourth studies in her "Small House Project." The helpfulness of the teachers and administrators of the public schools is greatly appreciated. In addition to my gratefulness to all these people, the acknowledgment of the funding for this project is offered with much more personal gratitude than the routine listing of the sponsoring agencies. Between the summer of 1970 and the end of 1973, the Forest Service, U.S. Department of Agriculture, supported this research effort, which was carried out by Stephen Kaplan and myself. In addition to financial support, we felt and welcomed the moral support that went with it.

2. Prior knowledge may actually lead to opposite effects in terms of curiosity. For the boys it seems to have whet the appetite; for the girls, there is the suggestion that it was "as good as seeing it." In addition, across all groups, there were notable sex differences suggesting a speed-accuracy tradeoff. The boys tended to go farther, explored more, and saw more different things. The girls were far more accurate in their map renditions and labeled their maps more prodigiously. They proved themselves to be more verbal, offering more answers to the various open-ended questions.
3. Devlin (1973) reported on many aspects of this study, carried out as a doctoral student in environmental psychology under our supervision.
4. Oblique and vertical aerial photographs were also used extensively in environmental learning by the Clark University Place Perception Project. See Muir and Blaut (1969-1970), Blaut et al. (1970), Hart (1971), and Stea and Blaut (1973b) (the editors).
5. The reader is referred to Part III for further proposals on methods for assessing environmental knowledge and education (the editors).
6. The cartographer McCleary and his colleagues have been struggling with exactly these problems recently, especially in the preparation of guide maps for seminatural, semibuilt environments like parks and historic sites. See McCleary and Westbrook (1974) (the editors).

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