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ABSTRACT

The purpose of this paper is to examine from a cognitive behavioral point of view the processes of path selection. This activity is designed to interface with another project concerned with building a GIS based Computational Process Model designed to identify feasible opportunity sets for destination choice and path selection. The project is multi-year in nature, depending in part on the successful completion of laboratory and survey research which is designed to define the criteria used in path selection and to show how sets of prioritized temporal activities can define spatial sets of feasible alternative destinations.

1.0 PURPOSE

There are two significant components in trip activity patterns that continue to attract a major part of research attention. First there is the question of destination choice, second is the path selection process. In this proposal I plan to examine both questions from a cognitive behavioral point of view, focusing on finding reasons why people make their destination choices the way they do, and whether or not route selection criteria change as different sets of feasible destinations are considered. The long run purpose of this research is to provide criteria for using selected GIS functions (e.g., buffering) in destination choice scenarios used in trip scheduling and assignment models, and to suggest which (if any) of popular network based assignment models best represent actual decision making under different choice conditions.

2.0 BACKGROUND

Travel behavior has been studied at both the disaggregate and aggregate levels, and has been characterized as the overt acts consisting of execution of routines, with the entire picture being complicated by the occurrence of some spontaneous or less deliberated actions (Hanson & Huff, 1986). Destination choice is one of the critical decisions determining the spatial extent of travel patterns. Path selection is the other major decision. Destination choice has frequently been modeled using gravity or entropy type formats, and more recently with relatively successful logit based discrete choice models (Timmermans & Golledge, 1990). To bypass some of the unnecessarily restrictive assumptions of discrete choice models, including the conventional utility maximizing one, some experimentation with computational process modeling has taken place (Leiser & Zilberschatz, 1989; Gärling, Kwan, & Golledge 1992; Golledge, Kwan, & Gärling, 1992; Kwan, 1994; Stopher Hartgen, and Li, 1994). In these latter frameworks, destination choices are conceived of as dependent on several preceding decisions including choices to participate in different activities, prioritizing of activities, and conflict resolution between household members with respect to trip purpose allocation and made choice.

Path selection has been modeled with a variety of network algorithms using criteria such as least effort, shortest path, and maximal distance, in linear programming, traveling salesman, network optimization, and location-allocation formats. The need has arisen to explore ways to select from the many existing network based software (e.g., TRANSCAD) to help solve traffic assignment problems.

One of the critical problems related to this activity, however, concerns the selection of the type of assignment criteria in the path selection modality. In general, not only do we select and follow a limited set of paths within the complex networks in which we live, but we have developed many models for finding solutions to the path selection problem. The question is, however, do they incorporate the criteria used by humans to solve their own movement problems? Or, do they use methods best suited to mathematical or computer determination of optimal paths through networks to ensure efficiency of flows, but using criteria that people in general are either unaware of or incapable of working out themselves? In this paper I report on pilot studies conducted in laboratories. For example there is a clear indication that criteria <u>other</u> than those embedded in almost all traffic assignment models are the ones used by most people undertaking travel. For example, Gärling et al. (1986) show that for pedestrians, shortest path and least time or effort criteria do <u>not</u> dominate the path selection processes. The question arises as to what degree traditional criteria reflect the criteria used in motorists' actual path selection processes?

3.0 RESEARCH QUESTIONS AND TASKS

A variety of computer simulation models (called Computational Process Models or CPMs) have been developed for navigational purposes (e.g. Kuipers, 1977; Gopal, Klatzky & Smith, 1989; Leiser & Zilberschatz, 1989, Kwan, 1994). The assumption generally made in these models is that experience with a large scale environment is at first unstructured. Although specific environmental cues are recognized and learned they are not necessarily spatially connected one to another but are simply listed in a declarative knowledge base. As experience increases and routes are learned, however, specific locations and connections between them are developed. Next, relational characteristics between places on and off these segments are formalized. Proceduralization of knowledge necessary for route following or wayfinding is a precursor to actual movement. Increasingly information has become available (Sadalla, Burroughs & Staplin, 1980) that shows the direction of travel between any two points may be asymmetric, particularly if one of these is a major anchor-point or reference node (e.g., place of home or work). Säisä, Svenson-Gärling, Gärling & Lindberg (1986) have demonstrated that segment and route length estimates can also be asymmetric. It is, consequently, difficult to see how a single set of production rules (such as are incorporated into most aggregate and disaggregate choice models to date) can account for the different types of directional and orientation problems that occur during spatial learning process and travel activity. Little if any work, however, has examined what happens when this symmetry hypothesis does not hold. This destination choice and route selection problem may be quite different to that normally used by humans. The latter do not explore sequentially and successively all areas in the vicinity of every node in the network. Human search space is invariably sectoral and may be guided by even a small piece of information (such as a perceived direction or the location of a known cue). Thus, if from one's cognitive map a conclusion is drawn that a destination is to the north, then east, west, and southern alternatives may be eliminated early in the destination search process. Once sectoralized a further constrained set of production rules can guide segment selection by eliminating turns that appear to direct the traveler away from "moving in a northerly direction." As more information about the layout of the environment becomes known, this orientation rule may be violated if the traveler finds an effective route can be defined by first moving in the non-prime direction. A person may make a short trip to the south to enter a freeway which later turns north and passes near a given destination thus providing access to that destination in a more spatially indirect but quicker time frame.

Questions that are investigated in this research include:

a. What characteristics other than minimum distance, minimum time, or minimum effort influence route selection for normal daily activities?

b. What path selection criteria lie behind the process of taking different routes to and from the same origin and destinations (i.e., do route selection criteria differ between heading away from 'home' or towards 'home')?

c. How can specific route selection criteria (e.g., longest leg first, shortest leg first, fewest turns, fewest lights or stop signs, fewest obstacles or obstructions, variety seeking behavior, negative externalities, detours, actual or perceived congestion, minimizing the number of segments in a chosen route, minimizing number of left turns, minimizing number of non-orthogonal intersections, minimizing number of curved segments, and other variables) influence the route selection process?

d. What proportion of people actually retrace their routes to and from any given destination? What does this mean for selection of criteria for choosing a path? (e.g., if "minimizing" left turns is the criteria, how can this allow for a route retrace?)

e. What factors are likely to produce divergence from a route retrace?

4.0 PROCEDURES

For the path selection process two phases were envisaged. Phase one consisted of laboratory experiments using simplified maps in which alternate routes that could be chosen will reflect one or more of the path characteristics listed above. The actual path selected will be drawn on the maps and counts will be made of the frequency with which particular types of routes are selected. Phase two will consist of an examination of symmetry in O-D-O loops.

5.0 THE ROUTE CHOICE EXPERIMENT

Not only do we select and follow a limited set of paths through the complex networks in which we live, but we have developed many models capable of finding solutions to these path selection problems (e.g., linear programming; traveling salesmen; shortest path). The question is, however, are these the criteria used by humans to solve their own movement problems - or are they methods best suited to mathematical or computer determination of optimal paths through networks to ensure economic efficiency of flows, but yet using criteria of which people in general are unaware, or are incapable of using? Are we in effect engaging in ecological fallacy, building models suited to commercial or fleet routing then inappropriately extending them to cover disaggregate or aggregate individual behaviors? The question asked here is whether or not the criteria used in travel behavior models are real and relevant (i.e. useful for explaining human travel choice behavior), or are only artifacts useful for obtaining normative statistical or mathematical solutions? To examine these questions we now turn to outline and describe experiments undertaken to discover the relative significance of criteria used for navigation and wayfinding in a variety of environmental conditions.

6.0 SUBJECTS

Subjects consisted of 32 adults, 16 women and 16 men. Most were students. Ages ranged from 20-35 years of age. Half of both male and female subjects had geographic training consisting of five or more college level geography courses.

7.0 THE TASKS AND TASK ENVIRONMENTS

In the first task we examine a variety of routes that people select through given environments. Initially, subjects were given a series of maps on which two locations were marked. These maps consist of simple regular grids. Three different routes were laid out from a common origin a to common destination (Figures 1a, b, c, d). Subjects were asked to imagine that they lived in a town built around the grid network shown on each map, and to imagine that moving from the origin to the destination represented a daily trip-making activity. They were asked to decide which of the three routes they would take. In this first task the routes allowed them the choice of taking the longest leg first, the shortest leg first, or a stepwise route that approximated a diagonal join between origin and destination (supposedly simulating perceived least effort or least time). Given the regularity of the grid, however, each route was exactly the same distance and varied only in its configurational properties. Maps and routes were configured so that trips were undertaken either as one travels away from the body (i.e., South to North in conventional coordinate terms) or towards the body (i.e., North to South). Different configurations of a diagonal path were provided while actual distances were kept constant, but only the simplest forms are examined here.

A second task involved increasing the number of nodes connected by paths. Again, routes were configured so that travel took place either away from or toward the body (Figure 2a, b). In part two of this task the regular grid was altered to be more irregular. This new environment had non-orthogonal and intermittent intersection blockages.

In a third task, polygons representing either negative or positive externalities (e.g., waste dumps or parks) were interspersed throughout the maps (Figures 3a, b). Blockages were described on different trials as parks (a positive attractor) or waste dumps (a negative attractor). The same route choice task was repeated controlling directional components. The latter two tasks examined if multiple segment routes with and without barriers were chosen using criteria that differ from simple barrier free path selection . Data was collected on route choice, including variables such as type of route chosen, number of segments in chosen route, number of left and right turns on chosen route, number of non-orthogonal intersections and turns on chosen route, frequency of positive or negative externality along route, number of curved segments, distance along chosen route, and perceived time of travel. Individual suggestions were solicited regarding what route choice criteria were being used and what criteria were thought to be normally used in daily path selection activities (Figure 4). Such variables were examined to isolate the type of reasoning or inference that underlies path selection.

8.0 PROCEDURES

Individual data was first compiled on packets of maps in the following manner:

(a) Six stimulus groups were formed by crossing the three environments (grid, diagonal, and curved) with the two orientations ("A in the N^{th}" and "A in the S^{th}"). A in the S^{th} was a 90° rotation counter-clockwise from A in the N^{th}.

Point A was accurately located in the Southwest in the former and Northwest in the latter orientation. A separate packet was used for each rotation.

(b) Within each stimulus group for each unique route drawn by subjects between each pair of points (i.e., on each page of the packet) a line of a different color was drawn on the compiled map. The number of subjects in the group who had drawn each of the unique routes was tallied at the bottom of each page.

(c) Routes were classified into cadres such as shortest distance, fewest turns, longest leg first, shortest leg first, most aesthetic, many curved roads, least time, first route noticed, most turns, and "different from a way I had already gone."

Results of matching these apriori route types with routes actually chosen by subjects (i.e., percentage time each route was chosen) were then tabulated.

9.0 HYPOTHESES

Questions investigated included the following:

- What criteria do people usually think they use when they are performing route selection tasks in the laboratory and in the field?
- What criteria do people feel they use most frequently when choosing routes in their normal everyday movements through geographic environments?
- Are spatial or temporal factors more important to route choice?
- How often do people retrace the same route when traversing between origins and destinations?
- How often is the same criteria chosen when traveling routes of different complexity?
- Do people try to retrace routes when the task involves using more than a single origin or destination (i.e. when trip chaining occurs)?

- Are people consistent in their criteria for route selection (e.g., fewest turns, least time, shortest distance, longest leg first, etc.) regardless of whether the origin is distant from the body (i.e., journeys from a distant origin to a closer location on the map - i.e. towards home) or is close to the body (the destination is distant and the origin is close to the body)?
- How consistent are people in terms of their criteria for route selection as the environment changes (e.g., from simple grid to grid with curves or grid with diagonals), and as trip purpose changes from single stop to trip chaining?

10.0 RESULTS

Results appear to support other research that argues that people are not shortest path or least time decision makers (Gärling, Säisä, Böök, & Lindberg, 1986). Data from all six compiled packages was entered into an Excel spreadsheet and summarized for each of the offered hypotheses. Here we discuss only a selection of the results.

10.1 Perception of Criteria:

As part of the general information collected from our subjects we asked them to rate on a seven point scale (with values ranging from "unimportant" to "extremely important"), what criteria they thought they used when performing the route selection task. The response indicated that shortest distance was given the highest rating across the sample group (mean=4.2) with shortest time close behind (mean=4.1) (Table 1). Fewest turns was rated 3.6 and the most scenic or most aethetic route received 3.5. Table 1 show there is then a noticable drop to the remaining criteria.

Table 1

Mean Ratings of Criteria Used in Single O-D Route Choice Task

	Mean Rating of Criteria Used in Task	**Mean Ranking of Criterion "Usually Chosen"**
Shortest Distance	4.2	4.4
Least Time	4.1	2.6
Fewest Turns	3.6	3.5
Most Scenic/Aesthetic	3.5	1.9
First Noticed	2.5	4.3
Longest Leg First	2.3	2.3
Many Curves	2.3	1.6
Most Turns	1.8	2.7
Different from Previous	1.8	2.1
Shortest Leg First	1.7	3.4

Source: Golledge, Experimental Data

Ratings were scored on a 7-point scale

When asked what criteria they *usually chose* when selecting routes in their real world activity patterns shortest distance again received the highest rating (4.4) but the "first experienced" or noticed route was rated second (4.3). This was invariable a route heading in the "general direction" of the destination. Routes with the fewest turns (3.5) and routes with the shortest leg first (3.4) followed in importance. Others are shown in Figure 10. Obviously the map route selection task was perceived as being something different to what would normally be experienced in real world interaction patterns. What is interesting, however, is the lack of relative significance given to variables which are often said to be perceptually "popular" such as minimizing time (2.6) and scenic/aesthetic routes (1.9). The significance of the first route experienced or chosen between an origin or destination is quite noticeable and supports suggestions made by Golledge & Zannaras (1973) that when choosing routes people are likely to limit experimentation and quickly develop a firm preference for a route to be followed on a regular basis after a small number of trials, regardless of its economic, temporal or spatial optimality; usually the first leg of this route generally heads in the general sectoral direction of the destination.

Let us now turn to a detailed discussion of selected criteria and examine consistency of selection in different environments and from different perspectives.

10.2 Route Selection Criteria

Fewest Turns: For each environment the total people who chose a route with the fewest possible turns between each pair of points was recorded. If there was more than one unique route on the compiled map that had the fewest turns possible, then this data would represent the total number of people using all such routes. The actual number of turns that defines "the fewest" for each pair of points was also recorded. The proportion of people in the particular stimulus group who chose a route with the fewest turns was then calculated. The average is a summary score for the particular stimulus environment, across all pairs of points, for the use of the strategy "choose the route with the fewest turns" (Table 2). It is apparent that as the environment changes, so does the popularity of this criteria, dropping from a high of 67% in a simple regular grid environment to 25% in a curvilinear environment. Data is reported for each of three environments (Grid, Diagonal, Curves). A second table illustrates changes in criteria selection when perspective changes , i.e. when travel is from a distant origin or to a distant destination (Table 3).

Table 2

Fewest Turns: Criterion Selection in Each Environment

Environment	% Subjects Choosing This Criteria
Grid	67%
Curves	25%
Diagonal	57%

Source: Golledge, Experimental Data

Table 3

Fewest Turns: Perspective Change

Environment	A in N^{th} (Heading away from body)	A in S^{th} (Heading towards body)
Grid	7%	65%
Curves	56%	58%
Diagonals	32%	18%

Source: Golledge, Experimental Data

In the case where perspectives differ, there is a remarkable difference in choice of this strategy when the path to be traveled heads away from the body (65%) as opposed to heading toward the body (7%). A significant difference occurs in the diagonal environment also, but not in the curvilinear one.

Longest Leg First: Here, data represents the total number of people who chose a route in which the longest leg was the first segment. "Longest" was defined in terms of total distance traveled on each segment, not number of blocks, and related only to the actual route chosen. In the first experiment routes were given; in later tasks subjects chose their own routes and each route was judged as a unique unit. No attempt was made to define some form of optimal "longest leg first" route. If no one chose a route in which the longest leg occurred first then the count was zero. Summary strategies across the population and statistics stratified according to travel orientation are given below for the condition where a single pair of origins and destinations are used with no intervening points. In terms of criterion selection for each environment regardless of point of view, choice percentage varied from 47% in the simple regular grid environment to 27% in the diagonal case (Table 4). When perspective was considered, this criterion tended to be chosen somewhat equally when each perspective was considered (Table 5). In the curvilinear environment the "longest leg first" strategy was chosen approximately the same proportion of the time regardless of orientation, while in the diagonal environment, a somewhat higher proportion selected this strategy when traveling from a distant origin rather than a closer one.

Table 4

Single O-D Pair

Longest Leg First: Percent People Using This Criteria in Each Environment

Environment	**% Subjects Choosing This Criteria**
Grid	47%
Diagonal	27%
Curves	33%

Source: Golledge, Experimental Data

Table 5

Single O-D Pair

Criterion from Different Perspectives: Longest Leg First

Criteria	**A in Nth Person %**	**A in Sth Person %**
Grid	45	49
Diagonal	31	23
Curves	32	34

Source: Golledge, Experimental Data

Apparently in tasks involving a simple path between a single origin and destination, individuals emphasize different criteria depending on the nature of the environment represented on the map. Let us look now at what happens in a slightly more complex case.

9.3 O-D with Intervening Points

Turning now to a slightly more complicated situation in which an intervening point was included on the trip (i.e., from homebase A to intermediate point E to destination point C) we find substantial differences in path selection criteria in each type of environments. Focusing still on longest leg first criteria, for the simple orthogonal grid map where the origin was far from the body, *16.5%* used the longest leg first as a strategy on the outward trip but only *7%* used it on the return trip (Table 6). Except on the simple grid map, it usually didn't matter whether the origin was distant from or close to the body, similar results were obtained.

Table 6

Trip Chaining: O-D Plus Intervening Point: Longest Leg First

Population Summary by Environment and Perspective

Environment	**A in N^th^**	**A in S^th^**
Grid	16.5%	7%
Diagonal	9%	10%
Curves	17.5%	16.5%

Source: Golledge, Experimental Data

10.4 Route Retraces

Now let us consider situations where individuals were required to travel between A and B in each direction. Again we are concerned with the problem of whether the same route was retraced, and if so, what this did to the route selection criterion. Here we present results only for the longest leg first criterion.

First in the simple grid environment, route retrace was not usually followed. For example, 44% subjects chose longest leg first when traveling from A to B when A was distantly located. However, *61%* chose this strategy on the return route. This means the return route could *not* have been a retrace of the original! (Table 7). More confusion occurs when we change perspectives and pursue a path from a close A to a distant B. Here, only 29% used this criterion. In the reverse task, however, 64% chose the strategy!

Table 7

Simple O-D Pairs

Route Retrace: Longest Leg First Case

Criteria	Route	A in N^{th}	A in S^{th}
Grid	A-B	44%	29%
	B-A	61%	64%
Curves	A-B	35%	13%
	B-A	12%	0%
Diagonal	A-B	24%	7%
	B-A	24%	20%

Source: Golledge, Experimental Data

On the map with curves, 35% chose this strategy when traveling from a distant origin to a close destination, but only 12% chose the strategy on the retrace task. When the origin was close and the destination distant, 13% chose it on the outbound journey and zero chose it on the retrace. When diagonals were included, a similar outbound and retrace pattern occurred, but with a close origin, differences again fluctuated widely from 7% to 20%.

When considering a path through an intervening point, differences in criteria selection become marked depending on orientation. In a simple grid, 33% chose longest leg first when traveling from a distant origin towards a close destination. *Zero percent* did this on the return trip (Table 8). When traveling from a close origin to a distant destination, 14% chose the strategy, but zero percent chose it on the return trip.

On the map which included some diagonals and again required traveling through an intermediate point, when the origin was distant, *35%* used longest leg first, but on the return trip *zero percent* used that strategy. When the origin was close to the body, *33%*

used longest leg first and again on the return trip *zero percent* used that criteria. In the curvilinear condition 15% to 20% respectively chose the strategy on the outbound trip, but zero selected it on the retrace. It might be suggested that in these cases, a pure retrace strategy may have been used, thus precluding any "longest leg first" strategies from being implemented. Visual examination of subjects' maps tends to confirm this explanation. The occurrence of zero percent choice on the return trip *does* indicate that exact route retracing *was* a possible option as a route selection strategy.

Table 8

Longest Leg First: O-D Plus Intervening Point

Route Retrace Data

Criteria	Route	A in Nth	A in Sth
Grid	A-E-C	33%	14%
	C-E-A	0%	0%
Curves	A-E-C	18%	20%
	C-E-A	0%	0%
Diagonal	A-E-C	35%	33%
	C-E-A	0%	0%

Source: Golledge, Experimental Data

10.5 Preference for Curved and Diagonal Routes

The question examined next was whether people have a *preference* for routes involving curves. For each pair of points the number of people who indicated routes including at least *one curved portion* were averaged (Table 9). Each unique route was recorded.

Preference for curves was quite high (74% chose a route with curves in routes heading towards the body and 90% chose a route with curves in routes heading away from the body). There was quite a bit of variation between routes. However, this measure does not take into account how many curved routes were possible between each pair of points; data is only for routes actually chosen by subjects.

Table 9

Revealed Preferences for Path Types

	A in N^{th}	A in S^{th}
Revealed Preference for Routes with Curves	74%	90%
Revealed Preference for Rows with Diagonals	68%	91%

Source: Golledge, Experimental Data

Preference for diagonals proved to be similar to the preference for curves results (Table 9). Again, the overall preference for taking a diagonal was quite high (68% chose a route using at least one diagonal when traveling towards the body; 80% chose a route with at least one diagonal when moving away from the body).

11.0 Conclusions

Practical needs have lead to the investigation of a variety of methods and techniques for describing spatial relations. They have also raised important questions as to which sets of spatial relations are the most fundamental, and the most important to include in an environmental knowledge base. In today's GIS, for example, many queries are based on some form or another of spatial concepts (Dangermond, 1983; Pequet 1984). It is essential both to understand what those concepts may be and how people are able to

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interpret or understand them, as well as to know if they are relevant to common sense decision making or are relevant only in the realm of the expert! For example, we need to be aware of and be able to describe spatial objects standing alone, in sequence (chain) or list form, connected, networked, or regionalized. The lack of a comprehensive theory of spatial relations to allow us to do this has been identified by the NCGIA as a major shortcoming and impediment to further GIS development (NCGIA, 1990). The problem inherent here is one of determining which spatial relations should be identified, how to define them, to understand their various semantic interpretations, and to know how much people understand and can use them. The research reported in this paper is in this vein. What are the consequences of this research?

1. Even simple spatial concepts may not be well comprehended by many people (e.g. trip chaining; shortest path; orientation, and direction).
2. The spatial terms we freely use to help understand how people behave are not as widely used or understood as we would like them to be.
3. That the "naive" or "common sense" understanding and use of spatial information and spatial relations is error ridden, naive, and very incomplete, often resulting in misconceptions and misunderstandings (e.g. of which are closer? which way is shorter?).
4. That many of the criteria that geographers use in models to comprehend and explain spatial relations and spatial interfaces may not necessarily be the ones typically used in common sense spatial problem solving, but are normative criteria useful for producing elegant mathematical solutions, but perhaps not relevant for much human decision making! When relevant they apply most to certain environments, are directionally biased, and are used only by segments of a population.

5. There is a need for much research into the frequency of use of commonly used decision criteria and into the stability and validity of models that rely on such criteria - especially when used in policy and planning situations.
6. In free choice situations such as epitomized by the single O-D pair experiments, multiple criteria were used as route selection strategies and route retracing for the return trip was not a commonly observed strategy. However, in constrained environments, as when the route chosen must pass through an intermediate point, route retrace *was* a common strategy. However, considerable variation in strategy selected did occur.

In short, while our experiments are preliminary, we do provide evidence that conventional network route selection strategies found in most computer models may not accurately reflect the decision making strategies of travelers. While we should not hasten to discard existing models, we should realize that they may be more normative than we usually assume. We also suggest that much needed research should be undertaken on path selection criteria to throw more light on this problem.

With regard to the future modeling of human activities, using a combination of an activity scheduler and a GIS would enable a network to be visually displayed on a screen and possible paths or routes to be highlighted. The paths selected by a potential traveler could be checked against network based models such as are included in TRANSCAD or TRANPLAN. Simultaneously displaying different possible paths determined by several network models could then provide insights into which of the feasible alternative paths the user would select.

Research Questions that now arise and beg answers include:

1. The assumptions of symmetry of route choice associated with specific activities;

2. The role that temporal constraints on performing activities has on defining a feasible destination choice set; and
3. Defining the priorities that individual households allocate to the performance of specific activities by different household members, the direction of travel, and the impact this may have on destination choice and path selection.

The question also arises as to how and why individuals allocate priorities to certain types of activities, transportation modes, and paths. This task requires the development of a series of trade off situations where choice of alternatives will define or will reveal the criteria or principles used in the process of prioritizing activities and the paths to be followed so as to successfully pursue those prioritized activities at specific destinations.

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Figure 1(a)

Map Grid - A in S^{th} - 2 Locations Step Diagonal

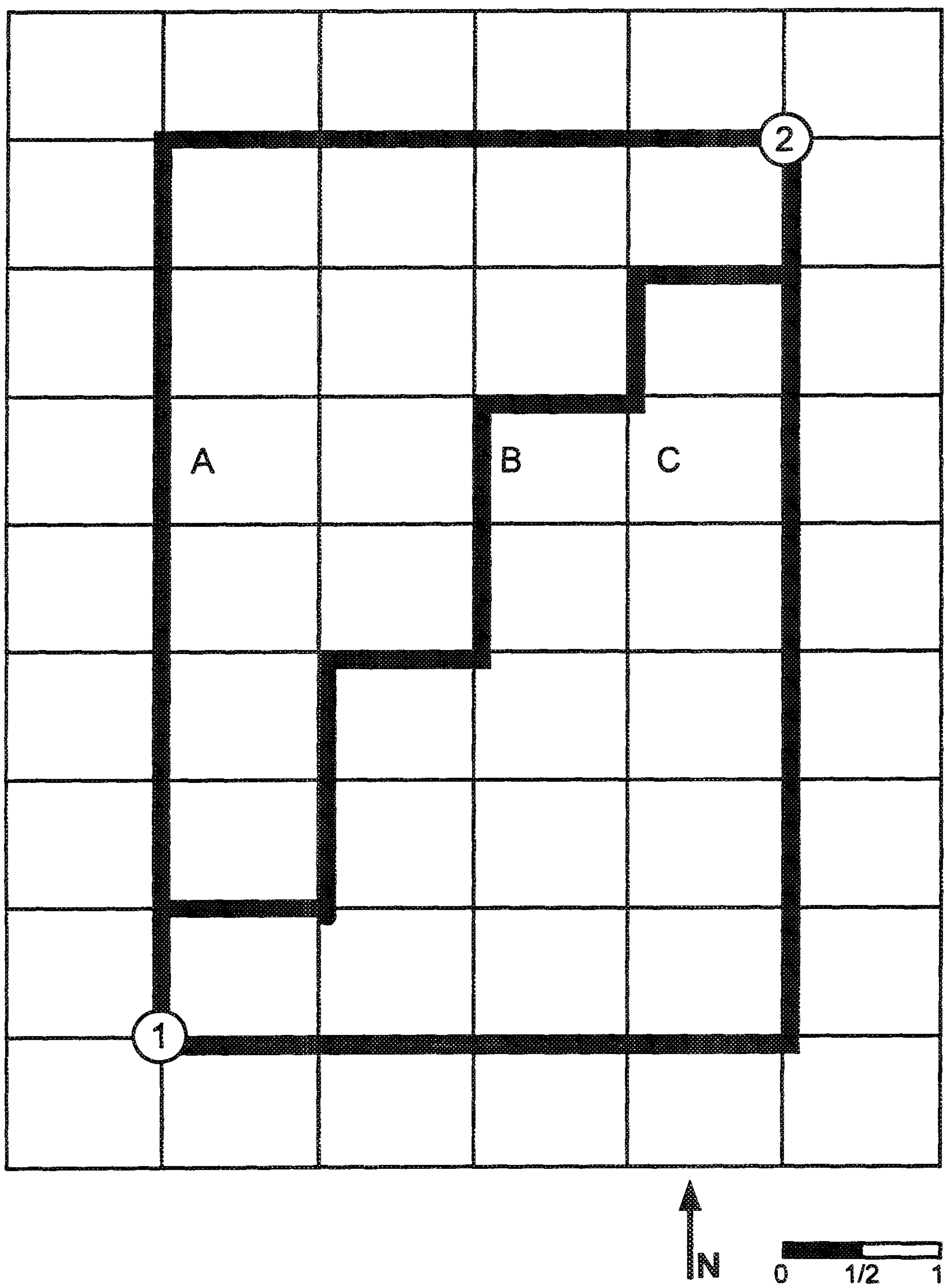

Figure 1(b)

Map Grid - A in Nth - 2 Locations Step Diagonal

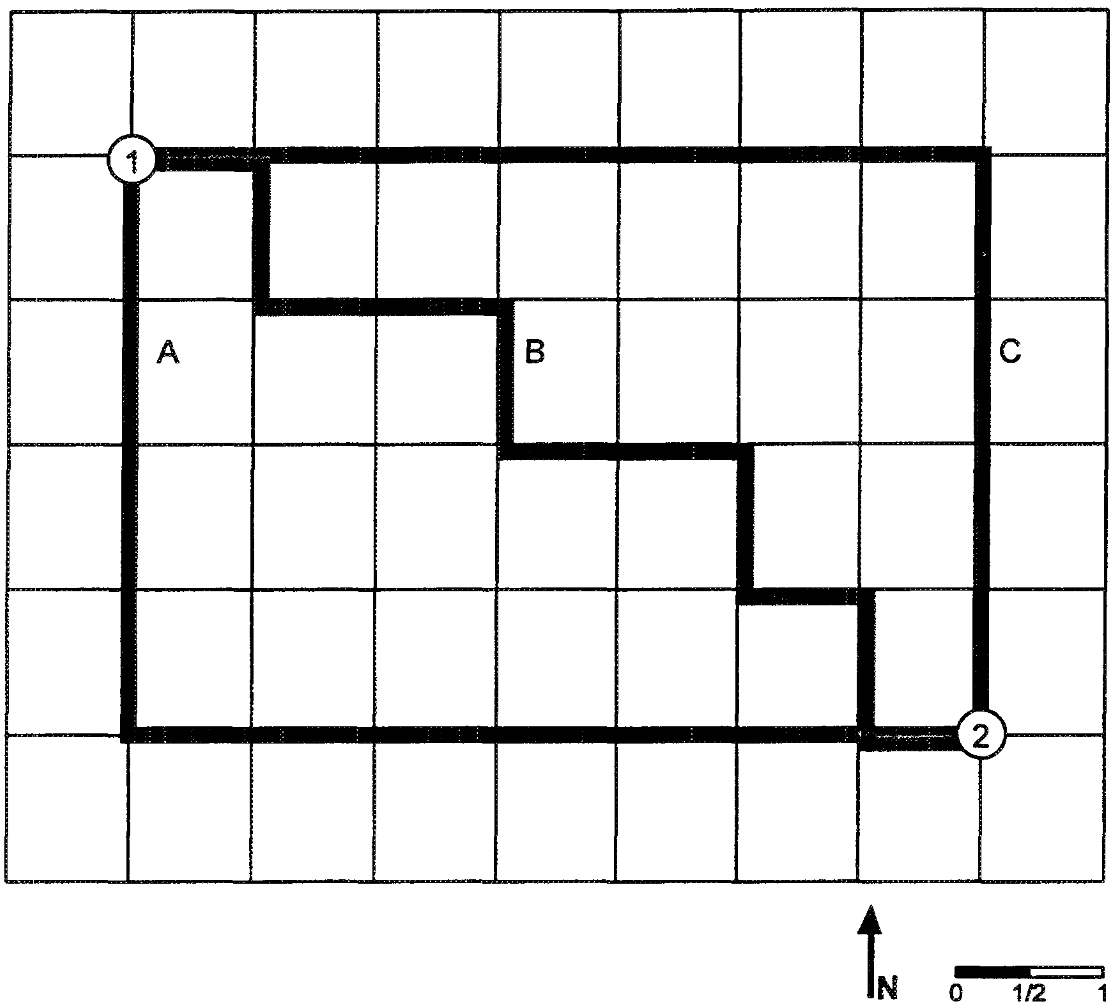

Figure 1(c)

Map Grid - A in S th - 2 Locations Angle Diagonal

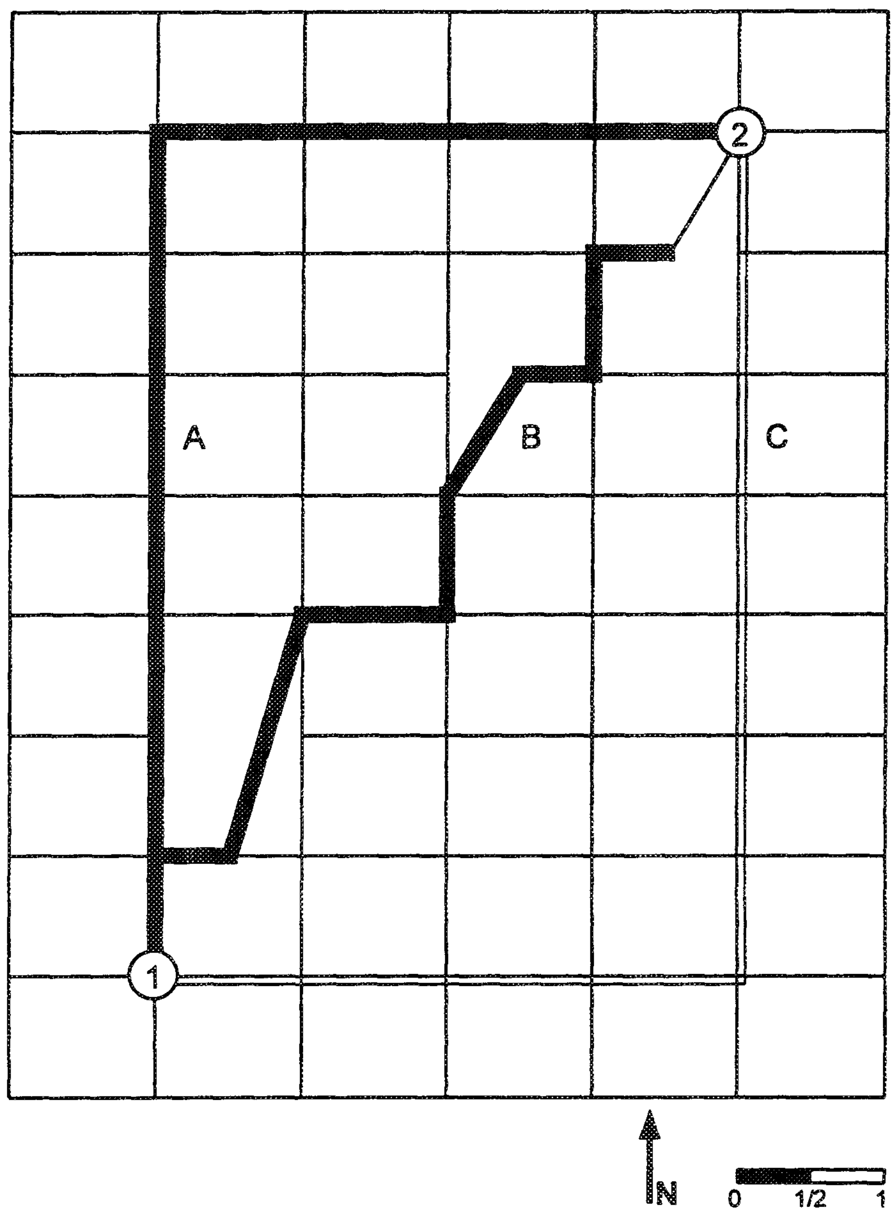

Figure 1(d)

Map Grid - A in N^{th} - 2 Locations Angle Diagonal

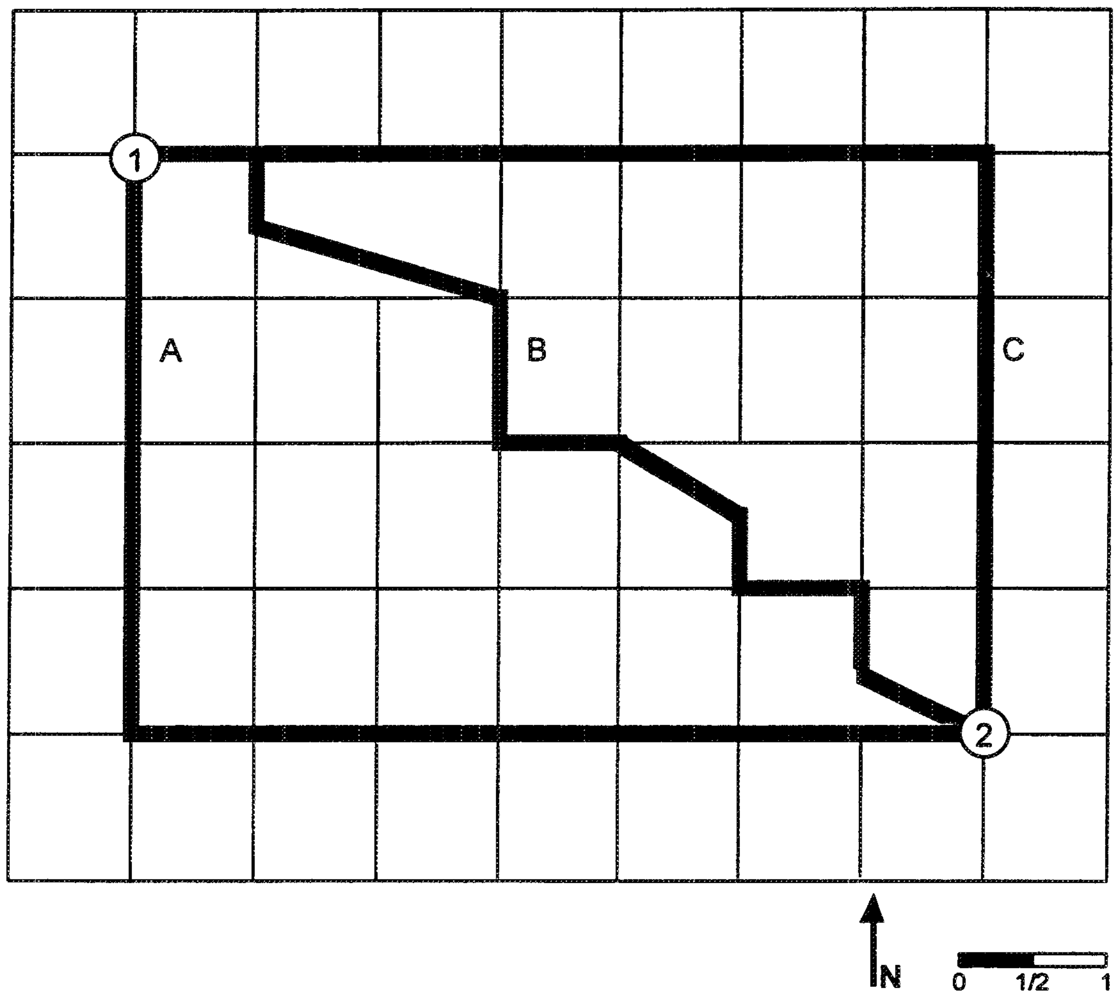

Figure 2(a)

Map Grid - A in Nth - with Diagonals

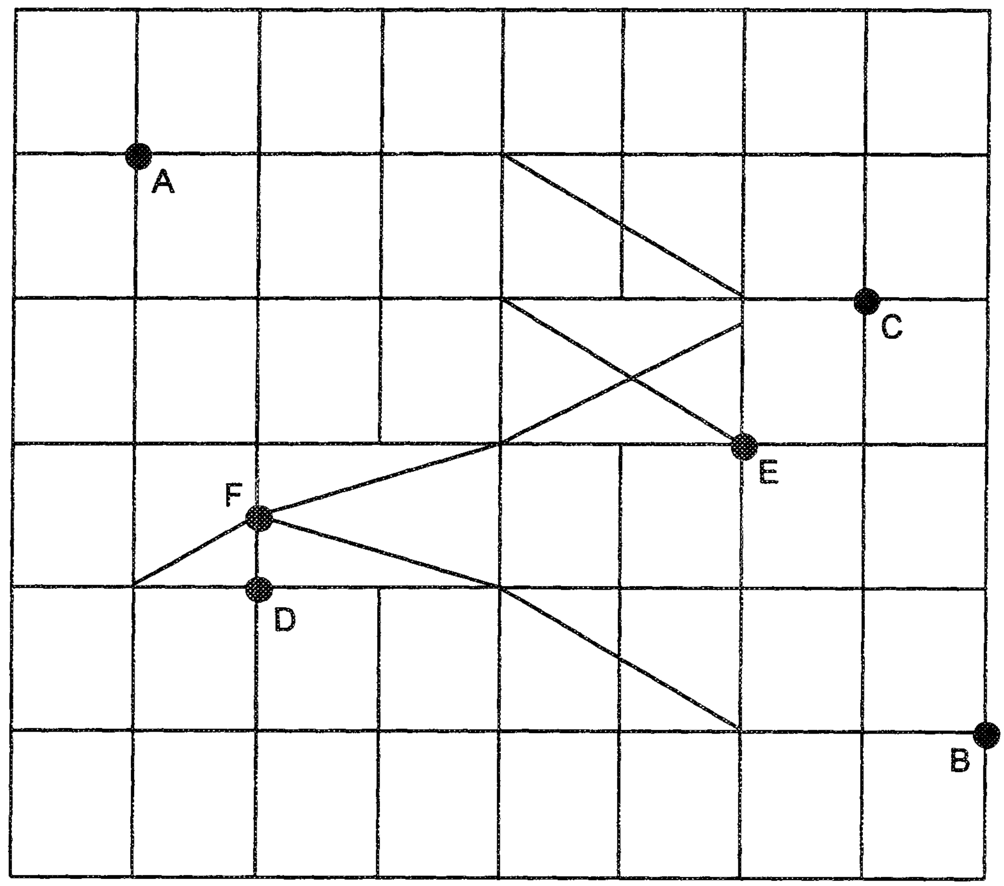

Figure 2(b)

Map Grid - A in Sth - with Diagonals

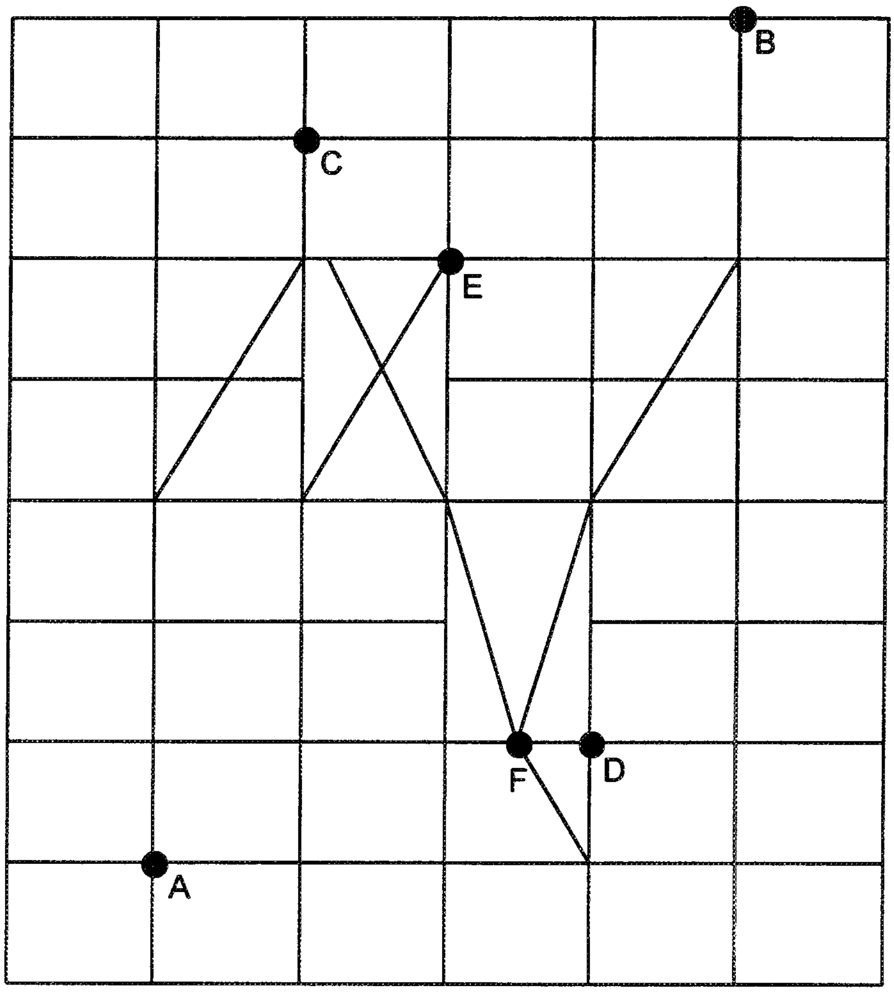

Figure 3(a)

Map Grid - A in Nth Aesthetics

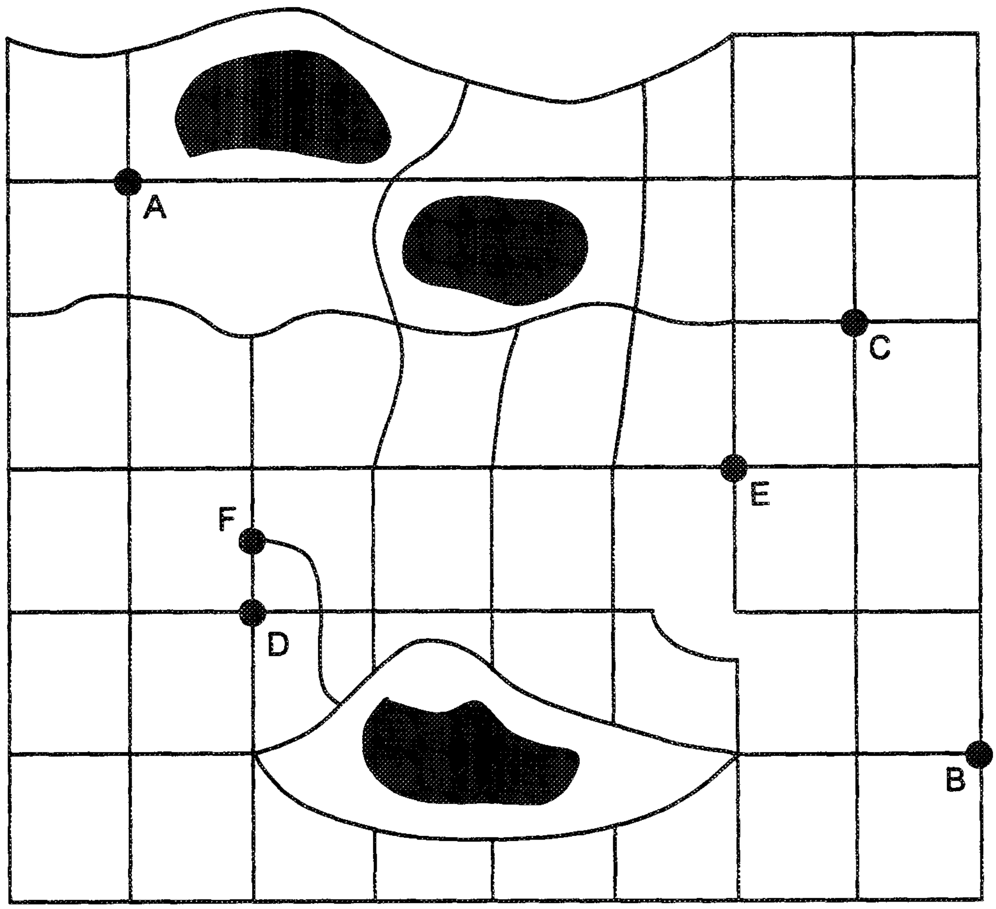

Figure 3(a)
Map Grid - A in N^{th} Aesthetics

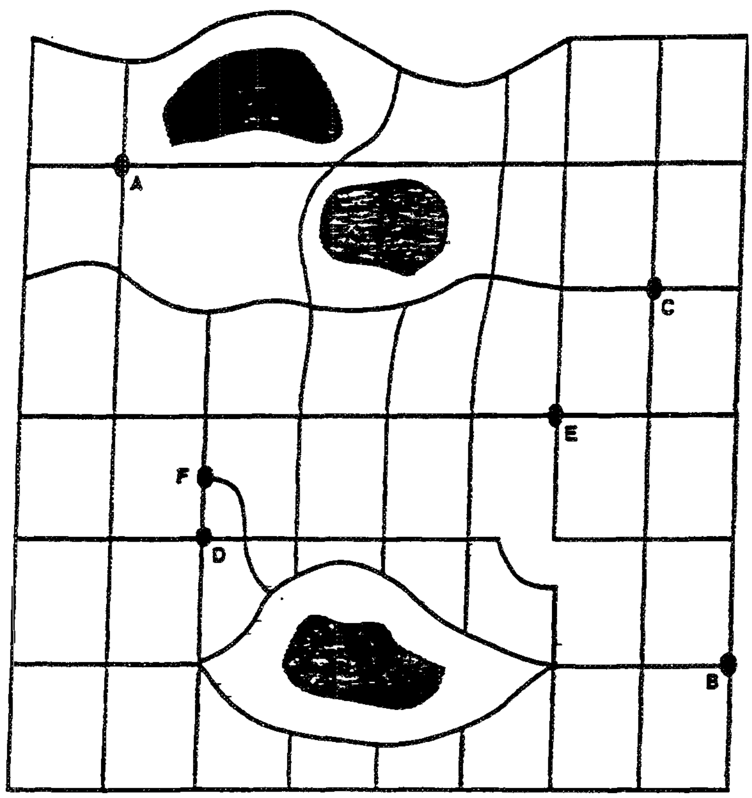

Figure 4 Questionnaire

Criteria Used in Daily Path Selection Actitivties

Please think about the criteria you used to decide on the routes in the first task you completed (each task = a forward and a reverse trip).

Rate each of the following statements on how **IMPORTANT** each was to your choice of routes for each of the tasks (1 = quite unimportant; 2 = somewhat unimportant; 3 = important; 4 = quite important; 5 = extremely important).

TASK #1

The route:					
was the shortest to travel	1	2	3	4	5
had the fewest turns (straightest)	1	2	3	4	5
had the longest leg of the route first	1	2	3	4	5
was the most aesthetically pleasing	1	2	3	4	5
had the shortest leg of the route first	1	2	3	4	5
had many curves	1	2	3	4	5
would take the least amount of time	1	2	3	4	5
was the first route I noticed	1	2	3	4	5
had the most turns	1	2	3	4	5
is the way I usually go	1	2	3	4	5
is an alternative to my usual route	1	2	3	4	5
always proceeds in the direction of the destination	1	2	3	4	5