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SPATIAL STRUCTURE IN PEDESTRIAN ROUTE CHOICE[1]

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Abstract

Aggregated pedestrian trip lengths typically follow gravity model predictions. Given this, the present research asks which route will a pedestrian choose when confronted by two or more distance-minimizing routes of equal length. Ethological, questionnaire, and interview data reveal the spatial structure of pedestrian route choices in terms of spatial complexity measures. Route complexity is found to vary by age and gender. The study is based on data collected in Lincoln, Nebraska.

SPATIAL STRUCTURE IN PEDESTRIAN ROUTE CHOICE

In the present study, ethological observations, disguised interviews, and survey questionnaires were employed to uncover the spatial complexity of routes taken, remembered, and planned by pedestrians in an urban area. Specific details on sample sizes, data analyses, methodological techniques, and full-fledged empirical results are found readily in the references appended to this paper. My presentation today has three major sections.

First, I outline the macro institutional context within which micro-level route choice decisions by pedestrians occur. Second, I summarize my findings on spatial complexity and route choice by pedestrians. Third, I suggest that the findings in this — and similar quantitative empirical studies — are doomed to reflect linear thinking and institutionalized patriarchal practices if one simply dumps aggregated behavioral data into predicting regression equations for planning purposes. Our goal as researchers and planners is to transcend the past to create emancipatory urban environments for the present and the future. Reaching this goal requires reflexive, critical analyses of techniques and data.

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THE HUMAN AND INSTITUTIONAL CONTEXT OF ROUTE CHOICE

I assume the following interrelated points of departure. Together, these four points outline the human and institutional context within which pedestrian behavior and experience can be critically and reflexively analyzed.

(1) First, human beings are embodied selves. Human/social activity, experience, and meaning are fundamentally contingent on the potentials, limitations, and possible extensions of the human body.

(2) Second, all distinctively human activity and experience takes place within — and is made possible by — macro institutional social patterns such as language, religion, law, education, economy, technology, polity, family, urban form, racism, sexism, classism, etc.

(3) Third, macro institutional patterns are not inherently "natural," but are negotiated, constructed, and reproduced by social beings in the course of routine, mundane decision-making in everyday life.

(4) Fourth, the allocation of routine decision-making authority and scope within macro institutional patterns in contemporary western nation-states is not uniform. The distribution of decision-making authority is highly structured along the dimensions of social class, race, sex, and bureaucratic hierarchies, among others.

These four points of departure outline the sociological and corporeal context within which micro spatial behavioral studies in the transportation sciences must be interpreted and understood.

SUMMARY OF EMPIRICAL FINDINGS

Triangulated data collection methods were used to uncover the spatial complexity of routes taken, remembered, and planned by pedestrians in urban areas. "Spatial complexity" is determined here by comparing the minimum, maximum, and actual number of left/right turns that pedestrians can and do incorporate in the routes they take from place to place.

The conceptualization and measurement of route complexity discussed here are subject to two conditions:

(1) First, that pedestrians restrict their routes to public rights of way, and

(2) Second, that routes from one point to another are shortest distance routes.

These two restrictions are not burdensome when analyzing data on pedestrians living and walking in the study site, Lincoln, Nebraska. This midwestern city of 180,000 population is characterized by a street network representative of most spatial forms found in the typical U.S. city. The street pattern in and around the central business district has a regular, rectangular grid alignment. Outward from the CBD, a few diagonal streets and boulevards provide discernable breaks in the basic rectangular pattern. Recent suburban tracts on the outer edge of the city are distinguished by winding, curving road and sidewalk patterns. The sampling design in this study captures Lincoln's environmental diversity and varied street geometry in a representative manner.

My observations of 350 randomly selected pedestrians in a representative range of envionmental settings reveals that these midwestern pedestrians — virtually without exception — chose shortest distance paths from point to point and utilized public rights of way almost exclusively.

The spatial complexity of pedestrian routes observed and recorded in this study is measured using a modification of the conventional formula for computing standardized Z-scores. This measure has maximum positive value of approximately 0.7, a mean of 0.0 and a minimum negative value of approximately -0.7 regardless of the size or shape of the path network on which a route is chosen. Negative values indicate reduced complexity whereas positive values indicate increased complexity. More graphically, the more negative the value, the fewer turns in the route, that is, the more linear it is. On the other hand, the more positive the value, the greater the number of turns in the route, that is, the more twisting and sinuous it is.

With this measure, we can compare complex route choice options drawn from from three samples in this study. These initial samples included:

(1) Routes walked by randomly selected adult pedestrians who were unobtrusively observed and tracked (n=200),

(2) Routes offered by pedestrians "giving directions" to a researcher who posed as "lost" and requested instructions on how to walk to neighborhood landmarks (n=100), and

(3) Routes walked by randomly selected gradeschool children making their way home from school. These children were unobtrusively observed and tracked (n=50).

The data in Table I represent situations where each pedestrian chose from among three or more routes to a destination selected by the pedestrian. This sub-set of special cases represents a little less than one-third of all usable cases observed and recorded. In each case analyzed, all of the three or more routes are of equal length and are characterized by varying degrees of spatial complexity. As will be noted again below, these complex choice situations are relatively infrequent in urban settings.

The mean route complexity measures for these sample sub-sets are presented in Table I. For ease of comparison, these data are arranged in order from the least complex to the most complex.

TABLE I: ROUTE COMPLEXITY BY SAMPLE SUB-SETS
Arranged from Least Complex to Most Complex

Sample	Data Type	Complexity Index
Adult males	observed walking trips	-0.523 [Least complex]
Adult females	giving directions	-0.509
All adults	giving directions	-0.471
Adult male	giving directions	-0.447
All adults	observed walking trips	-0.275
Adult females	observed walking trips	-0.097
School children	observed walking trips	-0.059 [Most complex]

INTERPRETATION AND DISCUSSION

Where do these data bring us, given the corporeal and institutional contexts outlined earlier? The remainder of this paper interprets the results in Table I and discusses their implications for urban planning and design.

Pedestrians are embodied selves who routinely choose routes from place to place in urban environments Of these choices, structural characteristics — such as spatial complexity — can be described and quantitatively analyzed. There are variations in route complexity associated with age, gender, and route choice task, that is, whether the pedestrian is actually walking to a destination or is giving spatial directions to someone else who will make the trip. Fundamentally, route choices can be studied because choosing a route and acting on that choice requires the observable movement of an embodied being through space.

The first major characteristic to note about the data in Table I is that there are no positive values on the complexity index. The mean complexity index for all samples reveals far less complex routes being chosen than could have been selected. It may be, however, that opportunities for complexity are not built into our environments with sufficient frequency to encourage complex route choice.

The socially constructed built-environment is a setting dominated by patriarchal control and bureaucratically structured routine decision-making. Examples include zoning ordinance enforcement, building regulation and inspection, and transportation planning and facility construction. A characteristic of this setting is that approximately two-thirds of all pedestrian trips in the study site evidenced little or no spatial complexity whatever. The majority of all trips observed were linear, straight-line routes with no opportunity for choice between more or less spatially complex alternatives.

Less than a third of all trips provided the possibility of choosing relatively complex routes. When confronting the chance to add spatial complexity to routes, adult males choose less complex routes than do gradeschool children or adult females. Indeed, adult males taking walking trips evidenced the least preference for complexity of any of the samples examined.

When a stranger asks directions to a neighborhood landmark, it appears functional to give structurally simple instructions — these are more easily remembered than complex directions. Note that adult women give structurally more simple directions than do men. When it comes to giving pragmatic, easy to follow directions, it is women who give them more often than men.

It is striking — and perhaps telling — that men infuse greater spatial complexity into the directions that they provide to a "lost" stranger than they willingly choose or tolerate in routes they choose to walk themselves. Women, while choosing greater complexity than men in the routes they walk themselves, give much simpler routes than men do when asked for directions. Put another way, men talk a complicated game to strangers while actually behaving in a structurally simple, essentially linear fashion when walking themselves.

Three significant patterns emerge. First, most pedestrian trips in urban environments — environments constructed by men — are linear due to the spatial organization and geometry of pathways, origins, and destinations. Second, men generally ignore the opportunity — when present — to add spatial complexity to their routes. Third, when asked how to get from one point to another in the urban environments they — and there forefathers — have constructed, men apparently camouflage their demonstrated preferences for the linear by giving unnecessarily complex, dysfunctional directions.

This study of route selection by pedestrians was initially designed to uncover the spatial strategies that pedestrians utilize when walking from one place to another. It was thought that if these strategies were made manifest, then more interesting, more challenging pedestrian environments could be designed. The original thinking behind this study was the conceptualization of pedestrian route choice as a a huge, life-size boardgame — something like chess or checkers.

With careful design, the normally mundane act of walking from place to place could become a game — not a game played competitively, but a game played joyfully, for the playfulness of experimenting with variations on a range of spatial strategies.

It is clear that youngsters, gradeschool children specifically, do engage in more complex, possibly more playful route selection. And, so do adult women when compared to the relatively linear route choices made by adult men. I believe it is here that the data from this study speak most eloquently.

Given urban environments which celebrate complexity rather than the linear, will not our youngsters and the more creative among us reflect this potential in our routine, everyday decision-making?

The complex route choices made by women and children point toward playfulness when possible and pragmatism when necessary. But this message, this empirical suggestion pointing toward complex, non-linear pedestrian environments is easily lost if route and traffic data are not reflexively salvaged and rescued from too eager users of linear regression models.

The data from this — as well as similar studies — could be simply aggregated and plugged into the regression equations of which transportation planners seem so fond. We would, as a result, recommend to urban designers and transportation officials that pedestrians — in the aggregate — prefer relatively low levels of spatial complexity in their routes. I submit this would be a serious mistake, a mistake which would again project the patriarchal status quo into the future to become a self-fulfilling and coercive prophesy.

The women and children in this study reveal in their behavior a preference for complexity and — I believe — a greater degree of playfulness than is now found in our contemporary urban form. That their behavior does not now manifest even higher levels of complexity stems — I submit in part — from the subtle message that the linear, patriarchal patterns etched in our environments are not only supreme, but must also be conformed to. This patriarchal pattern will be changed only when emancipatory values become institutionalized and form the basis of routine, day-to-day decision making in planning agencies and transportation departments. Only then will we realize pedestrian environments which celebrate complexity and encourage playfulness in the routine, day-to-day route choices of ever larger numbers of pedestrians in the U.S.

Further Reading and Related Sources

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