Characteristics of Urban Activity Patterns

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•THIS PAPER describes the continuing research on the daily activity patterns of residents of a metropolitan area, which is being conducted within the Department of City and Regional Planning at the University of North Carolina.

Despite the tremendous gains made in the past 20 years in understanding and simulating the urban area, it is apparent that techniques are tied strongly to observations of present patterns and draw very little from a theoretical understanding of the city, its processes, or the forces that lie behind the observable phenomena.

The work described here focuses on activities as the means for characterizing urban phenomena. These activities are simply the things people do—what, where, when, and how long. Their collection or sum is the pattern we observe in the urban area.

Work to date has concentrated on defining satisfactory measures of activity patterns. Although several measures have been used (described later) that strongly resemble those used in various analyses of travel, it is anticipated that measures more completely describing the complexity of daily activities can be defined. One such measure is suggested.

Implicit in this work is a model of the activity patterns of urban residents. The analysis suggests that there are both strong similarities and strong differences in the activity patterns of various groups of urban residents. These patterns are differentiated by familiar socioeconomic variables and by measures of the residents' accessibility to specialized locations for urban activities. It is anticipated that the model may be responsive to changes in these patterns.

The paper is organized into three sections. The first briefly discusses a theoretical framework for the analysis and for the model in general. The second describes more specifically some of the relationships anticipated between activity patterns and characteristics of various urban subgroups. The third section discusses the results of analysis to date, concentrating on socioeconomic groups and using crude measures of mobility and spatial effects.

FRAMEWORK

The activities in which people engage are, in effect, their choices in a marketplace that offers various opportunities for the dispersal of their resources—both monetary and otherwise.

Many of the fundamental notions about activities incorporated here are from Stuart Chapin and his colleagues (1). In a recent article he has outlined a working schema for the development of a conceptual framework for urban spatial structure using activity analysis and activity systems. Simply stated, his schema is an evolutionary process involving motivation-choice-activity.

In discussing the components of the schema, he suggested that motivation is derived from two sets of needs, fundamental and supplemental. Fundamental needs are involved with shelter, clothing, food, and so forth; i.e., choices to minimize feelings of discomfort or deprivation. Supplemental needs for reason of achievement and status are requisite to a "full sense of well-being" and require choices to maximize satisfaction. He suggests that each of these needs (and they may be further broken down)

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is satisfied by or is sought for in different roles and arenas, sometimes simultaneously and sometimes separately.

In discussing the choice component, Chapin specifies the activity as the output, with motivation (and the values it represents) forming the inputs to a final decision. "The context is the social system consisting of the environment and all other human activity relevant to the situation in hand" (1). He suggests that in making choices of activities and in budgeting his time, the individual attempts to find an optimal combination based on his needs for "security, achievement, status, and other needs essential to his sense of well-being." The final output is, of course, his set of activities in various time scales: daily, weekly, annually, and throughout his entire life cycle.

In examining the activity patterns that result from the motivation-choice-activity sequence, it is obvious that all three elements of the sequence must be influenced by the alternatives available. The alternatives are obviously numerous. One clear distinction may be drawn between those that occur in the home and out of the home. Chapin, through the use of time-budgets, has begun an investigation of this division and of the various activities that make up each subset (2). Activities, however, are those with which planners—transportation and otherwise—are directly concerned, for these are the activities that crowd streets and highways, that become patronage when translated into market transactions, and that create demands for publicly supplied or regulated facilities and services. In brief, the patterns observed resulting from the motivation-choice-activity sequence of urban residents are fundamental factors in many decisions that affect the physical structure of the urban area.

At the same time, the components of the physical structure—the spaces adapted to various activities—exert an influence on the choices made. The situation is strongly analogous to the economic concepts of supply and demand and their interaction with price and production.

Activities may be distinguished according to who performs them. Chapin suggests that three groups—residents, firms, and institutions—are distinguishable. This discussion involves the activities of the residents.

Finally, activities are clearly cyclical. Some are daily—the trip to work, eating, some sort of recreation. Others may be weekly—grocery shopping, trips to the bank. Still others may be monthly, annual, or at even longer periods (for example, the decision to move.) A general discussion of cyclical activity is given by Chapin (3).

Activities are of varying duration: Some have fixed durations; others, flexible. Watching television is of variable duration, but going to a movie usually involves a commitment of at least 2 hours.

Our focus is on the linked sequence of activities occurring over a day. Two kinds of linkage sequences occur. First is the set of out-of-home activities comprising the full daily cycle. Second is the smaller set of activities that occur on each foray out of the home—activities that are linked together on each individual journey.

EXPECTED RELATIONSHIPS

In attempting to structure the choice of activities for analysis (and eventually for simulation) there are apparently three principal dimensions or components of activity choice and sequencing in addition to the socioeconomic characteristics of the individual. These are time, space, and the activities themselves. The selection of daily activities, the selection of places where they will be performed, and the time devoted to each activity are all interconnected; together they comprise the activity pattern.

Time enters into the structure of activity patterns in two ways. The first is the duration of each activity, and the second is the time of occurrence of the activity. The duration of each activity is, of course, a basic ingredient in the account of a day's activities. At present little is known about the average amount of time spent on different activities, about how time spent varies among activities, or about how time spent on activities varies with characteristics of the persons performing them. The time of day when an activity occurs is also a basic ingredient in an account of a day's activities. But it also may be important to the duration, the choice, and the sequencing of activities.

It is possible that the duration of an activity influences whether that activity is chosen at all and how it is sequenced with other activities. This would apply to those activities that normally have a fixed minimum-time duration. The reciprocal influence suggested is that the sequence of activities chosen may influence the duration of each of the activities. The time of day may have an influence on the selection and linkage of activities. Some activities by custom or by their very nature are performed in the evening, for example, rather than in the morning.

The distribution of adapted space of the facilities for particular activities and the distribution of transportation and other facilities for interaction among adapted spaces obviously are interrelated with the choice of activities, and perhaps are related to the time dimensions of activities. As is well known, people are inhibited to some degree by distance, however measured. It follows that if facilities for a particular activity are relatively inaccessible, that activity probably will be performed infrequently. It may be that an activity will have a longer duration when access is difficult than when access is easy. If this is so, then the location of adapted spaces is relevant to both the occurrence and linkage of activities. The effective distribution of adapted spaces can be changed by modification of the transportation facilities for movement (the less tangible quality of them); this change may affect the selection and sequencing of activities. It should be pointed out that the distribution of activity places is viewed by the individual from the perspective of his location in the urban area, either in the conduct of some out-of-home activity or at home. Thus his view of the opportunities for various activities changes as he moves about the urban area. Because he often selects activities one at a time from home and after accomplishing them returns home, the residential location is the dominant focus from which the individual views the alternate opportunities for engaging in out-of-home activities. The distribution of adapted spaces and transportation facilities may affect either or both the time of day at which an activity is engaged in or the duration of the activity. Perhaps an activity that is difficult to perform because of some factor of space will, when it is chosen, have a longer duration than would otherwise be the case. If the preferred time for this activity is midday, it might be postponed until evening because sufficient time is not available at midday.

Activity choice itself can be explained only in terms of the motivation, needs, wants, and capabilities of the individual. The whole range of socioeconomic characteristics of the individual and the family unit of which he is a part is the source from which an explanation and structure for the variations and patterns in activity choice will be sought. The selection of activities by an individual may be a function of his preferences, tastes, information of alternatives, habits, or financial circumstances, and most certainly is a function of his requirements for personal and household maintenance. An understanding of activity patterns and linkages must be based on these factors, but it is an underlying hypothesis of the approach suggested here that the dimensions of time and space are also significant to the structuring of activity patterns.

In this discussion, these relationships between time, space, and activity are posited for the short run—a period of a day in a given urban environment in which the tastes, preferences, and attitudes are fixed for the moment. Looking to the long-run problems of projecting activity choices over time, it is clear that as preferences and attitudes change and as technology changes, the relationships will become more complex. A model that attempted to deal with activity choices over time would probably have to incorporate reciprocal relationships among the dimensions of time, space, and activity. As the urban area grows and changes, for example, prevalent choice patterns of activities will be reflected in the amount and location of adapted spaces designed to accommodate them.

PRELIMINARY EMPIRICAL RESULTS

As already indicated, two groups of activity linkages are being observed. First is the daily cycle; second is the composition of each journey made from the home during that cycle. Beginning with the widely used assumption that the majority of travel is home based—people start from home in the morning, return home, leave again, and

finally end up at home at night—a journey is defined here as a home-to-home circuit comprised of two or more trips (in the usual sense of the word "trips").

Data

The data used for this study are the "home interview" data obtained by the Niagara Frontier Transportation Study in the Buffalo, New York, area in 1962. The data represent the results of direct in-home interviews of 4 percent of 300,000 households in the study area. Along with considerable social, economic, demographic, and geographic data, each interview obtained a complete description of the out-of-home travel of the members of the household for a selected day. Information on activities has been derived from this trip information by inverting the original data. Activities have been defined in terms of combinations of the original trip purposes and land use at the origin and destination of each trip in the original data. For example, each land-use and trip-purpose combination, such as recreation in local parks or recreation at spectator sports, could be considered a separate activity. Many of the 400 possible activities are either too similar to others or occur too rarely to be treated separately. These have been combined into 43 distinct activity codes for this study (Table 1).

Additionally, three of the conventional trip-purpose codes—ride as a passenger, change mode (of travel), and serve passenger—are transportation-connected activities that are secondary to the real purpose or activity represented by the travel. To obtain purposeful trips in terms of activities, the transportation-connected purposes were eliminated by a process similar to linking of trips traditionally performed in transportation analysis. For example, two trips that were recorded as "home to change-mode" and "change-mode to work" respectively were combined in a single home-to-work trip.

The resulting data set contains information on the type, location, duration, and time of day of some 92,000 out-of-home activities performed by the 55,000 members of 16,000 households on a selected weekday. These have been reduced to a working data set of 10,300 households (for which trip reports are available) including 24,800 persons who made 33,500 journeys containing 83,300 trips. It should be emphasized that these data contain information only on out-of-home activities that require the use of transportation facilities—private car, taxi, bus, rail, or truck. The only walking trips included in the original data are those to work; no bicycle trips are recorded. These limitations are most severe when attempting to examine the activities of school children

TABLE 1

PERSON ACTIVITY CODES BASED ON TRIP PURPOSE AND LAND USE

Code	Activity	Code	Activity
01	Home	23	Social-recreation/indoor
02	Work/residential	24	Social-recreation/clubs
03	Work/retail	25	Social-recreation/schools, museums, libraries
04	Work/service and offices	26	Social-recreation/hospitals, etc.
05	Work/wholesale	27	Social-recreation/church
06	Work/durable manufacturing	28	Social-recreation/outdoor
07	Work/nondurable manufacturing	29	Social-recreation/local parks
08	Work/institutional	30	Social-recreation/spectator sports
09	Work/recreation	31	Social-recreation/miscellaneous
10	Work/transportation terminals and facilities	32	Eat meal/residential land
11	Work/other	33	Eat meal/restaurant or club
12	Shop/food, drug, liquor	34	Personal business/residential land
13	Shop/other convenience goods	35	Personal business/personal services
14	Shop/department store	36	Personal business/medical, dental
15	Shop/other shopping goods	37	Personal business/business service
16	Shop/automotive	38	Personal business/other services
17	Shop/miscellaneous other	39	Personal business/manufacturing and wholesaling
18	School/elementary	40	Personal business/hospitals, etc.
19	School/secondary	41	Personal business/church
20	School/other, including college	42	Personal business/other public buildings
21	Social-recreation/residential land	43	All other personal business
22	Social-recreation/eating and drinking		

and teenagers. Also missing are the walking mode shopping trips in the older, dense neighborhoods near the city core, and walking trips from one store to another in a shopping center and the heart of the central business district (CBD).

Measures Describing Activities

Several measures have been evolved in examining activity patterns and linkages. Because the primary purpose in analyzing and attempting to simulate activity patterns is to determine how people actually use the urban area and how they will use it in the future, we first are trying to discover who links activities, to what extent, and under what conditions. To date, the "who does it" and "to what extent" questions have been examined. The question of under what conditions it is done is much more complex because it involves not only the individual's schedule of activity demands, but the supply (the amount and location) of opportunities for satisfying them.

To analyze activity linkages within journeys and over a 24-hour day, the trips to and from home and activities and between activities are structured as an absorbing Markov chain in which the return-home state is absorbing and all the other states—leaving home and all the out-of-home activities—are nonabsorbing. The logic of treating travel/activity data this way is, as argued before, that each out-of-home journey is a "closed loop" containing one or more activities and that the whole day's travel is simply a series of such loops. The benefit of using the absorbing-Markov-chain model for analysis of the data is simply that it permits easy and economical reconstruction of journey patterns from the source data; and by taking advantage of some of the properties of Markov processes, we can gain some additional information from our data. [For further discussion see Kemeny et al. (4).]

A fundamental matrix is derived from the summed absorbing chains (representing the probability of visiting activity states during a day). The first row of the matrix represents the average number of activities visited given that the leave-home state has been exited. Each entry in the first row, in turn, represents the number of times the activity will be visited. The effect is to provide a summary of the entire original matrix for the leave-home condition.

Other measures are more traditional: averages of time spent in various activities, numbers of journeys per day by households, and frequency of occurrence of various activities by time of day.

Journey Complexity

Figure 1 shows the average number of trips per journey for households classified by four variables. The mean, 2.486, is indicated by the single horizontal line, and the dotted lines are two standard deviations from the mean. It is apparent the high-income suburban whites make more complex journeys than do any other groups. Family size has a notable inverse relationship to journey complexity.

From other analyses it appears that members of households who live in apartments or two-family houses are less likely to make multiple activity journeys than are persons

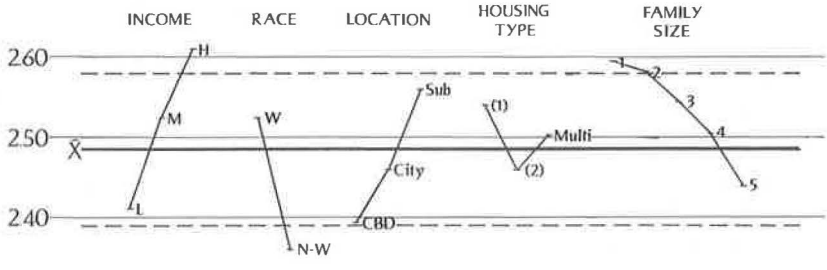

Figure 1.

living in single-family houses. The likelihood of multiple activity journeys by all members of a household is related inversely to the age of the head of the household; the older the head, the fewer non-home-based trips there are. Also, the likelihood of multiple activity journeys is related directly to household car ownership. If a car is owned by the household a person is more likely to link activities than if no car is owned; if two cars, a person is more likely to link activities than if only one car is owned. Similarly the likelihood of multiple activity journeys is related directly to occupation of the head of the household, ranked from high socioeconomic status to lower socioeconomic status. In summary, members of households that are young, white, middle class, live in single-family houses, and own several cars are most likely to link activities in complex out-of-home journeys. Members of households whose characteristics are the opposite of these are least likely to make multiple journeys. More of their out-of-home activities are done one at a time with a return home before another is undertaken.

From one perspective, multiple activity journeys would seem more economical and efficient than single activity journeys. It would seem reasonable to expect the poor and car-less to economize on trips by linking out-of-home activities. From another perspective, however, activity linkage itself can be viewed as a fairly luxurious practice involving comparison shopping, a desire for full utilization of available opportunities, and the ability to exercise these interests. We are far from reaching satisfactory explanations of this behavior, but we will not have the full answer until we can examine this behavior in terms of the location pattern of activity opportunities available.

Table 2 gives the estimated number of trips per journey for the same variables used in Figure 1. Several relationships among these control variables and the number of trips in a journey are evident. Considering the white middle-income group only, the relation of family size to journey length can be seen most clearly. As family size increases, journey length gets smaller; i.e., fewer activities are linked on a single journey or there is less likelihood of multiple activity journeys. For low- and high-income whites, family size seems to have little effect on journey length. For nonwhites there is no clear relation between family size and journey length.

The effect of race on journey length is also clearest for the middle-income group. In general, nonwhites make shorter journeys, and are less likely to link activities than are whites. The effect of income on journey length is clear for all groups in the table. The pattern is that the rich tend to make longer journeys than the poor. This pattern is subdued somewhat by the effect of family size and location. Residential location also is related to journey length. Suburban dwellers make longer journeys and are more likely to link activities than are central-city dwellers. This effect is least

TABLE 2

ESTIMATED ACTIVITIES PER JOURNEY BY HOUSEHOLD CHARACTERISTICS[a]

Income	Location	Activities per Journey by Family Size and Race									
		1		2		3		4		5+	
		White	Non-white	White	Non-white	White	Non-white	White	Non-white	White	Non-white
High (≥$10,000)	City core	2.600	—	2.869	2.083	2.557	3.000	2.344	2.406	2.477	2.25
	Rest of central city	2.100	—	2.856	—	2.458	—	2.538	2.667	2.405	—
	Suburbs	2.611	—	2.874	2.000	2.651	—	2.566	2.000	2.583	2.000
Middle ($5,000-9,999)	City core	2.727	2.333	2.508	2.443	2.429	2.542	2.367	2.264	2.364	2.295
	Rest of central city	2.611	2.000	2.510	2.000	2.486	2.433	2.465	2.000	2.409	2.000
	Suburbs	2.858	—	2.625	2.000	2.631	2.833	2.572	—	2.448	2.500
Low (<$5,000)	City core	2.296	2.429	2.388	2.697	2.355	2.234	2.233	2.260	2.242	2.188
	Rest of central city	2.478	—	2.458	2.286	2.362	2.193	2.400	2.000	2.344	2.100
	Suburbs	2.719	—	2.497	2.286	2.457	2.400	2.401	2.301	2.293	2.700

[a]From fundamental matrix based on observed behavior.

marked for high-income households because the effect of incomes is to increase journey length. These results support and reinforce those reported above. In summary, the members of rich, white, suburban households tend to link activities on complex journeys. The poor, nonwhite, city dwellers do not.

Activity Duration

Looking at the duration of activities during the day (Table 3), there is a clear difference in mean duration of activities when separated into those performed in the morning, afternoon, or evening. As was hypothesized in structuring the framework for analysis and simulation of activities, duration of activity is related to the time of day.

Activities last longest if they are performed (or at least started) in the morning. Excluding work, 20 of the remaining 31 activities given in Table 3 have their longest durations in the morning. The exceptions are primarily social-recreation and personal-business activities. Slightly more of the activities (17 versus 14) have longer duration in the afternoon than in the evening.

Skimming over the results in Table 3, some well-known behavior patterns are clearly shown as well as some of the limitations of the data. For example, the longest

TABLE 3

MEAN DURATION OF ACTIVITIES WITH DIFFERENT STARTING TIMES[a]

Code	Activity	Mean Duration (hr)			
		Independent of Start Time	Before 12 Noon	Between 12 Noon and 5 p.m.	After 5 p.m.
02	Work/residential	2.96	4.48	1.04	3.74
03	Work/retail	5.44	7.24	3.48	3.13
04	Work/service and offices	5.46	6.84	2.90	2.27
05	Work/wholesale	5.62	6.84	2.50	0.95
06	Work/durable manufacturing	7.68	8.22	5.88	9.47
07	Work/nondurable manufacturing	7.38	8.19	4.73	6.01
08	Work/institutional	6.05	7.10	3.35	2.90
09	Work/recreation	5.45	8.93	4.03	2.75
10	Work/transportation terminals and facilities	6.59	8.01	3.47	5.10
11	Work/other	6.57	7.34	5.20	—
12	Shop/food, drug, liquor	0.54	0.78	0.53	0.47
13	Shop/other convenience goods	1.35	3.56	0.28	0.91
14	Shop/department store	1.16	1.62	1.16	0.97
15	Shop/other shopping goods	0.53	0.60	0.50	0.53
16	Shop/automotive	1.21	1.04	0.82	1.68
17	Shop/miscellaneous other	1.16	0.80	0.64	3.07
18	School/elementary	6.19	6.47	4.13	—
19	School/secondary	7.35	7.60	2.50	1.10
20	School/other, including college	4.58	5.07	—	2.23
21	Social-recreation/residential land	2.74	4.95	3.32	2.04
22	Social-recreation/eating and drinking	1.16	2.01	1.51	1.00
23	Social-recreation/indoor	3.00	—	3.82	2.82
24	Social-recreation/clubs	2.35	2.86	1.94	2.35
25	Social-recreation/schools, museums, libraries	2.31	4.60	1.03	2.50
26	Social-recreation/hospitals, etc.	1.10	—	1.23	0.98
27	Social-recreation/church	2.84	1.68	4.68	2.78
28	Social-recreation/outdoor	2.83	4.96	2.54	1.71
29	Social-recreation/local parks	2.68	6.80	3.04	2.00
30	Social-recreation/spectator sports	3.74	9.88	3.81	2.85
31	Social-recreation/miscellaneous	2.25	1.40	1.89	2.50
32	Eat meal/residential land	1.70	0.45	1.80	1.49
33	Eat meal/restaurant or club	1.05	1.01	1.13	0.99
34	Personal business/residential land	1.56	0.90	1.19	1.91
35	Personal business/personal services	1.04	1.11	0.95	1.18
36	Personal business/medical, dental	1.33	1.66	1.55	0.86
37	Personal business/business service	0.61	0.66	0.55	0.69
38	Personal business/other services	1.29	2.40	0.83	0.91
39	Personal business/manufacturing and wholesaling	0.81	1.18	0.58	0.47
40	Personal business/hospitals, etc.	2.30	9.03	2.92	0.93
41	Personal business/church	1.94	2.81	1.07	1.47
42	Personal business/other public buildings	1.02	1.48	0.56	0.92

[a]Based on 10 percent sample of full data set.

shopping activity is the morning shopping excursion for miscellaneous convenience goods—the housewife's tour. The big shopping excursion for a new car, on the other hand, occurs in the evening. The long evening shopping tour for miscellany probably reflects the activities of those who were "out shopping around" at shopping centers or downtown. Perhaps these might be better classified as recreation activities, at least in part.

Activity Choice and Time of Day

In the conceptual framework it is hypothesized that choice of activity is related to time of day. As given in Table 4, frequency of occurrence of activities undertaken in the morning, afternoon, and evening are about the same. But many more social-recreation activities occur in the evening than in the morning or afternoon; more shopping is done in the afternoon and evening than in the morning (although morning shopping activities typically have longer duration); and more personal business activities occur in the afternoon than in the evening or morning. To validate the hypothesis that activity choice is related to time of day, the following were used: (a) the proposition

TABLE 4

FREQUENCY OF OCCURRENCE OF ACTIVITIES[a]

Code	Activity	Number Occurring			
		Over 24-Hour Period	Start Before 12 Noon	Start Between Noon and 5 p.m.	Start After 5 p.m.
02	Work/residential	137	60	56	21
03	Work/retail	257	136	102	19
04	Work/service and offices	353	233	97	23
05	Work/wholesale	88	64	22	2
06	Work/durable manufacturing	324	231	81	12
07	Work/nondurable manufacturing	194	145	39	10
08	Work/institutional	127	92	30	5
09	Work/recreation	12	4	6	2
10	Work/transportation terminals and facilities	127	83	32	12
11	Work/other	13	10	2	1
12	Shop/food, drug, liquor	629	83	285	261
13	Shop/other convenience goods	39	11	19	9
14	Shop/department store	279	44	134	101
15	Shop/other shopping goods	131	22	51	58
16	Shop/automotive	33	7	13	13
17	Shop/miscellaneous other	36	11	18	7
18	School/elementary	137	121	16	—
19	School/secondary	135	129	4	2
20	School/other, including college	25	21	1	3
21	Social-recreation/residential land	578	58	184	336
22	Social-recreation/eating and drinking	119	9	23	87
23	Social-recreation/indoor	85	1	17	67
24	Social-recreation/clubs	31	7	9	15
25	Social-recreation/schools, museums, libraries	47	4	12	31
26	Social-recreation/hospitals, etc.	21	—	10	11
27	Social-recreation/church	52	4	4	44
28	Social-recreation/outdoor	49	11	23	15
29	Social-recreation/local parks	77	7	18	52
30	Social-recreation/spectator sports	49	5	9	35
31	Social-recreation/miscellaneous	70	7	16	47
32	Eat meal/residential land	55	2	44	9
33	Eat meal/restaurant or club	178	25	77	76
34	Personal business/residential land	125	12	43	70
35	Personal business/personal services	60	13	33	14
36	Personal business/medical, dental	75	15	34	26
37	Personal business/business service	123	40	62	21
38	Personal business/other services	94	26	40	28
39	Personal business/manufacturing and wholesaling	24	10	10	4
40	Personal business/hospitals, etc.	41	3	16	22
41	Personal business/church	36	15	8	13
42	Personal business/other public buildings	94	41	37	16

[a]Based on 10 percent sample of full data set.

that the probabilities of home-activity, activity-activity, and activity-home trips were equal for different times of the day tested; (b) chi-square; and (c) analysis of variance tests. In virtually every case the test showed that the probabilities of transition occurrence were significantly different by time of day.

Activity Profile

Figures 2 through 6 show the profile of average numbers of visits to various activities (from the fundamental of the transition matrix), given that the initial leave-home state has been exited. (The absorbing return-home state is omitted; by definition it is always equal to 1.0 per journey.) Another way of looking at these is to read the figures as the number of visits per 1,000 journeys. For the total white population in the sample (Fig. 2, lower) the 1,000 journeys will include 2,513 trips, 1,523 to activities and 1,000 back home. Of the 1,523 trips, about 180 will be made to shop at a food, drug, or liquor store.

The major noticeable difference in these profiles is that white, higher income families have a more even distribution of activities than do their opposite numbers. Apparently, as observed with journey complexity—or perhaps interacting with journey complexity—higher income, white suburbanites have more diverse activity choice. Whites exhibit no strong orientation in work selection, whereas nonwhites are concentrated to some extent. Nonwhites make most of their social-recreational trips (in this activity breakdown) to other residential land. Although both show high frequencies for shopping at food, drug, and liquor stores, whites make many more such trips. Whites also go out to eat at restaurants and clubs more often than nonwhites.

Similar trends are evident in the three income groups and the three residential locations. Unanswered is the obvious question of intercorrelation of race, income, and residential location; further analysis is needed to separate these effects. [Extension of multivariate statistical analyses to the vector representation of activity choice is conceptually not too difficult, but is computationally tedious. See Anderson (5) for further discussion.] As would be anticipated, housing type shows similar differences (Fig. 5). In regard to family size, the concentration in a few activities is most intense for single persons and decreases for larger households (Fig. 6).

The implications of the evident concentration of a few specific activities (and the nature of the concentration) are similar to those that might be anticipated from the fundamental-supplemental division suggested by Chapin. Low-income nonwhite families

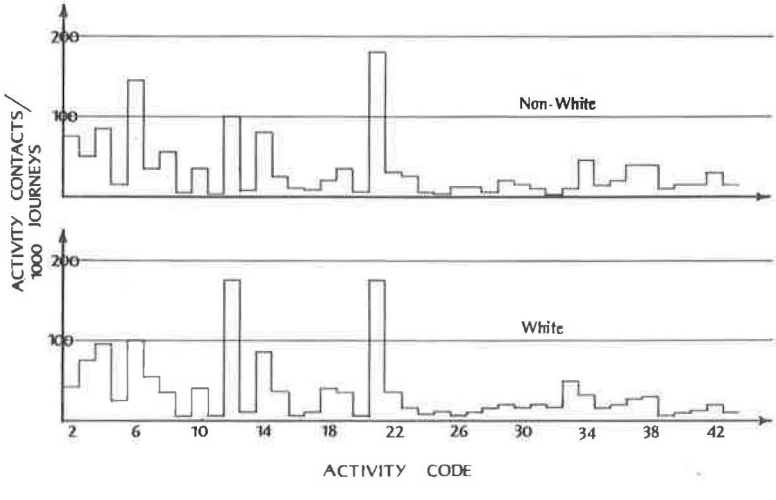

Figure 2.

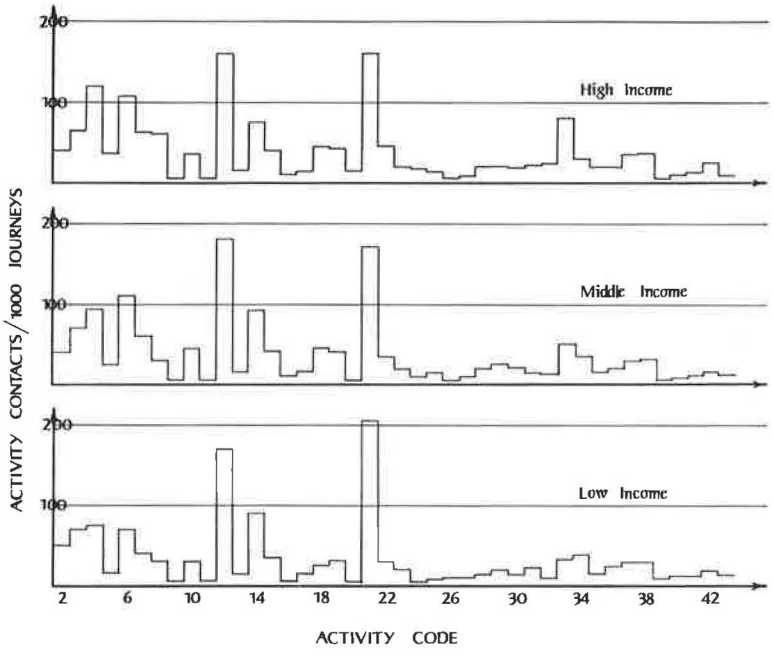

Figure 3.

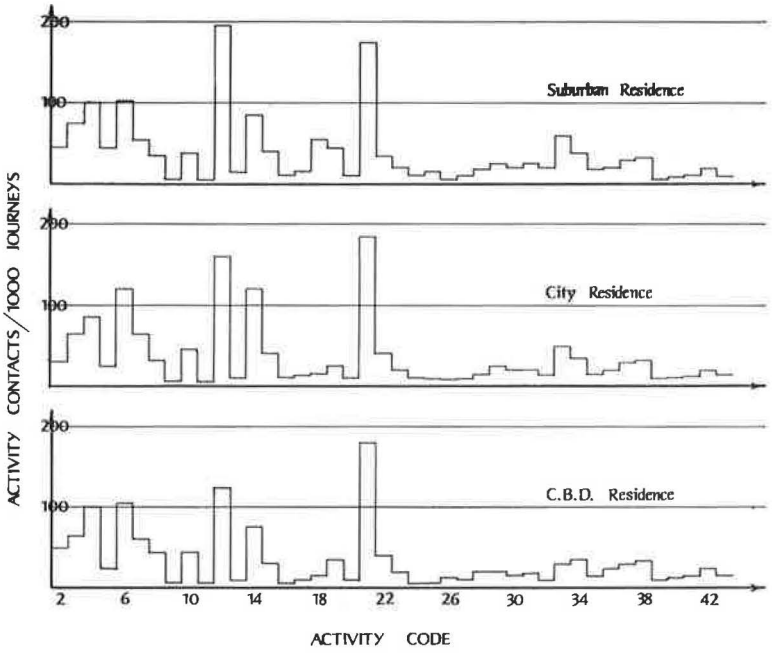

Figure 4.

There are strong repetitive patterns evident in the analysis reported here, with some anticipated variation, not all of which is easily explained. It is hoped that this material, drawn from the rich data base of home interview surveys, may be linked with more intensive time budget data to fill the gaps in home interview travel information. The eventual product should be a stronger insight into the demand for the facilities available in the urban structure: not only transportation facilities, but also those meeting the basic needs of families in their normal routine and satisfying their demands for leisure.

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