An Analysis of Individual Preferences for Accessibility to Selected Neighborhood Services

G. L. PETERSON, Northwestern University; and
R. D. WORRALL, Peat, Marwick, Mitchell and Company

Individual preferences for accessibility to selected neighborhood services are analyzed based on a trade-off between the individual's desire for ready accessibility to the service and his competing desire for insulation from irritation. The analysis provides the basis for a simple theory of accessibility preference. The paper serves to illustrate the potential utility and shortcomings of attitudinal research as applied to transportation planning.

•AN INDIVIDUAL'S REACTION to possible changes in his immediate residential environment caused, for example, by an urban renewal project or right-of-way taking for a new expressway is clearly influenced by many different factors. One of these, though not necessarily the one that dominates all others, is his perception of the probable effect of the change on the existing distribution of neighborhood services, such as shops, churches, parks, and similar local focuses of activity, about his home. His interpretation of the project as good, bad, or indifferent is colored, at least in part, by his attitudes concerning the desirable location of such services and by his interpretation of any change in their existing pattern as being either beneficial or detrimental to his family.

This paper examines the locational preferences of a sample of Chicago residents with respect to 8 such services and develops a simple theory of accessibility preference based on a perceived trade-off between the desire for proximity on the one hand and a desire for insulation from irritation on the other.

DATA COLLECTION

The 8 services selected, somewhat arbitrarily, for study and the 4 categories into which they are divided are given in Table 1. Obviously other activities, such as school, work, or social club, might equally well have been chosen.

Data for the study were collected by means of home interviews conducted on the near north side of Chicago in 1968. Respondents were asked first to rank the 8 services in increasing order of desired proximity to the home. They were then asked to make a succession of binary comparisons between pairs of services, in each case selecting that one that they would most prefer to have readily accessible to their households. Finally, they were asked to play a simple locational game, using the format shown in Figure 1. They were asked to locate first each service optimally with respect to their homes and to assume that all other elements of the environment remained constant (location being expressed here in terms of average travel times from the home and by the most convenient mode).

They were also asked to specify their current levels of expenditures for housing—rent, mortgage payments, insurance, and the like. With 7 of the 8 services at the most desired location, the eighth was then moved in successive stages both closer to home

Paper sponsored by Committee on Community Values and presented at the 49th Annual Meeting.

TABLE 1

NEIGHBORHOOD SERVICES AND CATEGORIES INCLUDED IN STUDY

Category	Description	Service
Local community focuses	Places to which local residents travel regularly and in person	Local shopping center Church or place of worship Children's park
Informal activity focuses	Places of informal social or family activities in immediate neighborhood	Friend's house
Access points	Places from which local residents travel from neighborhood to rest of metropolitan area	Public transportation stop Freeway entrance ramp
Local distribution centers	Places from which services are delivered to residents	Fire station Emergency hospital

and farther away. For each change in service location the respondent was asked how much his current expenditures for housing would have to be reduced in order for him to remain equally satisfied with the overall environment, assuming that nothing else changed. This process was repeated for each of the 8 services over the range from $2\frac{1}{2}$ to 60 minutes travel time.

The objectives of both sets of measurements, i.e., rank-order and paired-comparison versus the "game," were respectively (a) to establish quantitative measurements of the subjective importance of convenient accessibility to the various services and (b) to establish a value, expressed arbitrarily in a monetary metric, that people might attach to changes in accessibility. These objectives in turn were designed to provide the basis for evaluating the probable impact of new freeway construction on the accessibility patterns and preferences of the existing neighborhood traveled by the road.

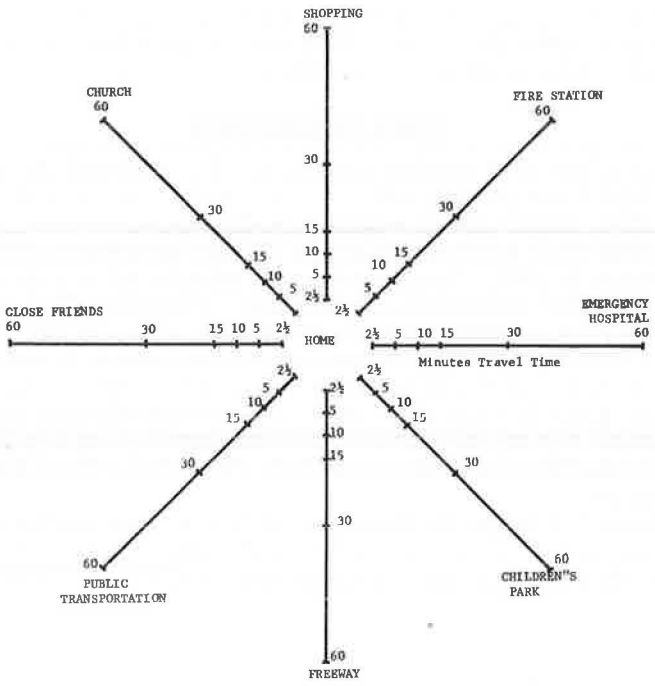

Figure 1. Accessibility game.

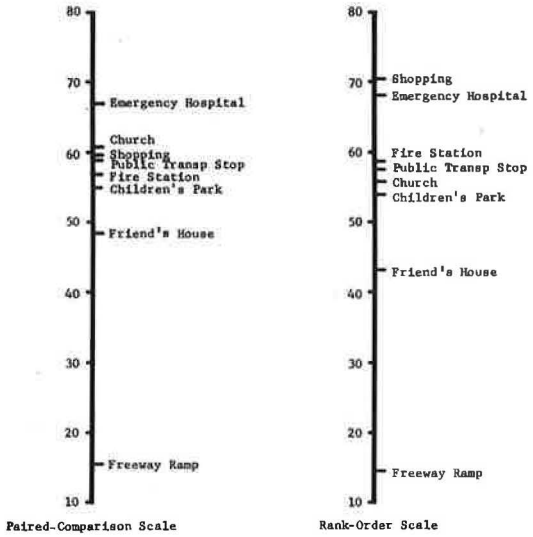

Figure 2. Preference scales for accessibility to neighborhood services.

A total sample of 250 households was obtained. The study population was relatively homogeneous. It was composed primarily of mature, blue-collar households with an average annual income of approximately $8,500. There was a small, but significant, number of elderly and retired couples with no children. There were relatively few young families, few professional or managerial employees, no single young persons living on their own, and no Negroes. The large majority of the families were native to Chicago and had lived in their present neighborhood, and frequently in their present house, for at least 6 to 10 years. The majority of the houses were small, single-family homes. There was a small proportion of apartments.

The rank-order and paired-comparison measurements produced useful results. The location game was not successful, however, in doing what it was intended to do. The data and the experience of the interviewers have shown that few of the respondents were able to relate accessibility and housing cost. They judged a situation to be either acceptable or unacceptable. This unexpected circumstance defeated the attempt to measure the respondents' monetary evaluation of changes in accessibility. However, it produced an interesting result that provides a new basis for evaluating the accessibility of neighborhood services in a probabilistic way. The results suggest a model that, when developed further, should permit a neighborhood to be evaluated in terms of the probability that it will be acceptable to its inhabitants. The suggested approach thus measures the probability that a neighborhood is "adequate" rather than the degree to which it deviates from "optimality."

The location game was designed to handle only the simplest case in which each service was moved individually from its most desired location while the other 7 services were held at their optimal position. This does not permit the examination of trade-offs between services or combinations of services. Discussion of that subject is therefore not justified here. Research is currently in progress that examines the problem of trade-offs.

INITIAL RESULTS

The data from the rank-order and paired-comparison tests were used to construct a pair of conventional, psychometric preference scales. These are shown in Figure 2. The scales have interval properties but arbitrary zero points and arbitrary linear dimensions. Their units are not commensurate, and they are comparable only in qualitative terms. It is clear, despite minor differences between the 2 scales, that the 8 services fall into 4 distinct priority groupings. In the case of the paired-comparison test, the highest priority, i.e., the highest priority for accessibility, is assigned to emergency hospital. In a second cluster, at a slightly lower level of priority, are church, shopping, public transportation, fire station and children's park. Friend's house falls in a third category below this second cluster, and freeway ramp has by far the lowest priority of all. The pattern in the case of the rank-order analysis is essentially the same, with the single exception that shopping and emergency hospital share the top priority. The others fall into the same secondary and tertiary classes, and freeway ramp again is the lowest.

TABLE 2

PREFERRED TRAVEL TIMES TO SERVICES

Travel Mode	Service	Average Travel Time From Home to Service	Standard Deviation	No. of Respondents
Private automobile	Public transportation stop	3.3	1.44	3
	Fire station	7.2	5.76	249
	Emergency hospital	8.6	6.50	249
	Church or place of worship	12.3	6.56	39
	Local shopping center	12.8	9.14	50
	Children's park	18.0	16.19	10
	Freeway entrance ramp	23.6	19.56	249
	Friend's house	23.7	12.56	67
Walk	Public transportation stop	4.8	4.15	244
	Church or place of worship	8.1	6.37	204
	Local shopping center	8.2	6.37	191
	Friend's house	10.3	7.35	173
	Children's park	12.3	12.49	237
Transit	Public transportation stop	3.8	1.77	2
	Children's park	6.3	5.30	2
	Local shopping center	15.3	9.86	8
	Church or place of worship	18.3	9.83	6
	Friend's house	21.9	10.29	9

Clearly, ready access to friend's house or freeway ramp carries low relative priority in the respondent's scale of values, reflecting in the one case an expansive area of social contact and, in the other, a strong disinclination to be located adjacent to a service that almost all respondents clearly consider more of an irritant than a convenience. This latter finding is due, at least partly, to a neighborhood freeway controversy that was raging at the time of the study. Uniformly heavy weighting was placed on the importance of easy access to shopping, reflecting in large degree the fact that many of the respondents were housewives, and to public transportation. Emergency services similarly ranked high in the scheme of things, suggesting a certain desire for insurance against an improbable but potentially urgent demand for service.

These relative priorities are reflected also in Table 2, which gives the respondents' perceived optimal levels of accessibility to the 8 services according to their chosen travel mode. Freeway ramp, fire station, and emergency hospital are included only in the private automobile mode on the grounds that one is unlikely to walk or travel by bus to a freeway ramp or emergency hospital or require that the fire department travel to one's burning house on foot.

In this case, public transportation heads the list, indicating that accessibility to transit, though not of dominant importance, is interpreted in terms of a travel time by walking of roughly 5 minutes and by car of just over 3 minutes. The large majority of respondents (Table 2, number of respondents column for the walk mode) indicated a preference for walking as the travel mode for journeys to public transportation, church, children's park, local shopping, and friend's house. Significant use of the automobile was restricted to friend's house, shopping, and, of course, to the 3 automobile-constrained services.

Clearly, the travel times given in Table 2 convert into significantly different spatial arrangements of services depending on the mode used. In all cases the preferred location of the public transportation stop is within 5 minutes of the home, equivalent roughly to $\frac{1}{4}$ to $\frac{1}{2}$ mile, no matter what mode is used after allowing for parking and unparking delays. In the case of shopping, church, and friend's house, however, considerably greater travel distances appear acceptable where the automobile mode is used, suggesting a considerably different neighborhood orientation on the part of automobile users and walkers. It should again be noted, however, that the large majority of respondents opted for the walking mode, suggesting that major emphasis should be placed on the walking rather than on the automobile mode results.

Respondents perceive distance and time somewhat differently. Table 3 gives the average acceptable distances to services for the entire population of respondents for

TABLE 3

PREFERRED WALKING DISTANCES TO SERVICES

Service	Average Acceptable Walking Distance (miles)	Standard Deviation
Public transportation stop	0.28	0.23
Local shopping center	0.50	0.36
Children's park	0.51	0.56
Church or place of worship	0.54	0.39
Friend's house	0.63	0.49

the walk travel mode. The values range from just over ¼ mile for a public transportation stop to over ½ mile for friend's house, comparable to the time values given in Table 2. The order of the entries, however, is different.

The results of the accessibility game are shown in Figure 3. For each service i, values were computed of the proportion $p_a(t)^i$ of respondents accepting each of the 6 levels of accessibility t indicated on the game board. These values, interpreted as conditional probabilities of accessibility acceptance, are plotted as functions of the travel time t in Figure 3. The approximately log-normal form of each of the 8 services and the apparent non-negative vertical intercepts for zero travel times suggest that, although there is a relatively wide acceptance range for each service for the population at large, there may also be upper and lower bounds beyond which the respondents consider their environment unacceptable and that there is disutility associated both with undue proximity to the service and with inadequate access.

Further, there appears to be a portion of the population that is indifferent to the location of the 8 services. The curves do not appear to approach a probability of zero

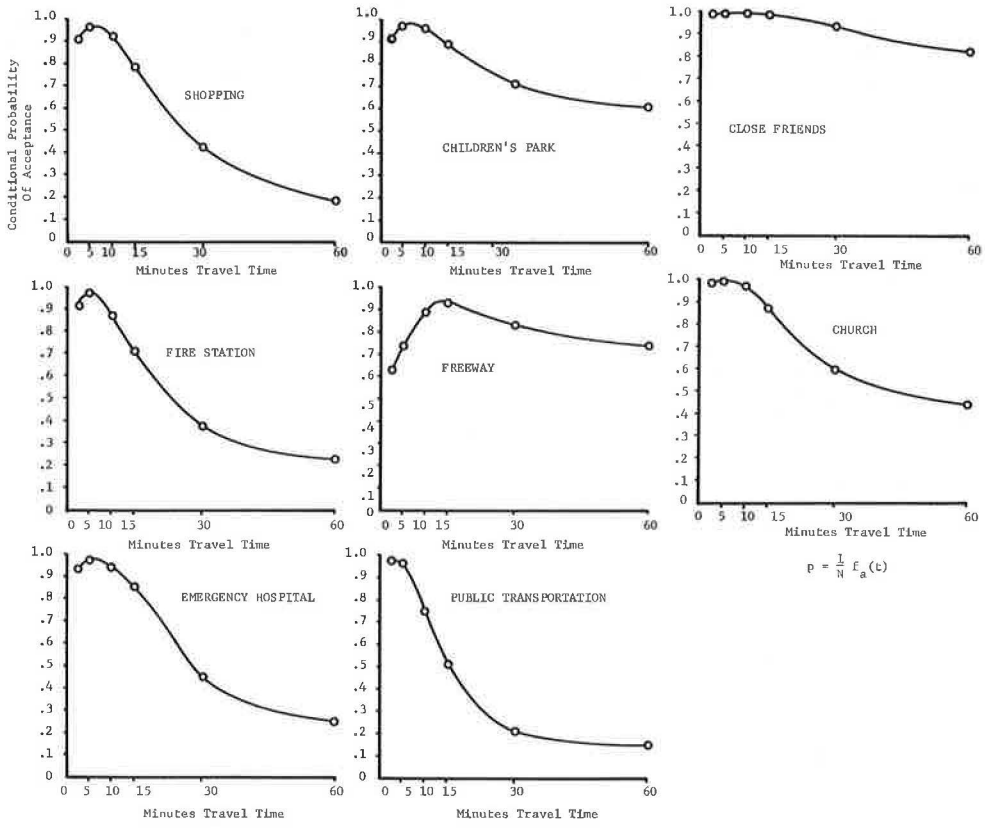

Figure 3. Probability of acceptability as a function of access time.

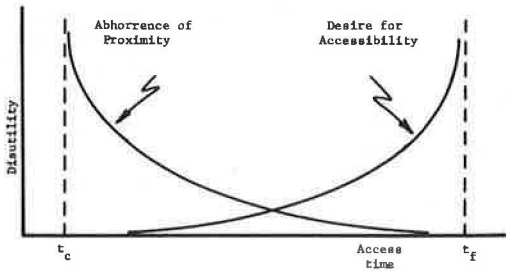

Figure 4. Postulated relationship between disutility and access time.

acceptability as distance increases but rather some nonzero asymptote, suggesting indifference to the distance or travel time involved. This is most obvious for public transportation stop, freeway ramp, children's park, and church; it is least obvious for shopping. Similarly, the nonzero intercept on the ordinate for zero travel time suggests an equivalent proportion who are insensitive to proximity. Some services, especially public transportation, appear to be more sensitive to changes in accessibility than others. Friend's house, for example, is almost totally insensitive to travel time. These results may have been caused by an indifferent subgroup or, alternatively, may have occurred because many respondents were not playing the same game.

Finally, as noted previously, there is substantially more distaste for proximity to a freeway than for any of the other services studied. The vertical intercept in this case indicates that roughly 30 percent of the respondents rejected totally a freeway ramp within 5 minutes of the home. Preference for access to a freeway appears relatively insensitive to travel times greater than 30 minutes.

TOWARD A THEORY OF ACCESSIBILITY ACCEPTANCE

Assume, as argued earlier, that an individual responds to changes in the accessibility of a given neighborhood service in terms of 2 independent objectives that he is trying to satisfy simultaneously. One objective is concerned with an abhorrence of proximity and the other with a desire for convenience of access. For simplicity, assume further that dissatisfaction relative to the first objective increases at an increasing rate as the level of accessibility increases, i.e., as the travel time between home and the service location decreases, approaching infinity at some critical travel time. Likewise, assume that dissatisfaction relative to the second objective increases at an increasing rate up to a similar critical level as accessibility decreases, i.e., as travel time increases. Let these two critical values be defined as t_c and t_f respectively as shown in Figure 4.

For any given population, the values of t_c and t_f may be expected to vary from individual to individual. We will assume here, but not prove, that this variation is noncorrelated, i.e., that the values of t_c and t_f are independent. We will further assume that intermediate travel times t are perceived in terms of the ratio t_o/t_c or t_o/t_f.

Let $z_c = \log t_c$ and $z_f = \log t_f$ be 2 independent random variables with distribution functions $g_c(z)$ and $g_f(z)$, as shown in Figure 5.

The probability that a given travel time t will not be rejected for being too small is then given by

$$p\{z_c < z\} = \int_{-\infty}^{z} g_c(z)dz = G_c(z)$$

where $z = \log t$.

Likewise, the probability that t will not be rejected for being too large is given by

$$p\{z < z_f\} = \int_{z}^{\infty} g_f(z)dz = G_f(z)$$

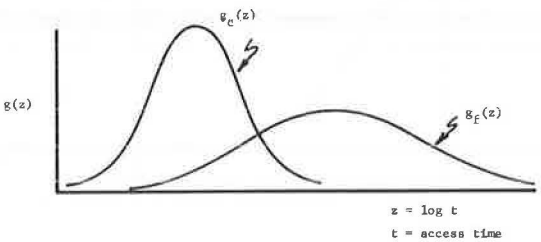

Figure 5. Postulated frequency function for rejection thresholds.

Hence, if we assume that $g_c(z)$ and $g_f(z)$ are independent, the probability that t will not be rejected for being too small or too large is given by

$$p\{z_c < c < z_f\} = p\{z_c < z\} \Omega p\{z < z_f\} = \int_{-\infty}^{z} g_c(z)dz \int_{z}^{\infty} g_f(z)dz = G_c(z)G_f(z)$$

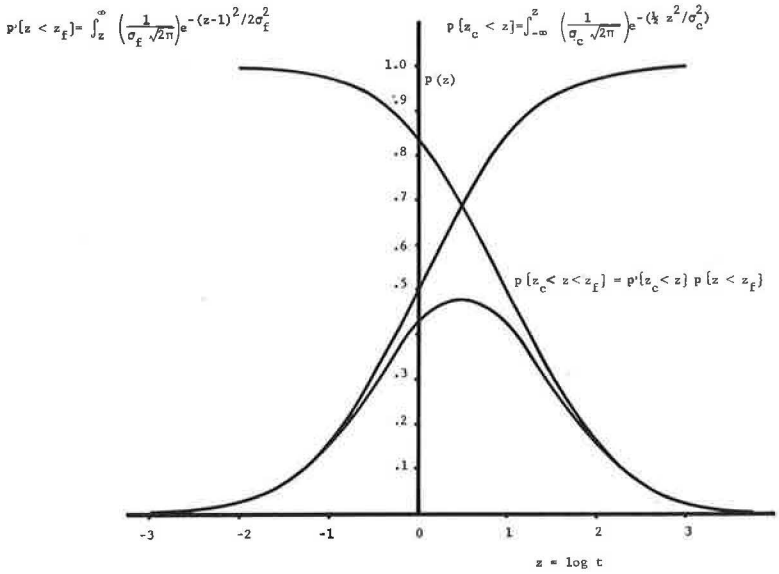

Figure 6. Hypothetical joint density function (logarithmic).

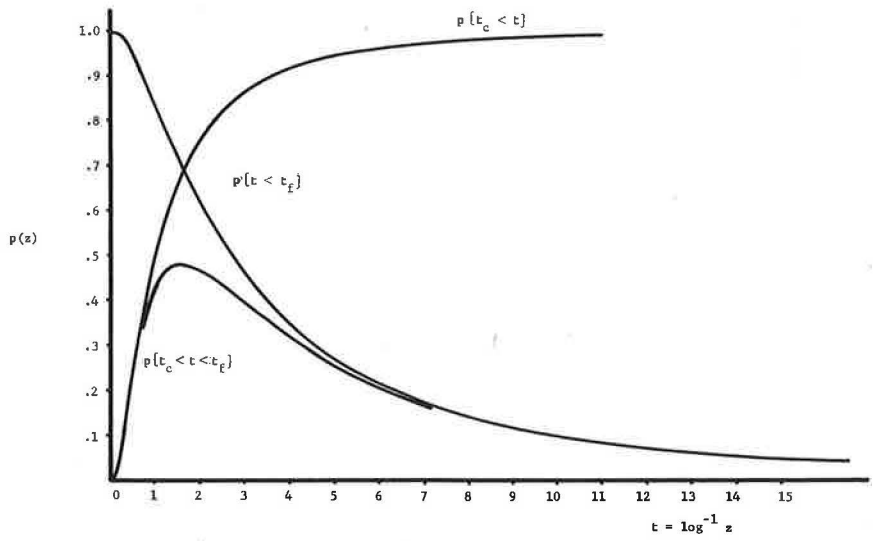

Figure 7. Hypothetical joint density function.

If z_c and z_f are normally distributed, as suggested by the data shown in Figure 3, the functions $p\{z_c < z\}$, $p\{z < z_f\}$, and $p\{z_c < z < z_f\}$ will have the form shown in Figure 6. Transformed to the original arithmetic scale for t, these curves will be of the form shown in Figure 7.

We further assume that a certain proportion a of the population is indifferent to the closeness of the service and that some similar proportion b is indifferent to its remoteness, with z_c and z_f being normally distributed for the remainder; then $p\{z_c < z\}$,

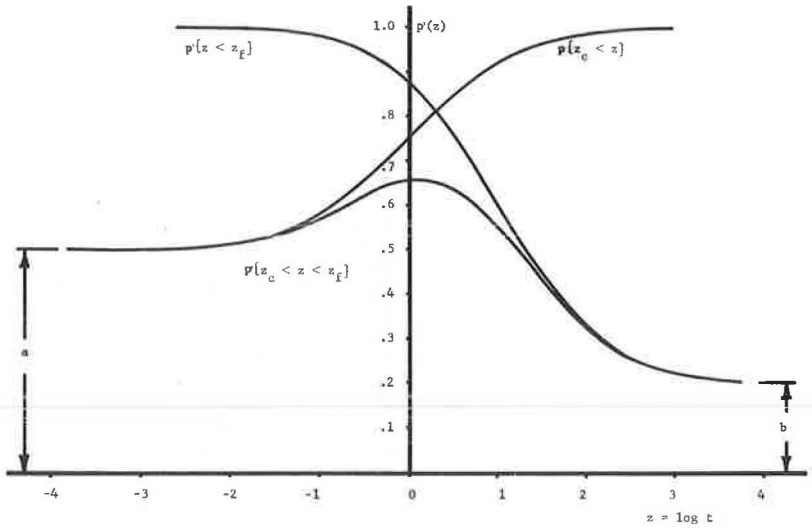

Figure 8. Hypothetical joint density function with indifference parameters (logarithmic).

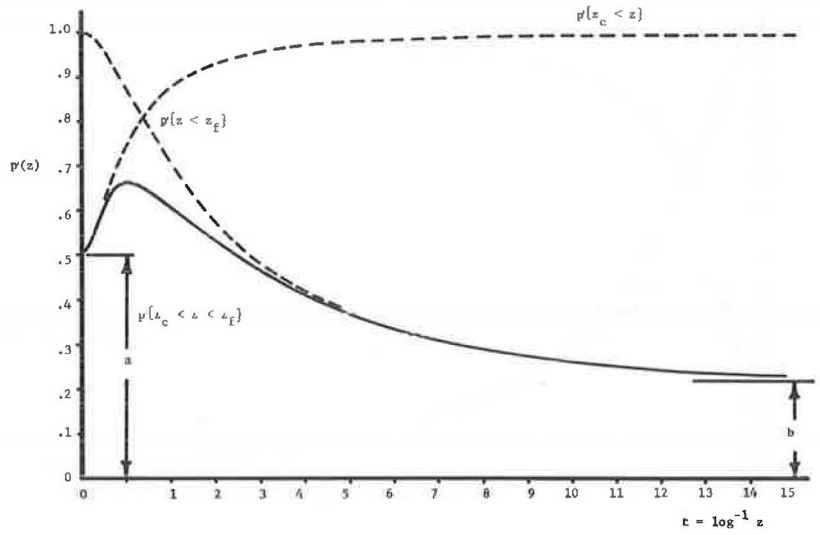

Figure 9. Hypothetical joint density function with indifference parameters.

$p\{z < z_f\}$, and $p\{z_c < z < z_f\}$ will take the form shown in Figure 8. On the original time scale the joint function will have the form shown in Figure 9. This is very similar to those shown in Figure 3.

A MODEL OF ACCESSIBILITY PREFERENCE

The preceding theoretical structure may be summarized formally in the following manner. Let

$$F_c(z) = \int_{-\infty}^{z} f_c(z)dz = \frac{1}{1 - a}\left[G_c(z) - a\right]$$

and

$$F_f(z) - \int_{z}^{\infty} f_f(z)dz = \frac{1}{1 - b}\left[G_f(z) - b\right]$$

be normal distribution functions of the probability that for a given service, all other things held constant, a given travel time $t = \log^{-1}(z)$ will not be rejected for being too small or too large respectively by that proportion of the population that is not indifferent to proximity in the case of $F_c(z)$ and by that proportion of the population that is not indifferent to remoteness in the case of $F_f(z)$.

Solving for $G_c(z)$ and $G_f(z)$, we find that

$$G_c(z) = (1 - a)F_c(z) + a$$

and

$$G_f(z) = (1 - b)F_f(z) + b$$

If $A(z)$ is defined to be the probability that the travel time $t = \log^{-1}(z)$ will be acceptable, then a general equation for the curves indicated by the data in Figure 3 is given by

$$A(z) = G_c(z)G_f(z) = \left[(1 - a)F_c(z) + a\right]\left[(1 - b)F_f(z) + b\right]$$

That is,

$$A(z) = \left\{(1 - a)\int_{-\infty}^{z} \frac{1}{\sigma_{zc}\sqrt{2\pi}} \exp\left[-\frac{1}{2}\left(\frac{z - \mu zc}{\sigma_{zc}}\right)^2\right] + a\right\}$$

$$\left\{(1 - b)\int_{z}^{\infty} \frac{1}{\sigma_{zf}\sqrt{2\pi}} \exp\left[-\frac{1}{2}\left(\frac{z - \mu zf}{\sigma_{zf}}\right)^2\right] + b\right\}$$

This model is presented only as a hypothesis that has been suggested by the data. It should be studied further.

CONCLUDING REMARKS

This paper has developed a simple theory of locational preference for neighborhood services. It has been suggested that an individual perceives the distribution around his home of neighborhood facilities, such as shops, parks, fire stations, and transit stops, in terms of 2 competing objectives. One objective is concerned with the need to use the service and desires ready accessibility. The other is concerned with avoidance of irritation and undue proximity. The result is a trade-off, the implications of which are exhibited empirically in the form of a log-normal distribution of accessibility acceptance. This distribution may be modeled theoretically as the outcome of 2 independent, normally distributed response functions, one reflecting the desire for accessibility, the other the desire for insulation from irritation.

The structure has considerable implications both for original design and plan evaluation. It may, for example, be used as input to a mathematical programming model

of optimal service arrangement. Alternatively, it may be used as a basis for predicting public response to some enforced change in the existing service configuration. Neither of these topics is discussed in detail here.

A word of caution in interpreting the present empirical results is in order. The empirical data were obtained by using an experimental instrument designed for purposes other than that of testing the immediate hypothesis developed here. Although they tend to support rather than negate the postulated theory, they require additional external verification. Equally, the population studied and the characteristics of the respondents' current environment covered only a small portion of the total possible spectrum of socioeconomic and locational characteristics that might be of interest to the analyst. The peculiarities of both the population and their current environment are clearly reflected in the results.

Similarly, attention should be directed to the question of substitutability among services. The analytic procedure here was to locate optimally all but one service and then to vary the location of that one to approximate the respondent's perceived threshold of accessibility acceptance. This results in a conditional rather than an absolute distribution of accessibility preference for each service. The results for one service may be dependent on the perceived optimal location of the others. It is conceivable that this threshold would differ if other services were not located optimally.

An intriguing approach to this problem might be to locate all but one of the services at their minimally acceptable rather than at their optimal locations and then to vary the location of the remaining one until it, too, was just acceptable. The threshold of acceptance thus obtained would in all probability be considerably different from that established here.

If this hypothesis can be verified, an intriguing next step might be to examine the trade-offs among a mix of services, leading ultimately to establishment of a set of acceptable locational combinations that collectively define an adequate rather than an optimum environment.

Finally, a number of general comments are appropriate concerning the methodological approach employed in this paper. Attitudinal research and the concomitant analytical procedures of psychometric scaling have been employed in fields other than transportation planning for many years. Although by no means universally successful, they have provided a basis of valuable information of such varying disciplines as market research and education. This paper has attempted to indicate, albeit in a rather tentative fashion, how such methodology might usefully be applied to a particular problem of transportation analysis. Any value that the paper may have stems probably from this source rather than from the substantive results reported.

The rationale underlying the use of attitudinal and related studies in the present context is based on 3 major points:

1. They provide the planner with a mechanism for studying subjective and qualitative factors that are frequently omitted from analyses based solely on real-world observations.
2. They provide the analyst with a means for exposing the respondent to alternative environments in a format of at least quasi-experimental control and in a manner that allows him to focus on particular dimensions of the respondent's preference structure.
3. They permit the evaluation and modification of planning policy decisions in a manner not otherwise possible. This may include both analyses conducted at a greater level of detail than has been the case heretofore and analyses along dimensions which have been previously ignored.

These assets are unfortunately accompanied by an equivalent set of procedural and analytical problems. Of these, by far the most serious concern respondent cognition of the decision environment. In part, this is a function of the accuracy and care taken in displaying the environment to the respondent—for example, explaining the purpose of the locational game employed in this paper and ensuring that the "players" understand precisely what it is that the researcher desires of them. Even more seriously, it is also a function of the degree to which the survey mechanism is capable of recording accurately the respondent's perception of and response to the factors under study.

It is inevitable, unless the total number of factors included in an attitudinal study is larger than that attempted here by the authors, that there will be serious errors of specification bias in the structure of the survey device. A large number of relevant factors have been omitted from the study, all of which are likely to influence the respondent's reactions. Equally, in any situation where time and distance measurements or both are involved, it is questionable how information may best be presented to the respondent—either in terms of one or the other, or in terms of a ratio of both. This question was conveniently side-stepped in this research. Somewhat similar problems associated with the respondent's perception of housing costs have been discussed previously.

Considerable attention has been directed by other researchers to the questions of "halo effects" and the effect that the survey instrument itself may have on respondent behavior. In this case, no attempt was made to control for such effects. It is, in fact, questionable whether anything beyond refinement of the survey tool itself could be achieved in this direction without the expenditure of considerable resources. It is probably fair to say that, although by no means unobtrusive, the rank-order and paired-comparison tests, and particularly the simple, locational game described here, provide a reasonably accurate insight into the locational preferences of the individuals studied. Perhaps the most interesting question for consideration is how one may build on work of this type, both in terms of a more rigorous research design and in terms of the development of an operational planning methodology. The present study is clearly far removed from either of these 2 objectives. It is the authors' first steps along a path that has not been previously investigated with any degree of vigor and that warrants further attention in the future.

ACKNOWLEDGMENT

The research on which this paper is based was conducted at Northwestern University and supported in part by the National Science Foundation.

Discussion

HAROLD HANDERSON, Office of High Speed Ground Transportation, U.S. Department of Transportation—This paper supports the hypothesis that negative reactions to the location of neighborhood activity points are bimodal—that is, that some things (such as freeway ramps) can be too close as well as too far away. The research reported here was not a longitudinal study, though family histories could have been gathered from survey respondents in a particular neighborhood when the survey was taken.

The orientation of the paper toward the development of "a mathematical programming model of optimal service arrangement" and its discussion of the utility of developing parametric information on an "adequate" environment set me to wondering about the following questions:

1. What are meaningful subgroupings of a population, in terms of their responses to access or service locations such as those identified in this paper?
2. What factors are relatively important in determining housing prices and family settlement and relocation patterns?
3. Which of these factors are apt to change over the life cycle of a family whether or not they actually lead to relocation decisions?
4. What should a planner do or recommend as a result of these findings?

I think that, lacking very firm answers to these questions, we are still some distance from an operational model of "optimal service arrangement." However, more attitudinal research appears worthwhile, combined with information on family socioeconomic characteristics; neighborhood environment; frequency of use of activity centers or service locations; relative perceived desirability of changes in the location of such

centers for the family, particularly over time; and the possible design or redevelopment of population centers, taking these findings into account.

As the authors note, the work reported here was not designed to produce the present paper. However, several specific comments on the paper appear worth making. As noted in a concurrent HRB paper (1), blue-collar families are apt to value and engage in visits with nearby relatives more than with close friends. Familial ties were included in the informal activity focus but the location of friends was the closest topic reported. It also seems overly trite to say that the relatively low importance ascribed to having close friends nearby reflected "an expansive area of social contact." Some hypotheses at least appear warranted to guide further research. It might be, for example, that the respondents (predominantly housewives) visited more by telephone than in person; or that "visits" took place at some central location, such as a bowling alley, among families with some more dispersed housing pattern but a nonresidential (e.g., work) focus.

It is not certain that the peculiarities of the population reported, and particularly its immediate environment, are sufficiently clearly linked to the results reported. The responses do seem to show that the survey population was basically composed of relatively healthy older families, more dependent on public transportation and local stores than on children's parks and freeway ramps. This would indicate that the respondents were more urban than suburban, and one-or-no-car rather than two-or-more-car families. The large (though nonspecific) number of female respondents to the survey might indicate that relative nondrivers were heavily polled. Thus the relative dislike for being close to a freeway ramp and the relative indifference to increasingly greater distances to a ramp may be overstated. The general results, however, are plausible compared to trips to a public transportation stop, which are much more apt to be made on foot.

The responses that the authors interpret as possible indifference to increasing travel time may, however, merely be respondent inability to imagine what one's responses might be to a situation that is perhaps perceived as being rather remote. Support for this hypothesis is provided by the responses regarding shopping, an activity that must be done relatively frequently, regardless of one's other family or locational circumstances. The reported difficulty that respondents had in making trade-offs between accessibility and housing cost sounds very realistic, though such considerations doubtless take place when a family is in the process of locating itself. However, it is highly likely that no family takes all theoretically pertinent factors into consideration, but rather seeks a location that satisfies some particular subset—a subset that may well change with time as well as experience. The best example of this presented in the paper is the question of accessibility to a children's park. Childless families, or families with no children or grandchildren close by, might prefer less rather than more accessibility; but families with young children or grandchildren might prefer to have it next door. Therefore, no general standard of neighborhood "excellence" would appear to be possible in terms of distance or ease of access to a children's park. It is not surprising, therefore, that the widest variances reported for the walking mode occurred on this item.

Another complicating factor, which may show up in the findings reported here, results from the following possibility: An older couple that has lived in one spot for a number of years suddenly realizes that it is difficult to get to a hospital from its location. This would then affect the family's response to the perceived desirability of having a hospital more or less accessible, though this may never have been an issue earlier when the family was deciding on its current location.

A valuable refinement of this research would be to differentiate subpopulations in terms of their abilities as well as their interests and desires—for example, dividing walkers from nonwalkers and drivers from nondrivers. This would supplement reported material, such as that given in Table 3.

The absence of automobile ownership and journey-to-work information from this report is unfortunate. Does the family tend to rely more or less on public transportation for local shopping? Does the family exhibit stability in terms of job location as well as housing? Does this pattern occur for urban areas of various sizes, or is it restricted

to particular socioeconomic classes or city types? On this latter point, obviously, the present report can provide only part of the necessary information to develop a fuller understanding of existing patterns. The reporting of standard deviations as well as averages from respondents, however, is to be applauded as a useful addition to a set of important, though partial, findings.

References

1. Fellman, Gordon. Sociological Field Work Is Essential in Studying Community Values. Paper presented at the 49th Annual Meeting and included in this Record.

G. L. PETERSON and R. D. WORRALL, Closure—The paper is intended to be exploratory rather than developmental. Specifically, it is intended to explore a simple hypothesis concerning the individual's perception of his physical environment. There is no attempt to be comprehensive nor is there any attempt to reach earth-shattering conclusions. It is simply an initial examination of what may be an interesting and perhaps useful idea.

The paper does not describe a mathematical programming model. Such a model could be developed and, in fact, has been developed based on the work described. It is not, however, the subject of this particular paper.

The paper represents one relatively small part of a very much larger investigation. This investigation addressed many short points that the discusser apparently wishes we had included in this paper. Specifically, it included an analysis of the attitudes of local residents toward alternative investments in the physical environment, a longitudinal analysis of trip-making and household activity behavior, and an analysis of individual perception of neighborhood structure and neighborhood extent. However, in preparing this paper, we elected to focus attention on a portion of the overall study.

Further work is in progress and will be reported later. A PhD dissertation is currently being completed at Northwestern University on the subject (2). The authors and R. W. Ellis (3) also presented another paper on this subject in June 1969.

References

2. Redding, Martin J. The Quality of Residential Environments: Preference for Accessibility to Residential Opportunities. Dept. of Civil Eng., Northwestern Univ., Evanston, Ill., PhD dissertation in preparation.
3. Worrall, R. D., Peterson, G. L., and Ellis, R. W. Toward a Metric for Evaluating the Impact of Urban Highway Construction on Neighborhood Structure. Paper presented at the Joint National Meeting of the Academy of Applied Science and the Operations Research Society of America, June 1969.