35

PERCEPTION AND EVALUATION OF THE JOURNEY TO WORK

W. Young
Lecturer in Transport
Monash University

J. Morris
Research Scientist
Australian Road
Research Board

Abstract:

Modellers of transport-related decisions have often drawn the distinction between "objective" measures of attributes used to describe the transport system and individuals' perception and evaluation of these attributes. Only a few studies have been made, however, of the relationship between these objective and subjective assessments. This paper examines individual's satisfaction with the length of the work trip. The primary aims are to establish the nature of the relationship and its stability across different groups of travellers. The study is based on data collected in a home interview survey of residential location choice conducted in outer suburban Melbourne during 1978-79. A number of broader issues are addressed, including implications for modelling and policy.

The authors gratefully acknowledge assistance with the computer analysis given by Steven Goschnick and Gerard Garlick.

PERCEPTION AND EVALUATION OF THE JOURNEY TO WORK

INTRODUCTION

The ease with which people can participate in activities is influenced by the transport system. A good transport system may entice people to partake in certain activities while a poor transport system may discourage such involvement. However, in order to ascertain what is a good or a bad transport system it is necessary to investigate both objective and subjective measures of effectiveness. It may be that one individual views the separation between two activities in a much different light than another. Handicapped people, for example, are likely to view a trip to the corner shop as being much more onerous than a neighbour who can walk without difficulty.

Transport planners have often developed models of transport choice or measures of accessibility which have assumed that individuals view the transport system in the same manner. Car drivers are assumed to have the same satisfaction with a travel time of ten minutes as those travelling by public transport. Males and females are similarly assumed to have similar satisfactions with travel time. Yet these people experience quite different conditions and constraints. Moreover, most such models are calibrated using data on existing travel patterns. This approach suffers from a major flaw, in that all people clearly do not have the same sets of choices. Alternative choices must be built into the analytical procedure for evaluating spatial patterns before we can state firmly the nature of the relationship (i.e. the shape of the curve) between satisfaction and journey length.

This paper explores individuals' perceived satisfaction with the length of the work trip. The primary aim is to establish the nature of the relationship and its stability across different groups of travellers.

ATTRIBUTE EVALUATION

Evaluating attribute levels entails a number of steps (Levin *et al.*, 1979) (Figure 1). Individuals must first have some estimate of the magnitude of the attribute in question (in this case the length of the work trip). The relationship between the actual length of journeys and travellers' estimates is influenced by such factors as the level of familiarity with the trip, the purpose of the trip, time constraints (e.g. flexibility of arrival times) conditions of travel, and so on. More often than not the relationship is assumed to be monotonic.

Secondly, individuals must decide whether the particular attribute level is acceptable or not. That is, the perception of the attribute (trip length) must be transformed into a measure of satisfaction.

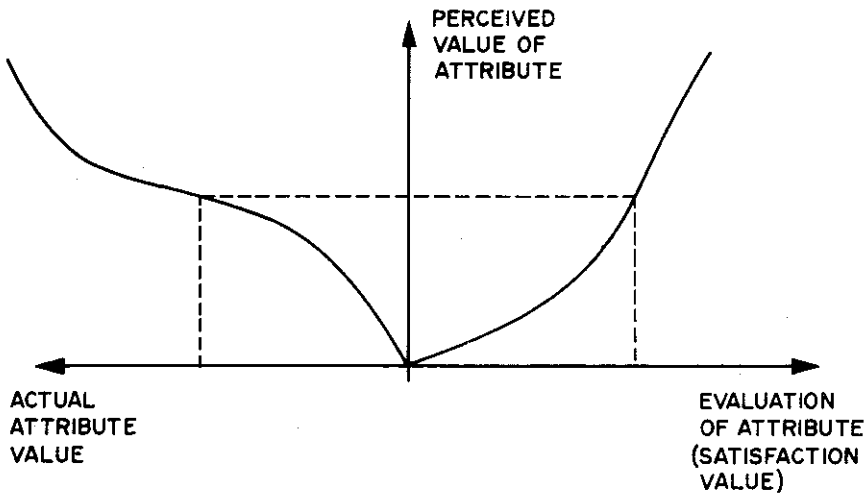


FIGURE 1. Individuals' transformation of attitude ratings from actual attribute level to satisfaction with attribute.

This two-stage process may not be the simple one-dimensional transformation shown in Figure 1. Rather it may take place in several dimensions since the attribute may be evaluated on the basis of a number of characteristics. In the case of closeness to work the individual may consider characteristics such as comfort, convenience and his ability to read the paper during the trip. There may also be a problem with being too close to work, by being reminded of it during one's leisure time. The particular characteristics and the weighting given to each of them are closely tied to individual preferences.

This paper concentrates on the second part of the transformation shown in Figure 1. It is worth noting, however, that the findings may have wider applicability. Several studies indicate that the relationship between perceived and objective measures of travel time - the first part of the relationship - is in fact monotonic (O'Farrell and Markham, 1974; Levin *et al.*, 1979).

SURVEY METHOD

The information for this study was drawn from a survey of residential location choice conducted in three outer suburban areas in Melbourne during 1978-79. The three survey areas - East Burwood, Wantirna and Belgrave (Figure 2) - are in various stages of urban development.

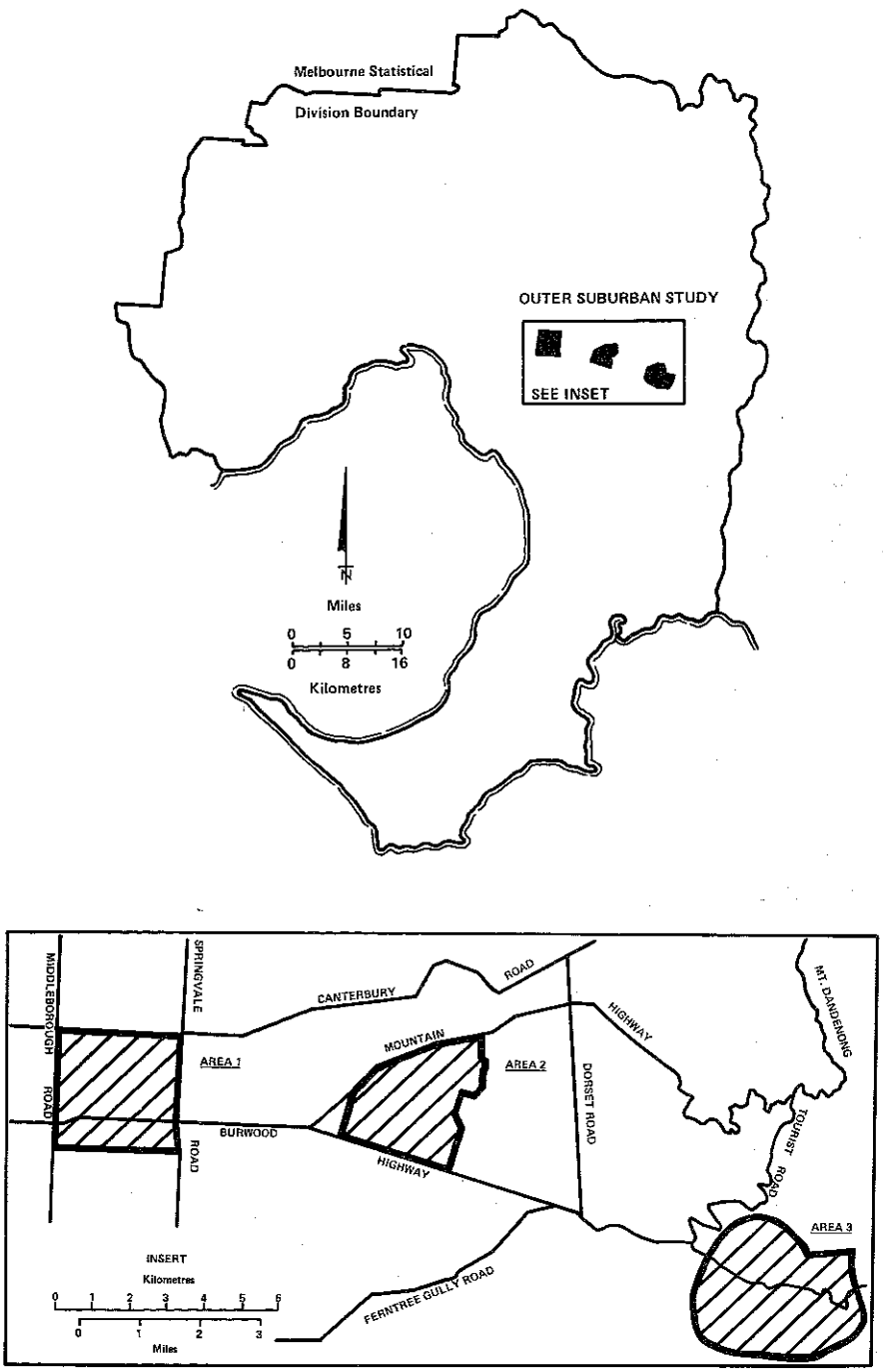


FIGURE 2. Location of outer suburban study areas.

New residents in each area were asked, inter alia, to rate their level of satisfaction with closeness to their present workplace (Figure 3), and then to evaluate a number of possible travel times to work (Figure 4).

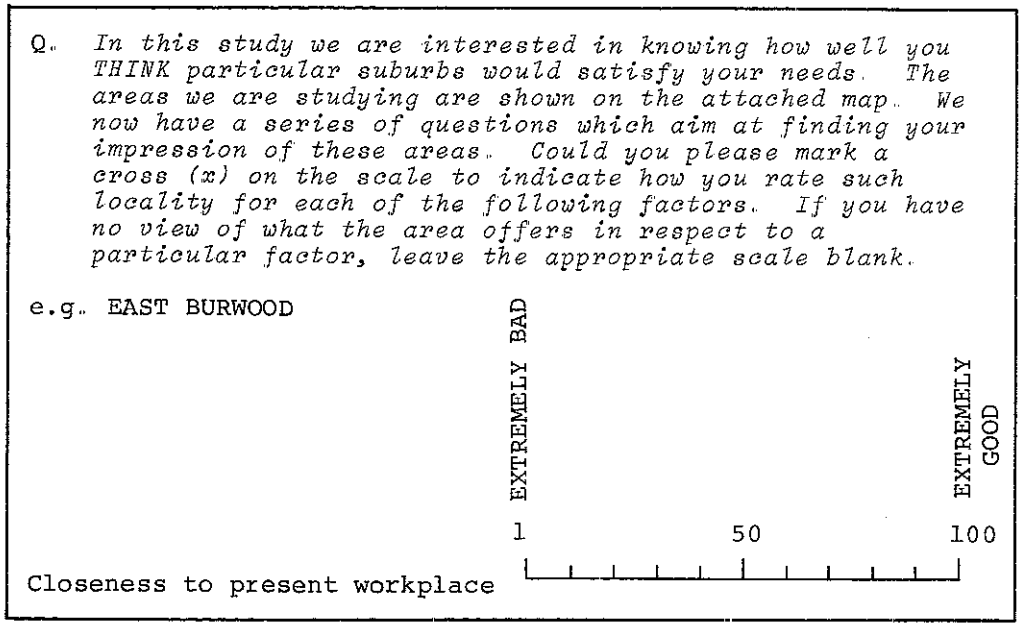


FIGURE 3. Question and measurement scale used to obtain satisfaction ratings for closeness to present workplace.

The first set of information relates to observed travel patterns; such data are usually termed 'market' data. The second approach is more accurately described as 'experimental' data (in that the respondents were presented with alternative hypothetical travel times).

In later questions the respondents were asked to record further details of their present work journeys, including the time spent travelling and the mode used. In addition, respondents were asked to indicate the importance they attached to closeness to work when deciding where to live (Figure 5).

The survey took the form of household interviews and information was collected for all major decision makers in the household. The usable sample of employed persons in this study was 1049.

Full details of the survey may be obtained elsewhere (Young, Morris and Ogden, 1978; Young, 1980a).

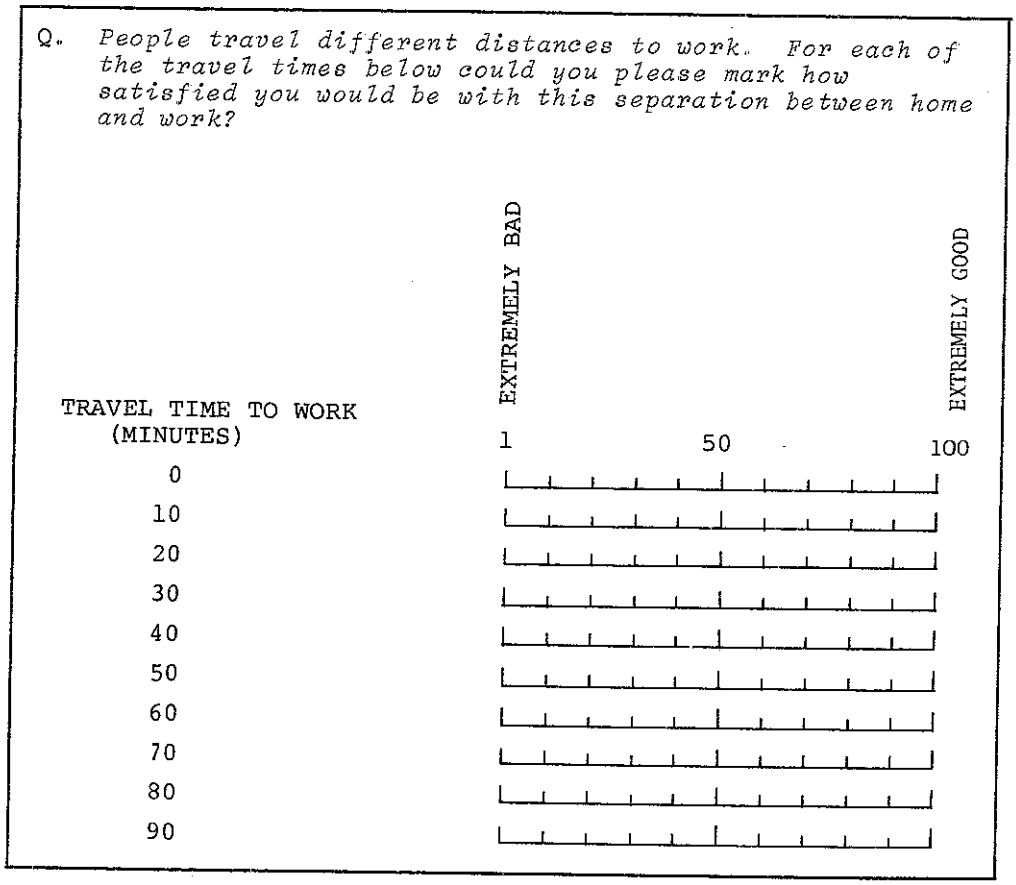


FIGURE 4. Question and measurement scales used to obtain satisfaction ratings for hypothetical alternative work journeys.

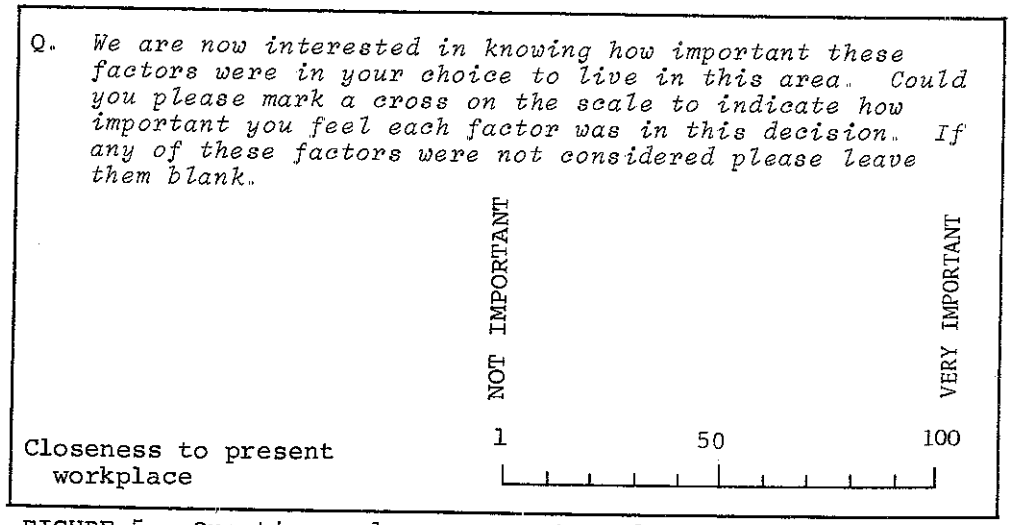


FIGURE 5. Question and measurement scales used to obtain importance ratings for closeness to present workplace

SATISFACTION WITH THE JOURNEY TO WORK: A COMPARISON OF 'OBSERVED' DATA AND 'EXPERIMENTAL' DATA.

The form of the relationship between satisfaction and perceived length of work journeys is examined here using both sets of data. The 'observed' data were analysed using regression analysis, and the straight line fit (r^2 = .42) is plotted in Figure 6. The 'experimental' data were analysed by calculating mean satisfaction ratings for the range of travel times presented; and the resulting curve OCD is shown in Figure 6. Several non-linear functions were fitted to the 'market' data, but without significant improvements in the level of explanation.

It will be seen that the straight line AB, which was fitted to the 'observed' data, is a reasonable approximation to the curve OCD produced by the 'experimental' data. However, theoretical interpretation of the relationship between satisfaction and length of work journeys differ quite markedly, depending upon which approach is adopted.

The relationship AB is the classical distance decay function; this implies that satisfaction decreases directly with increasing travel time. By contrast, the curve OCD implies the existence of both 'proximity' and 'accessibility' thresholds. That is, people like to be close to work, but not *too* close. Intuitively, this appears to be a reasonable finding. High proximity to work may produce a stressful situation for households, through the attendant noise, pollution and congestion often associated with employment concentrations. Some amount of time spent travelling may also be necessary to achieve mental separation of work and home activities. Similarly, very low accessibility may produce a stressful situation, due to the large amounts of time and energy spent travelling and the increased length of time spent away from home.

Empirical evidence from other studies also lends support to a curve of the form OCD. A series of studies undertaken at the University of Philadelphia, Pennsylvania, found that for most services people compromise between accessibility on the one hand and proximity considerations (e.g. noise, pollution and congestion) on the other (Wolpert, Mumphrey and Seley, 1972). Using questionnaires, ordinal data were collected for a wide variety of public and private services using the four distance categories: (1) on your block; (2) on a neighbouring block; (3) within rest of neighbourhood; (4) within neighbouring community. Most curves were found to be of the form OC, although it has been suggested that extending the distance categories would probably produce an overall curve OCD, with the distance from 0 to the peak C varying for different services (Massam, 1975).

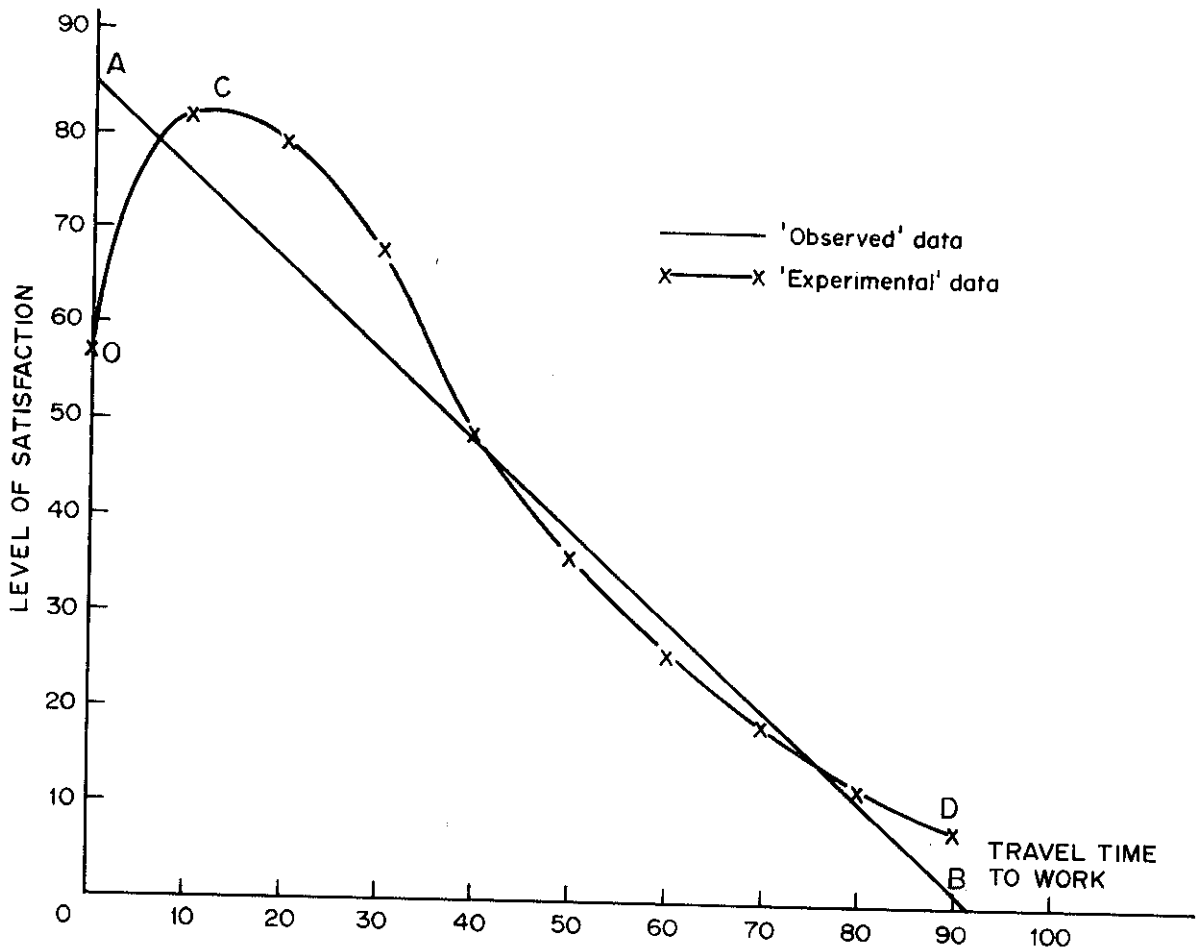


FIGURE 6. Comparison of 'observed' and 'experimental' relationships for evaluation of travel time.

Redding (1970) has also postulated a non-linear relationship between accessibility and locational valuation, as shown in Figure 7. Support for these ideas was forthcoming from a study of four amenities (shopping centre, elementary school, playground, and hospital) serving residents in Stokie, Illinois. It was found that nearness as well as inaccessability thresholds existed for most individuals. The 'inner' thresholds for these services were mostly one-quarter to one-half block from the given amenity.

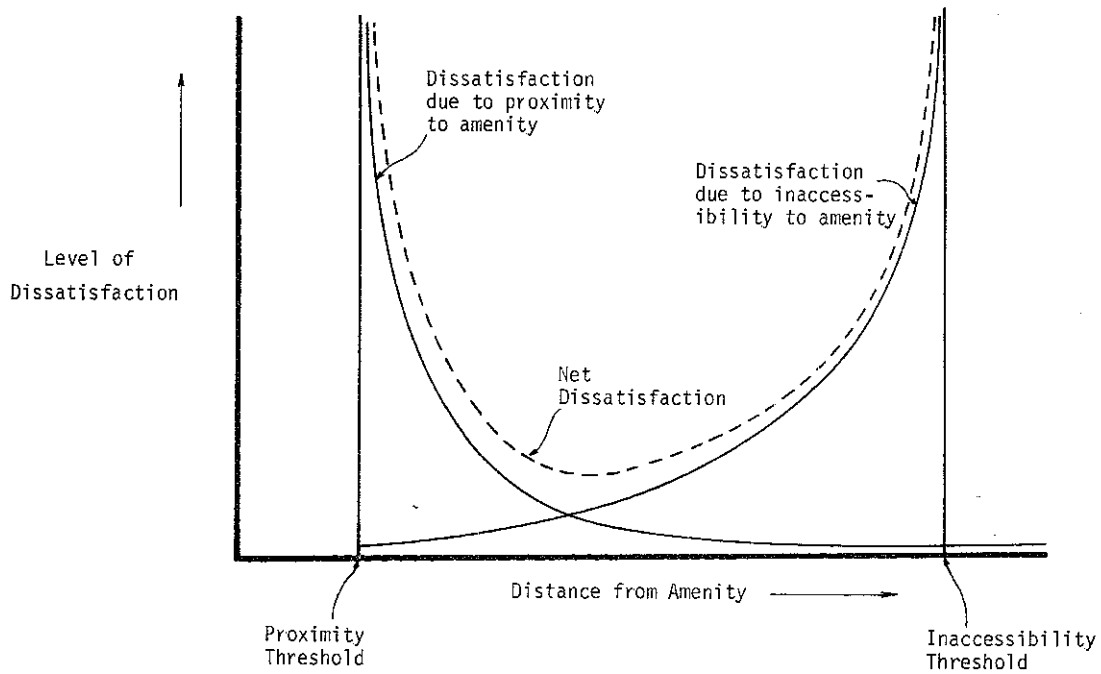


FIGURE 7. Relationship between dissatisfaction and accessibility to amenity. Source: After Redding (1970), reproduced in Moore (1972).

On both empirical and theoretical grounds, therefore, a non-linear relationship appears to be highly plausible. Of course, it might be argued that at this level of aggregation the 'observed' data provide a reasonable empirical approximation. However, the choice of approach becomes more critical when examining the stability of this relationship across different population groups.

STABILITY ACROSS MARKET SEGMENTS

Perceived satisfaction with both existing work journeys and hypothetical travel times was examined further

by segmenting the sample into a number of groups. The groups were based on a number of variables commonly employed in transport studies (age, sex, travel mode and occupation), plus two others relating to the 'perceived importance' of closeness to work and the respondents' 'present travel times'.

In comparing the observed and experimental approaches, however, there are a number of problems. The 'observed' data pertain to only one travel time (i.e. the 'present' travel time) for each individual, whereas the 'experimental' data yield satisfaction ratings for a range of travel time values for each individual. It follows therefore that 'present travel time' is a meaningful basis for testing the stability of travel time evaluation *only* in the case of 'experimental' data.

Comparison of the two approaches is also complicated by differences in the methods of analysis. Between-group differences in observed behaviour were tested using regression analysis and standard statistical tests (Table 1). However a somewhat simpler method was employed for the 'experimental' data, given the non-linear form of the relationship. The test developed here essentially compares the degree of overlap between the distributions of mean satisfaction (i.e. the OCD curves) calculated for the various sub-groups. The method is capable of handling only two sub-groups at a time. No overall test of significance is available; but the method is capable of detecting localised differences between the sub-groups.

Specifically, a simple t-test was used to determine whether the sub-groups differed significantly (at the 5 per-cent level) in the mean satisfaction ratings assigned to each travel time. A measure of the total difference between the respective distributions was subsequently obtained by summing the squares of the differences in their average ratings. This measure is analogous to the between-groups variance in analysis of variance. The grouping which produced the largest sum of squares of differences in the means was deemed to have the largest variance in evaluation and formed the basis for subsequent steps in the analysis. This process of dividing the sample into two groups then investigating the lower order groupings is similar in nature to the clustering program referred to as the Automatic-Interaction-Detector (Hensher, 1976). Segmentation of the 'experimental' data continued until there was no significant difference between the average evaluation ratings for any of travel time values. (This step is analogous to the within-groups variance produced in analysis of variance). Table 2 and Figure 8 summarise the results of this analysis.

Comparison of Results

Turning, first, to the results of the regression analysis (Table 1), there appear to be very few differences between the sub-groups in their observed behaviour. The variation in the slopes of the lines is not significant (at the 5 per cent confidence level) for any of the groupings. The intercepts do, however, show some variation, indicating

TABLE 1. Perceived satisfaction with closeness to present workplace among population sub-groups: regression analysis of 'observed' data.

Respondent	r^2	n	Intercept	Standard Error	Slope	Standard Error
TOTAL	0.42	1019	85.6	1.35	-0.93	0.0342
SEX						
Male	0.39	671	84.9	1.72	-0.91	0.0437
Female	0.48	347	86.6	2.15	-0.97	0.0546
MODE						
Car	0.42	845	89.0	1.50	-1.09	0.0438
Public Transport	0.34	149	82.7	5.40	-0.76	0.1880
AGE						
≤ 24 years	0.56	226	89.7	2.41*	-1.01	0.0597
25-29	0.37	343	82.8	2.50*	-0.87	0.0611
30-39	0.45	290	87.9	2.49*	-0.98	0.0644
≥ 40	0.27	154	80.6	4.02	-0.83	0.1238
PERCEIVED IMPORTANCE (1)						
Unimportant	0.20	173	60.3	4.75*	-0.61	0.0945
Relatively Important	0.30	256	71.0	2.89*	-0.68	0.0642
Important	0.37	327	87.1	2.13*	-0.85	0.0614
Very Important	0.38	219	94.3	4.74*	-0.92	0.1163
OCCUPATION						
Upper White Collar	0.45	342	86.3	2.1	-0.98	0.0603
Lower White Collar	0.38	348	87.2	2.7	-0.94	0.0705
Blue Collar	0.39	299	91.4	6.27	-0.94	0.1647

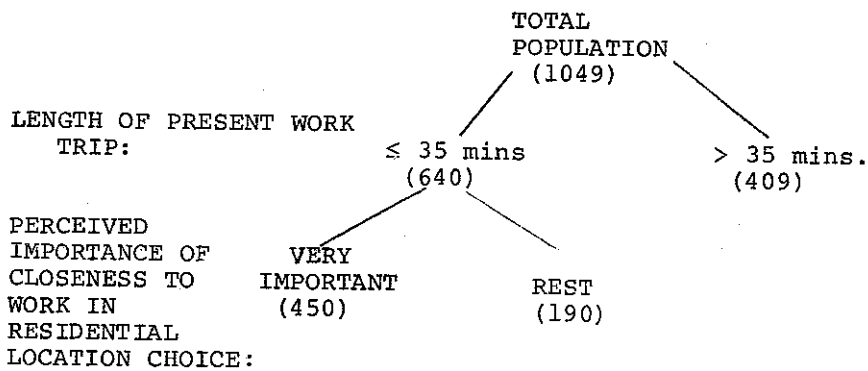
* denotes significant differences at the 5% confidence level between at least one other sub-group.

(1) These groups were derived on the basis of natural breaks in the frequency distribution of responses. The corresponding importance ratings are 1-18, 19-51, 52-84, 85-100.

TABLE 2. Differences in travel time evaluation among population sub-groups: Sums of the squares of the differences in the mean satisfaction ratings.

SUB-GROUPS COMPARED		STAGE OF GROUPING STEP 1	STEP 2 (For those presently travelling > 35 mins)
SEX	Male/Female	131	128
MODE	Car/Public Transport	466	200
AGE (Years)	≤ 24/25-29	31	52
	≤ 24/30-39	47	65
	≤ 24/≥ 40	119	82
	25-29/30-39	33	50
	25-29/≥ 40	54	70
	30-39/≥ 40	82	127
IMPORTANCE	Very Important/Rest*	492	296
OCCUPATION	Upper White Collar/Lower White Collar	48	104
	Upper White Collar/Blue Collar	34	36
	Lower White Collar/Blue Collar	31	33
PERCEIVED TRAVEL TIME TO WORK (MIN.)	0-15/16-35	265	265
	0-15/36-55	836	
	0-15/≥ 56	1597	
	16-35/36-55	381	
	16-35/≥ 56	986	
	36-55/≥ 56	216	
	0-35/≥ 36	723	

* The importance groups Unimportant, Rel. Important and Important have been combined into a group called Rest.



( ) population in sub-groups

FIGURE 8. Breakdown of population sub-groups with significant differences in travel time evaluations ('experimental' data).

some differences in their evaluation of low travel times. For example, those who feel closeness to work is relatively unimportant rate low travel times somewhat below the other groups.

Analysis of the 'experimental' data, however, indicates that existing patterns of behaviour impart a significant bias to travel time evaluation (Table 2). By far the greatest difference in the preference distributions occurs when the population is grouped according to the perceived length of their present work trips. Mode of travel and subjective ratings of importance also appear to be significant discriminators ; but, as will be seen later, these show systematic relationships with existing travel times.

Figure 9 compares the preference distributions for those who travel between 9 and 35 minutes to work and those who spend more than 35 minutes travelling. Generally those who travel the shorter distance are less satisfied with travel times over thirty minutes than is the case of those who presently spend the longer time travelling.

Taking this as the second stage in the grouping, there are no significant differences in any of the possible groupings of the people who travel more than 35 minutes to work. Those who travel less than 35 minutes can, however, be grouped into those who feel closeness to work is very important in the decision to live where they do and the remainder of the population. Figure 10 shows that those who feel closeness to work is very important are less satisfied with longer travel times than the remainder of the sub-population.

It is of interest, however, to note that grouping individuals who travel less than thirty five minutes to work by importance produces only a slightly larger difference in the two distributions than would have resulted had the grouping used those who travel 0 to 15 minutes and those who travel 16-35 minutes (Table 2). Moreover, similar results using 'observed' data and travel distance have been documented elsewhere (Young, 1980b).

The tendency of sub-populations to rate their existing travel time higher than the rest of the population may result from several factors. Firstly, the individual may adapt to a particular travel times once it has become part of his regular routine. Secondly, the individual may go through a process of rationalisation where in order to accept certain decisions he must convince himself that the distance he has to travel is satisfactory. Thirdly, we should not rule out the possible influence of other mediating factors. For instance, a large proportion of public transport users spend more than 35 minutes travelling to work (Table 3). Moreover, public transport users tend to be less dissatisfied with these longer travel times

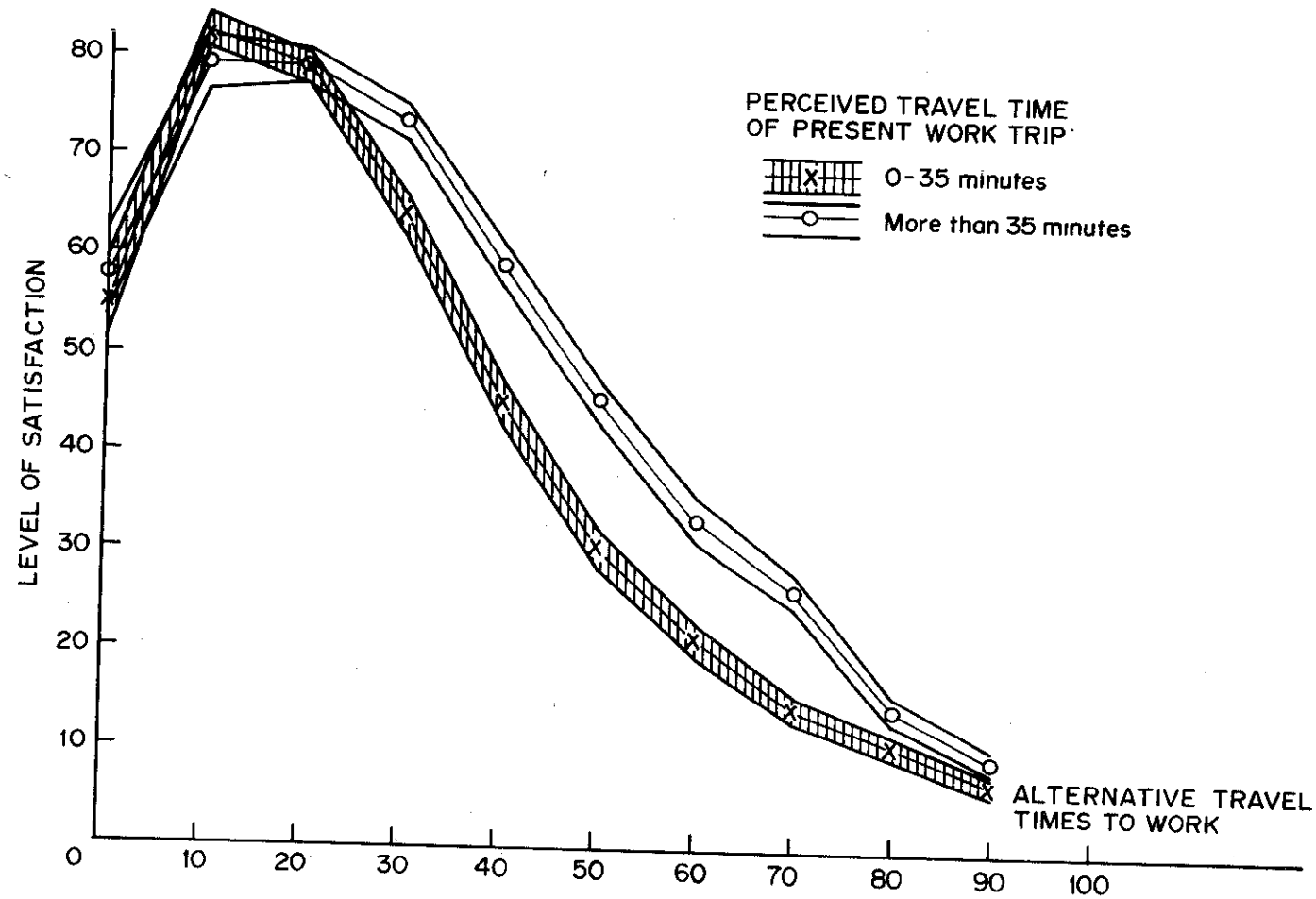


FIGURE 9. Evaluation of hypothetical travel times by those presently travelling less than 35 minutes and those travelling more.

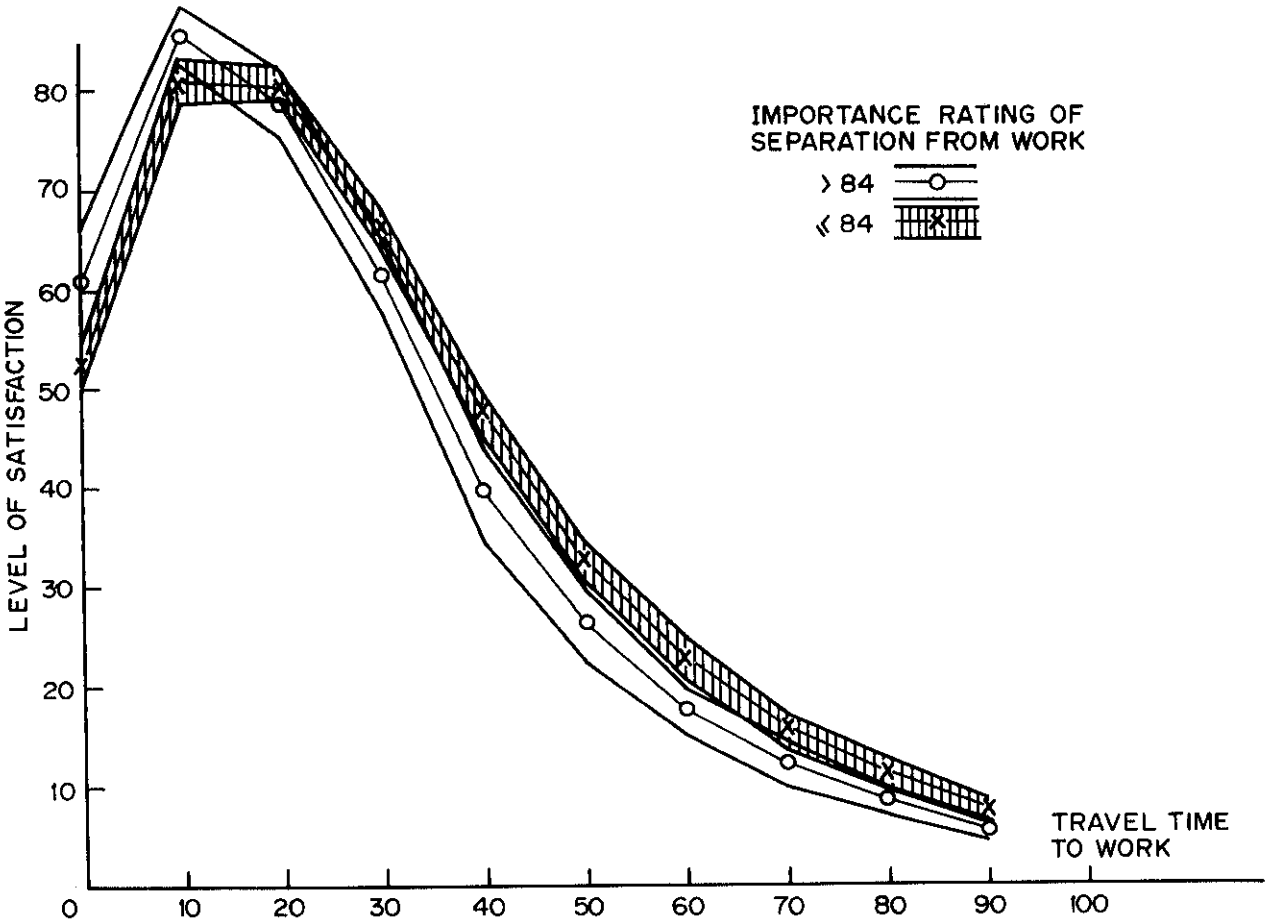


FIGURE 10. Evaluation of hypothetical travel time by perceived importance of closeness to work for sub-population travelling less than 35 minutes.

(Figure 11). This may partly reflect a greater opportunity to use the time spent travelling more productively (e.g. reading the paper, talking to friends). Finally the individual may in fact prefer the said travel time. There is no clear evidence as to the degree of influence each of the above considerations has on the differences shown in Figures 8-10.

TABLE 3. Relationship between mode usage and perceived travel time to work.

PERCEIVED TRAVEL TIME FROM HOME TO WORK (MIN.)	MODE OF TRAVEL	
	CAR	PUBLIC TRANSPORT
0 - 15	251 (27.4%)*	6 (3.7%)
16 - 35	377 (41.1%)	19 (11.7%)
36 - 55	204 (22.2%)	48 (29.6%)
55+	85 (9.3%)	89 (54.9%)
Total	917 (100.0%)	162 (100.0%)

* percentages indicate the travel time distribution of persons travelling by each mode.

The findings of the experimental approach clearly highlight a major problem in using observed data. The observed behaviour approach implicitly assumes attribute evaluation to be independent of existing choices and conditions. That is, people are assumed to rate their existing travel time in the same way as would other individuals travelling different distances to work.

The second difficulty with the observed behaviour approach lies in the distribution of travel times at which people live from work. Figure 12 shows that the majority of observations for the total sample lie between 10 and 30 minutes, with few people living within 5 minutes from their work and only a small number of people living more than 65 minutes from work. The small proportion of ratings in these areas means that they will only have a small influence on the regression line, which, in turn, is less representative of these travel times.

Even with these apparent differences, however, comparison of the relationships obtained from the

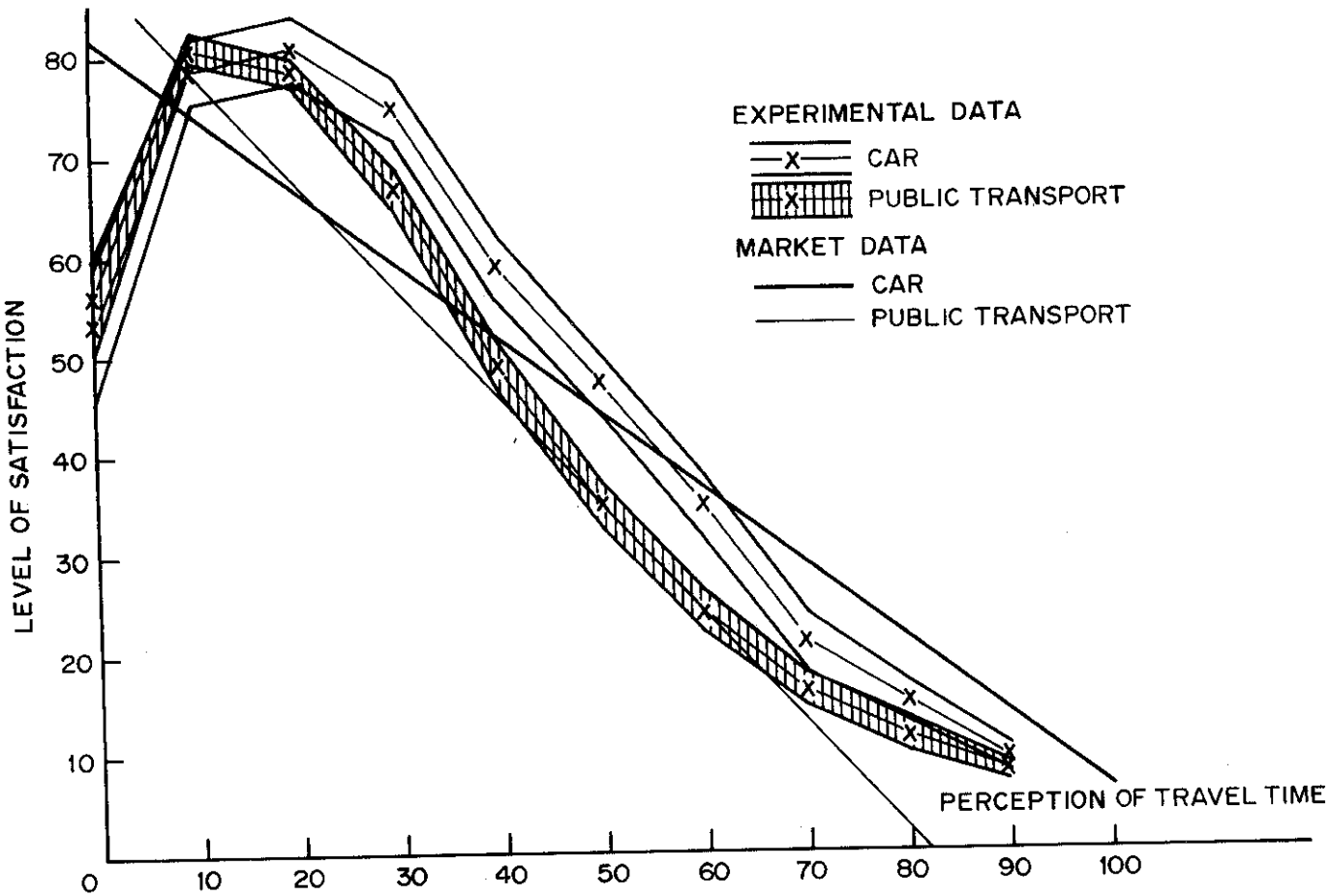


FIGURE 11. Comparison of 'observed' and 'experimental' relationships for car and public transport users.

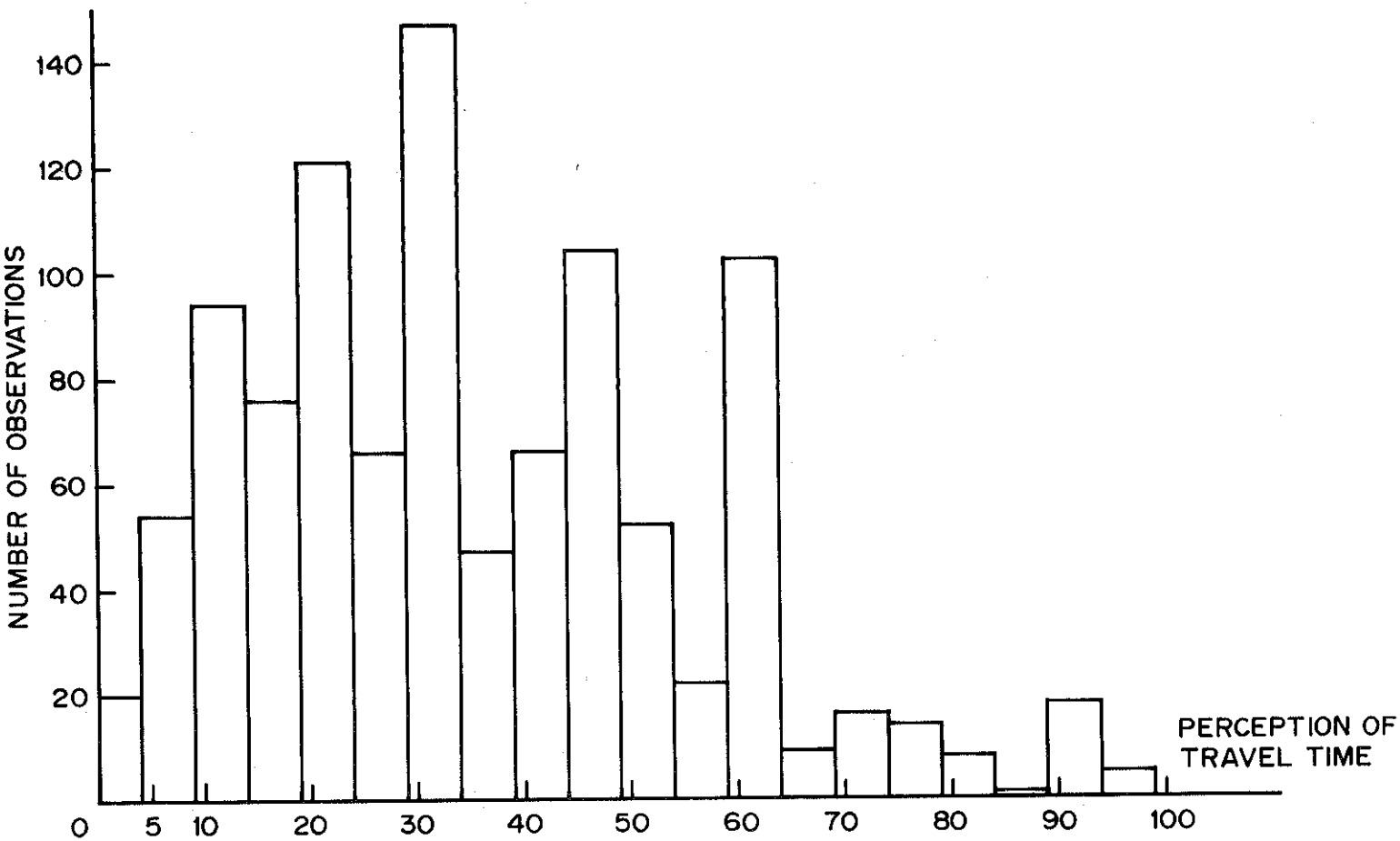


FIGURE 12. The frequency distribution of self reported travel times for the present journey to work.

observed and experimental approaches shows marked similarities. Figure 11 is fairly representative of the level of correspondence between the results. Both approaches suggest that car users are less satisfied with longer travel times than are those travelling by public transport. But, as has been emphasised earlier (Table 3), public transport users generally have higher travel times. Consequently, the regression coefficients are likely to produce less reliable estimates at the lower end of the travel time range.

The general spread of data points in the observed data approach and its inability to relate people's perceptions to their existing conditions casts doubt upon its validity. The experimental approach appears to overcome some of the problems outlined, although it, too, has its limitations. One key unresolved issue is whether people are able to respond accurately to hypothetical attribute levels. It is also unclear whether the processes of travel time estimation and evaluation are indeed independent as conceptualised in Figure 1. Even assuming this to be the case, it may be unrealistic to expect individuals to evaluate a given attribute in isolation from other considerations. The latter is more an argument for extending the experimental approach to a multi-factorial design, than a fundamental criticism of the method itself. Work along these lines has been carried out in other contexts under the guise of functional analysis (see, for example, Anderson, 1971; Louviere, 1980).

IMPLICATIONS

The relationships and procedures investigated in this paper have implications for both modellers and those who venture out to collect data.

Taking the data collection procedures first, this paper provides some evidence for questioning the suitability of basing comprehensive data sets solely on 'observed' patterns of behaviour. The very nature of the urban system means that not all possible variations in choice and attribute levels will be available. Models developed on observed data may be appropriate for predicting changes within a similar environment or range of experience, but as soon as one steps outside that environment, the observed data and the models thus derived become less reliable. 'Experimental' data such as those presented here would seem to provide a sounder basis for building models, by providing for greater control over attribute levels.

The general form of the relationship between perceived satisfaction and travel time also has implications for modelling and for the development of accessibility measures. Most commonly the impedance to travel is assumed to be (i) constant across groups of people; and (ii) a monotonically decreasing function of travel time. However, the evidence put forward in this paper indicates that a monotonic

relationship does not hold for all people: there is a general tendency for individuals to be less satisfied with living close to work than living at ten to twenty minutes from work. The exact form of the relationship must await more refined analyses.

CONCLUSION

Two approaches for investigating the relationship between individuals evaluation of travel time and their perception of travel time were investigated. The 'observed' data approach used only information on peoples existing travel patterns, while the 'experimental' approach collected information on a number of hypothetical travel times. The 'observed' data approach although providing similar relationships to the 'experimental' approach did so with an unrepresentative set of data points. Less reliance could, therefore, be placed on these results.

The 'experimental' approach showed that the respondents tended to prefer a ten to twenty minute separation between home and work. Lower and higher travel times were found to provide a lower level of satisfaction. Although this general distribution held for all groups of individuals studied there were variations between some sub-populations. These variations were most marked between those groupings of people who actually spend different amounts of time in travelling.

In closing, the paper questions the assumption made in many models and accessibility measures that peoples satisfaction with temporal separation decreases with distance. More realistic measures could result if the distributions discussed in this paper are incorporated.

REFERENCES

Anderson, N.H. (1971). "Integrating Theory and Attitude Change". Psychological Review, Vol. 78, No. 3, pp. 171-204.

Hensher, D.A. (1976). "Market Segmentation as a Mechanism in Allowing for Variability in Travel Behaviour", Transportation, Vol. 5, No. 3, pp. 257-284.

Levin, I.P., Louviere, J.J., Meyer, R.J. and Henley, D.H. (1979). "Perceived versus Actual Modal Travel Times and Costs for the Work Trip", Technical Report 120, Institute of Urban and Regional Research, The University of Iowa.

Louviere, J.J. (1980). "Applications of Principles of Experimental Design to the Modelling and Prediction of Judgement and Choice: A Functional Measurement Approach". Proceedings, Workshop on Measuring Social Behaviour in Road Research, Australian Road Research Board (Melbourne, April 1980).

Massam, B. (1975). "Location and Space in Social Administration". Arnold, London.

Moore, E.G. (1972). "Residential Mobility in the City". Commission on College Geography Resource Paper No. 13, Association of American Geographers, Washington, D.C.

O'Farrell, P.N. and Markham, J. (1974). "Commuter Perceptions of Public Transport Work Journeys", Environment and Planning A., Vol. 6, pp. 79-100.

Redding, M. (1970). "The Quality of Residential Environments: Preferences for Accessibility to Residential Opportunities". Unpublished Ph.D. dissertation, Department of Civil Engineering, Northwestern University, Evanston, Illinois.

Wolpert, J., Mumphrey, A. and Seley, J. (1972). "Metropolitan neighbourhoods: Participation and conflict over change". Resource Paper 16, Washington, D.C.: Association of American Geographers.

Young, W. (1980a). "Residential Location Choice Study: Coding Details and Initial Analysis". Australian Road Research Board, Internal Report AIR 301-2.

Young, W. (1980b). "Perceived Aspects of Location". Proceedings, Workshop on Measuring Social Behaviour in Road Research, Australian Road Research Board (Melbourne, April 1980).

Young, W., Morris, J.M. and Ogden, K.W. (1978). "Developing and administering a home interview survey". Australian Road Research Board, Internal Report, AIR 301-1.