

## EXPLORING CHOICES

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**ABSTRACT:** *The results of an exploratory survey, in which the evaluation of choice factors underlying travel was a principle goal, give interesting insights into the understanding of travel behaviour. Activity patterns are examined at the level of the individual and the household, and both existing behaviour and the choices and constraints which influence it are discussed.*

*Age, sex, and stage in the life cycle variables are shown to be strongly related to the number and type of activities undertaken, and to time budgeting. It is concluded that the survey technique was valuable in describing existing activity patterns and behavioural choices, but that other approaches will be necessary to achieve the full potential of the information for use in policy issues.*

## 1. INTRODUCTION

The concept of travel as a derived demand has gained prominent consideration in transport planning during the past decade. The term "derived demand" implies that travel is rarely an end in itself, but rather a means of linking a series of destinations or activities. It is, then, the destination or activity which constitutes the real demand variable. Examples of this concept are reflected in disaggregate models (e.g. Ben Akiva & Lerman 1978), in quantitative non-metric approaches (e.g. Louviere 1978), and in activity-based research (e.g. Brög & Erl 1981, Jones et al. 1980, Wigan & Morris 1979). It is the underlying premise of all of these approaches that the concept of derived demand, coupled with the corresponding necessity to study behaviour at the individual level rather than at the population (aggregate) level, leads to a better understanding of travel behaviour and the policy measures which may best affect that behaviour.

The activity-based research mentioned above is characterised by its study of travel in the broader context of daily behaviour (often measured as individual or household activity budgets or patterns) and a concern with choice or options in the context of constraints<sup>(1)</sup>.

This paper looks at travel from an activity point of view, describing existing behaviour patterns (Section 3), exploring current choices and constraints to behavioural change (Section 4), and briefly examining the policy and forecasting implications.

## 2. THE DATA SET

As a preface to the implementation of a large scale travel survey in Sydney in 1981, a number of small pilot surveys were carried out. At the time of the first pilot, some interesting experiments with disaggregate modelling had already been initiated at the Study Group. In particular, the requirement of these models for a series of choice data was influential in the design of the exploratory pilot survey which sought to gather as much information as possible on "choice set" (the choices available or perceived to be available to the individual).

Consequently, in addition to socio-demographic data, car ownership details, and a description of all travel movements for a single day, respondents were asked about

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(1) A recent comprehensive review of activity-based studies appears in Damm (1981).

their travel behaviour when taking part in the following activities ("trip purposes") -- work, school, grocery shopping, clothing shopping, banking, recreational activities in the City of Sydney, other recreational activities, and visiting friends. Interviewers used a fairly non-structured approach to obtain information on frequency of travel, timing (day of week and time of day), duration, and the incidence with which trips linked more than one out-of-home activity. Reasons for car ownership/non-ownership choices were also obtained.

The survey sample contained 292 households distributed randomly throughout the Sydney region, although complete information from one or more members of the household was gathered on only 196 occasions. In the survey, which occupied three weeks of August 1979, all individuals over the age of 17 were to be personally interviewed. Travel data were also gathered for all persons between 4 and 17 years -- either personally or by proxy -- so that a total of 896 individuals were involved.

The exploratory nature of this initial survey and the underlying demand for a design which could eventually be used for about 20,000 households, combined to place limitations on both the data collected and the collection technique. Nonetheless, the resulting set of data reveals some interesting insights into the understanding of the complex constraints and choices in activity behaviour.

### 3. OBSERVED BEHAVIOURAL CHOICES WITHIN EXISTING CONSTRAINTS

The types and patterns of behaviour which a respondent reports reflect one way in which an individual can take part in a set of activities within the limits of existing constraints. This section begins with a close look at some aspects of the activity patterns chosen by the interviewees in the exploratory study. Representative results will be given at both the individual and the household levels. For the individual, age and sex have been chosen as the descriptive characteristics, many previous studies having indicated strong correlations between these variables and activity patterns (e.g. Hanson & Hanson 1980, Damm 1981).

If the individual could be described as "the true decision maker" (Supernak & Talvitie 1980), it may suffice to examine only individual variables in order to better understand travel behaviour. Since most decisions are made in the context of the household, however, it seemed appropriate to study the influence of the household on behavioural choices. Many household level characteristics have been studied in relation to activity behaviour. These characteristics include such factors as age mix in the household (Hopkin et al. 1978), car availability (Hautzinger & Kessel 1976), number of children of certain ages (Kutter 1973), and the presence of a working spouse (Damm 1981).

One of the most useful characterisations of the structure of the household is the concept of stage in the family life cycle which takes into account many of these aspects. This approach has been adopted by various authors (e.g. Clarke and Dix 1981, Frost 1977) and will be used here as a basis to observe behaviour variations. Households were grouped into 6 basic stages of the life cycle:

1. Single adults
2. Married, no children
3. Married, 1 pre-school child
4. Married, 1 dependent child
5. Married, 1 independent child
6. Retired.

Using age, sex and life cycle as measures, attention will now be focussed on two components of activity behaviour:

- 1) the number and type of activities, and 2) the time spent taking part in and travelling to these activities.

#### Activity Patterns

All out-of-house activities were grouped into the following categories -- 1) work-related activities, 2) shopping activities (all purchases and attempts to purchase), 3) social and recreational activities, 4) attending school, 5) "personal business" activities, and 6) activities where the purpose was solely to accompany someone else (e.g. to take a child to school). Significant variations in the number and type of activities were observed at both the level of the individual and of the household.

#### Variation at the Individual Level

Table 1 presents a summary of total out-of-house activities by two individual characteristics -- sex and age group. It can be seen that while overall mobility variations by age are apparent, any important behaviour variations between sexes and between the type of activities performed are not clear. In fact, a cursory look at the similarities between males and females may well lead one to assume that the whole area does not bear investigation. Indeed, when the disaggregate results are examined purely on the basis of age, many of the relationships seem to be completely obvious. For example, none of the children under 10 years of age, and only 1 in 20 between the ages of 10 and 15, took part in any work-related activities on the sample travel day. Similarly, only one person over the age of 26 reported any travel to school.

Even the seemingly common relationships, however, served to paint a clearer picture of the way people organised their (travel) lives, and it is only by attempting to understand the complex array of factors which shape behaviour that travel and its determinants can be seen in the correct perspective. Care will therefore be taken to explain some fundamental variations in behaviour between people of differing age and sex.

TABLE 1  
PARTICIPATION IN OUT-OF-HOUSE ACTIVITIES BY SEX AND AGE

Age Group	Number of Out-of-House Activities			
	All Persons		Mobile Persons	
	Male	Female	Male	Female
0 - 5	1.34	1.97	1.96	2.57
6 - 10	1.18	1.55	1.40	1.65
11 - 15	1.47	1.48	1.61	1.63
16 - 20	2.00	1.63	2.16	1.80
21 - 25	2.15	2.41	2.21	2.65
26 - 30	2.63	2.67	2.93	3.20
31 - 35	2.31	1.85	2.45	2.24
36 - 40	2.18	1.74	2.18	1.94
41 - 45	2.13	2.13	2.55	2.46
46 - 50	2.56	1.86	2.63	2.36
51 - 55	1.63	1.74	2.21	2.29
56 - 60	1.41	1.96	1.82	2.33
61 - 65	2.13	1.53	2.91	1.93
66 - 70	1.14	1.06	1.60	1.70
70+	0.93	1.04	1.71	1.85
All Persons	1.85	1.82	2.14	2.19

School constitutes between 50-55% of all out-of-home activities for children up to the age of about 10, at which time social/recreational interests (like sport) begin to become important. These interests then represent up to 40% of the activities, with school dropping down to about 40%.

An important, and often overlooked, part of the daily life of children of all ages, but particularly of those up to the age of 5, is their being taken by others (usually their parents) to destinations which have no specific interest for them, e.g. shopping, banking, and even some recreational and social activities. These occurrences represent nearly 1 trip (.98) per day for children under 5, and proportionally more (1.3) when only those persons who have left home on travel day (mobile persons) are considered. It

is interesting to note that these children, while not considered to have travel "demands" in traditional travel demand analysis, play a significant role in shaping the activity patterns of their parents. The implications of this fact will be considered further in Section 4.

By the time the children are of school leaving age (beginning at about 16 years), social activities represent up to 50% (nearly 1 per day). At the expense of school activities, work and personal business (e.g. banking) assume a more important daily role. Out-of-house activities increase significantly at this stage and peak between the ages of 26 and 30 when the average is 2.6 and reaches 3.1 for mobile persons.

At about this stage (25 - 26 years), sex differences become accentuated, particularly for work purposes. Whereas prior to the age of 20, females were actually found to take part in more work activities (.58 per day) than males (.41), after that time there was a complete reversal, with men taking part in up to three times more work-related activities than women. This trend declines markedly, however, beginning at age 46-48 when many women reenter the workforce. At that time sex differences in the participation in work-related activities become less obvious.

Sex differences are also apparent in shopping activities and are inversely proportional to the number of work activities. Women engage in shopping almost twice as often as men during the time when men are dedicating most of their out-of-house activities to work. Activities involving 'serving a passenger' also seem to be the realm of women, particularly between the ages of 26 and 45 when just under one such out-of-house activity per day is undertaken (usually involving another member of the household). Involvement in social and recreational activities remains almost constant between the sexes at all ages.

With increasing age, all persons tend to shift the focus and increase the extent of out-of-house activities. After the age of 68, no one in the sample participated in work-related activities, and although many less activities were engaged in, the focus was on social visits and shopping, with men doing about as much shopping as women.

In summary then, the results show that both the number and type of activities vary significantly according to a person's age and sex, suggesting that behavioural choices and the resulting activity patterns may well have real or cultural limitations associated with these two factors.

### Variation at the Household Level

An observation attributable to life cycle stage has already been made in Section 3, namely the marked fluctuation in the number of work activities of women by age. Closer scrutiny of the data tends to support the speculation that women often work until the birth of the first child (only 37% of women with a child less than five years of age were employed), reentering the workforce when the youngest child is no longer completely dependent.

Another important relationship is that adults in households with no dependent children participate in many more social activities than do those where children still attend school. Similarly, parents of independent children make many fewer journeys to 'serve passenger' than do their counterparts in households where children are dependent. Participation in work activities also varies with life cycle group. Members of households in which there is no traditional family unit, or in which there are no children, make about 30% more work-related trips than do other adults.

Perhaps even more striking than the behaviour variations which can be attributed to life cycle itself, are those variations which occur between families which are in the same stage of the life cycle but which have a differing number of parents in the work force. For example, pre-school children in families where only one parent was working outside the home, took part in about 25% more social activities than children of the same age where both parents worked. Children of two working parents, on the other hand, made about twice as many 'serve passenger' trips. Adult behaviour also exhibited marked differences when there was a second worker in the household. Many less shopping activities per household (32%) were recorded in these families, and 'serve passenger' travel was also less. The latter may indicate a contrast to that of Oster (1979) who found that the presence of a second worker tended to add an activity to the work trip.

Stage in the life cycle was therefore shown to relate to the behaviour of the household members, and in particular influenced the number and type of activities in which they participated.

### The Influence of Time

All activities occur within a temporal framework and an overview of behavioural patterns would be incomplete without consideration of the time elements. Research into time budgets was, in fact, well developed when transport planners became interested in the concept and extended it to activities (see, for example, the work of Hagerstrand (1970)). Ideally both duration and the distribution of events in time

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(i.e. linking or chaining of trips) should be considered together. In this paper, however, only the amount of time spent in out-of-house activities relative to that spent at home will be discussed.

Variation at the Individual Level

Reference to Table 2 allows comparisons by age and sex of the time spent in daily activities, including travel. It presents complementary information to the details of activities given in Table 1 and, in general, serves to highlight many of the relationships already discussed.

TABLE 2  
DAILY TIME BUDGETS BY AGE AND SEX

Age Group	Time Spent (minutes)					
	At Home		Out-of-House Activities		Travelling	
	Male	Female	Male	Female	Male	Female
0 - 5	1229	1155	181	236	29	47
6 - 10	1095	1018	308	380	37	42
11 - 15	1028	1021	351	373	61	45
16 - 20	908	950	449	408	83	82
21 - 25	862	964	486	382	94	91
26 - 30	958	1051	395	326	87	61
31 - 35	907	1199	432	191	104	51
36 - 40	902	1164	453	204	87	75
41 - 45	957	1060	401	322	82	58
46 - 50	938	1072	429	316	73	53
51 - 55	947	1102	424	269	68	67
56 - 60	1078	1143	306	241	57	58
61 - 65	998	1221	367	181	76	38
66 - 70	1228	1228	155	132	56	74
70+	1267	1287	140	99	33	54
All Persons					68	59



During the years when men are involved in more work-related activities relative to women (25-40 years) they also spend more time out of the house -- up to five hours a day more than their female counterparts. Working males spent an average of 7.77 hours in work-related activities compared with 7.38 hours for working women.

Travel times peak between the ages of 20 and 40 when the daily average travelling time is as high as 1.7 hours for males. The lowest travelling times are for the very young and for persons over 70 years of age (when women spend significantly more time travelling than men). The overall daily average travel time, for all persons in the survey, was 64.8 minutes, with the average for males (68.2 minutes) being significantly higher than for women (59.1 minutes). Even when only mobile persons were considered, the differences were of the same magnitude with males travelling for 79.6 minutes and females for 75.1 minutes (overall average = 77.9). It is interesting to note that these figures are very high when compared with other studies. A German study reports average travel times of 54.1 minutes for all persons and 76.7 minutes when only mobile persons were considered (Brög 1980).

In general, it can be seen that there are wide variations in time allocated to out-of-home activities and travel by people of differing ages and sex. In addition, out-of-home time is allocated in different ways for older and younger persons, males and females. The significance of these relationships is even more pronounced when they are seen in the context of the household.

#### Variation at the Household Level

Table 3 gives an overview of daily time budgets as they vary for the 6 life cycle groups. Retired persons were found to spend the least time in both out-of-house activities and travel. In contrast, single adults averaged over 9 hours away from home on the sample travel day.

The presence of children in the household could not be directly related to differences in observed time budgets until the households were grouped according to the number of parents employed. It was then shown that each person in households with a second worker spent about 2 hours longer away from home than a person in a one-worker household. The difference was much more pronounced in families with pre-school children (nearly 4 hours) where children of working parents spent up to 6-7 hours being cared for away from home.

The single parent family represented only 4.8% of the sample (14 households), but shows marked behaviour variations when compared with other families. Most household heads in these families, whether male or female, were employed

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TABLE 3  
DAILY TIME BUDGETS BY LIFE CYCLE GROUP

Life Cycle Group	Time Spent (Minutes)		
	At Home	Out-of- House Activities	Travelling
Single Adults	893	463	87
Married, no children	945	412	83
Married, 1 pre-school child			
- 1 parent employed	1183	212	46
- 1 parents employed	911	435	92
Married 1 dependent child			
- 1 parent employed	1089	290	61
- 2 parents employed	1011	375	53
- parents unemployed	1156	209	76
- single parent	938	412	90
Married 1 independent child			
- 1 parent employed	1014	354	73
- 2 parents employed	938	412	90
Retired			
- No children	1265	133	41
- Independent children	1216	192	29

full-time. With the adults spending a large amount of time away from home it was expected that time budgets in these households would be similar to those of two-worker families. This is indeed shown to be the case in Table 3. It is interesting to note that children of single parent families appear to begin working slightly earlier than most children in the sample, with 56% of persons between the age of 16 and 20 from these families being employed full-time.

As with individual attributes then, characteristics related to the household were shown to relate to variations in the existing activity patterns of the household, particularly when employment status of the parents was considered.

#### 4. CURRENT CHOICES AND CONSTRAINTS TO BEHAVIOURAL CHANGE

Section 3 described some existing behavioural patterns and highlighted the significant relationships of age, sex and lifestyle to the number and type of activities in which people engage. This section will briefly examine some details of the individuals' reported choice sets and the way in which they are related to the activity patterns just described.

In examining the comments of respondents about choice it became clear that for some individuals only limited choices existed. This supports well documented findings which report that only 8-14% of the population had real options in mode choice when all other limitations (environmental and individual constraints, information barriers and subjective perceptions) were considered (Brög 1977). When choice of mode was regarded in relation to household factors in the current study, it proved to be similarly constrained. In many cases when two parents were in the workforce, public transport was effectively not an option within the given time framework, since the flexibility needed to leave children at baby sitters or child minding centres en route to work precluded public transport (often indirect services) as an alternative. Another example occurred for shopping trips from exclusively residential zones to centres which did not offer delivery services. The volume of goods purchased excluded public transport as a mode option. Often bound to this limitation was a time constraint -- the vehicle in a one-car family was used for work purposes and was therefore unavailable for family shopping activities except on Thursday nights, Saturday mornings, or with the use of flexitime.

Cost was often cited as a reason for limiting behaviour to existing patterns. The degree to which it was mentioned was closely related to stage in the life cycle. Households with pre-school and dependent children, particularly where only one parent was employed, mentioned it most frequently, independent of income. In terms of mode choice, it was often perceived that public transport was "too expensive for the whole family", and taxis were rarely an option for the same reason. Certain activities were not undertaken as frequently as preferred, also because of cost. This fact should be associated with income, but serves to illustrate another type of limitation in the organisation of travel behaviour.

Both timing and length of activities were frequently mentioned by respondents as being subject to numerous constraints. Congestion in shopping centres was seen as limiting the available shopping to certain hours. The ready availability of baby-sitters on week nights (rather than weekends) limited the social activities of some parents to week nights. The fact that the club shut at midnight was the only reason for not remaining until 1 a.m! These three cases give examples of perceived constraints and of those imposed by both cultural and environmental effects.

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Age was seen to affect choices about participating in, and travelling to, some activities. People who were too young or too old for a car licence were common examples. The physical ability to travel was also recognized by many, and is reflected in the high values of in-home time by retired persons.

In general, people perceived less constraints to reaching obligatory (fixed) activities than to discretionary activities. Whereas people would readily resort to telephone conversations to "visit" friends, travel to work and school would not have been interrupted -- even with continuing non-availability of the usual mode.

The constraints on behavioural choices which have been discussed represent some examples of the multi-dimensional influences on the individual when choosing an activity pattern. The combination of personal and interpersonal factors (of which age, sex, and life cycle represent only some aspects) together with environmental and perceived constraints can, therefore, be shown to have important influences on activity patterns. The number of activities and the types of activities chosen result in very different overall activity and travel patterns, and are therefore important elements in understanding travel behaviour.

### 5. POLICY IMPLICATIONS

Finally we look at the question of whether the relationship of age, sex and life cycle on activity behaviour can be useful for policy issues. For policy makers, as indeed for forecasting in general, it is important to be able to judge two factors from the population: (1) how a change in existing circumstances would affect current behaviour, and (2) to what extent there are real choices available to the persons who will be influenced by the change. The second point is actually inherent in the former but is frequently overlooked. If the public transport headways are reduced, but most people on the route need a car at work or en route to work, patronage is unlikely to increase substantially as a result.

While studies such as the one reported here give detailed information on current behaviour, it is difficult to extrapolate with any certainty the reaction to policies such as new freeways or changing work hours. This is largely because the data collected represent only one sample day of travel and, although questions on choices were asked, the detailed interdependencies between household members were deduced rather than gathered from indepth discussion. The foregoing analysis has therefore been useful in pointing to the need for even more indepth information about behavioural choices if the adaptation to changing policies is to be predicted.

The value of the existing information lies in its function of highlighting the needs of individuals and various groups of the population with respect to their current travel needs. The examples of single parent families and families in which there are pre-school children with two working parents have been cited. Results of the 1981 Travel Survey in Sydney will provide a large amount of this kind of data, and in line with the above comments, an indepth study is planned to supplement the survey by addressing several specific policy issues.

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