

## STRUCTURE OF THE FAMILY AND TRIPS BEHAVIOUR

by

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## 1 - INTRODUCTION

It is an accepted fact to day that traditional socio-economic variables only explain a slight percentage of variance in the levels of mobility and transport time-budgets of individual persons. The basic reason for this has been brought to light by the conceptual efforts of the last few years, which show the great number of explicative factors which simultaneously influence travel behaviour. The two pieces of research below (§2 & 3) have tried to get at least partially beyond this obstacle by resorting to macro-variables representing the family structure which all individuals belong to. These two pieces of research are however relatively dissimilar because of the techniques used. The first, on the basis of hypotheses resulting from an already carefully elaborated conceptuality, set out to structure the information so as to reveal highly typified intra-family behaviours in relation with the family structure of the households. In the second piece of research great care has also been taken with the setting-out of the information, but it tries to be more inductive by using data analysis methods. Each logic has its results which we will describe here succinctly before drawing a certain number of conclusions from them.

## 2 - A HYPOTHETICO-DEDUCTIVE APPROACH TO INTRA-FAMILY BEHAVIOUR

2.1. General approach

The objective of this study is to analyse the influence of family interdependences on the travel behaviour of the members of a family. Work on this theme has already been undertaken by authors like P.M. JONES et al [1], R.H. KNAPP [2], X. GODARD and J.P. ORFEUIL [3], A. BONNAFOUS et al [4], I. SALOMON [5]. This research is of considerable interest, but suffers from three limitations which we have tried to go past. The life-cycle explicative macro-variables can be improved. The same thing is true for the travel indicators. Finally, other than in the work of L.P. KOSTYNIUK and P. KITAMURA [6], no-one considers the organisation of the activities which are common to all the members of one household. Our general approach was divided into two steps.

- The first, traditional approach, is based on the following reflection. Family interdependences have two distinct origins. The first concerns purely objective elements such as the family structure of the household, the availability of a car and the residential location. On the other hand, the second approach concerns much more subjective factors such as the history of the households' life and its cultural origins. Since the empirical data which are the basis for this study only allow us to understand certain objective characteristics of the households partially, we have constructed an a priori typology for the households according to their family structures (§ 2.21). The analysis of the influence of this determinant factor on the behaviour of individuals was then carried out along two complementary lines : one in terms

of organization and the carrying of everyday tasks, the other in terms of the daily trips of individuals - only the husbands and wives have been considered (§ . 2.22).

After having carried this first stage through, it was obvious that in order to improve the pertinency of the analysis and its possible modelling repercussions, certain elements which had heretofore been considered individually should be put back together again. The trips seemed to require reintegrating into the wider concept of "outing" (cf. S. HANSON [ 7 ]), specially in the case of multi-activity outings. The issue of such a reasoning could also lead to the sequence of the daily trips of an individual with regard to his activity pattern. Furthermore, the individual himself in many cases cannot be isolated from the other members of the household without previous precautions. A certain number of extra-home activities are done together, and take on a series of common trip characteristics for those who take part in them. These two reflexions are at the basis of the second stage.

- This second approach, which we could call "Activities and trips within the household" is based on the following manner of proceeding. The hypothesis of the existence of a certain structure in the intrafamily behaviour of households has led to the elaboration of an a priori classification of these households according to the type of sequence of common activities (§ 2.31). Then the analysis of the groups thus made up enabled us to bring to light the links between this behavioural classification of the households and their typology according to the family structure as well as the effects of the sequences of common activities on the mobility of husband and wife (§.2.32).

In everyday life, the family interdependencies come out as the consideration by certain members of the household of constraints which are seen as heavier or lighter according to the individuals and which are of course due to the very family structure of the household, but which are also due to the manner in which the household is organized overall in both time and space. This conceptual vision of the phenomena naturally leads us to argue about the data of a mobility-activity pattern household survey, where the trips are seen as the mean of articulating activities in space and in time. This was a survey carried out in 1980 on 410 households on the outskirts of the Lyon conurbation (France).

## 2.2. Family structure and individual behaviour

### 2.21. Typology of households according to family structure

This typology was arrived at taking account of previous work and our conceptual framework. It results from the crossing of four socio-economic variables. Matrimonial status distinguishes couples from people living alone. Professional status distinguishes couples where both work from those where only one does so, as well as from working people living alone from those who do not work. The age of the head of the household was only taken into consideration for couples with children and the border was fixed at 40. Finally, the fact of there being children, without going into age groups, shows a high proportion of children under 10 in young couples (< 40 yrs) and a much smaller proportion in couples over 40. After correction to take account of certain slants, the working sample deals with 370 households comprising 694 husbands and wives. The high statistical quality disappears however for the three groups of persons living alone (n° 1, 2 and 11) and for the group of retired people without children (n° 10). Thus certain results must be considered with prudence despite their structural character and will have to be confirmed by

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wider samples. The two categories of wives in couples with children where one person works (n° 7 and 8) have been split according to whether a car was available or not.

TABLE 1 - Typology of households according to family structure

GROUP	NUMBER CONCERNED	TYPE OF HOUSEHOLD
1	14	Working people, living alone, no children
2	15	Working people, living alone, with children
3	34	Couples both working, no children
4	42	Young couples both working, with children
5	33	Couples over 40 both working, with children
6	27	Couples - one working, without children
7	73	Young couples, one } wives having car available (40) working, with children } wives not having car available (33)
8	70	Couples over 40, one } wives having car available (34) working, with children } wives not having car available (36)
9	33	Retired couples, with children
10	12	Retired couples, with children
11	17	Retired people, living alone, no children

2.22. Influence of family structure on spatial form of trips

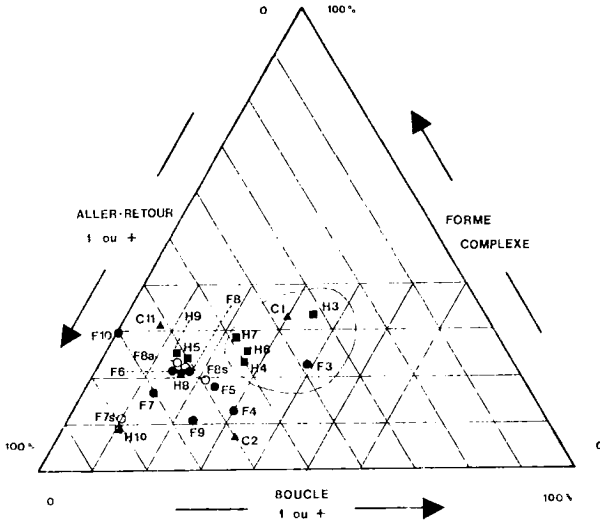
The results regarding the organisation and the carrying out of activities by individuals are not presented here, since they have no direct link with our second approach. They are to be found in reference | 8 |. The same thing is true for the most traditional results in terms of mobility | 9 |. As an illustration we have kept the example of the spatial form of outings.

For each category, schema 2 indicates the % of individuals who only travel back and forth in the day, the % who only do multi-activity outings, and the percentages of those who do the two sorts of outings in the day. The results are worth looking at :

- elderly people travel more in the form of back and forth trips since 65 % of them only travel daily in this manner ;
- working husbands, specially the younger ones, and working people living alone without children limit a trip rate and a travel time-budget which are already high by multiplying multi-activity outings. Only 50 % of them limit themselves to back and forth outings in the day ;
- working wives go out less than twice a day, but, like their husbands, concentrate their activities during each outing. Here there are only 52 % who limit themselves to back and forth outings ;
- finally, when there are children with the wives at home this radically leads to a simplification of the spatial structure of travel. 65 % of these

wives only go out for back and forth outings. For the younger ones (F7), the availability of a car has an opposite effect, where this fact has virtually no influence on older wives (F8).

SCHEMA 2 - Spatial form of outings



Thus, according to the category, 35 % to 50 % of the adult persons do sequences of more than two trips by grouping their activities by outing from home. The homogeneity of these sequences shows the point of dealing with these highly interdependent trips as one entity, or at least as elements of a whole. The other important aspect of this research is to be found in the remarkable differentiation which the family structure variable induces on the serve passenger\* | 9|. The widening of the reflexions coming from this result leads to the concept of "common activity sequences within the household".

### 2.3. Common activities and trips within the household

By common activity sequence, we mean a chain of activities outside the households' residence, which can either be in another place, or trips. The word "common" signifies that these activities are carried out simultaneously by two or more members of the household, and that at least one of them is the husband or wife or the person living alone, which does not exclude the presence of third parties.

#### 2.3.1. Classification of households according to the type of common activity sequence

The translation of the concept of common activity sequence into an operating variable is done on the basis of the following two conceptual hy-

\* Service passenger comprises two back and forth trips to the same point, simply to accompany someone to or back.

potheses. The consequences on the general organisation of family life are very different according to whether a sequence concerns the parents, the whole family, husband or wife (or a person living alone) and one or more of their children. This is the first classification we selected. Secondly, the very nature of the activities done during a sequence has a considerable influence on the activity pattern of each person taking part. This is why we have distinguished four types of sequence, set out in order of decreasing importance as below :

- OUTING : this comprises at least one return outing from the home and an intermediate activity.



- FOLLOW-UP : this comprises outings and does away with the outward or return trips and all the chains of common activities not linked with the home.

- SERVE-PASSENGER : this is one of the two trips of an outing to and from the same point during which one or more people are accompanied.

- ACCOMPANYING : this comprises accompanying someone on part of a trip which is undertaken for another purpose.

The synthesis of the information thus created was carried out at couple level taking account of the putting together of the sequences of each member of the couple. A similar procedure was used for individuals. The setting out of the sequences in order of importance by nature and the following two basic rules enabled us to work out a first very precise classification for the households corresponding to the "common household activities" variable nomenclature.

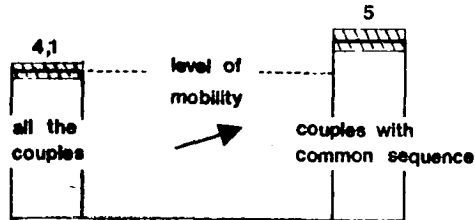
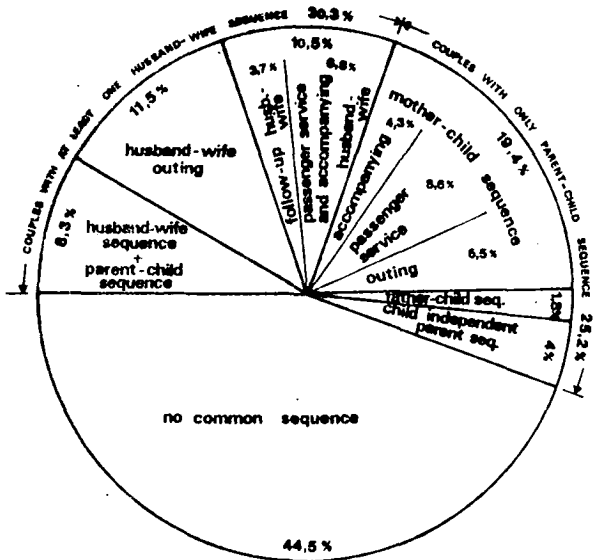
1. The fact that a household belongs any one of the modalities of the preceding variable signifies that, in the day, the household has carried out one or more sequences corresponding to this modality.
2. Further to the sequence or sequences corresponding to the modality in which the household is classified, the household may have done other sequences but which are all classified below the modality he is in.

The initial objective of the analysis of the family interdependences has led us to set out a separation of the couples into 6 classes created by regrouping from the basic classification. Finally, for two classes, we carried out a sub-classification purely based on the nature of the sequences (cf. schema n° 3).

The "common activities within the household" phenomena is of considerable importance since in a normal weekday, it concerns approximately 55 % OF THE COUPLES OR PEOPLE LIVING ALONE. This proportion is identical for couples only and goes down to 45 % FOR EITHER HUSBAND OR WIFE. Finally, for the couples again, we can see that 30,3 % have "AT LEAST ONE HUSBAND/WIFE SEQUENCE", while 25,2 % have "ONLY PARENT/CHILD SEQUENCES". This phenomena is furthermore accompanied by a rise in the level of mobility of the individuals concerned and which is very significant : + 22 %.

	couples : husbands and wives together (648)	couples : husbands and wives having at least one common sequence (298)
Overall trip rate	4,1	5
confidence interval (95 %)	3,9 - 4,3	4,7 - 5,3

SCHEMA 3 - Classification of the 180 couples with at least one common activity sequence. Distribution in % with reference to the 234 couples in the basic sample.



a rise of 22% in the level of overall mobility

3.32. Family structure and intra-family behaviour

For the first three groups analysed, the reference sample is made up of all the couples (324), where as for the last three it is only made up of couples with children (230). We must specify that the intra-family mobility term corresponds to all the trips made by two or more members of the same

household.

A - Couples with one or more husband-wife outings

The high spatio-temporal constraints engendered by husband/wife outings explain the considerable over-representation of the couples without children (+ 30 %) and retired people. Purchases-Care-Services and social life still represent 80 % of the major purposes for these outings which are mostly done by car (85 %). The overall trip rates of the husbands and wives, as well as the spatial form of their outings are similar to those of the couples as a whole. On the other hand, their intra-family mobility is high : 75 % for the wives, and 55 % for the husbands (cf. schema n° 4). A more detailed analysis shows that husband-wife outings correspond to family life organisation logic, or to very different modes of living. Where as for some a period in the day may simply be a time spent together free from any constraints, for others this may be a virtual necessity brought about by a previously chosen way of living.

B - Couples with one or more husband-wife common activities follow-ups

The less constraining character on the spatio-temporal plan of the husband-wife follow-ups compared with the husband-wife outings clearly explains the higher proportion of couples where both work than for couples as a whole (+ 16 %). The nature of these common follow-ups is highly diversified : 85 % have a point of contact outside the home. The husbands and wives are individuals who are scarcely any more mobile than any others, and for them intra-family mobility is average : 42 % for the wives and 38 % for the husbands (cf. schema n° 4). The concentration of activities per outing from the home is a very marked characteristic in this husband-wife group. It would appear that the decrease of constraints linked to husband-wife follow-ups, compared with husband-wife outings constitutes the functional adaptation to an increased spatio-temporal complexity in the husband-wife activity pattern in certain couples.

C - Couples only doing serve passenger or husband-wife accompanying

We can note a very high over-representation (+ 43,5 %) in couples where the wife works and where the availability of a car is lesser than in general, as well as the almost exclusive role of the husband in accompanying. The wives are no different from wives as a whole, both as far as the overall trip rate is concerned and as regards their spatial behaviour. On the other hand, their husbands would appear to be very mobile individuals who often tend to regroup their activities per outing from the home (cf. schema n° 4). Thus, serve passenger and husband-wife accompanying constitute the favoured means for couples where both work to reduce partially the travel constraints which are imposed upon them by the fact that the wife has to use public transportor walk when she leaves the home.

D - Couples with at least one husband-wife sequence plus one more parent child sequence

The percentage is higher for couples with young children, specially in those where the mother does not work, (+ 13 %) than in couples as a whole. The respective roles of the parents in the sequences with their children show a predominance of the mothers who have outings other than serve passenger or accompanying - this latter being the exclusive participation form for the husbands. When several types of common sequences are put together, the result is a high trip rate (cf. schema 4) which can almost entirely be explained by intra-family mobility ; wives : 4,6 outings per day, husbands : 3,4 outings per

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day. The husbands tend to group the activities together for each outing from the home. When we compare this group with those where there is no husband-wife sequence, we must ask ourselves whether the overall trip rates observed are the result of a partially desired family organisation or if they are imposed on a more or less temporary basis.

E - Couples having only independent parent-child sequences

When compared with couples with children as a whole, there is a higher proportion of couples with young children here (+ 20 %), there is an over representation of top-executives and of households with two cars. The similarity in the nature of the sequences (accompanying, serve passenger) between fathers and mother declines from the frequency point of view (1,3 against 2 per day respectively), and as far as the mode of transport used is concerned, the percentages are respectively 80 % and 40 % for private cars. Let us add that the husbands usually have to "see to" the outings in the evening. The overall trip rates are higher than average, while only the wives tend to concentrate their activities. This group of parents would appear to be particularly concerned with the trips of their children, no doubt for several different reasons : their being so young, far-distant equipement for free-time activities, an over-protective attitude, and thus, mothers and fathers play complementary roles as far as taking charge of the common sequences with their children is concerned.

F - Couples only having mother-child sequences

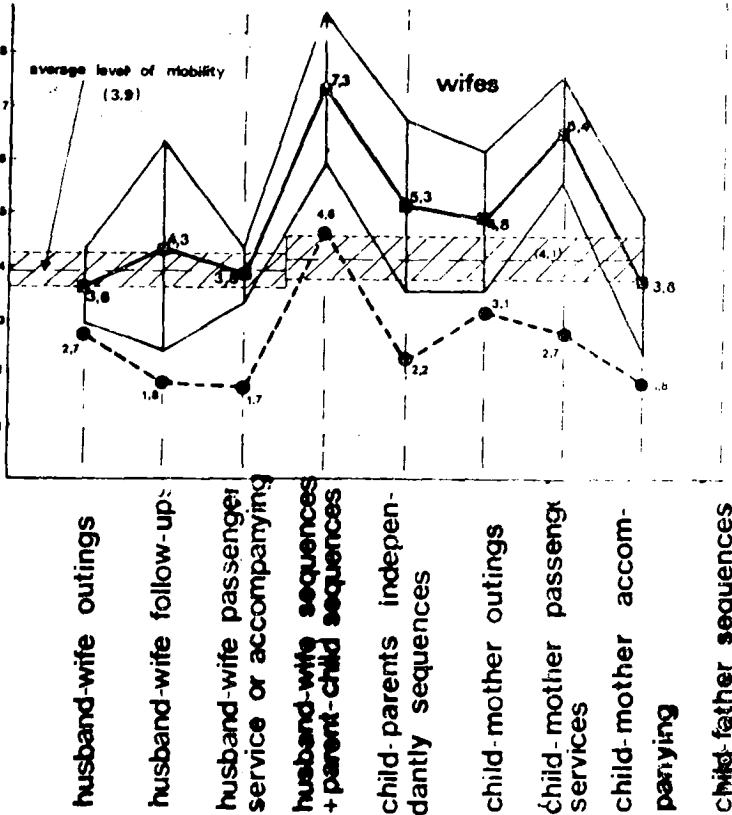
The dominant type of mother-child common activity sequence sets up a very clear typology for the couples.

- On the one hand, almost only couples where the wife does not work (88 %) are concerned by the two most constraining types of sequence, i.e. "outing and serve passenger". The average of two sequences per day mostly corresponds to trips on foot and leads to a high or very high trip rate (6,4) for mothers who are concerned by "serve passenger". The intra-family mobility is important here as is the fact that there is a predominance of back and forth outings.
- On the other hand, the "mother-child accompanying" situation concerns a majority of couples where both work (71 %). This result is linked to an exceptionally high level of households with two cars (93 %). The trip rate of these wives is average, and the accompanying (1,8 per day) is done by car 9 times out of 10. The concentration of activities per outing is relatively high.

This typology shows the very marked influence of the fact that the wives work, especially when there are young children.



SCHEMA 4 - Overall trip rate and intra-family trip rate as a function of the type of common activity sequences of couples (Confidence interval 95 %)



### 3.- AN INDUCTIVE APPROACH TO MOBILITY BEHAVIOUR

#### 3.1. Study presentation

The approach adopted in this second part differs from the preceding approach principally because of its inductive character. It starts off from the same representation of mobility as resulting from the inscription of the individuals' activity pattern in space and time. This approach is centred on the individual, whom we consider as a pertinent analysis entity, designated by situational characteristics (socio-economical, demographic) which include a family-constraint indicator. The individual is further characterized by commuting behaviour indicators, activity participation indicators, and urban space zone frequentation indicators.

There would be no point in our pretending that we deal with all aspects of individual behaviour. We are only able to deal with part of the reality using the indicators we constructed, and we must not deny the individuals' freedom within the framework of his own personal constraints. The individual is situated at the intersection of several groups according to different dimensions (social, economic, family, cultural, etc.) : we believe that these dimensions characterize the individuals' situation, inducing a certain type of behaviour indicated by the macro-indicator which the activity pattern is. Rather than try to get individual behaviours, we have therefore tried to define groups of situation at the level of which we can determine collective adaptation behaviours.

Our basic hypothesis is therefore to use a pertinent formalization of trip behaviour in order to make a typology of the population in identifiable groups which have a certain amount in common in their behaviour. This typology could therefore be used for the modelling and the forecasting of trip behaviour.

3.2. Method of analysis

Each individual is therefore defined by four major types of variable :

individual            situation            trips            activities            places

The last three types of variable result from a first reduction in the representation of the activity pattern. These various sets of variables must therefore be inter-related. What method can be used to do this ? A traditional approach by analysis of crossed tables generally includes a "ceteris paribus" hypothesis whereby all the implicit variables which could have an influence on the studied phenomenon are presumed to have a distribution independent from those of the explicit variables. This type of reasoning is not of course valid in social sciences where we only observe the state of the social system at a given moment, without there being any possibility of repeatable experiments as in experimental physics. The solution would be to introduce control variables into the tables, but this method very quickly reaches its limits because of the number of tables to be analysed. Without trying to pretend to deal with the phenomenon as a whole, we can try to widen the field of variables considered in the formalized representation of the phenomenon as much as possible. In order to do so, we will use multi-dimensional analysis techniques. These are well known tools which can be used in a systematic method of investigation of trip behaviour.

The principal technique used is the factor analysis of multiple correspondences and gives us an answer to the asked question (Lebart et al, | 11 |). This technique considers the logical table when the lines correspond to the individuals and the data to the modalities of the considered variable (e.g. age) :

	variable $V_1$ (age)				.....	$V_n$		
modalities	10-20	20-40	40-60	+ 60	.....	1	2	3
	⋮							
individual $i$	0	0	1	0	.....	0	1	0
	⋮							

Each individual verifies a single modality in each variable (e.g. 10 to 20 years old). This technique, by the calculation of chi-square between modality profiles (conditional frequencies) and between individuals' profiles, enables us to establish the best simultaneous representation of the proximities between individuals and between modalities, by looking for the axes of greatest inertia. This technique can therefore easily be used for the analysis of qualitative variables, but it is specially useful for considering simultaneously and in a closely-linked manner all of the active modalities in the analysis. Since the comparison deals with the modalities and not only the variables, it enables us to show the non-linear co-variations between variables.

The active modalities in the analysis (for those of the situation variables) enable us to situate the simultaneous representation plans of the individuals and of these active modalities. By simulation on the half-sample we look for the only stable factors : we reason in terms of the stability of the information rather than in quantity of information. The percentage of variance only gives us a pessimistic measure of the pertinency of the representation (LEBART et al | 11|). On these stable plans we visualize the active modalities which enable us to interpret the factorial axes. The coordinates of the individuals are the averages of the coordinates of the modalities they depend upon, except for a dilatation ( $\sqrt{\lambda}$ ,  $\lambda$  being the eigen value associated with the axis of coordinates). The reciprocal is also true. Rather than represent the cloud of individuals, we project the illustrative modalities which represent them (e.g; those of the trip chains) and whose coordinates are the averages of the coordinates of the individuals who satisfy them, with a dilatation. Only the most significant in terms of distance from the centre of the graph on each axis (threshold at 95 % on normal distribution) are selected. By this method we can cross each of the sets of variables which we have distinguished, two by two, alternatively using the active or illustrative character of each of them.

### 3.3. Content of the variables and coding

The coding or re-coding of the survey data is essential to put the information into form. For each of the four types of variable, this coding is constructed as a function of the basic theoretical framework. This phase is of paramount importance since the function of the coding is to transform a "complete" information into an "incomplete" one, but which has a greater practical value.

The situation variables contain a certain number of usual socio-economic and demographic variables. Using them, we were able to construct the "status" variable, taking account of sex, the individuals' working or not state and the presence of children (< 16) in the household if the individual is husband or wife : schoolchildren and students male or female (SH, SF), retired people male or female (RH, RF), non working women with or without children (FAE, FAĒ), working women (FAE, FAĒ) and working men (HAE, HAĒ) with or without children. This variable enables us to account partially for the influence of the family constraints on the individual and for his position in the life cycle (LEMEL | 12|, BONNAFOUS et al | 4|). The socio-professional category of the individual or head of the household shows up a certain number of differences compared with the classification established by the French National Institute of Statistics and Economic Studies (INSEE). They are : employers and merchants, top managers and non-salaried professions, middle-management (inc. foremen), employees, skilled workers, unskilled workers, retired people and non-working people. These groups are made up from the hypotheses of social status as a function of the characteristics of the indivi-

duals who constitute these categories (INSEE [13 ]), in order to give an a priori account of a certain homogeneity in the life style and in the activity pattern which designate it.

The trip variables essentially contain the notion of the form of trip chain characterizing the spatial form of the set of the loops carried out, during the day, from the home which is considered as the anchorage point from which the outings take place (departure from and return to the home). These different forms are distinguished for each mode : on foot, two-wheels, public transport, car-driver, car-passenger, other (car + public transport). The principal mode connected to walking is a function of the priority given to the car or to public transport over the other modes. With these forms of trip chains we aim at taking account of the nature of the succession of activities (outward and return trips as opposed to more complex sequences) in relation with the mode used.

Finally, the activity variables for each individual are the number of trips whose destinations are various sorts of activity outside the home (work, shopping, entertainment etc.). The localization variables are the frequentation (Yes/No) of various sectors of the conurbation. Since these did not lead to any results of real interest, they will only be dealt with briefly. This separation (trips - activities - location) certainly constitutes a considerable loss of information with reference to the activity pattern, but it is nevertheless necessary to make it usable for the automatic treatment algorithms used here.

### 3.4. Analysis and results

#### 3.4.1. Total sample (1 021 persons)

The analysis of the situation variables (multiple correspondences on the table individuals X modalities of situation variables) leads to a structuring of the sample according to the age and the working or non-working character : we can thus first distinguish schoolchildren and retired people from the other adults, and women who do not work from working adults. If we project the overall mobility modalities (number of trips in all modes) on the first plan, these modalities are generally not significant, except for the slight mobility (0 or 1) for retired people. The forms of trip chains clearly show the opposition between the chains carried out by car-drivers and those carried out by other modes. The former are essentially in groups of working or non-working adults except with retired people. The other plans give illustrative projections concentrated around the centre of the graph.

The opposite approach consists in analysing the travel behaviour variables and enables us to give a synthetic representation of them. Whether it be for the number of trips or for the forms of trip chains by mode, the analysis leads to two stable factors. The opposition once again appears between car-drivers and the other modes : we obtain an image of two differentiated modal universes, one of which is almost totally occupied by car-driving and the other by a plurimodal use other than the car. In terms of complexity in the form of trip chains, no obvious structure appears beyond this modal opposition. The illustrative projections of the situation variables give a highly concentrated image and reflect the overall opposition of male/female, working/schoolchildren and non-working, 25 to 50/under 18 (legal age in France to obtain a driving licence), associated with the car driver/other mode opposition.

These two approaches indicate the limits of an analysis at total sample level. The latter is in fact the more important for searching for a typology of the situation groups based on travel behaviour. When we analyse the travel behaviour of the total sample, we place together individuals whose reactions are translated in a similar manner from the point of view of their behaviour but for whom the constraints or adaptation mechanisms are different. This is why it seems to be of interest to segment the sample and analyse each group separately. Working from the preceding results, the following four groups are formed : schoolchildren - non-working women - retired people - working people. Such a segmentation is of course limited by the necessity of statistical significance.

### 3.42. Sub-samples

Each of the groups which we have distinguished is then analysed on the basis of travel behaviour : we consider as active, the modalities of the forms of trip chains per mode, the numbers of trips per type of activity and two modalities dealing with whether people leave their zone of residence or not. By this simultaneous consideration of the three types of variables we try to represent in a synthetic but partial manner the individuals' activity pattern.

The analysis of the group of schoolchildren (186 persons) clearly shows on the first, and only stable plan, a parallel ordering of the trip chains according to the modes. Their order is : car-driver (over 18 only), public transport, car-passenger, two-wheel and finally walking. All these trip chain forms are orientated in the same way, i.e. from the least to the most complex. Non-ordinary activities (shopping, visits, pub) are associated with this growing complexity, as opposed to work, collective sport or entertainment and walks. Leaving the residence zone is associated with the car-driver and public transport modes. The mobility actually appears as being linked to the complexity of the forms of trip chains but only slightly to the trip modes. Only the age appears clearly with regard to these trip modes. As the age of the schoolchildren increases (from 10 to 25) we go from walking to public transport or to car-driver. But there is no link between the age and the overall mobility to which it was not possible to connect a situation variable.

The analysis of the behaviour of non-working women (175 persons) enables us to differentiate two modal sets : the car-driver set and the car-passenger set, linked to going out of the zone, and the more heterogeneous one which either isolates walking or associates it to two-wheels or public transport. As an illustrative variable, the overall mobility does not appear to be linked to the complexity of forms of trip chains. We can verify that high income is associated with the use of a car. The presence of children (< 16) does not appear to have any link with the overall mobility of non-working women. However, if we single out and analyse the group of non-working women who go out of their residence zone, the presence of children is associated with a lower proportion of outings out of this zone (apart from the low incomes and the social category of the head of the household).

The group of retired people (122 persons) shows up behaviour essentially along two axes : car-driver (and other motorized modes) with rising complexity, walking with rising complexity. Activities of out-of-zone and spare-time trips are associated with the car and the other modes, whereas ordinary activities of shopping and serve-passenger are associated with walking. On the two axes we can see that mobility increases with complexity. Nevertheless, the situation variables do not appear to be significant on this plan.

The age does not allow us to differentiate the retired people according to their mobility. We can only see that there is a drop in mobility over 65. The group of retired people who go outside their zone of residence or who make more than 5 trips appears to be more mobile than the basic group in every dimension (all activities and all modes) : the income associated with the availability of a car appear as permissive factors and this does not prevent from a high mobility on foot. However, characterization by other situation variables does not seem possible.

The group of working people (460 persons) only contains those who said they were on a standard day. Only the first two factors are retained and we give them as a simplified image (Fig. 3.2.). The first axis opposes the car-driver and "other" mode chains to the other modes (two-wheels, public transport, car passenger). We can see a linked increase in the complexity of car-driver chains and work-mobility. The second axis is an outings-for-various-motifs (visits, shopping, walks) axis opposed to an average work mobility (2 or 3 trips) or passenger service (1 or 2 trips). This axis is, furthermore, the axis of high total mobility (7 or more trips, see fig. 3.3.). The extreme income modalities (individual or household) are orientated along the same axis of opposition between the car driver and the other modes : we thus find income and car-use associated. The social category of the individual and the one of his household allow us to characterize this modal distribution. The two extremes of the social scale (employers, top managers/workers) are in opposition along this same axis of modal distribution. We can thus show up the joint influence of income and social status on the "choice" of the travel mode. On the other hand, the group of middle-managers and employees does not project in a significant manner on this plan. Finally, on the second axis, no situation modality has a significant position. The situation modalities, in their extreme values (high or low income, "high" or "low" social category), show up the modal split but not the non-constrained outing-mobility factor. If we compare the significance (centrum distance/standard error) of the status and social category variables, the greatest opposition is between top managers (individuals or households) and unskilled workers (individuals) or skilled workers (households) then between men and women : but the presence of children only seems to have a slight impact on these travel behaviours.

As a synthesis (tables 3.4. to 3.6.) we give an image of the differentiations in behaviour according to the groups which we have analysed. These tables show the point of drawing up such a typology of the sample for these previous behaviour patterns. The representations of the phenomenon obtained depend indeed considerably on the coding which we have adopted. We have already referred to the fact that this coding is not random but comes from our desire to point out the dimensions of differentiation in patterns of behaviour (forms of trip chains, mobility linked with activities, etc.). The research in other fields of survey will of course have to be done.

#### 4 - CONCLUSION

The first approach enabled us to see the considerable weight of the family interdependencies generated by the structure of the household on the intra-family behaviour patterns, and it also led to a somewhat new line of reflexion on the phenomenon of substitution or, on the contrary, of addition in terms of mobility that these behaviour patterns correspond to. However, the absence of a totally bi-univocal relationship between family structure and type of common activity sequence clearly shows that other factors come into play simultaneously, specially subjective ones. The second approach is wider

		school- children	non wor- king women	retired people	employers top managers	middle ma. employees	workers
AR : Round trip							
2AR+ : at least 2 RT							
ChIII : 3 trips chain	walking	AR 2AR +	AR 2AR +	AR 2AR +	2AR +	AR	AR
ChIIIb: 3 trips chain + 1 or more RT	two-wheels	AR	-	-	-	-	AR 2AR +
ChIV : at least 1 chain of 4 trips	public transport	AR ChIIIb	-	-	-	AR	AR
ChV : at least 1 chain of 5 trips	car-driver	-	AR 2AR + ChIII	AR ChIIIb	from AR to ChVII	from AR to ChIV	from AR to ChIV
ChVI : at least 1 chain of 6 trips	car- passenger	AR	AR	AR	-	AR	AR
ChVII : at least 1 chain of 7 trips	Number of people	186	175	122	97	217	146

Fig 3.1. : Forms of  
trip chains  
distinguished  
by mode

Table 3.4. : Forms of outing in each group (at least 5 % of the group)

%	school children	non-wor- king women	retired people	working people	Total
Theatre museum	-	-	-	3	2
societies	-	3	5	2	3
Excursions	-	-	4	-	1
Ordinary shopping	12	67	43	20	31
passenger service	-	25	7	5	8
Visits	13	21	19	12	15
Exceptional shopping	7	15	4	6	8
Group Sports etc	39	5	-	16	17
Walk	11	15	12	5	9
Pub	7	-	-	7	6

Table 3.6. : Percentages of individuals in each  
group who travel at least one time  
for each type of activity

%	school children	non-wor- king women	retired people	working people	Total
Walking	54	60	59	26	42
Two- wheels	17	4	8	8	10
Public transp.	43	8	8	16	19
car- driver	6	36	34	72	48
car passenger	24	28	22	17	20
Other	3	2	4	4	3
All modes	100	100	100	100	100
Do not travel	2	9	27	1	6

Table 3.5. : Use (at least one trip) of each  
mode (reference : in each group  
only those who travel)

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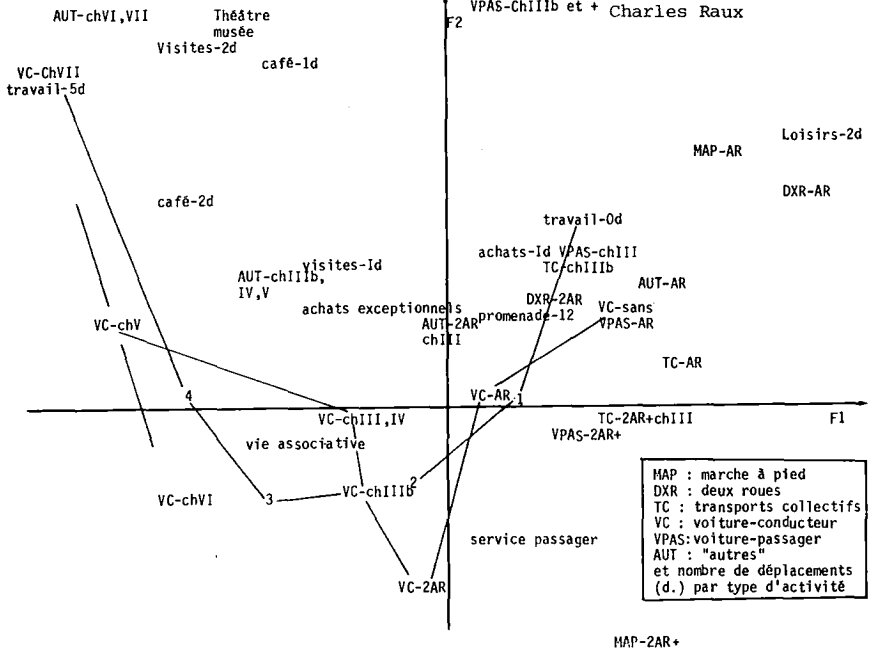


Fig. 3.2. : Correspondances multiples sur groupe des actifs : 460 individus, 17 variables, 63 modalités. Premier plan factoriel

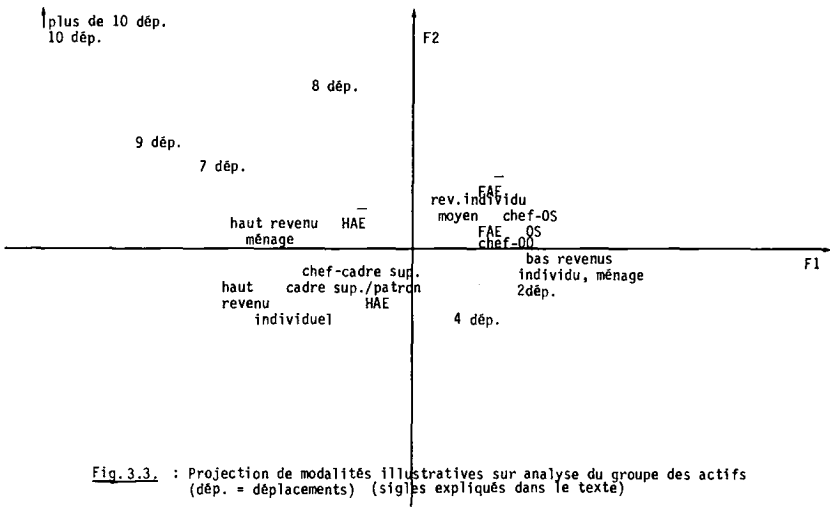


Fig.3.3. : Projection de modalités illustratives sur analyse du groupe des actifs (dép. = déplacements) (sigles expliqués dans le texte)



and more synthetical and is therefore more reductive in its formalization of activity programmes. It has the undeniable advantage of showing up groups with homogeneous mobility behaviour patterns. These two approaches thus offer a perfectly "complementary" vision of travel behaviour phenomena and lead us to a sort of permanent round trip in research between a very considerable breaking-up of the phenomena and their more synthetic representation. On the methodology plan, they both require a previous ordering of the material and this operation is both difficult and of considerable importance with reference to the bringing of the phenomena to light.

On the strict plan or what we call "generation" of trips, these two approaches remain limited (11 % of variance explained by the four situation groups in the second approach for example). However, the representations adopted here do not limit themselves only to the level of mobility, but also take account of the activity patterns (trip chains, activities carried out) and go on to more explicative typologies for the behaviour groups. More globally speaking, however, in terms of modelling and evaluation, they designate two fields of investigation which must be gone into a greater depth : the field of outings from the home, or even of daily trip sequences for an individual, and the field of linked mobility behaviour patterns within the household.

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