

***EFFECTS OF THE RESIDENTIAL ENVIRONMENT ON
TRAVEL PATTERNS***

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1. INTRODUCTION

"No other single modern product has affected the everyday life of man and the spatial structure in Western industrialized countries to such an extent as the car"

(Krämer-Badoni, 1996, p 1).

After the Second World War, the spatial structures of Western societies have been re-shaped by private mass motorization. This phenomenon has had a great impact not only on the geographical distribution of settlement, but also on the everyday life of people. On one hand, the car has enlarged the individual's physical range and choice space, but on the other, it has created new time-spatial constraints on the daily actions of people.

Initially, the environmental and spatial effects of car traffic will be discussed here. Then the research aims for a Swedish case study are described and related to theoretical concepts, methodologies and empirical findings within transport geography. Finally, the results from a small pilot study carried out in May 1998 are presented.

1.1 Background

Environmental and spatial effects of car traffic

Motorized transport in Sweden accounts for the majority of lead, hydrocarbon, carbon monoxide and nitrogen oxide air pollution, and for 80% of the emissions of carbon dioxide, the most important green-house gas (Kaijser, 1995). Sought after solutions for environmental effects of the growing car traffic have been mostly technical, including catalytic converters, energy-efficient cars and broader roads to speed up the flows. The effects of these solutions, though, are more than outweighed by the rising amount of kilometers travelled by car.

Before private mass motorization existed, Western society was characterized by a territorial organization. Dwellings, work places and services were mixed and the city structure dense. Transport technology improvements and better and broader roads brought with them the ability to cover an ever increasing distance within one and the same time limit. For the land-use pattern, this meant a change to a functional organization. The more roads were built, the more the different land-uses were agglomerated: dwellings, work places and shopping centres are now separated, even recreational establishments follow a centralized pattern. Lack of geographical proximity between different activities is in today's functionally organized society compensated by "time proximity". The

average distance travelled per person and day has steadily increased and today amounts to 40 kilometers.

1.2 Problem areas

Population redistribution and transport generation

When the need for people to live geographically close to the work place is reduced, there is more room for individual preferences, for example the desire to live close to nature, to be considered when choosing residential location. This has contributed to an out-migration of households from many middle-sized and larger Swedish towns to the surrounding countryside, resulting in a stagnation or even population decrease in urban areas in favour of small rural settlements. Between 1990 and 1995, the population living in the smallest settlements (50 to 200 inhabitants) increased by 6 per cent, while the Swedish population as a whole increased by only 2.9 per cent (SCB, 1997). The increase in the smallest settlements took place mainly in areas close to larger towns.

This development is often questioned from an ecological point of view, as longer distances between home and work place are supposed to lead to increased car mobility.

In my study, this focus on work trips, so common in transport research and planning, will be questioned. After all, commuting accounts for only 33 per cent of the total amount of kilometers travelled, whereas recreational mobility stands for 53 per cent and reproductional (to shops, hospitals, etc.) for 14 per cent (Tengström, 1991. Fuhrer and Kaiser (1994) claim that people having access to green areas have a lower recreational mobility than those without.

Before my aim within this research area is further explained, I shall turn to another complex problem, from which my second aim will be derived.

Freedom – and compulsion – to be mobile in the functionally organized society

"Humanity has just begun to benefit from the revolution in personal transport. Throughout most of history people have suffered a travel disadvantage compared to other forms of life" (Owen, 1987, p 87-88).

"...transport ceased to be a metaphor of Progress when mobility came to characterise everyday life more than the image of 'home and family'. Transport became 'the primary activity of everyday existence'" (Prato and Trivero, 1985).

Among most transport researchers there is a consensus that improved transport technology *per se* constitutes a prerequisite for economic and social development. Here, the

importance of infrastructure for economic and social welfare in general is not discussed; instead, the functionally organized societal structure will be related to the daily activity pattern of the individual.

According to Hägerstrand (1973), the increasing mobility of the individual has eliminated the conflict between the territorial and functional structures, or at least kept it latent. But when the transport technology has been built into the spatial structure of society, it will no longer serve as a tool of freedom but as a means of compulsion. In one of his later articles, Hägerstrand (1990) questions whether an individual's ability to cover ever increasing distances within ever shorter time spans has actually meant that the possibility of shifting location within the daily activity programme has also improved.

The car's role can be related to the consumers' society in general. It is a society where the individual experiences a constant lack of time, because the amount of services and goods offered steadily increases, while the available time remains fixed. The car is a means by which time is compressed and space widened (Hultman, 1994). This in turn leads to ever more consumption possibilities and to an enlarged geographical range of contacts – so the experienced need of mobility increases. Paradoxically enough, a Swedish study showed that individuals having access to cars more often felt that time was lacking for them to carry out the daily activities than those without cars. In Hägerstrand's (1970) terms, the fact that the individual is indivisible means that time becomes the principal constraint within an increasing geographical range of action. He doubts that there exists technical solutions to overcome this lack of time; on the contrary, it will increase the more the communication and transport technology are improved.

Modern daily life is characterized by a split into short time sequences which the individual spends at a lot of different places. Most daily tasks, productional and reproductional, are not carried out at home any longer; instead every single errand demands its separate trip, often at a certain time. The modern daily time-spatial constraints are usually so strict that the scope for spontaneous meetings or plans is very limited (Björk, 1997). The continuous time spent at home is becoming shorter, making time-consuming home work more difficult to carry out. Instead, the time-spatial coordination of the daily activity projects and the adherent transportation have become new "home work tasks". Still, the home as a centre and symbol of continuity in a time- and geographically split everyday life is considered to be very important by most people, maybe the more important the more mobile they become.

Mobility versus stationarity

Human geographers have launched the concept of "time-space-compression" to describe the consequences of the transport and information technology development. The geographical literature is full of expressions like 'speed-up', 'global villages', 'to overcome spatial barriers'... (Massey, 1994). But *who* actually experiences this increase of mobility? Doesn't the notion of time-space-compression represent only the Western view? Furthermore: Aren't there even within the Western world great inequalities between the possibilities for different social groups to be mobile, between men and women, old, middle-aged and children?

A statement acting as a point of departure for my study is that despite all the technical possibilities to cover ever growing distances faster, the demand for stationarity remains. There exists a dialectic between, and at the same time a mutual dependency of, some people's mobility and others stationarity. In the next section, this question will be dealt with from a gender perspective. The opposition between spatial flexibility and mobility on one hand (for to meet the demands of the productional sphere) and stationarity in terms of being available at home on the other (for to meet the demands of the reproductional sphere), will be discussed.

Mobility and stationarity from a gender perspective

"Everybody sees the value of mobility but fails to see the equally big importance of stationarity" (Hägerstrand, 1992).

"Mobility is strongly gendered and has to be appropriated in different ways before it can be used effectively" (Woolf, 1993).

The mutual dependency of mobility and stationarity and the demand for women to compromise between them becomes obvious in the study of Hanson and Pratt (1995). It confirms earlier results, showing that women in Great Britain generally have shorter work trips than men. But, in contrast to the widespread opinion that this is because women work in low-income sectors within which jobs are spread out and can therefore usually be found close to home, the authors claim that women's income are lower *because* they have to choose jobs close to home to minimize work trips and maximize the time available for domestic tasks. When the geographical radius within which women can accept a job is smaller than men's, so will the amount of alternatives be.

Modes and purposes of travel of men and women

On an aggregated level, quite a lot is known from earlier research about the differences between the travel habits of men and women. Swedish men travel 34 kilometers a day by car and women 22 (Svenskarnas resor 1994). Independently of how long the trip to work is, a larger share of the men go there by car. 50 per cent of the women go by car to work and 69 per cent of the men. But how are productional and reproductional tasks in general reflected in the daily mobility patterns of men and women?

Hanson and Hanson in 1980 compared the travel habits of working men and women in Uppsala. They found that women travelled shorter distances every day, but made more stops during each trip. Men carried out a much greater share of their daily trips by car. Men made more recreational trips than women and generally spent more time on recreational activities than women, who in turn made more shopping trips and trips to day-care centres and schools. Women thus carried out a larger share of the transports connected with household tasks, although "*a striking imbalance in the access to private transportation existed*" (Hanson and Hanson 1980, p 298). The authors made a comparison with households where the women were not in the labour-force. It turned out that husbands of non-working women had approximately the same daily activity patterns as those of working women.

Hanson and Hansons study is almost 20 years old. Things could have changed – or maybe not? The demands for both flexibility and stationarity might become even more difficult to live up to when the functional separation of activities continues. *My question is how these demands are reflected in the travel patterns of men and women in different residential areas.*

2. RESEARCH OBJECTIVES

2.1 Aims of the study

The object of my study is twofold. The first aim is to analyze how different access to work, services and recreational areas affects the travel patterns of households as entities. Concretely, the differences in daily mobility patterns between households living in three functionally different areas will be focused: in a regional centre, in a smaller peripheral town and in the urbanized rural area. From an energy consumption point of view, it is mainly the differences in car use that are interesting here.

As pointed out earlier, the most focused travel purpose is the commuting to and from work, although it accounts for only 33% of the totally travelled distances per individual.

The rest consists of other trips, mainly recreational. Earlier research has shown that geographical proximity to recreational areas might have a decreasing effect on the recreational mobility. This raises the question, *whether households in the countryside travel less in recreational purposes than those living in the regional centre, taking advantage of their better access to green areas close to the residence. Furthermore, do they "rationalize" their service and shopping trips to a higher degree? If so, how does this effect the total amount of kilometers travelled by car compared to households living in the regional centre? And what about the car use in a peripheral, small town with short distances to services, organized sport activities and to the nature, but where a much higher degree of the work force daily commutes to larger towns?*

The second aim is to analyze the opposition between the demands for mobility and stationarity in an increasingly functionally organized society. My research question (to be more developed further on) is how the time-spatial constraints for men and women differ in three residential areas with varying access to work, services and recreational possibilities.

In the following section, I'll try to place my research aims in a transport geographical context. I will shortly present adjacent studies and relevant theoretical concepts and methodologies.

2.2 Theoretical frameworks

Aspects of the concept of "compact city"

According to Breheny (1995) the most important contribution of human geographers to the debate about sustainable development is the analyze of how different city structures influence the energy consumption rates. In the general debate, the concept of the "compact city" is put forward as the most ecologically sustainable alternative. Several studies have aimed at confirming this. Naess (1993) compared the energy consumption rates per capita in 97 Swedish towns and found that they are smaller, the higher the urban density is. On the regional level, though, the energy consumption in Naess' study turned out to be smaller the more *decentralized* the pattern of residence.

Newman and Kenworthy (1989) showed similar results in their study of petrol consumption per capita in 32 different towns all over the world: the higher the density, the smaller the consumption rates. In general, a dense inner city structure was negatively correlated with petrol consumption, but among the European cities the dense suburban areas also showed lower figures. "Deconcentrated concentration" of the built environment thus appeared to be just as energy-efficient a concept as the "central concentration".

The most important criticism against these kinds of studies is that the variations in energy consumption cannot directly be related to the differences in city structure. Many other factors, like income, life style and car ownership, are not regarded at all, although they could be more important reasons for the observed differences. *"It might be reasonable to assume, that if these factors (that is income, life style, etc) could be accounted for, they would tend to reduce the difference between urban and rural consumption rates. Income and car ownership, for example, which are associated with higher energy consumption, are generally higher in small town and semi-rural areas..."* (Breheny, 1995, s 410). Furthermore, Naess' study includes only trips *within* the towns, which probably means that the work related trips are over-represented. These could be shorter in dense cities. Considering that over 50 per cent of all car kilometers are covered for recreational purposes, Bergs (1996) criticism of the concept of the compact city becomes relevant. He points out that this structure demands a lot of recreational trips out from the city.

In my study, I will try to keep the socio-economic variables of the households constant as far as possible, to be able to judge the impact of residential location on travel patterns. This is further explained in chapter 3.

The social transport geography

For the theoretical framework of my second research aim, ie to problemize the time-spatial constraints of women and men in different residential areas, the so called social transport geography offers some possible points of departure to be further elaborated on later.

The social transport geography developed in the 1970s as a reaction against the earlier focus within the discipline on the optimization of the transport system from a purely economic point of view (Hanson and Hanson, 1993). The transport structure was now placed within a social context and attention mainly paid to the inequalities between the mobility of different social groups. On an individual level, the focus was no longer on the single trip but on the whole activity pattern. The method which became dominant among social transport researchers had its roots in time geography. It is called the "activity-based approach". Here, the importance of regarding the trip as a means to fulfil an activity goal, not as a goal in itself, is stressed. The whole activity patterns of individuals are described, classified and modelled. Two different kinds of factors are regarded when trying to explain differences in travel patterns:

- 1) Factors related to the household and to the individual, like sex, age, income, working situation, civil status and car disposal.
- 2) Factors in the local area, for example proximity to various activities and transport service.

However, Hanson and Hanson point out that only few studies have focused the latter factors.

Time geography offers a method to understand how the surrounding structures affect the daily life of the individual (Hägerstrand, 1970). The focus is on the constraints defining the action space of the individual on his way through time-space. In time geography, the question is not *why* an individual acts the way he does, but which different possibilities of action exist. The *capability constraints* limit the activities of the individual because of his biological construction and/or the tools he can command. These tools affect the daily activity range of the individual: the better the transport technology, for example, the bigger the daily range within which the individual can travel.

For production, consumption and social communications systems to work, individuals, tools and/or materials have to be at the same place at the same time. They form "bundles" (ibid). The *coupling constraints* of an individual define where, when and for how long he has to join other persons, tools and materials to produce, consume or transact. Because the individual himself has only limited possibilities to decide where and when these bundles are formed, it is rather the bundles that influence the individual's path through time-space.

Vilhelmsson (1994) discusses how these constraints are changed. He claims that the capability constraints have gained importance during the last decades. Today it is a matter of people's ability to deal with the fast growing information flow. The coupling constraints, on the other hand, have partly weakened, as the demand for simultaneousness in space is reduced by the information technology development. But, as Hägerstrand (1970) points out, the price for this freedom of mobility in space will, due to the indivisibility of the individual, be increasing difficulties to find time.

Most studies within transport geography having a time-geographical approach have not focused how households actually travel, but which alternatives of choice there are. Mårtensson (1974) examined differences in living conditions between three cities due to varying spatial structures, including service patterns and transport systems. She constructed fictitious daily activity patterns and then tested, under which circumstances

they could be carried out in the three cities. Lenntorp (1976) built up a simulation model for individual paths in time-space, aiming at showing how the surrounding conditions affect the amount of possible paths. Forer and Kivell (1981) described the service supply for car-less house wives. Again, it is not the actual activity patterns that are examined, but the restrictions for the potential activity space, which the car-lessness shapes.

The only study found so far which applies a time-geographical perspective but analyzes the *actual* travelling is Fortuijn and Karstens "Daily activity patterns of working parents in the Netherlands" (1989). They compare the travel patterns of working parents in a suburb and inner city area and find that the households in the suburb face a tighter time-budget, ie their possibilities to combine productional and reproductional tasks in everyday life are smaller. Especially, the prospects of finding a job close to home are better for those living in the central city.

In my study, I also plan to investigate how the households actually travel. I am interested in whether the technical development, which reduces the need for geographical proximity between different types of land uses, in fact means that the capability and coupling constraints are similar independently of place of residence. That is, do the constraints differ between a larger and a smaller town and the accessible rural area?

For this second research aim, an interview study with men and women in the three areas is planned for later on. The methodology for the first aim is more developed by now and will be presented in the next section.

3. METHODOLOGY

Earlier research about travel habits has usually been carried out at an aggregated level. Thousands of individuals have been investigated, making it possible to compare, for example, the average travel distances and modes of transport of inhabitants in urban and peripheral municipalities. But to explore whether the out-migration to the nearby countryside (often within the same municipality) leads to increased car mobility, it is necessary to compare socio-economically similar households. If individuals would be chosen randomly, observed differences between the countryside and the town could be due to much higher rates of "mobile" people in the countryside than in the town. From earlier transport research, it is clear that for the daily travel pattern and modes of transport of a single individual, socio-economic factors like access to car, age, sex and income are of more importance than the geographical location of his/her dwelling (for example Hanson and Hanson 1993). To study the effect of residential location on the

travel patterns, it is therefore necessary to keep the socio-economic variables of the households constant as far as possible. For this aim, households in residential areas showing similar aggregated income levels are chosen for my case study. Only families with children are selected, as they are supposed to travel most and as their time-spatial constraints are probably the most complex.

Even though socio-economic factors may be more important as explaining variables for the travel pattern of an individual, the effect of residential location is interesting because it to some extent can be influenced by planning.

3.1 Choice of study areas

The three study areas chosen are all in the Gävleborg county: the regional centre of Gävle (70.000 inhabitants), a minor peripheral community of 3000 inhabitants, Ockelbo, situated 50 kilometers northwest of Gävle and the rural coastal area immediately northeast of Gävle.

1) *Gävle* as a regional centre offers a variety of work places and services. The population of Gävle is stagnating. The share of the population aged 0 to 17 is 21 per cent. 11 per cent of the working population commutes to other municipalities.

2) The small town *Ockelbo* is a sub-center to Gävle and to Sandviken, a town situated 35 kilometers away. 35 per cent of the work force daily commutes out of the municipality, mainly to Gävle and Sandviken. Ockelbo offers services and a nine-year compulsory school. The share of the population aged 0 to 17 is around 20 per cent.

3) The *rural coastal area northeast of Gävle* has experienced an in-migration during the last years, mainly through the changing of summer cottages to permanent residences, but to some extent also through new-built houses. In this area, the share of children aged 0-17 is 26 per cent. From here, the majority of the work force commutes to Gävle. The residents depend on Gävle also for most of the services.

An investigation of the daily mobility patterns of households in these three different areas, offering various access to work, services and recreational areas, will be made in the form of travel diaries in the autumn of 1998. Around 50 households in each area are planned to be included in the study. In May 1998, a small pilot study of 24 households was carried out. The aim of the study was to use the travel diary as a method in a tentative way, preparing for the main study planned for October 1998.

3.2 Selection of households for the pilot study

For the pilot study, the selection of households living in the rural coastal area was limited to a small settlement with a homogeneous, new stock of terraced housing. Its name is Hillevik and it is situated 20 kilometers north of Gävle. Around 40% of its 200 inhabitants are aged 0 to 17. There are no schools, services or organized sport activities in Hillevik. Within Gävle and Ockelbo, households were selected only from one residential area, showing similar aggregated income levels to Hillevik. The addresses were sampled from a data register of children aged 0 to 17. 17 households completed the diaries. 16 of these consist of two adult members and two to four children respectively. One household consists of a father with three children. The average age of the children is between 10 and 11 years in all three areas.

4. RESULTS FROM THE PILOT STUDY

Although a sample of 17 families with 83 members cannot allow broad conclusions, some differences in travel patterns due to location were apparent among these few households. The main study will further investigate possible bases for these differences.

4.1 Patterns of car use

Journeys to work

As expected, the households living in the regional centre of Gävle have the shortest average length of journey to work, 9 kilometers. In Ockelbo (where 65% of the total working population has its places of work within the community), the average work trip among the adults in the pilot study is 16 kilometers. In the rural seaside settlement of Hillevik, offering no work places at all, the figure amounts to 19 kilometers.

Car travelling during week-days

When including all week-day journeys by car, not just work trips, the investigated households in Hillevik show the largest average distance travelled: 56 kilometers per adult and day. This is due not only to the long work journeys, but also to evening trips to various sport activities of the children. The households in Gävle, although having shorter average distances to work, travel more by car, 48 kilometers, than those in Ockelbo, 34 kilometers.

Total amount of car kilometers, including week-end journeys

When considering the total average distances travelled by car, including week-end trips, the importance of the work trips for the total figure is further reduced. Now, it is the

households in Gävle that are at the top, travelling 63 kilometers per adult and day. This is due to long recreational trips undertaken during the week-end: visits to friends/-relatives, summer cottages and amusement parks. In the seaside rural settlement, where the households undertake short or no car trips at all during the week-end, the average car kilometers a day amount to 56 kilometers. In Ockelbo, where recreational and social trips are relatively short, the figure is 34 kilometers.

Differences between the car use of men and women

The women in Gävle and Ockelbo travelled less by car than the men during the week of investigation, and about as much as the men in Hillevik. At the first two places, their distance to work is usually shorter. Both parents give their children lifts in the evening; this is most common in Hillevik, where the nearest football ground is 10 kilometers away. In Gävle and Ockelbo, some men participate in regular sports or hobby activities. No woman at all seemed to do so.

4.2 Discussion of results

Concerning the week-day travel patterns, the most interesting differences are those of the children's modes of travel in the evening. In the regional centre of Gävle and, to an even higher extent in the peripheral community of Ockelbo, the children generally get along on their own to the evening activities by bike, feet or inlines. Parents have to give them a lift only for special events, like a football match of their team in another town. In the small seaside settlement of Hillevik, though, the parents are quite busy driving their children around by car to sport activities at a minimum distance of 10 kilometers from home.

In the Swedish National Atlas 'Work and Leisure' (1993), it is pointed out how children participating in organized evening activities act as a constraint on the time-budget of the whole family. A parent who drives a child to regular sport trainings on average gives up 4.5 to 6 hours on weekday evenings plus Saturdays and Sundays for a quarter of the season's weeks. This means that a week of training and competing of the child costs the parent as much time as Swedes on average spend watching TV, that is 12-14 hours a week.

My preliminar results point at considerable differences, due to residential location, in the degree to which the children's sport activities act as a constraint on the parents' time-budget. There seems to be hardly any possibility for the parents to join leisure activities themselves in the seaside settlement, nor to go for social visits during weekday evenings. This contrasts to the households in Gävle and Ockelbo where the

children's independence allows the parents to undertake more social visits and (this is for the men) to maintain own sport and hobby activities like running and shooting. The question thus arises: When the time-budget constraints of a household are eased due to the children's ability to travel on their own, does it mean that the gap is filled by the men's recreational trips? Another interesting tendency to be further investigated is that it is in the households where the women work part-time that the *men* find time to participate in leisure activities on their own.

An often cited reason to move out from the town to a rural idyll like Hillevik is the wish for the children to grow up in a calm and friendly environment. Inquiries of young adults' housing preferences have shown that a residence close to the nature is often equalled to being a good place for the children to live (Borgegård et al, 1994). This small pilot study indicates that children growing up in the rural settlement face less freedom of movement than those in the regional centre and peripheral town, in that they depend on their parents for car lifts to sport activities.

Concerning the total car travelling, including week-end trips, it will be interesting to see whether the tendency that the shorter work trips in the regional centre are "over-compensated" for, by longer recreational trips during the week-end, is confirmed in the main study. This is also important due to the general tendency, and enhancement, of more people working at home during one or a few days a week. The recreational trips can play an even larger role when the work trips are reduced, so the effect of the residential location on the recreational trips will be more important.

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