Urban Land Use, Mobility and Theory of Science

- Exploring the potential for Critical Realism in empirical research

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Petter Næss, Aalborg University, Fibigerstræde 11, DK-9220 Aalborg East, e-mail petter@i4.auc.dk
Ole B. Jensen, Aalborg University, Fibigerstræde 11, DK-9220 Aalborg East, e-mail obj@i4.auc.dk
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Abstract

Academic discussion where the adequacy of positions within theory of science is illustrated by means of examples from empirical research studies seems to be an area of neglect. The purpose of this paper is to contribute to such a debate, using examples from an investigation into the relationship between urban structure and travel behavior in the Danish municipality of Frederikshavn. The main research question of this study was whether, and to which extent, urban structural conditions, notably the location of residential areas relative to the city center, are influencing the residents' transportation activity. In other words, is there a causal relationship between urban structure and travel behavior? Furthermore, we asked whether results from studies of the relationship between land use and transport can provide a basis for predictions about the likely consequences of alternative land use strategies. The methodology and empirical findings of the study are discussed in the light of the theory of science position labeled 'Critical Realism', in an attempt to relate theory of science to empirical research, but also in order to contribute to the discussion of the usefulness of this specific approach.

1. Introduction

We shall start this paper with the rather bold assertion that academic discussion on the adequacy of different positions within theory of science is most often conducted at a purely philosophical and abstract level. Examples from concrete research studies showing the implications of taking a certain position are seldom given. In this paper, we wish to contribute to a debate on this neglected topic by discussing a recently completed empirical research study into the influence of urban structure on travel behavior in the light of the position of Critical Realism. Our purpose is twofold. Firstly, we attempt to address the question of how to relate theory of science to the methodology and findings of an empirical research study. Secondly, we shall explore Critical Realism as a position within theory of science that might be fruitful for research into the relationship between urban land use and transportation. However, it is important to notice that the latter discussion is articulated retrospectively, as the empirical research was conducted without any explicit references to Critical Realism. Needless to say, we had a number of epistemological reflections regarding this specific research project, but the comparison of our approach to the position of Critical Realism has mainly been made afterwards.

In the discussion, a recently completed empirical study in the little Danish town of Frederikshavn will be used as a case (Næss and Jensen, 2000; Næss, 2000). The question of whether urban structure affects travel behavior will be discussed with the relationship between travel behavior and the location of residences relative to the city center as an example. However, the general conclusions are to a high extent relevant also to the relationships between other urban structural variables and travel behavior.

The structure of the paper is as follows. First, we propose the main theoretical points of departure. Secondly, we shall give a brief introduction to the main themes within the position of Critical Realism. Then the Frederikshavn study and some of its main results will briefly be

presented. This leads us to a more general discussion influenced by the empirical findings and the position of Critical Realism concerning our physical surroundings' influence on human actions and on the possibility of generalization and prediction within social science. Finally, we offer some concluding remarks.

Before turning to the Frederikshavn study and its relations to Critical Realism, let us first consider why residential location could at all be expected to exert any influence on travel behavior.

2. Theoretical point of departure

Within studies of the interaction between land use and transport, a basic assumption shared by most researchers seems to be that the material structure of an urban area constitutes a set of incentives, facilitating some kinds of transportation behavior and discouraging other types of behavior. People are assumed, *ceteris paribus*, to minimize their efforts to reach their daily activities. The efforts may include money, time, inconvenience, etc. In order to estimate a person's total efforts associated with making a trip, transport economists have introduced the concept of generalized traveling costs. The concept is closely cognated with the concept of *friction of distance* within geography. The closer a destination is to the place where you are, and the faster, cheaper and more convenient ways of transportation are at hand, the lower will be your generalized traveling costs of going to this destination, and the higher will be its accessibility. In addition to the accessibility of a location, the trips to a destination of course also depend on the reasons people may have for going there. Here, factors like the number and diversity of jobs and service facilities in the area, or the number of residents, will be important for the extent to which trips are attracted to a certain location.

However, in practice also a number of other factors influence transportation behavior. These factors include personal socioeconomic characteristics of the travelers (age, sex, income, professional status, etc.) as well as their values, norms, lifestyles and acquaintances. Human behavior is influenced by structural constraints and incentives (among which the material urban structure is only one category), as well as the resources, preferences and aspirations of individuals. Also symbolic and cultural features attributed to an area may affect the number of

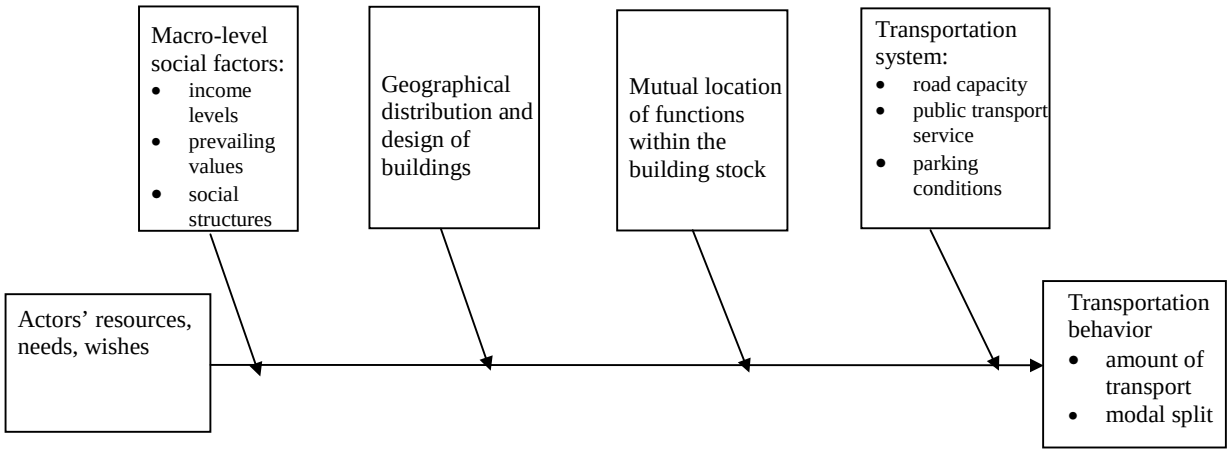

Figure 1. *Transportation behavior as a function of land use characteristics as well as individual characteristics of the travelers and freighters.*

visitors attracted. The emerging transportation pattern is a result of people's resources, needs and wishes, as modified by the constraints and opportunities given by the structural conditions of society (see Figure 1).

Traditionally, many European cities have had a concentration of workplaces and service functions (particularly civil service, cultural institutions, restaurants, entertainment and specialized stores) in the central parts. The closer to downtown the residences of such cities are located, the more workplaces and service facilities are likely to be available in the proximity of the dwelling. Therefore, inner-city residents could be expected to make shorter trips to work, school and a number of leisure activities than their outer-area counterparts. A higher share of the residents may also find it acceptable to walk or bike to these destinations instead of using motorized transportation. The location of a residence within an urban area also affects the likelihood of being surrounded by a high-density or low-density local community. Usually, there is neither tradition nor demand for the same densities in peripheral parts of a city as in the inner and central areas (Mogridge, 1985; Holsen, 1995). With a higher density of residences and/or workplaces in the local area, the population base for various types of local service facilities will also increase. Hence, the average distance from residences to local service will also be shorter, possibly encouraging some of the residents to make their trips to these facilities by non-motorized modes.

By influencing the distances to the downtown facilities as well as to local facilities, the location of the residence relative to the city center could, according to the above line of reasoning, be expected to influence both the residents' traveling distances and their modal choices. A central location of residences could be expected to contribute to shorter average traveling distances and a lower proportion traveled by car. Both would contribute to limit the use of energy for everyday traveling purposes.

However, the choices made by human beings tend to be a bit more complex and less predictable than indicated by the above influences. For example, high accessibility might create increased demands. A high accessibility might be utilized by opting between a wider range of jobs, shops and leisure activities, rather than reducing the amount of transport. Furthermore, traveling distances and choices of mode of transport are considerably influenced by factors like income level, household composition, and lifestyle. Thus, the relationship between land use and transport is embedded in contexts where causes are multiple and where it is necessary to take into account a broad range of possible factors of influence in order to disentangle the specific effect of residential location on travel behavior.

From this rough outline of the theoretical position taken upon the issue of transport and urban structure, we shall now present the theory of science position in question, namely Critical Realism.

3. The position of Critical Realism

The very influential and widely discussed position within theory of science labeled Critical Realism (hereafter CR) cannot be dealt with elaborately in this context (see Archer et al (eds.), 1998; Danermark et al, 1997; Outhwaite, 1987; Sayer, 1992 and 2000 for further elaboration). Here, we shall restrict ourselves to a short description of CR's main points of importance for the theme of this paper.

CR could be regarded an attempt to fuse important lines of thought within theory of science (e.g. hermeneutics, Critical Theory and realism), in opposition both to naive empiricism and positivism but certainly also to post-modern relativism (Sayer, 1993). The á priori attractiveness of CR lies in its aspirations to commit social science to scientific rigor and a rational agenda without falling back into the pitfalls of positivist dogma.

For the purpose of this exercise we shall start out with the some ontological and epistemological statements positioning CR as a theory of science. According to CR the world exists independently of our knowledge of it, and this knowledge is both fallible and theory-laden (Sayer, 1992, p. 5-6). On the one hand, CR conceives social phenomena such as actions, texts and institutions as concept-dependent. On the other hand, these by and large exist regardless of researcher's interpretations of them. The rigor of building consistent theories and exercising conceptual discipline is a central concern to CR. In other words, we should beware of the attitude saying; 'Never mind the concepts, look at the techniques' (Sayer, 1992, p. 2). Since we may have 'sensations' without concepts, but no perception without concepts, the importance of conceptual reflectivity and coherence must be acknowledged. Thus, a social science which neglects the importance of the conceptualization is prone to insert the misconceptions of unexamined common sense into its ordering frameworks (Sayer, 1992, p 62). In other words, the way we frame and articulate our research questions on the relation between urban land use and travel, but also the interpretation of the empirical findings, are dependent on our theoretically informed pre-conceptualizations.

Traditionally, the discipline of logic has contributed to the list of possible ways of reasoning within science with mainly the inductive and the deductive path of reasoning. According to CR however, we should expand this to a fourfold ways of reasoning (Danermark et. al, 1997, p. 134):

> *Induction* - Inference from a singular observation to a universal 'law' (e.g. the Sun rises tomorrow …)
> *Deduction* - Logical inference where the conclusion must follow from the premises (e.g. deduction of agent's maximization of profit in neo-classic economic theory)
> *Abduction* - A creative process by means of re-description and re-contextualization (e.g. Sherlock Holmes' ways of finding the perpetrator)
> *Retroduction* - Events are explained by postulating (and identifying) the mechanisms which are capable of producing them (e.g. profit, rent and interest presupposes surplus value)

The hallmark of CR in this context is that of retroduction, even though CR is not dismissive of the other forms of reasoning but rather complements these three ways with a fourth option. As we shall see later on, this way of reasoning puts quite some emphasis on the importance of theories and concepts in the process of qualitative reasoning. Furthermore, retroduction anticipates a differentiated world, where social structures contain mechanisms that may (or may not) create empirically observable events. This can be illustrated by Figure 2. This simple figure contains some of the more fundamental assumptions of CR. Therefore, we shall explain it into some more detail. The 'events' that take place (e.g. travel) are complexly composed effects of influences from different 'mechanisms', where some mechanisms amplify each other, while other mechanisms reduce each other's influences. At the lowest level in the figure, we find the so-called 'structures'. In accordance with Sayer, we understand these to be defined as sets of internally related objects and practices (1992, p. 92). Urban

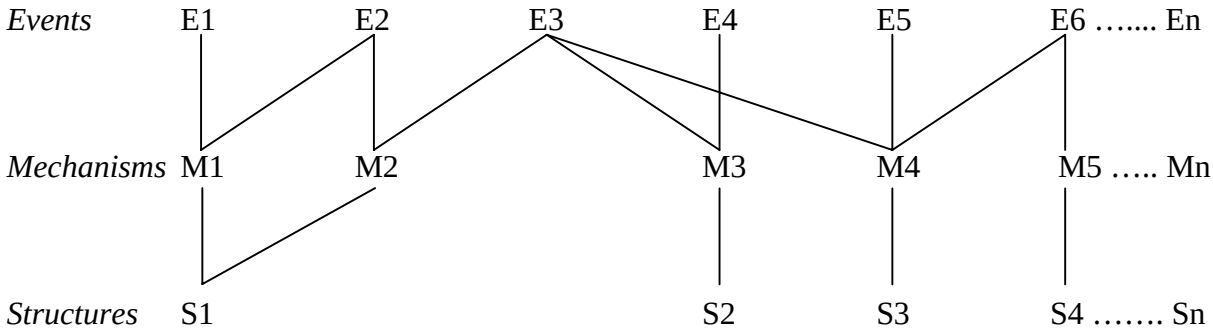

Figure 2: *Critical Realism on structures, mechanisms and events, based on Sayer (1992, p. 117)*

structures are among them, but the structures also include for example political and economic conditions in society, and in the way the concept is used here, also the cognitive and physical capabilities of individual persons. These structures have the potential to influence actions through a number of mechanisms. However, the mechanisms are only activated under certain conditions, depending on the combination of structural influences. In a similar way, the events that actually take place depend on the combination of mechanisms at work in the actual situation. As Outhwaite put it, realism is a common-sense ontology in the sense that it takes seriously the existence of things, structures and mechanisms. Furthermore, it could be said to be ontologically bold but epistemologically cautious (Outhwaite, 1987, p. 34).

As we noticed in the explanation of figure 2, causes might or might not be expressed in observable phenomena (’events’ in the CR terminology). Thus in the view of CR causality is not restricted to a mono-causal relation (A -> B). Causes are seen more like ‘tendencies’ and these may or may not be actualized since counteracting causes can both neutralize and reinforce a causal tendency, and thus prevent or create an empirical effect or event. Such a notion of causality might be seen as a ‘dynamic’ form of causality due to the qualitative difference in the way change and interaction between multiple interacting forces is interpreted. One could perhaps use the analogy of a magnetic field where dynamic and complex interactions between counteracting forces creates the empirically observable phenomena and events.

As a further consequence of the above mentioned retroductive mode of reasoning, CR advocates the practice of ’counterfactual thinking’. To think in terms of the counterfactual simply means to ask questions like; ’how would things be without … ?’ or ’would it make sense to think x without …?’ (Danermark et. al, 1997, p. 159). In thinking counterfactually we use our experience and knowledge about the social world in a productive combination with our ability to think in abstract terms and our capability to imagine *that which is not, but could be*. This retroductive (and counterfactual) way of reasoning emphasizes conceptual discipline, qualitative reasoning and the acknowledgement of theoretically coherent statements and assumptions. This means, according to CR, that we are not able to put forward propositions and statements with any scientific rigor if we do not acknowledge the importance of theoretical reasoning. In our interpretation this is a crucial point, since we shall insist on the importance of doing qualitatively and theoretically based reasoning in order to analyze and explain our empirical field of investigation.

The position of CR on the issue of prediction in social science seems to be one of ambiguity. The ambition of proposing law-like statements upon which to predict human behavior is certainly dismissed within CR – and we totally agree with this position. Even so there seems

to be room for a more pragmatic sense of prediction. Thus, Sayer holds that concerning human action, prediction is certain to be highly inaccurate. However, in so far as it stimulates action this may be better than having no prediction (Sayer, 1992, p. 138). The question of generalization within social science is also one of the less clear points in Sayer's presentation of CR. He dismisses the "natural science-like" generalization on the one hand, but on the other hand he reaches the conclusion that the value of generalization depends on the qualitative nature of the objects to which they refer (Sayer, 1992, p. 103). These points in particular will be dealt with more extensively in the latter part of this paper. In accordance with the position presented so far, it comes as no surprise that CR acknowledge that what science is typically concerned with is not truth in an absolute sense but rather relative degrees of truth and falsity, adequacy and inadequacy, better or worse knowledge (Outhwaite, 1987, p. 40). Thus, in a Popperian sense, the notion of 'truth' should be looked upon as nothing more than a 'corrective ideal'. In Outhwaite's words, we are more content with a 'good explanation' than with any high-flying statement on 'truth'. But how do we know if we have a 'good explanation'? This is so if we 1) have postulated a mechanism that is capable of explaining the phenomena in question, 2) have good reason to believe in its existence and 3) cannot think of any equally good alternatives (Outhwaite, 1987, p. 58).

Summing up on this brief introduction to CR, we would stress the following points that seem to be both useful to, and in accordance with, our empirical research on land use and urban travel. First of all we find it extremely important to keep developing the reflexivity on the level of theory of science. Secondly, the specific position of CR deserves attention since it tries to break with some of the unproductive tensions within the 'trench war' of social scientific epistemology debates (see Næss and Saglie, 2000 for a discussion of how to 'survive between the trenches'). Thirdly, we believe that the epistemology of the social sciences will benefit from a position that takes a more grounded position on its subject matter than what has been the case with the wave of post-modern 'post-critiques' (Williams and May, 1996).

Fourthly, we find some more specific ideas on how best to reflect upon one's own scientific practice that we would like to explore. This is first and foremost the acknowledgement of structures (social and natural) as capable initiators of mechanisms that might (or might not) result in empirical events that we as researchers try to comprehend. Furthermore, such thinking also acknowledges that the social world is not only made up of 'social constructions'. Within our specific research field we find it evident to acknowledge that there are both socially constructed structures of a more enduring and determining kind (material as well as immaterial), and there are socially constructed structures more easily subject to change by of means of human action.

In terms of keeping a strict theoretical and conceptual discipline we welcome the ideas of CR for sharpening reflexivity and attention towards the importance of coherent conceptualization. The notion of retroduction with its emphasis on counterfactual thinking is seen as a 'tool' to fulfil such a purpose. Furthermore, the more dynamic interpretation of the concept of causality with its implication of multiple and complex potential causes seems intuitively to be a more valid way of describing social reality. Eventually we also acknowledge the ambition of CR not only to work on a combination of an interpretative and a realistic framework, but also to stress the importance of a critical distance to its object.

Obviously there are also points of critique that can be raised against CR. For example it seems rather unclear how the status of prediction and generalization should be perceived. However,

these questions will be dealt with in the latter part of this paper. Thus in our interpretation we find in CR a promising combination of hermeneutics, Critical Theory and realism. A conglomerate that according to our opinion deserves to be explored for its potentials for a research field such as transportation and urban planning (it might be beneficiary to other fields as well). After these theoretical and epistemological deliberations we shall now first present the outline of the empirical study, and then some of the results.

4. The Frederikshavn study

The town of Frederikshavn is located in Northern Jutland, about 60 kilometers north of Aalborg, Denmark. The municipality of Frederikshavn has 35 000 inhabitants, of which 26 000 live in the main town and the remaining 9000 in smaller villages and settlements. With the theoretical considerations outlined in section 2 as a background, the study in Frederikshavn focused on the following research questions, of which the first could be characterized as the main one and the three next as secondary questions:

- What relationships exist between the urban structural situation of residential areas and the residents' travel behavior (amount, modal split and energy use) during the week, when taking into consideration demographic, socioeconomic as well as attitudinal factors?

- Are the relationships between the urban structural situation of dwelling and the residents' travel behavior the same across population groups, or do the location and structure of residential areas influence travel behavior differently among different subgroups of the population?

- Is the effect of a residential situation where the need for everyday transportation is low, offset by a tendency to compensate this by making more frequent and long trips during vacations and weekends?

- Does the urban structural situation of the dwelling put constraints on the range of activities in which people engage?

Our hypotheses and assumptions about the ways in which urban structure affects travel behavior concern *degrees* and *strengths* of relationships. As such the hypotheses are based upon the analytically and theoretically informed reasoning presented earlier in this paper. The purpose of the inquiry is not to test and possibly falsify hypotheses about dichotomous regularities without exceptions. The relationships we expected to find between residential location and travel behavior are *tendencies*. Among a large number of individuals, we expected that those living close to a range of facilities and functions regularly or often visited as a part of daily life, *on average* would travel less and carry out a lower proportion of the transport by car than those who live far from such potential destinations. In a number of cases, the travel behavior of individuals could still be expected to deviate significantly from what is *typical* among the residents of an area. It is difficult to imagine that such tendencies and differences of degree could be analyzed without making use of quantitative registrations and calculations. This implies a need for quantifiable information about the travel activity of a relatively high number of residents during a period. The respondents must also be recruited from areas reflecting the variation in the urban structural factors, the effects of which we want to investigate.

In addition to trying to uncover whether, and to what extent, urban structural conditions influence travel behavior, we also wanted to gain more detailed comprehension of *how* urban

structural conditions influence travel. In accordance with CR, we ask which are the *mechanisms* through which residential location influences transportation? Quantitative surveys can only to a limited extent contribute to such comprehension. For such questions, qualitative research methods could be more appropriate. This also applies to questions about people's motives and purposes of their ways of using their physical surroundings. In particular, qualitative interviews will be required to enable us to answer the fourth of the above research questions, but also for the three first research questions, qualitative interviews could contribute with deepening and more complex information.

In accordance with the above, the Frederikshavn study included a questionnaire survey as well as qualitative interviews with a limited number of residents. The questionnaire survey included households living in 11 residential areas, nine in the main urban settlement and two in smaller, peripheral settlements. Each household member at least 15 years old was asked to answer a range of questions about her/his travel activities, as well as about employment, income and education, leisure interests and shopping preferences, and attitudes to mobility, means of transportation, and environmental issues. For each day during a week, the respondents noted how long they had been traveling by different means of transport. In addition to these questions concerning characteristics of the individual respondent, one person per household was asked to answer a few questions about the household. The focus of these questions was on the household's vehicles and their driving distances, household income, and the number, sex and age of household members. The qualitative interviews included six households, three of which living close to the city center and three living in a residential area about 7 kilometers to the west of the downtown area. Each interview lasted for about one and a half hour and was carried out in the home of the interviewees. The persons participating in the qualitative interviews represented a broad variation of occupations, including an assistant social worker, a clerical assistant, a nursing assistant, a trainee teacher, a shipyard workman, two carpenters, two teachers, a chief archivist and a chief secondary school administrator.

5. Results from the study

Below, only a brief summary of the main results of the study will be presented. Readers who are interested in more details, might confer an English-language paper focusing more on the empirical results (Næss and Jensen, forthcoming), or the full-length, Scandinavian-language report from the study (Næss and Jensen, 2000).

In accordance with our theoretical considerations, we find that those who live furthest away from the center of Frederikshavn travel longer distances and have a lower share of non-motorized transport than their inner-city counterparts. This holds true also when controlling for the influence on travel behavior from a number of different urban structural, socioeconomic and attitudinal variables[1]. When controlling for these factors, the average weekly traveling distance increases from 84 km in the areas closest to the center, to 156 km when the distance from the center exceeds 5 km. Not surprisingly, there is a large variation also among people living in the same distance from the center. This reflects socioeconomic and lifestyle differences, as well as sheer chance, such as the choice of a respondent to visit his aunt in Århus (a city located approx. 175 kilometers south of Frederikshavn) during the week of investigation instead of another week. However, the statistical relationship between residential location and traveling distance is very strong.

The distance from the residence to the downtown area is a key factor influencing the accessibility to a number of facility types. The proximity or remoteness of these facilities from the residence has a strong influence on the distances needed to reach daily or weekly

destinations. Figure 3 shows the availability of various categories of service facilities within approximately one kilometer distance from one of the peripheral residential areas of the study (7.5 km away from the town center) and the most central of the investigated residential areas (less than 1 km away from the town center). As we can see, the accessibility to service facilities is very different in the two areas. In addition, our material shows that the commuting distances of the workforce participants are strongly influenced by how far away from the town center the residence is located.

Of all our investigated variables, the location of the residence relative to the town center turned out with the strongest effect on the weekly distance traveled. In addition, the amount of transport tends to increase if you hold a driver's license, have a preference for leisure activities away from home, belong to a household with a high car ownership, are not much concerned about environmental protection, are a male, and are not a student.

Figure 3
Various types of facilities within approx. 1 km distance from the center of each of the two residential areas Ravnshøj (to the left) and Downtown East (to the right).
The demarcation of each study area is shown with a thin, red line.
Scale 1/27 000

- Primary schools
- Other schools
- Kindergartens
- Grocery stores
- Other stores
- Culture and entertainment
- Restaurants

Our material also shows that the respondents' choice of mode of transportation is affected by the location of the dwelling. Controlling for the same variables mentioned in note 9, walking and biking could be expected to account for 38 per cent of the distance traveled by a dweller of the central area of Frederikshavn, as compared to only 15 per cent when the distance to downtown exceeds 5 kilometers. The proportion of distance traveled by car shows a similar relationship with residential location as for the share of non-motorized transport, but with the highest proportions of car travel among residents of the peripheral areas.

Public transport plays a modest role for local transport in Frederikshavn. Within the main urban settlement, distances are short enough that the bike most often appears as a more relevant alternative to the car than going by bus. None of the urban structural factors, including the public transport provision near the residence, appear to exert any influence worth mentioning on the share of the public transport mode.

The importance of the location for travel behavior is confirmed by the qualitative interviews. Two of the families of the central area have previously lived in satellite settlements, 8 and 13 kilometers from the town center. Asked about the main reason for moving to the town center, both immediately pointed to the advantage of not having to depend on so much transportation to reach daily activities. One of the interviewees claimed that the family had saved 500 Danish Crowns a month in gasoline expenses (corresponding to about 65 US$) when they moved in 1994 to the town center from Jerup, 13 kilometers to the north.

The location of the residence appears to influence car ownership to some extent. Our statistical analyses show that car ownership is higher in the peripheral than in the central residential areas, also when controlling for a number of the most plausible socioeconomic and attitudinal factors that might influence car ownership. It is of course hard to tell whether people adapt their car ownership to the needs of transportation generated by the location of the residence, or choose residence according to the mobility level they have at the outset. However, the qualitative interviews show an example of a household who found it necessary to buy an additional car after having moved to a peripheral neighborhood from a residence relatively close to the center, because it became too troublesome to reach daily activities with only one car.

Judged from the interviews, the location of the dwelling seldom prevents people from engaging in the activities in which they are interested. At least, this is true for the majority of households who own at least one car. For those without a car, living far from relevant destinations is more troublesome. In particular, this is true if you are not physically fit. A woman of the peripheral area, who had gotten her vigor reduced from disease, had her job at the nearby primary school. Still, she felt that she would be completely "imprisoned" without her car. This statement reflects a residential location making it very difficult to go to her desired destinations without a car.

After this summary of some of the results from the empirical study we will now turn to two more abstract themes and try to relate these to CR. First, we will discuss the physical surroundings' influence on human action. Secondly, the questions of generalization and prediction will be addressed.

6. Our physical surroundings influence human actions

Our study in Frederikshavn, as well as our previous investigations in Oslo (Næss, Røe and Larsen, 1995; Næss and Sandberg, 1996), show that 'space matters'. The location of residences does influence traveling distances and the chosen modes of transportation. This observation may seem trivial, but it is not. As mentioned in the beginning of the paper, there has for a long time been a prevailing opinion within certain social sciences (notably sociology) that physical and spatial conditions are of little importance to human actions. According to the Durkheimian tradition, social facts can only be explained by linking them to other social facts (as opposed to explanations referring to, e.g., psychological, biological or physical conditions) (Tonboe, 1993, p. 4; Lidskog, 1998, p. 22). The position in part also has its roots in the legacy from Max Weber. According to the American sociologists Dunlap and Catton (1983, p. 118) the impact of the above-mentioned disciplinary traditions on sociology's treatment of the physical environment had serious repercussions. Thus the Durkhemian legacy suggested that the physical environment *should* be ignored, while the Weberian legacy suggested that it *could* be ignored, for it was deemed unimportant in social life. If, according to Dunlap and Catton, one should violate these traditions and suggest that the physical environment *might* be relevant for understanding human behavior or social organization, one risked being labeled an 'environmental determinist'.

Some social scientists (e. g. Giddens, 1984) claim that structures cannot be causes of human actions, because they exist only as long as they are reproduced by such actions. But such an argument seems to confuse short-term and long-term conditions. CR explicitly disagrees with Giddens on this issue and understands structures and agency as ontologically separate entities. For example: The built environment is of course a result of human actions. But as soon as these buildings and infrastructure systems have been constructed, they become part of the *conditions* for human behavior (Danermark et al., 1996, pp. 96 – 97). The built environment creates accessibility and barriers, proximity and distance, and it facilitates some activities at the expense of others (Næss and Saglie, 2000, p. 739). Buildings and infrastructure, as "second nature", also have a considerable *permanence* (Harvey, 1989). Buildings often have a life span of 50 – 100 years or more, and today's roads and other technical infrastructure in older districts of a city often follow the same lines as they have done for several hundred years. For our concrete actions in daily life, the structures of society make up constraints and possibilities, often for a long time beyond the life of those who once created the structures. At the same time, the structures are being modified and changed by human actions, most often gradually and slowly, but sometimes more dramatically and fast.

Does this mean that *causal* relationships exist between physical surroundings and human actions? The answer to this of course depends on how causation is defined. Immediately, it seems clear that urban structural conditions cannot be attributed the status as a *sufficient* condition for a certain travel behavior. Obviously, a host of other circumstances will play a part, among others, the wishes and preferences of the traveler, the state of her/his health, obligations of being present at particular places, and access to means of conveyance. It appears more reasonable to attribute urban structural conditions (e.g. the location of the residence) the status of *contributory* (partial) causes of travel behavior, i.e. as one among several causes included in a causal relationship, but without the ability to produce the effect alone. This way of perceiving causes also fits the way CR conceptualizes causality in terms of 'tendencies' and 'liabilities' and with the notion of multiple and counteracting forces (Sayer, 1992 p. 105).

Causal explanations are sometimes contrasted with reason-explanations in the sense of explanations of 'purposeful action'. Such a reason-explanation of an action is to show that this action – according to the opinion of the acting subject – was the best mean to realize her or his wishes. In addition, the reason-explanation must show that this correspondence between action, wishes and opinions is not coincidental, and that the action was instead adapted to the wishes and opinions of the subject. (Føllesdal, Walløe and Elster, 1996:171). It seems clear that reason-explanations are relevant in order to explain actions of traveling. However, this does not preclude causal explanations from being included as elements in reason-explanations. For example, a resident of the Ravnshøj area (cf. Figure 3) may choose to travel 9 kilometers by car in the morning because this action, according to the person's opinions, is the best mean to realize a wish to reach the workplace at the scheduled hour. Another person, living in the downtown area, may instead choose to walk 1200 meters on foot in order to realize a completely similar wish. Thus, a common wish – to arrive at the workplace before the beginning of the working day – is realized by completely different means. Which mean is the best to realize a wish will depend on the *conditions* under which the wish is to be realized. These conditions are – along with the wishes and preferences of the actors – determinants of the actions a subject chooses to perform (cf. also Figure 1).

In his article 'Causes and Conditions' the Australian philosopher John L. Mackie (1965) introduces the concept of an 'INUS condition' (an *insufficient* but *necessary* part of a condition which is itself *unnecessary* but *sufficient* for the result)[2]. This way of framing causality is in our opinion also in accordance with the acknowledgement of contingency in causal relations that we find in CR (Sayer, 1992 p. 107).

Applied to the above example with the trips from home to work: The 9 km trip by car from the dwelling in the suburb of Ravnshøj to the workplace in the harbor area is the outcome, or result, of a number of contributory causes. This trip might have been carried out as a result of other conditions than the actual ones. Therefore, the conditions resulting in this specific trip are *unnecessary*, but *sufficient*. The distance of 9 kilometers between the residence and workplace was probably an INUS condition for his choice to travel 9 kilometers by car that morning. Given the circumstances, for example

- that he was employed in a company where the working hours started at 7 a.m.;
- that the day in question was an ordinary workday;
- that staying away from work would cut his wages and, if frequently repeated, would imply a danger of being fired, etc.;

then it was a *necessary* and *sufficient* condition for the 9 kilometer trip that morning that the distance from home to work of 9 km *either* had to exist in combination with the actual circumstances, *or* other conditions must be present that could make the person travel this distance at the given point of time.

In a similar way, the short distance of 1200 m between the home and workplace of a person living in the downtown area was an INUS condition for her choice to walk 1200 meters that morning in order to realize her wish to reach her workplace in time.

Mackie emphasizes that the results of INUS conditions are not only of the type *occurrence or non-occurrence* of an event or a situation. The results of INUS conditions are also of the type where the *magnitude* of an effect is influenced by a partial cause. The same applies to the partial causes, where the causal condition could be that a phenomenon is present to a higher or lower *extent*. The relationships found in our study between residential location and travel

activity, come within this category, termed by Mackie as cases of ‘functional dependence’ (Mackie, ibid, p. 260 – 261).

Thus, when stating that the urban structural situation of the residence influences the travel behavior of the residents, we mean that the urban structural situation is a contributory cause – understood as an INUS condition – for the traveling to be carried out to the extent, with the means of transport and along the routes chosen by the persons in question. This causal condition forms part of a reason-explanation, as it contributes to clarify why an acting subject considers one specific act of traveling (or more correctly, a certain, repeated pattern of transportation activity) as the best mean to realize his or her wishes. Such an argument seems only to gain in weight if a strategy of counterfactual thinking is applied. Thus, one would here ask questions like ‘what sort of urban structural situation would prevent the agent from realizing his or her intentions?’ or ‘what would the urban travel pattern of the particular agent look like if the distances to relevant facilities were considerably longer?’

7. Causal powers, mechanisms and events – a concrete example

Below (Table 1), we have attempted to illustrate Sayer’s (1992:117) model of structures, mechanisms and events by means of a concrete example from our Frederikshavn study, namely the journeys to work of the above-mentioned resident of the suburb of Ravnshøj, supplemented with his trips to the grocery store. In order to avoid confusion with the structures of the agency-structure relationship discussed earlier, we prefer in this context to use the notion of “causal powers and conditions” instead of Sayer’s term “structure”, since the latter also includes the powers, abilities and liabilities of individual persons. We must admit that the application of the Sayer’s model to this example proved more difficult than we had imagined. Although his model is compelling, it is often not obvious in real-life situations how events, mechanisms and causal powers should be distinguished. For example, the causal powers and conditions shown in Table 1 are of a more concrete and immediate nature than the “structures” mentioned by Sayer. Probably, one could speak of *chains* of causal powers, mechanisms and events. Whether the upper or lower parts of such a chain are focused, and whether a specific condition should be classified as a causal power or as a mechanism, will depend on the research issue at hand. In our specific example, a “basement floor” of more basic structural conditions could obviously be added, consisting of, among others, the social organization of labor, the overall urban spatial structure, the mental dispositions of the agents, the mobility resources of the agents, the organization of commodity sales, etc. However, in order not to make the table more complicated than it already is, we have abstained from including this level.

The events to be explained by means of the model, are (1) the fact that the resident travels 9 km in each direction between home and work each day from Monday to Friday, and (2) that he does his shopping on his car trip home from work at least once a week. Among a number of conditions, the location of the residence and the workplace, the existence of a cluster of shops along the road between home and work, the parking facilities at the workplace, and the poor bus services both at the residence and at the workplace are contributory causes of his travel pattern. The way these urban structural circumstances combine with car ownership, the temporal organization of work, closing times for shops, and a number of other “non-spatial” conditions, result in a few more specific conditions – or mechanisms – which in their turn combine in a way resulting in the observed travel behavior.

Table 1:
Causal powers/conditions and mechanisms influencing the journeys to work and shopping of an interviewee of the Frederikshavn study.

Event 1: **The respondent travels by car 9 km in each direction between home and work each day Monday to Friday.** **Resulting from: Mechanisms 1 and 2**
Event 2: **The respondent does his shopping on his car trip back home from work at least once a week.** **Resulting from: Mechanisms 2, 3, 4 and 5**
Mechanism 1: **Necessary for the person to travel between the residence and the harbor area each day from Monday to Friday.** **Resulting from: Causal powers and conditions 2, 3, 7 and 10** **Influencing: Event 1**
Mechanism 2: **Car is considered the only acceptable mode of transport for journeys to and from work, and this option is possible.** **Resulting from: Causal powers and conditions 1, 4, 5, 6, 7, 8, 9 and 10** **Influencing: Events 1 and 2**
Mechanism 3: **Cluster of stores alongside the road between downtown and the residence is considered a possible and attractive alternative.** **Resulting from: Causal powers and conditions 7, 10, 11, 121 and 13.** **Influencing: Event 2**
Mechanism 4: **The person considers it convenient to make shopping by car twice a week, and this option is possible.** **Resulting from: Causal powers and conditions 8, 9, 11, 14 and 15.** **Influencing: Event 2**
Mechanism 5: **Shopping must be carried out on the way home from work or on Saturdays.** **Resulting from: Causal powers and conditions 16.** **Influencing: Event 2**
Causal powers and conditions 1: Free and ample parking possibilities exist at the workplace. Influencing: Mechanism 2.
Causal powers and conditions 2: The person is an employee and is obliged to be at the workplace during working hours each workday. Influencing: Mechanism 1.
Causal powers and conditions 3: Every day from Monday to Friday is a workday. Influencing: Mechanism 1.
Causal powers and conditions 4: The person sometimes has to work overtime at the workplace in the afternoon. Influencing: Mechanism 2.
Causal powers and conditions 5: Low frequency of bus departures between the residential area and the downtown area, in particular at non-peak hours. Influencing: Mechanism 2.
Causal powers and conditions 6: Walking distance from bus stop to workplace is more than 1 km. Influencing: Mechanism 2.
Causal powers and conditions 7: The workplace is located in the harbor area 1.5 km east of downtown. Influencing: Mechanisms 1, 2 and 3.
Causal powers and conditions 8: The person considers biking distances above 3 km to be too long. Influencing: Mechanisms 2 and 4.
Causal powers and conditions 9: The person has a car at his disposal each day. Influencing: Mechanisms 2 and 4.
Causal powers and conditions 10: The residence is located in the periphery, 7.5 km west of downtown. Influencing: Mechanisms 1, 2 and 3
Causal powers and conditions 11: No shops exist in the proximity of the residence except a micro grocery store with very poor assortment. Influencing: Mechanisms 3 and 4.

Causal powers and conditions 12: Lots of shops are located in the downtown area, but there is sometimes congestion and scarcity of parking places. Influencing: Mechanism 3.
Causal powers and conditions 13: Well-assorted cluster of shops is located on the route between the residence and downtown (3 km west of downtown), with good parking facilities. Influencing: Mechanism 3.
Causal powers and conditions 14: The person considers it inconvenient to bring shopping goods home on a bicycle or by bus, except small quantities.. Influencing: Mechanism 4.
Causal powers and conditions 15: Using car for shopping trips makes it possible to bring large quantities at one time. Influencing: Mechanism 4.
Causal powers and conditions 16: Short time between the end of the working hours and the closing time for shops. Influencing: Mechanism 5.

The above table is, as already mentioned, based on two types of traveling purposes for one single person. Summarizing from corresponding specifications of casual powers and conditions, mechanisms and events among a large number of individuals and travel purposes, more abstract and general concepts could be derived, and the content of already formulated theoretical concepts could be refined. Possible examples of urban planning concepts at the level of causal powers and conditions are “car-oriented location”, “local availability of facilities” and “accessibility by public transport”. On the level of mechanisms, “automobile dependence” and “local area self-sufficiency” could be relevant abstract concepts. Corresponding examples on the event level could be “high automobility” and “car-less lifestyle”.

8. Is generalization and prediction possible?

Paralleling Bhaskar’s (1978) famous question about the necessary conditions for the empirical practice of science to be meaningful, the following retroductory question may be posed: “What are the necessary conditions in order for the activity of *planning* to make sense?” In market societies, the intervention into market processes represented by planning is justified by the need to promote the collective interests of society, counteract externalities, contribute to better information about long-term consequences and contribute to a better distribution of benefits and burdens (Klosterman, 1985). If planning is to perform these tasks, it must, among other things, be possible to identify measures by which the relevant objectives are likely to be achieved. In other words, it is necessary to *predict* whether a particular measure, for example the location and design of a new residential area, is likely to bring about a different (and better) goal-achievement than other solutions. Without at least some ability to predict the likely consequences of different spatial/physical solutions, the justification for public sector interventions into market mechanisms in the form of spatial planning will be frail.

Generalization across space

As mentioned in section 3, the authors of Critical Realism tend to be ambiguous about the possibility and/or usefulness of generalization about human behavior. It is usually considered much more important to identify the various causal powers and liabilities that activate the mechanisms leading to certain events. But it is also important to get knowledge about the form of combination and proportions of already known constitutive processes. For example: Does a specific causal relationship tend to be activated seldom and/or counteracted by oppositely directed causal relationship between the same variables? Or is it strong and stable enough to manifest itself with a high degree of generality? Knowledge of the form of combination and proportions of already known constitutive processes can be of a high importance in order to evaluate the *policy implications* of the causal powers and liabilities in

question, since such generalizations tell us about the *importance* of these structural powers. A concrete example of the need for such generalizations could be the question of whether a possible "compensatory" mechanism leading to increased travel among inner-city residents to ex-urban destinations (cf. problem issue no. 3 of the Frederikshavn study) is strong enough and occurring with a sufficient frequency to modify or offset the effect of the mechanisms leading to a lower amount of transport for "scheduled trips" among those living close to the city center. While the identification of the detailed mechanisms could best be made by means of qualitative research methods, quantitative statistical analyses may be needed in order to answer the latter type of questions.

As mentioned in section 5, the respondents of the survey investigation in Frederikshavn were recruited from 11 different geographical areas within the municipality. These areas were not randomly sampled, but were *chosen* according to urban structural and sociodemographic criteria, which seems to be in accordance with the information based case selection criteria (Flyvbjerg, 2001, p. 79). This will often be the case in studies of relationships between urban structure and travel behavior, as the concentration of respondents to a limited number of locations allows for a more in-depth registration of the urban structural conditions in each of the chosen areas. Furthermore, this corresponds to the central idea of CR that our analysis and design of research strategies are theoretically informed. In the Frederikshavn study, all households in each area had the opportunity to participate in the investigation, but only a minority (on average 24 per cent) actually chose to return completed questionnaires. Although the respondents appear to be fairly representative for the inhabitants of Frederikshavn in terms of, among others, sex, household size, car ownership, income level and driver's licenses, persons with a long education tend to be somewhat over-represented. The same applies to persons above 45 years.

Thus, the difficulties in making statistical generalizations apply not only to generalizations from the Frederikshavn study to other towns and cities. It will also be problematic to carry out statistical generalizations from our sample of respondents to the population of Frederikshavn, such as calculating the mathematical likelihood of a relationship found among our respondents to be present among the inhabitants of Frederikshavn in general. Instead, a generalization from our sample to the inhabitants of the municipality must be based on a number of qualitative judgments: To what extent do our residential areas, seen as a whole, deviate from Frederikshavn's residential areas in general with respect to characteristics relevant to our research questions? To what extent do relevant characteristics of the individual respondents, also seen as a whole, differ from the total population of Frederikshavn? Does it appear likely and reasonable to assume sample characteristics different from the general situation in Frederikshavn, to have exerted decisive influence on the relationships found between urban form variables and travel behavior? If the sample has no particular characteristics or distortions that could reasonably be assumed to create a different relationship between urban structural factors and travel behavior among our respondents than among the inhabitants of Frederikshavn in general, then this will add credibility to the statement that the results are also valid for Frederikshavn in general. As can be seen a generalization from our sample to the general population of Frederikshavn has, in line with the position of CR, to rely on *qualitative* arguments to a large extent (Sayer 1992, p. 103). As mentioned above, the same applies to an argumentation about the possibilities for a further generalization from Frederikshavn to other Danish or European cities. And the same of course also applies to the generalizations drawn from the qualitative interviews with individual households.

The possibilities for generalization also depend on whether the relationships between urban structural variables and travel behavior have been controlled for the influence from relevant socioeconomic and attitudinal variables, and whether any differences in the strengths of these relationships between different population groups have been investigated. In the Frederikshavn study, both these precautions were taken.

In statistical analyses of data from questionnaire surveys like the one carried out in Frederikshavn, it will not be relevant to interpret the significance level of a relationship as the probability that the same relationship will be absent within a larger population (e.g. the inhabitants of Frederikshavn). Instead, the levels of significance are indicators of the certainty of the various relationships found *within* the sample. The significance level may be interpreted as the likelihood that a relationship different from zero and with the sign of operation shown by the analysis, *could come into being by chance* (cf. Hellevik, 1991, p. 357 – 358).

Basically, social science studies aiming to throw light on relationships between variables, as distinct from measuring the extension of a phenomenon at a given point of time, must be considered a kind of case studies. Judgments of the extent to which the relationships found in such studies can be generalized, must be based on the analytic generalization logic of case study research, not on the statistic generalizations of the 'context-independent' sciences. In studies like our investigation in Frederikshavn, the main purpose of statistical analyses is to facilitate the interpretation of a material that would otherwise be completely over-complex.

Yin (1994, p. 31, 36-37) emphasizes the possibility of generalizing from case studies to theories about the phenomena made subject to inquiry in each case. Our study in Frederikshavn concerns a problem issue of general interest in urban planning, namely the relationship between land use and transport. The results of the case study can be compared to a theory about this relationship, e.g. the assumptions presented above [3]. The theory will function as a 'template' against which the empirical results could be compared (ibid., p. 31). Yin uses the term *analytic generalizations* about this type of generalizations, as distinct from statistical generalizations.

Seen in isolation, the Frederikshavn study can only provide a base for generalization within a quite narrow spatial context. However, if results are available from similar case studies in other geographical contexts (e.g. cities in countries with different social, political, and cultural conditions, or cities of varying sizes), comparisons across such cases may provide a base for more ambitious synthesizing and generalizing[4]. The generalizations that could be made will be of the same nature as those made in multiple case studies (see, among others, Yin, 1994, p. 31, 51). Drawing experience from several cases also provides a basis for more nuanced theories and more robustness in the conclusions. If the results of some of the case studies contradict the original theory, the theory may be modified. New cases should then be chosen in order to investigate whether the modified theory is supported by these cases (Yin, 1994, p. 46, Stinchcombe, 1968, p. 18 – 20).

Generalization across time

Even if the respondents had been sampled randomly among all inhabitants of the municipality, and all distortion due to differences between those who respond and those who do not had been eliminated, the problem of generalization across *time* would still remain. Social science investigations are seldom published in research reports until a year or so after the data collection. Often, another year or two passes before the results can be published in

scientific journals. The context, to which the planners might wish to generalize the results, is therefore already somewhat different from the context in which the data collection took place. The practical use of the results (e.g. in municipal planning) takes place for a number of years after the publication of the results. The planner must therefore make a qualitative assessment about the extent to which the present context is sufficiently similar to the original context to make the conclusions applicable in the actual planning situation. The longer time since the data were collected, the more obvious it is that the type of generalization that could possibly made, is an analytical generalization, not a statistical generalization.

The possibility to *predict* on the basis of a study like the Frederikshavn investigation depends on a similar qualitative generalization across time as when the present validity of the results from a study some years ago is assessed. Again, a number of judgments must be made: Does it seem reasonable to assume that the situation in the future will be different in ways that are likely to nullify the present relationships between urban structure and travel behavior? In case, what traits of development might be expected to cancel out the present relationships? Here, the time horizon of the prediction will obviously be of importance. Intuitively, it appears more likely that the relationships found today will be similar next year than in a century. It is also important to realize that a relationship may become stronger as well as weaker as time passes by. In the case of the relationship between urban structure and energy use for transport, one might, for example, argue that a possible future increase in fuel prices (e.g. due to international agreements on greenhouse gas emissions) is likely to reduce much of the 'optional' traveling, e.g. leisure trips. The remaining trips, e.g. between residences and workplaces, schools and stores, are to a higher extent influenced by urban structure. In such a scenario, the relative importance of urban structure to travel behavior is therefore likely to increase, and the negative social and welfare consequences of living in an area far from relevant facilities will be more serious (cf. Urry, 2000). On the other hand, if the general mobility continues to increase, trips within the urban region are likely to account for a lower share of the total amount of travel. The relative importance of the location of activities within the urban region to the amount of transport will then decrease.

The question of whether predictions based on present causal relationships should influence decisions with long-term consequences (e.g. location of buildings) is also a matter of the burden of proof. What will be the consequences of disregarding the relationship found today between urban structure and travel behavior if this relationship continues to exist in the future, compared to the consequences of letting this relationship influence the location of new residences if its importance diminishes or disappears? In such a judgement, the probabilities of either scenario must of course also be considered. Does it appear more likely than not to assume that urban structure will continue to influence travel behavior? Although it is impossible to predict for sure about the influences of structural conditions on human actions, in particular in a long term, some assumptions appear more reasonable than others do. Rather than ignoring our knowledge about present causal relationships, decisions with implications for the future should be informed by such knowledge.

Some of the disagreement about the possibility of making predictions about human behavior may be due to different ways of conceiving the term of prediction. For example, it is sometimes not clear whether the notion refers to predictions of individual actions or aggregate-level averages. While we agree that it will not possible to predict the influence of the location of the residence on the travel behavior of a particular individual, we still contend that crude predictions of aggregate averages can sometimes be made. Furthermore, it is often unclear whether a debater is talking about predictions of how a future *situation* will be or

predictions about the *effect* of some causal factor. The first is much more difficult than the latter, because of the impossibility of knowing the exact impacts of the many other factors of influence working in open systems. Transferred to the context of land use and transport, this implies that it will be completely impossible to predict, for example, the average number of kilometers traveled by the inhabitants of Frederikshavn by 2015 if all new residences built from now on were located to the downtown area. Along with the non-exact nature of our knowledge about the isolated effect of residential location on transport, the general development of mobility in Denmark is a factor of great uncertainty, depending on a number of economic, cultural and political conditions. However, this does not rule out the possibility of making a research-based assessment of the *effect* of such an urban developmental strategy on local transport, compared to a different location of residences (for example in the periphery of the municipality). Admittedly, not even such a crude, aggregate-level assessment could be made with ambitions of a high accuracy. In principle, it would be qualitative, stating the *direction* of influence (more or less transport) and perhaps some *order of magnitude*. Thus, the sort of research-based predictions about human behavior we consider possible, are of the rough "rule of thumb" type. Such non-quantitative and non-exact, but still grounded, predictions play a crucial role both in our personal lives and in public policy and planning.

This epistemological issue also has an important political implication: If prediction about social matters and human behavior is impossible, why then spend resources on public planning? As already mentioned, the possibility of some degree of prediction is necessary for public planning to exist. If the public sector gives up predicting the consequences of actions in the public domain, and hence also gives up planning, the arena of decision-making will be left over to other agents. Sensitive epistemological arguments about the impossibility of prediction will hardly prevent private-sector actors from predicting likely outcomes of strategies, and choosing those predicted to fulfil their own goals.

In our notion of prediction, theory and causality we adhere to a more 'modest' notion of these concepts compared to the 'strong' interpretations of these basic concepts within Natural Science. Thus, we address the question of prediction in terms of likelihood instead of 'laws'. In a theory of science perspective, the Frederikshavn study takes a 'probabilistic' position where we believe that it will, to some extent[5], be possible to predict how humans adapt their actions to their physical surroundings. The physical conditions constitute a set of framework conditions contributing to make some types of human activity and actions possible, and other types impossible. Furthermore, within the range of *possible* actions, the physical surroundings make some forms of behavioral adaptations more *likely* than other ones, for instance because differences in geographical proximity make some choices more time-consuming, costly or inconvenient than other alternatives. The *theories* that can be developed from research on the relationship between land use and travel are 'modest' in the sense that they apply to more or less strong probability relationships, valid within a limited geographical situation and a confined period of time. In this respect, a study in a single town, such as the Frederikshavn investigation presented in this paper, must be considered a *case study*. That this demarcation is necessary can be seen from the massive critique of the concept of 'theory' within Social Science (e.g. Flyvbjerg, 2001). Here we would surmise that the notion of 'theory' interpreted as law-like relations is better seen as a 'straw man' argument than an invalidating critique of theories within Social Science (see Næss and Saglie 2000, p. 736 for an elaboration of this argument).

9. Concluding remarks

This paper has attempted to illuminate the adequacy of key positions within Critical Realism by means of examples from an empirical study. We have shown that the practice of qualitative and theory-dependent reasoning advocated by CR goes well hand in hand with our exploration of the relation between land use and travel behavior. This position deserves attention since it aims to break with the unproductive tensions within the 'trench war' of social scientific epistemology debates.

On the more specific level we find CR's position on causality highly relevant to our research subject. Critical Realism acknowledges structures (social and natural) as capable initiators of mechanisms that might (or might not) result in empirical events that we as researchers try to comprehend. Within our specific research field we find it evident to acknowledge the existence of both socially constructed structures of a more enduring and determining kind (material as well as immaterial), and socially constructed structures more easily subject to change by means of human action. The notion of retroduction, with its emphasis on counterfactual thinking, is also a helpful device when it comes to postulating (and documenting) structures' way of creating mechanisms that result in empirically observable events, as is the case of urban structures' influences on physical mobility.

Critical Realism's conception of events as the results of the combined mechanisms at work in the actual situation, and the activation of mechanisms as resulting from the context-dependent combination of causal powers and liabilities, matches the multiple-cause situation a researcher is facing when trying to explain travel behavior. This model also helps us understand why we can never expect to find the same kind of strong empirical regularities between causes and events in open systems as in some natural sciences. However, as we have shown, Sayer's (1992:117) compelling and simple model turns out to become bit more complicated when applied to real-life situations in empirical research. We also believe that the alleged impossibility of finding empirical regularities between causal factors and human actions may be somewhat exaggerated, at least with respect to the connection between land use and travel. In many cases, the relationship between the built environment and human behavior is perhaps to some extent a "quasi-closed" (cf. Sayer, ibid:122) rather than a completely open system.

Obviously, there are also points of critique that can be raised against CR. For example, it seems rather unclear how the status of prediction and generalization should be perceived. As we have tried to demonstrate, using both our empirical research and more theoretically oriented arguments, there are good reasons to use generalizations and predictions within social science. The crucial matter is how one defines such notions. As shown here, we find it fruitful and necessary to operate with a 'modest' conception of generalization and prediction leaving room for analytical generalizations and the use of well-informed anticipations of human action based on more qualitatively informed reasoning. Needless to say, we do not find such scientific practice in opposition to the use of quantitative methods. Such opposition is rather the unfruitful expression of the ideologically anchored 'trench war'. Furthermore, we would advocate a similar 'modesty' regarding the possibility of 'theory' within social science. In our view, theories can and should be developed within social science, but according to a different theory concept than within natural science.

References

Archer, M el al (eds) (1998): *Critical Realism. Essential Readings.* London: Routledge
Bhaskar, R. (1978): *A Realist Theory of Science.* Hassocks: Harvester Press.
Brox, O. (1989): *Praktisk samfunnsvitenskap.* (Practical social science.) Oslo: Universitetsforlaget.

Danermark, B. et al. (1997) *Att förklara samhället* (Explaining Society), Lund: Studentlitteratur
Dunlap, R. E. and Catton, W. R. jr. (1983): ”What environmental sociologists have in common (whether concerned with ”built” or ”natural” environments).” *Sociological Inquiry*, Vol. 53, pp. 113-135.
Flyvbjerg, B. (1991): *Rationalitet of magt. Bind I: Det konkretes videnskab* (Rationality and Power. Vol I: The Science of the Concrete), København: Akademisk Forlag.
Flyvbjerg, B. (2001): *Making Social Science Matter. Why social inquiry fails and how it can succeed again*, Cambridge: Cambridge University Press.
Føllesdal, D., Walløe, L. and Elster, J. (1990): *Argumentasjonsteori, språk og vitenskapsfilosofi*. (Theory of argumentation, language and philosophy of science.) Oslo: Oslo University Press.
Giddens, A. (1984): *The Constitution of Society. Outline of a Theory of Structuration.* Cambidge: Polity Press.
Harvey, D. (1989) *The Urban Experience*, Oxford: Blackwell.
Hellevik, O. (1991): *Forskningsmetode i sosiologi og statsvitenskap.* (Research methods in sociology and political science.) Oslo: Oslo University Press.
Holsen, T. (1995): “Det tveeggede sverd. Teoretisk perespektiv på eiendomsutvikling og arealplanlegging i urbane områder.” (The double-edged sword. A theoretical perspective on property development and land use planning in urban areas.) *Plan*, no. 1/95, pp. 17-23.
Lidskog, R. (1998): ”Society, Space and Environment. Towards a Sociological Re-conceptualisation of Nature.” *Scandinavian Housing & Planning Research*, no. 1, Vol. 15, pp. 19-35.
Mackie, J. L. (1965): “Causes and Conditions.” *American philosophical quarterly*, Vol. 2, No. 2, pp, 245 – 264.
Næss, P. (2000): *Urban structures and travel behavior: Experiences from empirical research in Norway and Denmark.* Paper for the International Conference: “Land Use and Travel Behaviour” in Amsterdam, June 20, 2000.
Næss, P. and Jensen, O. B. (forthcoming): *Residential location and transport in Frederikshavn - an analysis of the relationship between land use and travel behavior.*
Næss, P. and Jensen, O. B. (2000) *Boliglokalisering og transport i Frederikshavn.* (Residential location and transport in Frederikshavn.) Series: ISP’s Skriftserie No. 256. Aalborg: Aalborg University, Department of Development and Planning.
Næss, P. and Saglie, I.-L. (2000): ”Surviving between the trenches: Planning research, methodology and theory of science.” *European Planning Studies*, Vol. 8, No. 6, pp. 529 – 550.
Næss, P. and Sandberg, S. L. (1996): ”Workplace Location, Modal Split and Energy Use for Commuting Trips.” *Urban Studies*, Vol. 33, No. 3, pp. 557-580.
Næss, P.; Røe, P. G. and Larsen, S. L. (1995): ”Travelling Distances, Modal Split and Transportation Energy in Thirty Residential Areas in Oslo.” *Journal of Environmental Planning and Management*, Vol. 38, no. 3, pp. 349-370.
Outhwaite, W. (1987) *New Philosophies of Social Science. Realism, Hermeneutics and Critical Theory*, London: MacMillan
Sayer, A. (1992) *Method in Social Science. A Realist approach*, London: Routledge, 2. Ed.
Sayer, A. (1993): *Postmodernist Thought in Geography: A Realist View*, Antipode 25:4, pp. 320-344.
Sayer, A. (2000): *Realism and Social Science.* London/Thousand Oaks/New Delhi: Sage Publications.
Stinchcombe, A. (1968): *Constructing Social Theories.* New York: Harcorurt Brace Jovanovich.
Tonboe, J. (1993): *Rummets sociologi. Kritik af teoretiseringen af den materielle omverdens betydning i den sociologiske og kulturgeografiske tradition.* (The sociology of space. A critique of the theorizing concerning the importance of the material surroundings in the traditions of sociology and human geography.) Aalborg: Aalborg University/Akademisk forlag.
Urry, J. (2000): *Mobility and Proximity.* Paper for the seminar: “Transport and tourism in sociology and geography” in Roskilde, November 2, 2000.
Williams, M. & T. May (1996) *Introduction to the Philosophy of Social Research*, London: UCL Press
Yin, R. (1994): *Case Study Research: Design and Methods. Second Edition.* Series: Applied Social Research Methods, Vol. 5. Thousand Oaks/London/New Delhi: Sage Publications.

Notes

[1] The factors controlled for were: public transport provision near the residence, sex, age, number of household members below 18 years, number of years of education, employment, whether the respondent is a student, personal income, driver’s license, use of car for official trips, responsibility for regular transportation of children, number of days at the workplace or school during the investigated week, attitudes to transportation issues, attitudes to environmental issues, and preferences for leisure activities.

[2] In many situations where we say that an event *A* was the cause of the event *P*, we actually mean, according to Mackie, that *A* was an INUS condition for *P*. *A* is an INUS condition for the result *P* if and only if, for some *X* and for some *Y* it is a necessary or sufficient condition of *P* that *either* a combination of *A* and *X or Y* is present, whereas neither *A* nor *X* are themselves sufficient conditions of *P* (Mackie, 1965, p. 246).

[3] Often, it will be fruitful to use more than one theoretical perspective in order to shed light on the investigated phenomena from different angles ("theory triangulation"). In the Frederikshavn study, this was done by employing perspectives from urban planning, transport economy, geography as well as sociology to elucidate the problem issues.
[4] The same may apply if experience exists from investigations carried out in different historical periods.
[5] Here, the term "probabilism" refers to a position assuming that one can not only distinguish between *possible* and *impossible* actions ("possibilism"), but in a number of cases also be able to predict which aggregate-level behavioral patterns will be *typical* or *dominating* among individuals acting under a certain set of conditions.