POWER AND KNOWLEDGE FILTERING

Urban structures' impact on travel



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Synopsis:

This project aims at investigating different mechanisms of power and knowledge filtering regarding urban structures' impact on travel and its practical implication, in terms of possibility, to influence the amount of motorized traffic in cities through land use planning.

The project takes a wide perspective on mechanisms of knowledge. The conceptions of knowledge filtering are based on different concepts of power, which are originally theorized in mutual excluding manners concerning some issues.

Filtering relevant knowledge of the effect on the built environment on travel will be investigated both within the academic and the political arenas.

It will be shown how state-of-the-art knowledge on urban structures' impact on travel is excluded, distorted or framed as less important because of power.

Jeppe Astrup Andersen

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1. Introduction

This project aims at investigating different mechanisms of power and knowledge filtering regarding urban structures' impact on travel and its practical implication influencing the amount of motorized traffic in cities through land use planning.

Transportation affects land use and land use affects transportation. Decisions that affect one also affect the other. That land use and transportation are two sides of the same coin can be read from the historic development of society.

In pre-modern time water-ways were most efficient in transporting goods and people over long distances and hence cities were most often located near the water in some form or another. Cities were very dense because transportation on land for most people was carried out by foot or on horseback. With the industrial revolution and the emergence of the railroad and public transportation in the nineteenth century, patterns of urban settlements also change remarkably. New towns developed along the railway, and at the same time the railroads made an outward migration from the larger cities possible.

In the twentieth century the automobile was a major force in allowing sprawl to continue in the form it did, just as the railroad had been a powerful force in the nineteenth century. In Denmark the period 1960-1979 was characterized by changes in the business structure, with a dramatic decrease in employment within the rural sector and an increase in industrial production. This process was followed by an extensive population migration from the rural to the urban areas. In this period cities did not only experience an extreme growth in population and workplaces, but the cities also grew to cover a much larger and less dense populated area than in previous periods of time. This period was especially characterised by extensive constructions of single family houses in the outskirts of the city, and considerable expansion of the road capacity based on the rational of optimising the accessibility (Hvidfeldt *et al.* 2000; Jensen *et al.* 2001; Hartoft-Nielsen 2002).

The high increase in prosperity and level of car ownership in the 1960's and 1970's made it possible to evolve mono-functional uses of land, segregation of activities and sprawling patterns of urban developments. However at the same time these sprawling and segregated patterns of urban development also cause a high level of car dependency, which contributed to increase in car ownership, and hence increase in energy consumption for transport. This has increased the demand for new roads to serve the new patterns of activity, which have generated their own development pressures, encouraging further changes in land-use and more traffic generation (Høyer 2002, 163; Owens & Cowell 2002, 78). As Owens and Cowell (2002) states:

"Purely residential suburbs and villages, out-of-town retail and leisure centers and isolated business parks became the Leitmotivs of the late twentieth century. So did vehicle pollution, congestion, the dominance of traffic and the decline of traditional centers." (Owens and Cowell 2002, 78).

With the energy crises' need for gasoline conservation of economic reasons, these selfperpetuating development trends towards more urban sprawl were queried because of the increased energy consumption and dependence followed by these development patterns. Already in the early eighties studies were conducted in Great Brittan and USA on the spatial organization of the society and energy consumption (Næss 1997, 18). In 1989 the two Australian geographers Newman and Kenworthy published their analysis 'Cities and Automobile Dependence' which consisted of data from 32 major cities worldwide. The research into the topic revealed that in dense cities residents on average travel shorter distances, carry out less of the transport by car and hence consume less energy for transport on a daily basis. Based on the analysis they concluded that urban density, especially population density has a significant effect on travel behavior. Based on that, they recommend urban densification in order to reduce the amount of car traffic and facilitating for other modes of transportation in order to reduce the energy consumption (Newman and Kenworthy 1989).

With the Brundtland Commission's report 'Our Common Future' from 1987, and its definition of sustainable development, '*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*', the interest on the relation between urban structures, travel behavior and energy consumption increased. With the emergence of the sustainable development concept, the rationales for energy consumption expanded from being based on economic aspects to include environmental and social aspects as well (Næss 1997, 19).

Reducing the consumption of fossil fuels is an important issue in the efforts to promote a sustainable development. During recent years, attention has increasingly been directed towards global warming and the accumulation in the atmosphere of greenhouse gases. The IPCC has suggested that the global-level of CO_2 emissions should be reduced by at least 60 % as soon as possible.

Denmark has obtained considerable improvements within other sectors, including manufacturing industry and energy use in dwellings. However, within the transport sector, energy use and emissions have continued to increase. In fact the transportation sector is one showing the highest increase in greenhouse gas emissions, thus the need for policies in order to 'break the curve' is strong within this sector (Næss 2006a, 3).

Transportation in urban areas has a number of other negative environmental and social impacts as well, including soil and water pollution, local air pollution, noise, loss of valuable buildings and recreational areas due to road construction, replacement of public urban space by parked cars, the barrier effects of major roads, and traffic accidents (Næss 2006a, 4). Urban sprawl does not only increase these traffic related problems, but also involves loss of farm-land and natural areas surrounding the urban areas.

In order to obtain a more sustainable urban development it is necessary to break the vicious spiral of increased mobility and a transport generating land-use patterns. To obtain such development it is necessary to combine land-use and transportation policies as well as other economic, social, and technological transport reducing policies.

Land use planning has an important role in order to obtain a more sustainable urban development, and the so-called Compact City Model is often articulated as a model for a more sustainable urban development. Reducing the need for motorized travel, especially travel by car, through dense and concentrated urban development makes up an important part of the rationale for the Compact City Model. Land use policies based on this model must focus on location and structuring of future urban development aiming to limit the needs for transportation.

Despite rather strong empirical and theoretical evidence within the academic literature show that urban structures matter to travel behavior and that the Compact City Model can reduce the transport demand, these relations are still a contested area in the academic literature, especially within particular academic disciplines. The pioneer researches into urban structures' impact on travel has been criticized for being based on too simple research methods, and for excluding important socio-economic determinants of travel behavior, which might explain the observed difference in travel behavior. However a vast amount of later research on the issue, based on much more credible methods, has confirmed the conclusions of the early studies, and in addition discovered much more complex casual relations between urban structures and travel behavior, investigating such relationships at scales ranging from the local to the regional level.

It is however not only within the planning theory that the Compact City Model is accepted. Also within policy making and actual planning practice the Compact City Model has been given attention. In 1990 the European Commission recommended in their Green Paper on urban environment that urban structures should be developed in such a way that they contribute to manage and restrict the growth in traffic. In short, the Green Paper recommended implementation of a compact city model, with high density and mixed landuse (Gudmundsson 2000, 185-186).

In planning practice the Compact City Model has especially been adopted by countries such as Norway and the Netherlands. In Norway, a long period of outward urban development since the 1950s has been reversed by a trend of reurbanization during the latest couple of decades. During the period 2000 - 2005 the average density of all Norwegian urban settlements has increased, especially in the largest cities. According to the Norwegian planning legislation, it is forbidden to establish buildings and technical infrastructure in areas set aside for non-development in the municipal master land-use plan. By avoiding setting aside large areas for development and keeping the developmental areas concentrated not allowing leapfrog development, the municipalities of Oslo Metropolitan Area have used the planning legislation actively to prevent urban sprawl. In Oslo Metropolitan Area, with a total population of approx. 850.000 inhabitants, the population of the core municipality has increased from about 447.000 in 1985 to 560.000 by the end of 2007, with virtually no spatial expansion of the urban area. In spite of the strong population growth, especially within the municipality of Oslo, car traffic in Oslo increased by only 25 % during the period 1992-2005, compared to 34 % for the country as a whole, where the rate of the population growth was much lower (Høyer 2002, 163-166; Næss 2007b).

However, in many countries urban sprawl has not been brought to a halt. In the postcommunist East European countries, urban sprawl is proceeding at a much higher rate than what has been the case in the West. In some EU countries, including Denmark, Spain and the UK, the tendency of sprawl is more moderate and combined with considerably inner-city regeneration and densification (Næss 2007b).

Despite the building activity in Denmark slowed down in the 1980's and 1990's and was on a much lower level than in the two earlier decades, the urban area grew in the period from 1975-2000 with 33%, whereas the population only grew by 5%. The decrease in building activity in 1980's and 1990's was mostly marked within the housing sector, and not so marked within the business sector, which in this period contains most of the growth in the building stock (Hvidfeldt et al. 2000; Jensen et al. 2001; Hartoft-Nielsen 2002; Miljøministeriet 2009, 41; By og Landskabsstyrelsen 2008, 5). Even though the rate of urban sprawl slowed down in the 1980's and beginning of the 1990's and that the resent rates of sprawl are more moderate in Denmark than in more extreme cases such as USA and the Baltic Countries, the larger cities are still sprawling, and inappropriate location of activities (seen from the perspective of minimizing energy use for transport) still takes place. Resent development trends are actually pointing towards increased urban sprawl. The urban zone was in the period 2000-2008 expanded with 10 %, whereas the urban population only grew with 4% (By- og landskabsstyrelsen 2008, 5). This is evident even though the employment structure has changed with a decrease in industrial production and an increase in the service and knowledge sector. This involved that many centrally located industrial areas have become available for urban regeneration because the industrial workplaces have closed down or been re-located to the outskirts. The demand for floor-space within the service sector is considerably less than within the industrial production, which improves the conditions for centralized densification. Besides many of the new service business don't pollute in the same manner as the industrial production and hence can be mixed with dwellings. This involves that the possibilities for inward, centralized and dense urban development have increased in resent time. Despite this 2/3-3/4 of the new dwellings and businesses constructed in the large provincial towns of Denmark in the period from 1990 - 2002 were developed at the outskirts of the cities or as leapfrog development. It is especially dwellings that are constructed as leapfrog urban development, whereas businesses more often are located in the outskirts. In the same period only 10 % of the newly constructed dwellings and businesses were located in the city

centers (Hvidfeldt *et al.* 2000; Hjortskov *et al.* 2001; Hartoft-Nielsen 2002). During the period 2000 - 2006, houses with gardens made up about 40 % of the new dwellings constructed in Copenhagen Metropolitan Area, whereas it was only 30 % in Oslo Metropolitan Area in the same period (Næss & Yao 2008).

In Denmark the planning system has within the last 10-15 years to a higher extend been focused towards generating economic growth by organizing plans with a view to attracting investments. This has been at the expense of carrying out a stringent location and land use and transportation policy, focusing on urban densification and centralization. This has been followed by an increased willingness to accommodate the location preferences of the business sector for outer-city building sites in order to attract investments in the global competition (Næss 2009a). In a city like Aalborg there exist such large centrally located brown-fields which could be regenerated for urban development, so that the expected urban development could be contained 2 ½ times within the period from 2002 - 2014. Despite this, equally large areas are set aside for urban development of dwellings and businesses in the outskirts of the city. The same problematic is evident within the other larger cities in Denmark (Hartoft-Nielsen 2002). In Århus the proposal for the new Land-Use Master Plan contains urban development patterns, which in the long term involve extensive leapfrog development (Århus Kommune 2008).

There has also been observed a tendency that to a higher extent urban development is taking place in bands along the highway, especially for the business which prefers visual exposure, and high accessibility. This is despite the fact that such location is conflicting with objectives concerning landscape conservation, accessibility with public transport and limiting of the transport demand (Næss 2009a).

It should be mentioned that within the Copenhagen Metropolitan area there has been a land use policy for about 20 years, with the object of locating constructions of new dwellings and businesses, near the metropolitan and suburban electric train stations. However these policy objectives are only followed to some extend (Hartoft-Nielsen 2002; Miljøministeriet 2009), and the National Planning Directive about Finger-Plan 2008 could be seen as an attempt to strengthen the principle of urban railway proximity (Landsplanafdelingen 2008)

Based on the above it can be argued that in Denmark recent trends within urban development, transportation and land-use are mostly pointing in the wrong direction, seen from the perspective of reducing the energy use and emissions from the transportation sector. As a consequence increasingly unsustainable urban development patterns are emerging, which are difficult to reverse when first established.

Plans and policies contributing to urban sprawl are conducted and passed (also in Denmark), despite of the fact that the state-of-art knowledge about urban structures' impact on travel shows that these developments patterns increase overall travel distance and the amount of travel carried out by car. Such plans are hence counter-productive in relation to political objectives concerning reduction in the amount of car traffic and transport related pollutions, amongst others the CO_2 emissions. This is a paradox and will be the focus of this project.

To investigate this paradox this project will focus on mechanisms of power and knowledge filtering. Several authors have pointed to the strong influence of power relations in the formation of opinions and beliefs about contested issues in society. Within the poststructural and Foucauldian tradition it is claimed that not only is knowledge power but at the same time power defines rationality (Flyvbjerg 1991). This means that it is not necessarily the most convincing scientific arguments, that policy-making and planning decisions are based on, but power relations also define the most convincing arguments, e.g. by excluding or filtering other kinds of knowledge.

In politics, problems that are defined ambiguous are often difficult to handle, especially if they are defined in conflicting manners, because it makes it hard to define the appropriate means of action to solve the problems. To render them governable often demands that one definition or one specific approach to the problem is highlighted, while others are tuned down or excluded. Hajer e.g. claims that this has been the case within IPCC to render the climate changes governable. He states:

"the approach of the working groups of the Intergovernmental Panel on Climate Change favours a particular sort of scientific approach that unnecessarily leads to a centralization of knowledge, an unnecessary reduction of flexibility regarding the inclusion of new evidence, and effectively prevents the application of the knowledge acquired for the development and assessment of various policy scenarios" (Hajer 2004, 278) This shows how certain kinds of knowledge are highlighted, whereas other types of relevant knowledge for policy-making were not taking into consideration, but were filtered, because they were inconvenient. The filtering of knowledge in relation to the case of IPCC has e.g. meant exclusion of approaches which questioned the over-consumptive western lifestyle.

Owens & Cowell (2002) have observed that such power-knowledge relations involving filtering of relevant knowledge also are evident within location and land use planning. They state as follows:

"..., those who seek to change the status quo and challenge powerful interests have the greatest need for resources to 'rationality'; in this case, for new policies to be accepted, it had to be 'discovered' that travel demand was related to urban form and density, that out-of-town supermarkets were associated with quite different travel patterns from those at central sites and that employees in remote business parks invariably travelled to work by car." (Owens & Cowell, 2002, 88).

Although, in many cases the political objective is to reduce motorized travel and reduce related CO_2 emissions, power may distort or filter relevant knowledge in order to legitimatize conduction and passing of plans and policies, which are contrary to state-of-the-art academic knowledge about urban structures and travel behaviour.

Power may, however, also influence and distort what is considered as true within the academia, too. For one thing, disciplines are resting on very different and conflicting foundations within theory of science. This has made communication between the different disciplines difficult, and there has been a tendency to exclude knowledge not based on the "right" kind of science. In addition the power play and competition between different academic disciplines for status and funding resources tend to create cultures, where other disciplines and research traditions are treated in a condescending way or simply ignored.

Movement, and hence transport, is a fundamental aspect of every human's life, and a precondition for every society. In addition travel is influenced by the physical surroundings as well as it pollutes the environment. The complexity of mobility is also reflected in the fact that multiple academic disciplines have included different aspects of travel. But just because such diverse disciplines are involved in mobility planning this doesn't mean that planning in reality is interdisciplinary. In fact, struggles between different disciplines or traditions within planning are evident in the academic debates on whether or not urban structures impact on travel. The Compact City Model's truth claim, that urban structure and land-use planning can influence the travel behaviour, is resting on the metatheoretical assumption, that physical structures impact on social praxis. Such metatheoretical assumptions have e.g. been contested by particular disciplines and may involve filtering of relevant knowledge about urban structures' impact on travel and related energy consumption.

Based on the above, this project aims at investigating the following research question:

Which mechanisms of power are involved in the filtering of relevant knowledge regarding urban structures' impact on travel and its practical implication in terms of possibility to influence the amount of motorized traffic in cities through land use planning?

The research question can be divided into four subquestions:

- How can power and knowledge filtering be defined?
- What is the state-of-art knowledge about urban structures' impact on travel?
- Which mechanisms of power are involved within the academic arena in filtering of state-of-the-art knowledge about urban structures' impact on travel?
- Which mechanisms of power are involved in filtering state-of-the-art knowledge about urban structures' impact on travel within the political arena?

In the following it will be discussed how the report is structured and by which methods the research question is approached.

1.1 Design

In this section the structure of the report will be presented.

In order to answer the first of the subquestions Chapter 2 will discuss different types of power and knowledge filtering. First a wide definition of power will be presented, based mainly on Haugaard's (2003) seven ways of power creation. Based on this framework different types of knowledge filtering related to the different forms of power will be elaborated.

In Chapter 3, three different disciplinary directions within mobility research will be presented. These disciplines have traditionally opposing knowledge and truth claims regarding how urban spatial structures impact on travel. The three disciplinary directions, that will be discussed are the Geographical, the Economic and the Sociological approach. These conflicting knowledge claims can, to a high extent, be linked to the disciplines' different conceptualising of space and their meta-theoretical foundations.

It can be argued that it would be more logical to discuss what the state-of-art knowledge within the field of land use and transportation, shows about urban structures' impact on travel, before discussing how meta-theoretical assumptions can be involved in filtering of knowledge about urban structures' impact on travel. Nevertheless, this design has been chosen in order to present some of the theoretical assumptions underlining the different disciplinary traditions, before discussing the results from studies on the field.

In Chapter 4 the second subquestion is dealt with. When investigating filtering of relevant knowledge about urban structures' impact on travel, it is, of course, important that what is claimed to be relevant knowledge, is critically evaluated upon. Because of that, a discussion about the status on the state-of-art-knowledge about urban structures' impact on travel will be presented. In addition, the criticisms of the truth, importance and feasibility the Compact City models, will be enlarged on.

In Chapter 5, the third subquestion concerning mechanisms of power and knowledge filtering within the academic area will be analysed. Here tactics to make knowledge claims related to the compact city model appear as unscientific will be dealt with. It will also be discussed, how unreliable knowledge, showing week or no effect of urban structures on travel, is recycled in literature reviews, and how relevant knowledge is excluded from leading journals.

Chapter 6 will deal with the last subquestion, concerning the analysis of mechanisms of power and knowledge filtering within the political arena. In this chapter three different levels will be investigated: The level of law and practice, the ministerial level and the municipal level. In relation to the level of law and practice and the ministerial level within the political arena I have chosen to include issues related to both land use and transport planning. This is because both sectors are relevant for the research question, and there

may be different mechanisms within the two sectors involved in filtering of knowledge about urban structures' impact on travel.

In Chapter 7 the observed mechanisms within the two arenas are discuss, in relation to each other, as well as in relation to the research question in general. This discussion will mainly be focused on *how* and *why* relevant knowledge about urban structures is filtered, distorted or framed as less important, in the cases investigated in this report

Chapter 8 will sum up the findings of the project and concluded on the research question.

1.2 Methodology

This project aims at investigating the research question within a wide perspective. Instead of applying only one definition of power and knowledge filtering to investigate one particular case study in details, the focus of this project will be at diverse forms of power and knowledge filtering and within different arenas. The manner, knowledge filtering is investigated is through a tracking of how state-of-the-art knowledge about urban structures' impact on travel are excluded, distorted or framed as less important within both the academic and the political arena. Based on this mapping of how urban structures' impact on travel is presented (or not presented), within the political and academic arenas, the mechanism of power involved in the knowledge filtering process will be elaborated on.

The reason, the wide perspective has been chosen, is because diverse mechanism of power and knowledge filtering are likely influence issues, relevant for the research question. Applying a narrow definition of power and knowledge filtering would involve that relevant mechanism might be excluded, because they were not included in the definition. Likewise, by focusing on only one case, important mechanism operating in a wider context, but not present in the particular case, may be missed. There are of course also pitfalls related to applying such wide perspective. This will be elaborated in the end of the section.

To answer the research question document studies will mainly be applied. Written material provides a good research base for approaching the research question within a wide perspective. This is because, it is easy to gain an overview of the different knowledge claims and statements presented within literature, and easy to compare these knowledge claims with the state-of-the-art knowledge within the filed of land use and transportation. Investigation of planning literature within the field of urban structures' impact on travel is the main empirical source applied to investigate mechanisms of power and knowledge filtering within the academic arena. By investigating planning literature, it not only becomes possible to answer the research question about, what the state-of-the-art knowledge within the field of land use and transportation shows about the relationship between urban structure and travel. It may also shed light on different mechanism of power and knowledge filtering within the academic arena.

Planning documents will also be the main empirical source for the investigations of power and knowledge filtering within the political arena. Within the political arena three different levels are investigated: the level of law and practice, the ministerial level and the municipal level. Official planning documents can provide relevant information about knowledge filtering within these arenas, e.g. by showing how the importance of urban structures' impact on travel is framed differently within different relevant ministries.

However, such a wide approach may involve that important qualitative knowledge about how knowledge filtering actually takes place, is missed. By only analysing academic literature and official planning documents, important information about the power struggles involved in the process of determining, what knowledge should be included and excluded and how much attention different knowledge claim should be given in the investigated texts, is not comprehended. This involves that important knowledge about the rationalities and the social context, which constitutes practises of knowledge filtering about urban structures' impact on travel, may not be absorbed within the wide perspective.

Because of the above mentioned pitfall related to the application of such wide focus within the project, this project can perhaps best be characterised as a pilot study. It would be of value, if further research into the subject, approached some of the issues dealt with in this report, by more qualitative methods, focusing on the rationales and social context constituting filtering of knowledge about urban structures, impact on travel.

2. Power and knowledge filtering

To approach the research question, it is first necessary to define how power and knowledge filtering are understood in this project. Within the litterateur on power creation, power has been theorized in different and in some cases divergent manners. In this chapter, I will argue that different mechanisms of knowledge filtering are attached to different theories of power creation. This involves that applying a narrow definition of power, would involve that that I would also have to apply a narrow definition of knowledge filtering. To avoid the pitfall of reductionism by disregarding relevant mechanisms of knowledge filtering, based on a too narrow definition of power, I will in the following outline a commensurable conceptual framework put forward by Haugaard (2003) regarding seven ways of creating power. This framework is based on different concepts of power which originally is theorized in mutual excluding manner concerning some issues. In relation to some issues Haugaard's (2003) framework has been supplemented with other relevant literature sources, which has been incorporated into the framework. Based upon the seven forms of power creation, I will afterwards make some reflections about which forms of knowledge filtering are attached to the different types of power creation, and how these conceptions are of relevance for the research question.

2.1. The creation of power

Because this project aims at investigating diverse forms of power and knowledge filtering, it can be useful to start by investigating different definitions of power within the academic literature which deals with the creation of power. Within this literature, two broad groups can be defined. One group regards power as coercion and goes back to Max Weber's conception of power as repressive. Another broader defined group regards power as reproduction of social order, in one way or another. This perspective also includes a productive side of power (Haugaard 2003; Oels 2005, 186). In my search for a wide definition of power, I started on investigating the conceptualising of the five faces of power (Thomsen, 2000), which are listed in table 1.

Table 1. The five faces of power	Theorist	Perspective	Unit of relational influence	Character of conflict	Objective of influence	Foundation within theory of science
First face of	Robert A.	Pluralistic	Individu-	Visible	Control of	Realism
power	Dahl	perspective	als/groups	conflict	behaviour	
Second face	Peter Bachrach	Elitist per-	Individu-	Hidden	Control of	Realism
of power	& Morton	spective	als/groups	conflict	the agenda	
	Baratz					
Third face of	Steven Lukes	Elitist per-	Individu-	Latent	Manipula-	Realism
power		spective	als/groups	conflict	tion	
Fourth face	Antony Gid-	Structural	Actors in	Capacity	Control of	Structural-
of power	dens, Jeffrey	perspective	their struc-	and re-	social order	ism/ Critial
	Isaac, Roy		tural posi-	sources	and trans-	Realism
	Bhaskar		tion		formation	
					processes	
Fifth face of	Michael Fou-	Structural	Institutional	Creation of	Discipline	Post-
power	cault, Emesto	perspective	complexes	tacit knowl-	and obedi-	structural-
	Laclau &			edge	ence	ism/post-
	Chantal					marxism
	Mouffe					

The first face of power is defined like this: A has Power over B to the extent he can get B to do something he would not otherwise do. Within this conception power is linked to visible conflict in a positivistic sense (Thomsen 2000, 15).

Contrary to the first face of power, the second face contains more hidden mechanism of power, and concerns A's ability to exercise power over B through decision strategies. It can be defined something like this: A executes some positive decisions which ensures A's privilege, and at the same time A executes some negative decisions, with the objective to prevent B from obtaining part of these privileges. In this sense, exercise of power is associated with control of the political agenda, in such way that the powerless do not have the opportunity to challenge status quo (Thomsen 2000, 20).

The third face of power concerns false consciousness and can be defined as: A exercises power over B when A affects B in a manner contrary to B's interests. This involves that power may distort people's conception of their own 'real' interest which may lead them to comply without resistance. The identification of people's 'real' interests is a matter of normative judgment (Thomsen 2000, 25; Oels 2005, 186).

Contrary to the three first faces of power, the fourth face conceptualises power in a much more structural sense. Within this perspective power is related to a capacity to act in a way, that is created by social structures. Power becomes related to the resources capacity available to an actor, who can be used to influence the pre-existing state of affairs or course of event. However, the actors' impact capacity is determined by the actors' structural position. Hence, it is not possible to analyse how agents and structures influence each others, because their characteristics and influential effects can not be identified respectively. This structural conception of power can be criticized of involving a static perspective on the social systems, and it is not capable of explaining dramatic changes in society, or how groups with relative few resources in some cases succeed in challenging the establishment (Thomsen 2000, 34-37). However, Bhaskar's Transformational Model of Social Activity is related to the fourth face of power and has a more dynamic and undetermined conception of the relationship between urban structures and travel. This model assumes, that structures and agency are two different phenomena. Even though social structures are created through human action, they can not be reduced to individuals, but is a prerequisite human action. Social structures enable actions, but they also set limits to what actions are possible. At the same time, structures are modified and transformed by human action at varying phases and impacts (Danermark *et al.* 2001, 178-182).

In the fifth face of power, power is still attached to some form of social structures, but social structures are defined in a much more strategic, dynamic and non-deterministic manner, than in the fourth face of power. According to Foucault, power should be regarded as a diversity of enforcing relations which are presents everywhere. Power is a process through which continuous struggles and confrontations modify, underpin, or reverse these force relations. Or in other words power is an outcome of a strategic process or struggle of which no actor can control the outcome. Without disregarding the cohesiveness of power this perspective highlights how identity is influenced by power relations. In this sense power is attached to the process and institutions which, through discipline, produces identity. This is contrary to underlying assumptions of the first three faces of power. Here the preferences of the actors are fixed. However it is not only identity which is influenced by power, power and truth become interrelated, and is an outcome of the above mentioned strategic power-struggle.

The fifth face of power was originally my point of departure for approaching the research question of this project. However, after going deeper into the research question, I discovered that this conception of power, even though it was useful, was too narrow to cover all the mechanisms of knowledge filtering, which I found. E.g. I discovered that, in some cases, deliberated misinformation was occurring, which perhaps was better understood by

Lukes' idea of 'false consciousness'. Because of that I decided to supplement this conception of power with other concepts.

The conceptualizing of five faces of power is useful to get an understanding of different types of power and they are each relevant to investigating different empirical phenomena. However in order to obtain a wider definition of power than the one put forward by Foucault (the fifth face of power), the five different forms of creating power, as they were presented in their original form above, are not commensurable in respect to all issues, because some of the faces are theorized in a manner which are mutually excluding. Therefore they can not be applied in the same analytical framework. As an example Lukes' concept of 'false consciousness' is not consistent with Foucault's concept of power/knowledge relations.

Instead I have chosen to base my definition of power on the framework put forward by Mark Haugaard concerning seven ways of creating power. Haugaard (2003) develops a framework based on elements from the five faces of power, but also includes a wide range of other power theorists, (both within the coercive and the social order group, al-though he includes mostly from the group that regards power as reproduction of social order). This framework imposes some order and explains a relationship between the five faces of power. The seven forms of power creation put forward by Haugaard (2003) are:

- 1. Power created by social order
- 2. Power created by system bias
- 3. Power created by system of thought
- 4. Power created by tacit knowledge
- 5. Power created by reification
- 6. Power created by discipline
- 7. Coercion

Applying Haugaard's seven ways of creating power, will enable me to apply a wide definition of power in the analysis and to avoid the pitfall of using different concepts of power in the same analysis, which can not be combined theoretically in their original form. Because of that I will in the following go into details with the seven forms of creating power. Before presenting the seven forms of creating power, it is necessary to outline the basic premises from which Haugaard (2003) re-examines the reproduction of social order and the relationship between structure and knowledge. It is assumed that social order premises reproduction of shared meanings within society, which gives actors a capacity to do things which they could not accomplish otherwise. Haugaard argues that:

"..., the added capacity for action which actors gain from society derives from the existence of social order. If social life were entirely a matter of contingency, social power would not exist. If actor A has no capacity to predict the actions of B, then A would be both unable to exercise social 'power over' B (power which B resists) or 'power to' (a capacity for action which B supports)".

This means that the creation of power through reproduction of social order is premised upon predictability in social life. In addition this involves that social power is premised upon some kind of ontological consensus or a shared interpretative horizon among members of society in order for them to make sense of the world in a largely similar way. Otherwise predictability in social life would be impossible. However, creation of power through reproduction of social order is not premised on a consensus about specific system goals, which would have excluded the scope for conflict.

So far the premises for Haugaard's re-examination of the reproduction of social order have been presented. The following is a presentation of the seven forms of creating power.

2.1.1. Power created by social order

The first way of creating power presented by Haugaard concerns social order as casual predictability created through the reproduction of meaning in the form of confirmed-structuration.

The theory on social order formulated by Haugaard is greatly inspired by Giddens' theory of structuration (the fourth face of power), but is considerably different from it. In accordance with Giddens, Haugaard (2003) claims that:

"The source of social order stems from social structures which lend order to an action through the reproduction of meaning. If an actor behaves in a structured way this entails that this action is interpretable as 'the same' as any other action with the same meaning but accomplished in a different time, place, and by a different agent". Basically, this involves that social structures are a form of regularity which gives meaning to action because other actors see it as the same as other actions preformed elsewhere (structuration). But it is not the acts themselves which contribute to the reproduction of meaning, because not all acts are ordered. An accident is not an ordered action, because it is not predictable and does not intend to reproduce meaning, which was the premise for social order.

Even though Haugaard (2003) agrees with Giddens about the importance of structuration in the reproduction of social order, he argues, that this is not sufficient for the reproduction of social power. He states:

"While it is true that the reproduction of structure presupposes structuration by an actor A, it also presupposes the recognition of that action as ordered, or meaningful, by an actor B (structuration is a necessary but not sufficient condition for the reproduction of social structure)"

This recognition by other actors of an ordered action as meaningful is the premises for reproduction of social order and is termed confirmed-structuration. This is in accordance with Barnes' theory of power, which presupposes circles of validating knowledge. E.g. the mayor of a city is only the leader because others are willing to confirm his act of structuration, even those who didn't vote for him. Contrary to the actor based conception of power, this involves that an individual does not possess power. Instead power is conferred upon the actors through their structural position, which is regarded as powerful by others, because they are willing to confirm-structuration. Seen from my point of view, this does of course not involve, that no actor has larger capacity of power, than other actors. Rather it highlights that this capacity of power is context dependent and social contingent.

2.1.2. Power created by system bias

As presented above structuration and confirm-structuration are what makes the reproduction of social power possible through social structures' ordering of actions, which render the actions of others predictable. However, if certain acts of structuration are to be met with confirmed-structuration, this implies its converse, that other acts of structuration are met with disconfirm-structuration or de-structuration. This means that the social order precludes certain actions through the imposition of structural constraint by one actor upon the other actor. The second form of power is attached to the capacity of social order to exclude certain actions and is termed system bias.

Even though structural constraint excludes certain conditions of possibility from the "agenda" of the existing social order (the second face of power), it should not be regarded entirely negative. If meaning was totally fluid, this would involve that members of society didn't share a common interpretive horizon, and hence the capacity for social action would disappear. According to Haugaard (2003) structural constrain is explained by the capacity of other agents to de-structure new practices of structuration. He argues:

"One of the most obvious reasons for de-structuring is the desire to maintain existing power relations. I would argue that this is central to the type of empirical phenomena which Bachrach and Baratz (1962) had in mind with their analysis of the 'second face' of power. In complex administrations some issues are deliberately made areas of non-decision-making so that power cannot be created with regard to certain controversial issues. When a non-issue is raised and directed at those in power, they will claim an inability to confirm-structure because that is not 'how things are done'." [...] "The use of structural constraint to disempower others is a significant and obvious motivational component in understanding why de-structuring occurs"

This means that in order to raise new issues on the "agenda" and to change the conditions of possibility within the existing social order, it is necessary to build consensus on new meanings which will be confirm-structured. This consensus building upon new meanings often starts out within marginal segments of society, in which actors confirm to the new structuration practice. It is from this base or arena that that the further struggle for further confirm-structuration of the new practice of structuration, takes place. Haugaard (2003) argues:

"In a contemporary context, new social movements attempt to create rival arenas where certain issues are confirm structured as 'relevant' or 'appropriate' and over time systemic change is forced upon those who try and maintain the status quo."[...] "Arguably the ability of actors to create new rival arenas of structural reproduction can be characterized as a form of organizational outflanking"

This means that different practices of confirm-structuration and structural constraint can be prevailing within different arenas of society and are fundamental to system changes. In order to construct a framework of power used for knowledge filtering, which can be applied in the analysis, this is relevant, because it highlights the importance of paying attention to different practices of confirm-structuration and structural constraint within in different arenas of society. Such relevant arenas in relation to this project are the academy arena and the political/administration arena.

2.1.3. Power created by system of thought

The third form of creating power is through system of thought. Systems of thought sustain conditions of possibility by facilitating certain types of confirm-structuration while impeding others. Haugaard claims that:

"[...] the possibility of empowering new social movements entail(s) a change in social order and in interpretative horizon. Structural constraint is not solely ensured by actors de-structuring from a desire to maintain existing relations of domination. The reproduction of structure entails the reproduction of meaning and certain meanings are consonant with particular systems of thought in a way which is analagous to the way in which words are language-specific. Incommensurability does not entirely equate to incomprehensibility" [...] "If a new meaning is not consonant with the current interpretative horizon, de-structuring will take place, hence, powerlessness will be reproduced with respect to the issue."

This means that if certain acts of structuration are incommensurable with specific interpretive horizons, de-structuration will take place, because it has no reference point within the exciting social order and is hence seen as arbitrary. However, when changes in the social order occur, this involves that the old order becomes regarded as chaotic, because it has no reference point in the prevailing system of thought within society.

2.1.4. Power created by tacit knowledge

The fourth form of creating power concerns the relationship between tacit and discursive knowledge. Haugaard (2003) states:

"[...] our social knowledge is divided between practical and discursive consciousness. Practical consciousness knowledge is a tacit knowledge which enables us to 'go on' in social life, while discursive consciousness comprises knowledge which we can put into words."

Most knowledge held by actors about social life is tacit knowledge, which is not reflected upon. This involves that many practices of structuration and confirm-structuration are reproduced by actors as a reflex, even though this reproduction of power relations disadvantage them. It is within this perspective Haugaard makes a reformulation Lukes' conception of the third face of power. He argues:

"It is in this context that something akin to the idea of 'false-consciousness' can be defended (the third face of power). The 'false' has to be dropped, but the concept of 'consciousness raising' through social critique can be maintained and defended. The radical feminist, the trade unionist and the Marxist are not dispensing true consciousness but it may be argued that they are making actors aware of aspects of their practical consciousness knowledge which they have never previously confronted in a discursive fashion. In this case, social critique entails converting practical consciousness into discursive consciousness. Once knowledge of structural reproduction becomes discursive, the actor may reject it. In this event, it may become apparent that certain structural practices contribute to relations of domination and/or are inconsistent with other discursively held beliefs."

This type of power is created in two different manners. On one hand, disadvantage power relations are being reproduced because the acts of structuration and confirm-structuration are based on tacit knowledge. Hence the powerful becomes empowered and the less powerful becomes disempowered. On the other hand, by making tacit knowledge discursive, the reproduction of power relations can change and empowers the less powerful.

By reformulating Lukes' theory of 'false consciousness' in terms of consciousness raising through the conversion of practical consciousness knowledge into discursive consciousness knowledge, it becomes consistent and commensurable with other theories of power presented in this framework, and in addition the idea of 'true consciousness' is omitted. The idea of true consciousness is problematic because it involves a form of conspiracy theory and ethnocentric perspective. However, the idea of 'true consciousness' can be defended in situations where deliberated misinformation occurs, as it will be discussed in the analysis.

2.1.5. Power created by reification

The firth form of creating power concerns the relation between power and knowledge and is termed reification. Within this Foucauldian perspective knowledge is power but power is also defining rationality and hence the knowledge and truth. Haugaard (2003) states:

"Truth reinforces structural relations by ensuring that confirming-structuration takes place, even when this entails collaboration in the reproduction of structures which disadvantage the confirmstructurer, through a process where de-structuration is the denial of truth. Those who deny truth are the essence of irrationality. De-structuring structures which are built upon the solid foundation of truth is the ultimate in self-contradiction."

This involves that actors in some cases confirm-structure to structures, which are part of their discursive consciousness even though they disadvantage them. This is because the structures appear as natural, despite they are a product of social conventions. A central element in Foucault's social critique is deconstruction of truth claims. By 'rolling back' a discourse and by showing that the claims of truth taken for granted in contemporary society, do not rest upon some universal order, but are a product of struggles in the past, it becomes clear that the order of things could have been different. Because things could have been different reification of the truth plays an important role in stabilizing structural reproduction.

The reification of the truth has traditionally been with reference to nature or Good, but within modern society science also plays an important role. Haugaard (2003) states:

"In modernity, truth performs a significant reifying function. If something is scientifically true then it is not 'merely' a convention."[...] "The reification of knowledge through science is, in functional terms, the modern equivalent of God or tradition in pre-modern societies and it is important to recognize that this mode of reification is everywhere".

Foucault has in his deconstruction of discipline, punish and sexuality, showed how a large number of medical and other scientific experts, in the beginning of the 18th century, were creating new objects of knowledge which was central to the establishment of a new emerging interpretive horizon based on scientific rationality. The experts were creating new personalities of deviance, which was essential for sustaining the new expert discourse. Haugaard (2003) argues:

"These objects of knowledge are not simply individuals who are deviant because they have not internalized dominant conventions but are objectively pathological relative to the certainties of non-conventional scientific truth." [...] "the recognition of their own pathology, contributes to the recreation of the interpretative horizon which created them as objects of scientific endeavour in the first place."

From this it can be seen how discourses link power, knowledge and truth together. By making phonemes objects of knowledge, and creating discourses which defines the phonemes' 'real' truth, these phonemes can be regarded as predictable, and hence governable.

It is important to note that reification of social order by power/knowledge relation is necessary for ontological security, and hence not solely a will of power, even though it may maintain some relations of domination which can be regarded as illegitimate.

2.1.6. Power created by discipline

The sixth form of creating power concerns the deliberated blocking of transforming practical consciousness into discursive knowledge through socialization or disciplinary powers. Haugaard (2003) claims:

"This is not the instilling of 'false knowledge' but the internalization of routine into the actor whereby structuration automatically elicits confirming-structuration through the careful deliberate socialization of agents. Disciplinary power is a mode of ensuring predictable structuration and confirming-structuration practices through enforced routine. When actors are inculcated with routinized behaviour then the appropriate actions and reactions become virtually reflex."

This careful deliberate socialization of agents through disciplinary power is elsewhere referred to as governmentality. Disciplinary power refers to a specific type of governmentality rising in the eighteen hundreds termed bio-power. Bio-power is particular to modernity and is an outcome of the transformation of interpretative horizon, which includes the idea that it is possible to shape socialization to a standardized mould. Bio power can be described in the metaphor of a shepherd who cares for the wellbeing of his flock, but at the same time disciplines them. Biopower uses a combination of disciplining the individual and the population. For that purpose bio-power uses the apparatus of security such as military, health service, schooling, computer models, etc. (Oels 2005; Howarth 2005).

Especially education is an important institution through which actors are disciplined in modern time. Haugaard (2003) states:

"... mass education is central both to the emergence of the modern nation-state and capitalism. The modern capitalist world is a meritocratic one where credentialization tells you who somebody is, [...]. Credentialization presupposes a state monopoly of education which makes the reproduction of culture (practical consciousness knowledge) a mass phenomenon and with this the idea of the 'perfect worker' and 'manager' emerges. This person is someone who is subject to discipline and, as argued by Foucault, a whole new series of 'crimes' emerge: lateness, improper gestures, etc. These irregularities are, of course, unpredictabilities and are, in turn, the enemy of social order, consequently the capacity to create social power.

The above shows how power creates identity through disciplinary practices such as mass education. This type of power has a clear link to reification as power creation, because education is regarded as a scientific enterprise, and though the institutions of education agents are disciplined to confirm-structure on reified scientific truths.

The latest type of governmentality identified buy Foucault is advanced liberal government. While society in bio power is conceptualised as a domain of needs then advanced liberal government regards the population as a pool of resources, whose potential for selfoptimization needs to be set free (Oels, 2005). Oels (2005) reports Foucault's notion of advanced liberal government like this:

"It is a government without society in that it is based upon subunits like community, family, neighbourhood and not addressed at society as a whole. Advanced liberal government introduces the market as organizing principle for all types of social organization including the state. Advanced liberal government employs market forces to guarantee freedom from excessive state intervention and bureaucracy. Markets have strong disciplinary effects on the subjects made to compete in them. These subjects model themselves on the 'calculating' and 'responsible' individual who needs to increase his/her competitiveness in a constant strive for self-optimization (to become and remain lean, fit, flexible, autonomous)" (Oels 2005, 191-192).

From this it can be seen that advanced liberal government is a market based governmentality, and it is through the market actors are disciplined to behave in a particular manner. Even though the different types of governmentality are linked to different time periods, it does not mean that they simply substituted each other. Instead each governmentality uses and recodes the techniques of earlier governmentalities (Oels, 2005). In section 2.2.6, it will be argued that within the environmental field there has been a shift in governmentality from bio-power to advanced liberal governance from the mid-1980's onwards. In the analysis it will be shown that there also is an indication of a shift towards advanced liberal government within land-use and transportation planning.

In accordance with the next type of power creation, disciplinary power does not exclude the use of physical power, but what makes it effective is the extent to which routines are reified or internalized as practical consciousness knowledge.

2.1.7. Coercion

The last type of power creation is coercion and involves physical power. The effect of physical power is rather limited and its use represents the failure of social power. Haugaard (2003) stats:

"In its raw form, physical power, violence, creates only two forms of predictability: mutilation and death. However, in most complex social orders violence is blended with social power and then we get coercion. In that type of relationship the less powerful actors are conscious of not wishing to reproduce the meanings or, alternatively, the outcomes required, but a threat is used to induce them to do so. It is within this context that the modern state strives for a monopoly of physical violence. However ... a state that continually uses coercion against citizens is actually relatively weak."

Power theorized as actors confirm-structure through the threat of physical power is of course relevant, when investigating many political regimes in contemporary society. However, this type of power creation has very limited explanation-value in relation to the research question of this project. Because of that the following discussion about different types of knowledge filtering will mainly concern the six first types of power creation presented above. The seven forms of reflecting power are summarized in table 2.

	Forms of power	Example
1	Power created by social order	Causal predictability created through the reproduction of mean-
		ing; theorized as structuration and confirming-stucturation
2	Power created by system bias	Order precludes certain actions: Destructuration
3	Power created by system of	Certain acts of structuration are incommensurable with particu-
	thought	lar interpretive horizons
4	Power created by tacit knowledge	'Power over' based upon social knowledge that is not discur-
		sive. Empowerment through the transfer of knowledge from
		practical to discursive consciousness
5	Power created by reification	Social order has to appear as non-arbitrary
6	Power created by discipline	Routine is used to make actors predictable through the inculca-
		tion of practical consciousness knowledge
7	Coercion	Natural power as a base: violence and coercion as a substitute
		for the creation of social power

Table 2. Hauggard's (2003) seven forms of power creation

2.2. Different types of knowledge filtering

It was claimed in the introduction to this chapter, that different definitions of knowledge filtering could be made from different definitions of power. From the perspective of power as cohesion a definition of knowledge filtering would be associated with the exclusion of knowledge by powerful actors with conflicting interests through the use of force, inducement, sanctions, rewards, manipulation etc. From the perspective of power created by social order knowledge filtering is more associated with structural positions and discursive mechanisms. Knowledge filtering is no longer automatically associated with actors' personal interests, but it becomes also associated with structural capacity, values, identity, beliefs and power/knowledge relations. In addition, knowledge filtering does not only become something negative, but it also premises for meaningful social action, and hence premises for social power. If not some knowledge or meaning were filtered, meaning would be completely fluid and predictability in social life would disappear.

Despite that in one way or another, I will mainly make use of conceptions of power attached to the social order, I will focus on the more negative forms of knowledge filtering seen from the perspective of the compact city theories. By taking the perspective of the compact city I don't claim that confirm-structuring knowledge claims about urbanstructures' impact on travel isn't related to knowledge filtering. Confirm-structuring these knowledge claims is of course dependent on de-structuring of divergent knowledge claims. The framing, within the compact city theories, of sustainable urban development in terms of energy requirements and related emissions form traffic and housing, often involve that issues emphasized by followers of the 'green city' are ignored (Høyer & Næss 2008, 196). However it is not knowledge filtering in itself which is the focus of this project, but filtering of relevant knowledge about urban structures' impact on travel. By delimiting the problem formulation to filtering of knowledge about urban structures' impact on travel I don't claim that the compact city theories represent universal truth or true consciousness. Instead I conceptualize the compact city theories as leveling a social critique of contemporary sprawling urban development patterns. By making knowledge about the environmental impacts of traveling patters associated with low-density and dispersed outward urban development part of the discursive consciousness, it becomes apparent that reproduction of this structural practice is inconsistent with the discourse on sustainable development. In addition, by taking this perspective I don't claim that this is the only relevant knowledge in sustainable urban planning, but I claim that it is an important aspect which is often filtered to the benefit of knowledge which is inconsistent with the discourse on sustainable urban development.

With point of departure in six of the seven forms of power creation presented above, this section will contain a more specific discussion about different mechanisms of knowledge filtering in relation to the research question. Even though I base by definitions of knowledge filtering on the six forms of power creation, I will expand some of the power forms with other conceptions than those presented by Haugaard (2003). By doing this it will become evident in the following that in some cases the term knowledge filtering can be a misleading concept for the type of power that I want to investigate. In those cases the terms knowledge framing or knowledge attention are more appropriate. This will be elaborated in the end of this chapter. The following discussion is not only supposed to define different types of knowledge filtering, but also to create a platform which will help direct the focus of the analysis on more specific issues related to different types of knowledge filtering.

2.2.1. Social order and knowledge filtering

Within the first form of power creation social order creates power 'to' and power 'over' through predictability in social life which a product of actors confirm-structuring to specific meanings. This involves that knowledge claims (meanings) are acts of structuration, and only the knowledge claims which are confirmed by other relevant actors obtain the status as valid knowledge. This will be elaborated below.

2.2.2. System bias and knowledge filtering

As it was presented in the above section, the act of confirm-structure to a specific knowledge claim is dependent on de-structuration of other competing knowledge claims (the second mode of power creation). This is central to this project because it aims at investigating why relevant actors don't confirm-structure but instead de-structure knowledge claims about urban structures' influence on travel behavior. It was also claimed that one of the most obvious reasons for de-structuring is the desire to maintain existing power relations. Knowledge claims concerning the environmental unsustainability of urban sprawl may not be welcomed by actors benefiting from this pattern of development because of financial interest or ideological beliefs and hence try to de-structure these knowledge claims. I will argue that this practice of de-structuration doesn't only involve a rejection of the validity of a truth claim, but the de-structuration practice can also be related to rejection of the importance of the truth claim or the feasibility of altering the existing social order. If a knowledge claim which has been attempted de-structured within powerful segments of the society and excluded from the agenda, succeeds in organizational outflanking to such an extent that it is confirmed-structured within sufficient relevant segments of society, this may involve that the de-structuring segment has to confirmstructure the inconvenient knowledge claim in order not to appear as radicals, extremists or deviants. In such situations, where the previous de-structuring segment can no longer just ignore the inconvenient knowledge claim, it may change tactic and attempt to undermine the knowledge claim by disputing its importance or by arguing that the knowledge claim may be both true and important, but the prevailing conditions of possibility make it un-feasible or unacceptable to alter the social order in accordance with the truth claim. This shows that it is not only what is excluded from the agenda which is associated with system bias. System bias can also be associated with framing of what is actually on the agenda. This will be elaborated below.

As mentioned above there exists rival arenas within society where the process of confirmstructure and de-structure follow different practices. These arenas function as a platform for further struggle for confirm-structuring of their knowledge claims. Such relevant areas in relation to the research question are the academic and political/bureaucratic arena. In the following I will discuss different practices of confirm-structuration attached to the

different arenas. In addition I will discuss different conceptions of how these different

arenas can be expected to influence on each other. It is important to note that these identified arenas shouldn't be regarded as unified entities in relation to specific practices of confirm-structuration. Instead, specific practices of confirm-structuration are attached to different segments within each of these two identified arenas. E.g. within the academic society different disciplines or positions may confirm-structure and de-structure divergent knowledge claims. This will be discussed further below in relation to different systems of thought prevailing within different segments of the identified arenas. Despite this some general distinction can be made between the different arenas in respect to the validating of truth claims.

Academic arena

The practices of confirm-structuring and de-structuring within the academic arena are very central to this project, because it is within segments of this arena that the knowledge claims concerning urban structures' impact on travel were first structured and confirm-structured. It can be claimed it is from these segments that the struggle for further confirm-structuring mainly takes place. Within the academic arena there exist several institutionalised practices about how to structure and confirm-structure knowledge claims. In order to claim that knowledge is 'scientific' within the academic arena, following specific approaches or methods have to be produced. There exist specific procedures to assess reliability and validity of scientific truth claims. The credibility of different methods applied in studies on urban structures' impact on travel are discussed in further details in the Appendix.

One specific practice of confirm-structuring and de-structuring within the scientific arena is the use of references within the academic literature. This squares well with Barnes' circles of validating knowledge. When referring to other studies the meanings are reproduced. Studies, which are referred to a lot within the academic literature, often obtain a special status. The use of references can also be associated with creation of power through a particular form of tacit knowledge. This will be elaborated below.

Political/bureaucratic arena

The political arena is central to the project because it is here that plans and policies concerning urban development are conducted and passed. Within politics and policy-making scientific knowledge also plays an important role in legitimizing decisions even though this it not the only kind of relevant knowledge. However, the institutionalized criteria of scientific validity and reliability within the academic arena will probably influence on the formation of assumptions and beliefs among politicians and stakeholders to a smaller extent than among the researchers studying a phenomenon. Thus, knowledge considered highly credible among researchers within a field may still be met with skepticism among policy-makers and stakeholders, who in some cases may attempt to de-structure the knowledge claim. This raises some doubt about the consistency between the ideal of policy-making as an objective, rational and scientific process, and how power is influencing policy-making in reality. Flyvbjerg argues:

"Ideals seem to block the view to reality. Modern democratic constitutions typically prescribe a separation of rationality and power, much like the untenable separation of fact and value in conventional social and political thinking. The ideal, which often remains unrealized, prescribes that first we must know about a problem, then we can decide about it. For example, first the planners investigate a policy problem, then they inform the city council, who decides on the problem. Power is brought to bear on the problem only after we have made ourselves knowledgeable about it. In reality, however, power often ignores or designs knowledge at its convenience." (Flyvbjerg 2002)

There have been many examples through history concerning how political regimes have attempted to de-structure scientific knowledge claims which were validated within large part of the scientific community, because they were treating powerful interest and/or the existing social-order. Governments have also promoted convenient scientific theories even though they were regarded as non-valid within large parts of the scientific community. This shows how power/knowledge relations play an important role in maintaining dominant power relations by reifying political decisions as a result of an objective scientific analysis and not mere ideology.

Above it was argued that system bias does not only involve knowledge filtering by excluding specific issues from the agenda. The framing of what is actually on the agenda is also a topic worthy of attention. Knowledge contained in planning documents and urban strategies has survived a previous knowledge filtering process (the agenda setting process). The plans, analysis or strategies may involve elements from divergent knowledge
claims or discourses, but the framing of these knowledge claims may involve that some elements are highlighted and others put in the background. This corresponds well with the first two of Patsy Healey's four key dimensions of a strategy-formatting process. The first dimension involves a filtering process and the second involves a framing and focus process. According to Healey (2007) strategies involve a selective focus or a frame in order to create and make sense to a morass of issues, ideas, claims, arguments and to identify one or more concepts. It can be argued that Healey's concept of framing and focusing has some similarities with Haugaard's system of thought, in that sense that they both shape and structure meaning. Healey states:

"Strategy formation that has effects involves the generation and consolidation on a new frame, a new discourse with its supportive storylines and metaphors." [...] "Such a strategic frame is highly selective, foregrounding some issues and backgrounding others" (Healey 2007, 189).

What makes framing different from the concept of system of thought is that a frame can contain elements from story-lines attached to various system of thought. This does not involve that these elements are given the same attention, rather it involves that the frame contains one or more dominant story lines, and some less dominant. The framing of planning documents involves that some storylines are highlighted and others are put in the background.

In many cases, but not necessarily, frames are a result of systematic research procedures. Very often planners have an important influence on the creation of a frame through the research procedures they apply. Throgmorton (1996) argues:

"... planners do not simply write texts; they are also characters whose forecasts, surveys, models, maps and so on, act as tropes (figures of speech and arguments) in their own and other people's persuasive stories" (Throgmorton 1996, 49).

This involves that scientific planning tools in many cases have an important role in framing of the dominating story-lines in planning documents and strategies. Below it will be discussed further how planning-tools can be used to reify certain story-lines through the mechanism of black-boxing. The institutional setting within the political administration may also contribute to exclusion of certain knowledge or perspectives through structural constraint. The traditional division of the sectors of society into specific policy-fields, that are administrated by lineministries with specialized competences within that specific field, can act as structural constraint for the implementation of policy issues which demands inter-sector planning.

Implementation of policies based on the compact city theories must involve collaboration between the authorities within the fields of environmental, traffic, land-use, tax, housing etc. However, there may be different systems of thought attached to different ministries. This involves that the framing of a policy issue is influenced by which segment of the administration that is dealing with the issue. Different practices, cultures, values, notions of the importance of different political objectives may prevail within the different ministries and make collaboration difficult. In some cases it causes rivalry between the different ministries about who should take the head of the table. This system bias can be characterized as a form of structural constraint through which particular issues are filtered or distorted.

2.2.3. System of thought and knowledge filtering

As mentioned above de-structuration does not only occur because of a desire to maintain existing power-relations, but also because certain meanings are not consonant with specific interpretative horizons or system of thought. I will argue that de-structuration through system of thought is a very central mechanism of knowledge filtering in relation to the research question of this project. Within segments of the political and academic arenas different systems of thought prevail.

Within the academic arena meta-theoretical assumptions and positions of theory of science prevailing within different disciplines, act as a kind of system of thought which makes confirm-structuring to knowledge claims which are incommensurable with those underlining assumptions, unlikely. According to Schram (2006), the prevailing positivist paradigm excludes much valuable research. He states as follows:

"... it (the positivistic paradigm) assumes that the study of a single case is 'unscientific', provides no basis for generalizing, does not build theory, cannot contribute to the growth of political knowledge, and, as a result, is not even to be considered for publication in the leading journals and is to be discouraged as a legitimate doctoral dissertation project" (Schram 2006, 19). However it is not only the system of thought attached to the positivistic paradigm which is associated with knowledge filtering. As it will be discussed in the following chapter, other meta-theoretical assumptions, e.g. those attached to classical sociology, also function as system of thought which filterers incommensurable knowledge claims.

Within the political arena different systems of thought can also be identified. The political ideologies can function as a knowledge filter, where knowledge claims originated within different political ideologies are excluded, because they do not fit into the interpretative horizon.

Certain assumptions about the world and specific values are imbedded in the compact city. Some of these may be incommensurable with some of the prevailing system of thoughts within the political system and/or dominating meta-theoretical assumptions within the academic arena. When investigating different types of knowledge filtering in relation to urban structures' influence on travel, it becomes especially interesting to investigate if there are some links or coalitions between the different segments of system of thought within the academic and the political arena which tend to de-structure knowledge claims about urban structures' impact on travel.

2.2.4. Tacit knowledge and knowledge filtering

Power creation by tacit knowledge is, according to Haugaard (2003) both positive and negative associated with 'consciousness raising' through social critique, and is a reformulation of Lukes' idea of false consciousness. If knowledge is tacit, it has not been critically evaluated, and is confirm-structured as a reflex even though the structure reproduced presupposes a structural relationship which is disadvantageous for the confirm-structuring actor. By leveling a social critique of un-reflected confirm-structuring practice, these practices become discursive, and actors may reject them, because it might become apparent that these previous tacit practices of confirm-structuration are inconsistent with other discursively held belief and/or contributing to relations of domination.

This involves that the compact city theories are not necessarily dispensing true consciousness, but are anyway formulating a social critique of the present sprawling urban development patterns, and hence raising public consciousness about the environmental impacts of this development pattern. By making the environmental impacts of sprawling cities discursive it is shown that this development pattern is inconsistent with the discurse on sustainable development. In this way the idea of urban structures' impact on travel as representing universal truth is avoided.

Based on the above it can be argued that knowledge filtering in relation to power created through tacit knowledge involves that some knowledge claims are confirm-structured without critical evaluation. Discursive knowledge about the inconsistency of the knowl-edge claim with other discursive held beliefs may exist, but is not part of consciousness of the confirm-structuring agent and is hence confirm-structured as a reflex. In other words, relevant discursive knowledge is filtered because actors are unaware of its existence. In this sense it can be argued that the concept of practical consciousness is a bit misleading. If one is unaware of the existence of discursive knowledge, which articulates the inconsistency between un-reflected knowledge claims and other discursively held beliefs, is this then part of one's practical consciousness?

In order to discuss this issue I will elaborate a bit on the example about references within the academic arena. The use of references can also be associated with creation of power through a particular form of tacit knowledge. Knowledge, which has been proven unreliable, may be confirm-structured through academic references without reflections, because the credibility of the source has not been carefully examined. In such case it is not part of the confirm-structuring actors' discursive consciousness that the confirm-structured knowledge claim is inconsistent with discourses on scientific credibility. There may exist divergent discursive knowledge of a more scientifically credible character, which has not been taken into evaluation, but is filtered because the confirm-structuring actor was unaware of its existence. The frequent use of secondary, tertiary, quaternary and even longer chains of quotation aggravates this problem. In such cases I would argue that the concept of false consciousness may characterise the phenomena better than 'practical consciousness', but without claiming that the more scientific credible knowledge claim represents 'true consciousness'.

Another form of knowledge filtering created through tacit knowledge attached to references within the academic literature is the deliberated exclusion of relevant references. This exclusion may be done consciously because the relevant knowledge was undermining other more convenient truth claims. I will argue that also in situations with manipulation and deliberated misinformation, knowledge filtering is better characterized by 'false consciousness' than 'practical consciousness'.

2.2.5. Reification and knowledge filtering

Power created by reification in the form of claiming scientific truth is everywhere in this project. When followers of the compact city theories claim that they represent scientific truth, they are making a bid of power. Also the sceptics against the compact city theories are making a bid of power, when claiming that their counter-arguments are based on solid scientific knowledge. In relation to the research question, this means that it is not the presence of power created by reification in itself, that is of main interests. It is not how scientific knowledge excludes other types of knowledge (e.g. layman knowledge), because the knowledge is not formulated in a scientific manner, which is in focus. What is more interesting are the methods and tactics used to make a scientific knowledge claim appear as more true than other scientific knowledge claims, and the mechanisms of knowledge filtering attached to phenomena.

I will argue that power created by reification, is not only related to this struggle for truth between different scientific knowledge claims, it is also related to de-reification of incommensurable scientific knowledge claims, or in other words, making divergent knowledge claims appear as un-scientific or associated with uncertainty, can be an effective tactic to reify advocated knowledge claims.

A tactic which has been widely applied within the industry in USA to defend commercial products in court, is de-structuration of knowledge claims concerning the harmfulness of these products. This is associated with spreading doubts about the credibility of the critical knowledge claims. This is done by assessing the credibility of the critical scientific knowledge by such high standards for validity and reliability that almost no scientific knowledge passes the test. Based on such high criteria for credibility the critical scientific knowledge claim can be termed 'junk science'. This high standard for assessing scientific credibility is, however, only applied selectively, and not used to evaluate the advocated knowledge claim only the critical one. E.g. such tactics have been been used in some cases within the tobacco and the pharmaceutical industry (Hellesnes, 2008, 10-11).

This type of tactic is a kind of de-structuring through de-reification of truth claims. In the analysis it will be shown how this tactic has also been used to raise doubts about the cre-

dibility of research on the relationship between urban structures and travel. In addition the tactic has been used to de-structure knowledge claims about global warming and hence to spread doubt about the importance of reducing the transport related CO_2 emissions which are one of the most important arguments for implementing a compact and centralized urban development pattern.

Reification of a new frame may be troubled by the production and promotion of counterknowledge. How important a problem is perceived, depends of how the problem is framed, but also on how disputed the framing of the problem is. The existence of counterknowledge involves the existence of uncertainty about how to define the problems and hence which means are efficient to cope with the problems and is hence an important mechanism through which status-quo is sustained. Beder (1999) quotes Phil Lesly, who is the author of a handbook on public relations and communication, and advises corporations:

"People generally do not favour action on a non-alarming situation when arguments seem to be balanced on both sides and there is a clear doubt. The weight of impression on the public must be balanced so people will have doubts and lack motivation to take action. Accordingly, means are needed to get balancing information into the stream of source that the public will find credible. There is no need for a clear cut 'victory.' ...Nurturing public doubts by demonstrating that this is not a clear cut situation in support of the opponents usually is all that is necessary" (Beder 1999, 119)

This shows that the counter-arguments don't have to be of a particularly credible character. The mere existence may favor inaction and sustain status quo. In other words, if a frame or knowledge claim is disputed by counter-claims it appears less reified and is hence less taken for granted or natural. In such a case it can be argued that it is not knowledge filtering which is problematic. It is either the lack of filtering of low-credibility knowledge or the amount of attention which is given to the different knowledge claims which is problematic. This underpins the argument put forward above, claiming that destructuring practices do not only involve rejections of truth claims but can also be related to rejection of importance or feasibility. According to Beder (1999) the above mentioned tactic has been used with success within the global warming debate by creating doubt about the importance of the human impact, especially in countries such as USA and Australia (see also Piltz 2009).

Needless to say that the fact, that truth and power are interrelated, does not involve that everything which is claimed to be true is entirely false. Neither does it involve complete relativism, where one cannot judge whether a knowledge claim is better than another knowledge claim. But one should not be naïve and claim that this judgment is not influenced by power in some way or another, and is hence not needed to be critically reflected upon.

As discussed above there exist institutionalised practices within the academic arena to estimate the credibility of scientific knowledge claims. This estimation of scientific credibility is however premised upon expound of the precondition and procedures which has produced the knowledge claim. By keeping these pre-assumptions hidden or in a blackbox the knowledge claim cannot be exposed to a critical evaluation of its credibility, and may hush appear as natural and truth. Hajer (2004) describes the black-boxing effect as follows:

"An actor grows with the number of relations he or she can put, as we say, in black boxes. A black box contains that which no longer needs to be reconsidered, those things whose contents have become a matter of indifference. The more elements one can place in black boxes – modes of thought, habits, forces and objects – the broader the construction one can raise. This is perhaps one of the most fundamental of discursive mechanisms. Making things appear as fixed, natural, or essential is the most effective way of steering away latently opposing forces. Storylines of course almost always lead to black boxing" (Hajer 2004, 272)

It can be argued that black-boxing is based on a combination of power created by tacit knowledge and reification. By placing the presumptions of the knowledge claim within a black box, they are not part of the discursive consciousness, and the knowledge claim may be confirm-structured without reflections (power created by tacit knowledge), because the knowledge claim is reified as objective, scientific and natural (power created by reification). This also involves that story-lines which succeed effectively in black-boxing may appear more natural or determined than other, less effective story-lines. Thus black-

boxing can be important in relation to the mechanisms of framing issues, by putting specific story-lines in the foreground and others in the background (see section 2.2.2.).

Some 'scientific' or 'technical' decision-support tools within planning, such as demand forecast, transport models and cost-benefit analysis are associated with black-boxing. Traffic models are relevant to this project because they have been used to assess the credibility of the compact city theories' truth claim within the academic arena, but also because in some cases they are used at the planning level within the political arena to assess the feasibility of reducing the amount of urban traffic by land-use planning. Hence black-boxing and reification of transport model results may be important mechanism in relation to framing policy-issues by promoting specific story-linens. Wachs (1989) is describing how 'scientific' planning tools as e.g. transport models can be manipulated to reify preferred solutions as the objective scientific truth, through manipulation. He states as follows:

"The most efficient planner is sometimes the one who can cloak advocacy in guise of scientific or technical rationality. Rather than stating that we (planners) favour a new highway project [...] for ideological reasons or because our clients stand to gain more from that project than from alternatives, we adjust data and assumptions until we can say that data clearly show that the pre-ferred option is the best. Our recommendation is not merely personal judgment, we claim, but the result of a neutral process of analysis" (Wachs 1989, 477).

From this quote two important issues can be emphasized: An issue about model results is often being reified by being presented as more exact and scientific than the real case, and another issue concerning the results is being influenced or manipulated by those who build and run the models.

Technical and quantitative knowledge often appears more scientific and objective than social and qualitative knowledge. Lord Kelvin has famously stated:

"When you can not express it in numbers, your knowledge is of a meagre and unsatisfactory kind" (Quoted from Brox 1989, 35).

I strongly oppose to this positivistic statement for at least two reasons. First, the social and the nature are open and complex systems and not all phenomena can be quantified

into numbers and explained by universal causal laws. Social phenomena are historically contingent and thus context dependent. If qualitative context dependent knowledge is to be given a secondary status, much vital information will be excluded (Clegg 2006, 171-175).

Second, knowledge which can be expressed in numbers does not automatically square with credibility and objectivity. It's almost inevitable that individuals influence result of analysis by choosing between approaches, input data, assumptions, calibration, different logics about cause and effect, and also through interpretation of results etc. Therefore results from technical analysis such as transport model calculations are dependent on who carry out the analysis, but because these preconditions may not be clarified, but instead black-boxed, this involves that the results of the technical analysis are reified as objective and scientific despite the fact that they are influenced by those who construct and run the analysis (Tennøy 2004, 34-35).

Traffic model calculations are often presented in absolute figures in the documents introduced to decision-makers. In that way the results often appear as exact, objective and deterministic, often without risks associated with accuracy of the data and validity of the pre-assumptions being clarified, and without possibility for others than some few experts to test the validity of the model results and pre-assumptions. In addition, the calculated scenarios may appear so complex that it is almost impossible for opponents to formulate alternatives which appear equal (Tennøy 2004, 36-37). This black-boxing effect associated with transport models can function as an important mechanism to reify the model results, and hence create dominant story-lines which exclude or background other kinds of relevant knowledge.

In accordance with the above Mackett (1998) states that one of the reasons that demand forecasts are still being used despite their inaccuracy is that they appear to provide a scientific objectivity to the decision making process, which also enables professionals in keeping people without the required technical knowledge out of the process. This show other scientific decision-support tools than transport models can be used to reify specific solutions, based on scientific objectivity, while excluding other kinds of knowledge. Rendering a phenomenon governable in this manner squares well with Foucault's' conception of Bio-Power. It is reasonable to assume that the technical character and black-boxing effect associated with transport models has a stronger reification effect within the political/bureaucratic arena than within the academic arena. In the public and political debate the results from scientific decision-support tools associated with black boxing such as traffic forecast, transport models and cost-benefit analysis may be important mechanism to reify specific story-lines, which highlight pre-preferred policy-actions and cloak advocacy with the claim of scientific truth, and exclude or tune down other competing story-lines. Within the academic arena there exists more knowledge about the technical procedures and assumptions which are stored in the models. These have been critically reflected upon. This involves that many of the limitations and biases associated with transport models are part of the discursive knowledge within segments of the academic arena. This involves that people with academic training within relevant disciplines have a larger capacity to dereify model results as junk-science despite of the black-boxing effect. It should however be noted that there may be important differences between different disciplinary fields or planning identities in relation to how important these biases are regarded, and how the results of the traffic models are interpreted. How different planning identities are associated to specific types of knowledge or interpretative horizons will be elaborated upon below.

2.2.6. Disciplinary power and knowledge filtering

Power created by discipline concerns, how actors are being socialized or disciplined to predictable and routined based behavior through the inculcation of practical consciousness knowledge. This involves, that disciplinary power is related to the creation of identity. Especially education is an important institution through which actors are disciplined in modern time. It is through these disciplinary practices that actors internalize and become carriers of discourses or discursive elements.

Urban planning is a profession containing many different disciplinary identities. Originally it was dominated by architects and engineers, but also geographers, sociologists, political scientists, economists, biologists, etc. have entered the profession. Each discipline focuses on different aspects of the social and physical world. Despite that planning is claimed to be inter-disciplinary, multidisciplinarity are in many cases a better label.

Within the education system, students of a specific discipline are socialized to grasp the world in a specific manner. They are disciplined to frame phenomena within a specific interpretative horizon. However some of these disciplinary frames may be associated with

a particular system of thoughts which is incommensurable with other systems of thoughts attached to other disciplinary frames. This involves that the internalization of disciplinary interpretative horizons may involve that knowledge claims which are incommensurable with the disciplinary frame are filtered, de-structured or at least regarded as less important. This is relevant to the research question because some planning identities are more likely than others to confirm-structure to the truth claims of urban structures' influence on travel.

That different planning professions or planning identities frame phenomena in different manners and are thus more likely to confirm-structure particular interpretations of a phenomenon than other interpretations. How this may involve knowledge filtering about urban structures' influence on travel, can be illustrated by an example put forward by Tennøy (2004) regarding interpretation of transport model results.

She argues that if the results of transport model analyses showed that the expected amount of traffic in the road system would exceed the capacity limit, an environmentally minded urban planner would frame the problem as one of reducing car traffic by means of spatial planning of urban structures, i.e. to reduce the amount of generated motorized transport. On the other hand a road engineer or transport planner would most likely interpret the results within another frame, and suggest other means of actions, such as road capacity extension in order to secure the speed of the traffic flow (Tennøy 2004, 35).

It is however not only planners who are disciplined to confirm-structure particular interpretive horizons. Planning can in it self be regarded as type of governmentality which makes use of disciplinary practices in order to render phenomena governable. In addition it can be argued that different planning practices and associated discourses are attached to different governmentalities, and that there are increasing tendencies towards advanced liberal governance within transport, land-use and environmental planning in general. To illustrate this, arguments of Oels' (2005) analysis on changing govermenatlities within the environmental field will be presented in the following. The concepts of bio-power and advanced liberal governance will be used to discuss how the production of climate change is facilitated by a specific governmentality that renders it governable.

According to Oels (2005) the debate on climate changes in the 1980s was made governable by bio power and justified global management of the Earth in the name of survival of the life of Earth articulated as a moral issue. The discourse which was dominating the environmental debate was then sustainable development, where economic growth was regarded as something which should be contained but not out to an end. The presence of bio power can be seen by the way governments managed to capture the scientific discourse regarding climate changes, by the creation of the climate panel IPCC as the main authoritative voice which was speaking in the name of science. This made influence possible to persons who could speak qualified and scientifically about climate changes, by carefully selecting certain scientists who were allowed access to the panel. This was essential for policy making because the panel could define problems in the name of science and thereby 'eliminate' the many uncertainties by silencing other views. IPCC framed the climate debate as an issue regarding global management of the world, and because of that it required the expertise of natural science and technology. Computer modelling of the entire 'global' climate system is one of the main technologies of making sense of that data (Oels, 2005).

"The planet gets to look like a spaceship that humankind is able to steer on the basis of data and models provided by the natural sciences. The planet needs to be protected from self-inflicted as well as human made destructive forces that may become excessive if not managed carefully."

However, from the middle of the 1990s the climate was articulated in terms of economic issues that required market solutions to facilitate cost-effective technological solutions. This rationality is very much in line with a weak variant of the concept put forward by Hajer of 'ecological modernization' which draws on the apparatus of liberalism and bio power but recoded in economic terms. The core of 'ecological modernization' is an economic rationality regarding environmental problems and solutions, which were previously articulated in terms of natural science. Within this discourse pollution is regarded as an economic inefficiency, and the focus is on technical improvement of the production. Environmental problems seem to decline in terms of moral discussions and instead articulate as issues which require the judgment of cost-benefit analysis. The market is hence regarded as efficient to solve environmental problems (Oels, 2005). By limiting all activity to cost-effectiveness and energy efficiency, many other relevant initiatives to prevent excessive climate changes are filtered. As Oels (2005) states:

"On a provocative note, one could argue that climate stability was the entity to be secured by biopower, while advanced liberal government renders economic growth as the entity to be se-

cured from excessive climate protection costs. It is concluded that there is some indication that the scope for policy interventions by states has been reduced as a result of the shift of governmentalities from biopower to advanced liberal government" (Oels 2005, 201).

The above shows how different discourses within the climate debate are associated with different types of power and governmentalities. Dependent on whether the climate changes are framed within discourses on 'sustainable development' or 'ecological modernization', different types of climate changes are produced, and different means of actions are suggested as appropriated. The turn towards advanced liberal governance based on recording the apparatus of bio-power, is however not only evident within the debate on climate changes, but it is also indicated within the transport and land-use planning.

Traditional transport planning can to a high extend be associated with the governmentalities associated with Bio-power. The use of transport models mentioned above can be seen as a disciple practice to render the traffic governable, in accordance with the global climate-models used by the IPCC to render the climate changes governable. Transport models can be regarded as a perfect Panopticon where structuration always meets with confirm-structuration (as it will be discussed later, the practice of confirm-structuration stored in most transport models, does not often reflect the practise actually taking place outside these micro universes). The shift towards advanced liberal governance within the transport sector can be indicated by the increased use of cost-benefit analysis as the base of decisions within the transport sector, rather than moral issues such as equal development at the national level. How mechanism of power attached to advanced liberal governance can function as a barrier of implementation of the Compact City Model, will be the issue of section 6.1.

2.3. Sum up discussion

In the above discussion a wide definition of knowledge filtering was presented based on six different types of power creation.

It was discussed that different practices of confirm-structuration were attached to the academic and political arena. Within the academic arena meta-theoretical assumptions and positions of theory of science, prevailing within different disciplines, act as a kind of system of thought. This makes confirm-structure to knowledge claims, which are incommensurable with those assumptions, unlikely. Within the political system political ideologies may function as system of thoughts in the same manner as meta-theoretical assumptions within the academic arena.

The definition of system bias was expanded, by including framing of what is actually on the agenda. In addition it was argued that de-structuration only is not related to denying the truth of a knowledge claim, but can also involve that the importance and/or feasibility are called in question. Recycle of old unreliable knowledge in literature reviews is a particular type of confirm-structuring to false consciousness. Reification is not only related to struggle for truth between different scientific knowledge claims, but it is also related to de-reification of incommensurable scientific knowledge claims. The mechanism of blackboxing related to many scientific policy-tools may have an important effect of reifying particular story-lines, cloaked in scientific objectivity.

Within the education system, students of a specific discipline are socialized to grasp the world in a specific manner. However, some of these disciplinary frames may be associated with a particular system of thoughts, that are incommensurable with other systems of thoughts attached to other disciplinary frames. That means that the internalization of disciplinary interpretative horizons may involve that knowledge claims, that are incommensurable with the disciplinary frame, are filtered, de-structured or at least regarded as less important. This will be elaborated on in the below chapter.

3. Different academic approaches to mobility and planning

Above it was discussed that, within the academic arena meta-theoretical assumptions and positions of theory of science prevailing within different disciplines act as a kind of system of thought makes confirm-structure to knowledge claims unlikely, claims that are incommensurable with those assumptions. Because this project aims at investigating the filtering of knowledge, regarding how urban structure influences travel and hence the effect of urban sprawl on travel, this chapter will present three different disciplinary directions within mobility research, which traditionally have opposing knowledge and truth claims regarding how urban structures impact on travel. The three disciplinary

directions that will be discussed are the Geographical, the Economic and the Sociological approach.

These conflicting knowledge claims can to a high extend be linked to the disciplines' different conceptualising of space and their meta-theoretical foundations.

Because of that this chapter starts with a discussion regarding different concepts of space, and how these different conceptions of space are linked to the above mentioned disciplinary directions.

Next follows a presentation of the theoretical assumptions of the geographical approach regarding how urban structures can be designed in order to reduce the car traffic.

Subsequently, the criticisms raised against the geographical approach from the economic and the sociological traditions, respectively, will be presented. Both of the latter traditions are traditionally more sceptical about the effect of urban structure's impact on travel, but the scepticism is based on very different arguments. But it is common for the criticism of the two different traditions that it can be blamed of resting on a "naive" concept of space, which neglects that the physical environment can influence on social practise as e.g. travel behaviour.

3.1. Different concepts of space

Movement, and hence transport, is a fundamental aspect of every human's life, and a precondition for every human society. In addition travel is influenced by the physical surroundings as well as pollutes the environment e.g. by emissions of CO_2 . This implies that approaching mobility analytically is a complicated issue and is dealing with such diverse and intersecting aspects of the world as: the built-up environment, the natural environment, the economic, the social, the aesthetics and also the symbolic level of social life. This means that the aspects that mobility planning has to deal with reach far beyond the scope of one discipline or one method, hence planning needs to be not only multidisciplinary but interdisciplinary. The diversity of the aspects of mobility is also evident by the fact that it involves such different professions as architects, engineers, geographers, sociologists, biologists, economists and political scientists. By focusing on different scales and aspects each of these disciplines makes important contributions to planning.

But just because such diverse disciplines are involved in mobility planning this doesn't mean that planning in fact is interdisciplinary. Actually these different disciplines are

resting on very different and conflicting foundations within theory of science. This has made communication between the different disciplines difficult, and there has been a tendency to exclude knowledge not based on the "right" kind of science. Hence planning can in many cases be claimed to be neither multi- nor interdisciplinary, but rather monoparadigmatic and this is a serious barrier for a sustainable urban development.

Such struggles between different disciplines or traditions within planning are evident in the academic debates on whether or not urban structures impact on travel. The claim of the geographical approach concerning location and land-use planning can influence travel behaviour, is resting on the ontological assumption that physical structures impact on social praxis. Or in other words: the natural and built up environment make up possibilities and constraints for how social life can be practiced

These assumptions have been contested by disciplines such as economics and sociology, and Marxist inspired social-geography. All of these diverse disciplines claim that physical spatial relations shouldn't be given attention when explaining human behaviour, but the scepticism is originating from very different foundations.

It can be argued that this dispute between different disciplines fundamentally is a debate rooted in different conceptions of space. Within geography and other interdisciplinary forums, especially within spatial planning research, the conceptualising of space has been debated a lot over the last four decades. Within this debate at least four different concepts of space have been identified; the absolute space, the relative space, the relational space and the socially constructed space (Simonsen 1999, 6). These different concepts will now be introduced and discussed to give a deeper understanding of the background of the dispute about urban structures impact on travel. For the purpose of the following it is only the three first concepts of space which will be presented.

3.1.1. Absolute Space

The absolute space is characterized as a container or a passive arena within which things are happening. Here the space is something in itself with its own existence independent of its contents. This conceptualising of space can be attached to the classical regional geography (Simonsen 1999, 6).

An extreme example of such a conceptualising of space can be found within Nazi-Germany, where the state was regarded as an organism to which the rules of Darwin applied. A more moderate version of the absolute space within the field of urban planning can be found within the landscape-architects' and urban designers' focus on visual qualities within a demarcated area (Næss 2008, 8a).

The absolute space can be criticized of containing environmental deterministic perspectives in relation to the social aspects, where social aspects of the people living within these physical spatial structures, as e.g. socio-economic characteristic and lifestyle preferences are neglected.

3.1.2. Relative space

The relational concept of space can bee seen as the first attempt to avoid this environmental determinism and develop a social geography resting on a positivistic foundation. Here the space is understood as relations between objects, and the space only exists because the objects exist and stand in physical relations to each other. The relative perspective makes use of contributions mainly from mathematics and physics. Based on this concept it becomes meaningful to analyse geographical patterns including the location of facilities (Simonsen 1999, 6).

The inspiration from the physic can clearest be illustrated by example that transport between two places is assumed to be determined by the degree the location attracts and by the level of friction associated with reaching the destination. The friction is assumed to increase with the distance between locations, that are termed distance decay. Based on this assumption gravitation-models such as the four-step transport model (see Appendix), have been created to optimise the traffic flow (Gudmundsson 2000, 178). Besides being inaccurate to predict the actual traffic and to reflect traffic reducing means, these models have been criticized of not containing any theoretical foundation concerning the behaviour of the users of transport infrastructure. It is e.g. hard to argue that a person's travel behaviour is determined by gravitation forces, without any link to people's intentional level for reaching the destination. This has involved that the models have been substituted or supplemented with micro-economic theory as will be presented in section 3.2.3.

The geographical approach and its claim that urban form and the location of facilities as a mean to reduce the urban travel-related energy consumption, (as will be presented in section 3.2.1), can also be argued to be originated in the relative concept of space.

The relative concept of space has e.g. underpinned the rational of locating workplaces in the suburbs to reduce the commuting traffic. This rationale can be criticized of being based on an undue beliefs in absolute distance as a determent for peoples' choice of work neglecting the preferences and labour skills of the people living in the neighbourhood (Næss 2008).

The same critique applies to the early studies on urban form and travel, which was marked by mono-causal perspectives, only focusing on urban structural factors' influence on travel, such as density and distance, without taking socio-economic or lifestyle related factors into account.

The relative concept of space can be criticized for involving the same kind of determinism as the absolute concept of space. The determinism is just resting on physical rather than environmental perspectives. This has involved that approaches which are only based on the relative concept of space tend to reduce social praxis to positivistic founded casual laws.

3.1.3. Relational space

Within the perspective of the relational space, contrary to the absolute and relative concepts of space socio-spatial relations are regarded as internal relations, meaning that the space is contained in the object, and so the objects can only exist if they contain and represent relations to other objects. The consequence of such an understanding of space involves that not only the spatial becomes immaterial to the social, but it also involves that the social and spatial relations melt together, where one can not exist without the other (Simonsen 1999. 6-7).

This conception of space is expressed by the Marxist inspired social-geographer Castells' earlier work He claims that space has no meaning independent from the one of the social background, which has produced it. Everything, that the space might mean, is a product of social, political and economic processes which have produced it, and the physical and the social processes can not be analysed separately (Næss 2008).

This conception of space expressed by Castells doesn't manage to incorporate the physical spatial processes influencing social organisation. This can be illustrated by the social segregation patterns based on class emerging after the industrial revolution in many industrial cities in Northern Europe. Here the upper-class residents are mostly located in the western part of the city. These segregation patterns are of course a product of social, political and economic processes, but to explain why the residents of the upper-class are mostly located in the western-part, cannot be done without taking into account the effect of the westerly wind dominating these degrees of latitude, blowing the smog mainly in an eastern direction.

Castells is of course right when he claims that human made physical structures, as the built up environment, are a product of human action. But as Næss (2008) argues, when first these structures are established they become not only a product of human action, but they also become a precondition for human behaviour by creating distance and proximity, and at the same time they encourage certain activities at the expense of others.

The relational concept of space becomes problematic from a planning point of view, if it is claimed to be of universal validity and incompatible with other perspectives, because this perception implies that there would be no point in practising physical urban planning, since the spatial process is regarded as irrelevant for social praxis. This doesn't mean that this concept of space has to be completely rejected within planning. As Næss (2008) argues, this perspective has an advantage, when the objective is to investigate the societal driving forces behind the urban development and the possibilities to intervene in these processes. As will be discussed in section 3.2, the meta-theoretical assumptions of the economic and sociological traditions involve the same blindness about physical structures' impact on social praxis, as the relational concept of space.

3.1.4. Dialectic space

These three different conceptions of space: the absolute, the relative and the relational space, have often been presented as competing and mutually excluding. The spatial process is either determining or determined by the social process, and this involves reduction-ism. Common for these conceptions are that they all adduce mono-causal relations between the social and the physical spatiality.

Instead of this mono-causal ontology, concerning the relation between the spatial and the social processes, it can be argued that in some contexts the absolute, the relative and the relational space can co- exist and are interacting in a dialectic relationship (Simonsen 1999, 7-8).

It can be argued that sustainable urban planning is fundamentally about the dialectic relation between on one hand social practises influence's on the built up - and natural environment, and on the other hand the built up - and natural environment's is influencing on social practice. An example could be how urban structures influence travel behaviour, and how this behaviour is impacting on the natural environment or the way the behaviour patterns are being manifested in the built environment.

Of course with reference to departure in specific problems it can in many cases be both legitimate and of relevance only to focus on one of the two sides, or only focus on the physical or the social part. But it becomes problematic if this involves a rejection of the complex interaction between the social and the physical spatiality.

Unfortunately there has been a tendency among some disciplines involved in planning not only to focus on one side of this double causal relation, but also to neglect or to deny the other side based on ontological or meta-theoretical assumptions. As earlier mentioned this has been the case in the question whether urban structures influence travel, where especially the economic but also the sociological traditions have expressed scepticism about such effect. This will be elaborated below.

3.2. Different academic disciplines' meta-theoretical conceptions

Above conflicting conceptions of space were presented. In the following it will be discussed how these particular conceptions are embedded in the meta-theoretical assumptions of respectively the geographical, sociological and economic tradition. It can be argued that the meta-theoretical assumptions embedded in different disciplines act as a type a system of thought which makes confirm-structuring or de-structuring of a particular knowledge claim likely, depended on the consistency of the knowledge claim to the particular system of thought. It will be argued that underlining theoretical assumptions within the main segments of the three different disciplines are incommensurable. However prevailing assumptions within other segments of the three disciplinary traditions squares well with the under assumptions of the compact city model and can be combined in a multi-disciplinary approach. Such an approach is necessary in order to investigate the many factors influencing travel behaviour.

First the geographical approach will be presented. In this section some of the theoretical arguments underlining the Compact City Model for why urban structures can be expect to influence travel behaviour will be discussed. In addition the traditional geographical approach will be criticized for ignoring social aspect's influence on travel. Next follows a discussion traditional sociological approach. Within this tradition prevailing meta-theoretical assumptions involves a tendency to ignore the physical spatiality as influence-

ing social behaviour. The same applies to the economic tradition, which is the one most sceptical about the idea that urban structures matters to travel behaviour. The Economic tradition will be presented as last.

It should be mentioned that segments within the geographical, sociological and economic traditions articulates travel within particular manner which can be combined into an interdisciplinary approach.

3.2.1. Geographical tradition

The geographical tradition's claim that urban structures influence on travel is originally founded in the relative concept of space. The first studies were solely focusing on spatial location and urban form in relation to travel behaviour, but has in more resent studies combined social and economic aspects as well. The recent studies on urban structures' effect on travel are not conceptualising urban structures as determining travel behaviour in an absolute or mono-causal manner associated with the relative concept of space. Instead urban structures are assumed to influence travel by creating possibilities and constrains, proximity and distance and facilitate certain activities at the expense of others. In this way, it is acknowledged that other factors that are not comprehended in the relative concept of space influence on travel, such as people's income level, life-style and attitudes.

According to the geographical approach and in accordance with the assumptions of the relative space, the transport between two places is on the one hand influenced by how desirable the location is and on the other hand how much difficulty or friction associated with reaching the destination. This difficulty or friction is caused by the fact, that the two places are segregated in space. Travel is on an individual level regarded as a derived need for carrying through a person's daily activity program.

This view is inspired by the founder of the time-geography, Torsten Hägerstrand. The time-geography is a method to describe and understand peoples' transport activities on an individual level. If a person has a high-speed mean of transportation, this involve that activities dispersed in space to a higher extent can be reached. A person's radius of action is of course not only limited by travel speed, but also by the time available for reaching the activity. By identifying different kinds of restrictions associated with the activities, determining the individual's line of action, a better understanding of the geographical locations of the activities can be obtained. Hägerstrand differentiates between three cate-

gories of restrictions: authority, capability and coupling. These restrictions involve considerable limitations for peoples' use of time and the spatial distribution of the activities that the individuals can participate in. In reality this means that the individual's mobility is rather restricted (Gudmundsson 2000, 183-185; Næss & Jensen 2005, 52-53)

The time-geographical perspective has been used to argue that the location of residence will influence on peoples' need to have a car at one's disposal. If a person is living far away from the 'daily destinations' and doesn't have a car, relatively much time will be consumed reaching the 'daily destinations' at the expense of other (time demanding) activities. On the other hand if a person does have a car at his or her disposal, greater travel speed can be obtained, involving less time are spend on reaching the activities, leaving more time for participating in other activities (Næss & Jensen 2005, 54).

Hägerstrand's time-geography has been criticized for containing, not spatial deterministic perspectives, but temporal deterministic perspectives, because the travel speed is just substituting the absolute distance, and making it measurable in time. Time then becomes the new determinates instead of absolute distance, but this doesn't give any answers to questions such as how bound the individuals actually are to the activities. This means that the time-geographical approach is more a physical theory than a social science founded theory. This has involved that the theory has been criticized of missing a link between the measurable factors and the intentional level or rationality for behaviour (Gudmundsson 2000, 185). The reaction to this criticism has been the development of the activity-based approach, which is also taking sociological aspects into considerations when investigating the mobility. The activity-based approached is a development of the time-geographical approach with more qualitative and sociological methods. Here the mobility is described just as detailed as in the time-geography, but is supplemented with qualitative research concerning the intentional level underpinning the actual travel pattern (Gudmundsson 2000, 202).

Also Walter Christaller's 'central place' theory has been used as a theoretical foundation within the geographical approach. This theory is originally concerning the geographical distribution of cities with different sizes within a region, but the theory can also be used to explain the presence of centres within a city. Some functions or facilities demand larger catchment areas than others, e.g. a specialised hospital demands a larger catchment area than a grocer's shop. This difference in size of function of catchment area is used to

explain the presence of an intra-urban centre- hierarchy, such as downtown, second order centre, corner shop (Næss & Jensen 2005, 54-55). This is illustrated in figure 1.



Figure 1. Walter Christaller's 'central place' represented in hexagonal graphics (from Günay 2006).

Based on a similar manner of reasoning it can be argued that dense residential areas facilitate catchment areas underpinning a greater diversity of facilities within walking and biking distance. Besides a high population density facilitates more frequent departures and shorter walking distance to public transportation (Næss 2003, 159-160).

With point of departure in the 'central place' theory it also becomes reasonable to assume that the location of dwellings relative to the urban centre and nearest sub-centre, influences on the travel distance because it is here the widest range of activities are located, historically. Therefore, inner-city residents could be expected to make shorter daily trips than their outer-area counterparts and a most of the trips can be reached by foot (Næss 2003, 161).

The 'central place' theory can also be argued to be rooted in the relative concept of space. It has been criticized of being based on positivistic principles, which assume that there exist an identifiable order in the material worlds, that people are rational, profit maximising and that the economic activities are taking place within free-market conditions (Næss, 2008, 49). Actual urban patterns are also often differing considerably from those predicted by the central place theory, especially in USA where much development has taken place on the urban fringes at the expense of downtown degradation (Næss 2006a, 23-24). However this doesn't mean that the theory doesn't have any value. Even though individuals don't always act in a rational and profit maximising manner, this doesn't mean that individual doesn't use any instrumental rationality at all. According to the anti-positivist

Andrew Sayer, the central place theory gives an important contribution to understanding the mechanisms influencing the location of centres. In this way the theory has its advance when explaining location patterns, while its ability to predict actual location patterns are limited (Næss 2008).

Based on the "Central Place" it can be assumed that by creating urban structures which prioritise certain modes of transportation and by creating proximity and distance between activities, the overall travel distance will be reduced, making non-motorised and public transportation more attractive, reducing the overall travel-related energy consumption.

The policy recommendation, which is advocated based on the above theoretical assumptions, is to avoid urban sprawl because it is causing larger distance between activities which stimulates car travel. Instead densification and concentration of the urban area is recommended to obtain a less energy demanding urban form. This strategy is also known as the Compact City Model (as presented in chapter 1). This strategy often recommends, in addition to urban densification and concentration, a mixed land-use patter with location of workplaces, residents and service facilities relatively close to the urban centre. By locating workplaces near to the city centre, the accessibility by public transport is increased considerably in contrast to a location on the urban fringes (Næss 2003).

As a supplement to the densification and concentration strategy it is often recommended that the public transport system is improved, and other means to reduce the car traffic are implemented as well (e.g. reduction in the amount of parking lots and road capacity, besides use of economic means as road-pricing or increased tax on fuels are often recommended). The overall claimed benefit of the Compact City Model is that it reduces the overall travelling distance, and besides it makes it more preferable to travel by public transportation or non-motorised means of transportation, which reduce the overall travel-related energy consumption.

Underlining much of the Compact City Model that argues for containment of low-density, outward and leapfrog urban development patterns is the assumption that land-use and the transport system influence each other in a dialectic relationship. The transport development concerning the amount of transportation and modal split, is bound up with land-use development, and land-use development impacts on transport development. Urban sprawl is blamed for being part of a vicious spiral, where outward, low density development and poor location induce or generate more car traffic, at the expense of public and non-

motorized transportation. The increased amount of car traffic causes congestion problems in the long term. Expanding the capacity in congested road-systems as a strategy for solving problems with congestion may encourage outward urban development, because people can take up residence in the urban periphery with less inconvenience as regards to travel time. In addition this involves that location of activities can take place more independent of the public transport system. This can in itself cause more urban sprawl, which in the long term not only creates longer travelling distance and increases car dependence, but also induces new traffic which increases congestion problems. This may be dealt with by more capacity extension, which again encourages sprawl (Tennøy 2004).

The Compact City Model tries to break this vicious spiral, which facilitates outwards urban growth and increases car dependence. Instead the model aims to create a good spiral by avoiding urban sprawl, and instead it concentrates new development around the nodal points of the public transport system, especially the city centre. This will encourage shorter travelling distances and less car-driving involving that the passenger base of the public transport system is improved. This may lead to improved service level of public transport system. A high quality public transport system compared to the conditions for the car users may involve that the location of activities is done more in accordance with the public transport system. Again, in the long term this will cause additional densification around the nodal points of the public transport system (Tennøy 2004).

To summarize it can be argued that the Compact City theory is underpinned by a reasoning preventing growth in the amount of car-traffic through planned land-use restrictions, instead of facilitating this growth by providing urban sprawl. In addition the Compact City Model presumes that planning is necessary in order to obtain the desired urban structural conditions. As it will be discussed below these underlying presumptions are disputed within theoretical positions dominating by the micro-economic tradition.

3.2.2. Sociological tradition

Within the sociological tradition there has been a dominating tendency to ignore the physical environment when trying to understand social behaviour and organisation. Instead social phenomena are explained by their relations to other social processes. This neglecting of the influence of physical environment on social behaviour has many similarities with the relational concept of space.

The tendency of sociological tradition to neglect the effect of physical spatial structures on social praxis can be traced back to the legacy of the two sociological classics: Emil Durkheim and Max Weber. According to Emil Durkheim the cause of a social fact must always be another social fact, as distinct from psychological, biological or physical facts. Max Weber does, however, claim that peoples' behaviour is influenced by how they conceive their surroundings, but the conceptions are mainly created through social interaction and not the through interaction with the physical environment.

The background for the spatial blindness of the classical sociology should be understood in relation to the reaction of tradition against the domination of theories, trying to explain social phenomena by biological and physical factors with environmental deterministic perspectives, rooted in the absolute concept of space, which where dominating until the early twentieth century (Dunlap & Catton 1983, 116-117). But the legacy from the classical sociology can be criticized for also involving determinism; the perspective has just shifted from the physical to the social aspect. Dunlap & Catton summarize the impact of Weber and Durkheim on sociology within treatment of the physical environment as follows:

"The Durkheimian legacy suggested that the physical **should** be ignored, while the Weberian legacy suggested that it **could** be ignored, for it was deemed unimportant in social life. Should one violate these traditions and suggest that the physical environment **might** be relevant for understanding human behaviour or social organisation, one risked being labelled an "environmental determinist" (Dunlap & Catton 1983, 118).

This legacy can be traced in the fact that the sociological tradition within mobility research has mainly focused on the influence on mobility and travel behaviour of social relations, values, preferences, conceptions and lifestyles (Gudmundsson 2000, 205).

The sociological tradition's lack of concern with the physical spatiality is also evident in some of the work of John Urry, who is one of the founders of the "sociological mobility paradigm". Urry (2001) claims that personal mobility such as increased car or air travel, is not just a simple consequence of increased traffic-need manifested through longer distances e.g. between residence and work place. Urry regards mobility as a base or precon-

dition for a late-modern lifestyle, and by being mobile the individuals are set free from constrains caused by time and space.

It's true that mobility has evolved a new dimension after the rise of the car and aeroplane era and with the revolution within telecommunication and computer technology, where the physical distance doesn't have the same constraining impacts as earlier. But to claim as e.g. Skjeggedal *et al.* (2003) that the ordinary individual on an everyday basis is set free from constrains caused by time and space, is naïve seen from my point of view. This is because that the decreasing constraining effect of distance on the individual's choice of activity should not be mistaken with the location of the activity's influence on the amount and type of transport and the energy consumption generate by reaching the activity. On the contrary, as Næss & Jensen (2005) argue, in a highly mobile society, where individuals can chose activities, such as education, job, shopping and leisure, more independent of the local area than previous generation, the amount of transport carried out will to a higher extend be influenced by the residential location in relation to the city-level patterns of these activities (Næss & Jensen 2005, 427).

The blindness of space of sociological traditions doesn't mean this tradition is irrelevant for obtaining a sustainable urban development. The sociological approach contributes with very important knowledge concerning why people travel and the driving forces generating a still more mobile society. If the objective is to regulate people's travel behaviour in a more sustainable direction, it is, of course, important to have insight into the intentional level of people's behaviour. Still this spatial blindness becomes problematic if it involves a rejection of physical spatiality, not as a single determinant for social behaviour, but as a possible contributory factor. This spatial blindness becomes especially problematic when it comes to environmental issues, as e.g. the compact city vs. the sprawling city.

It should be noted that the blindness of spaces of the sociology does not apply to the whole tradition of course. Some sociologists have been focusing both on how social organisation is influencing the environment (ranging from built to natural) as well as the other way around (Dunlap & Catton 1983, 119). Such focus is combining different aspect of the space, as it was advocated for above to avoid a mono-causal and deterministic way of reasoning associated with the absolute, relative and relational concepts of space. Conceptualising space in this manner, squares well with the concept underlining more resent studies about the relationship between urban structures and travel (see section 3.2.1).

3.2.3. Economic tradition

The traditional way of thinking about and practicing mobility planning and research has been within a rationalistic approach, dominated by technical and neo-classical rationalities. The micro-economic tradition is the discipline within social science, which has mostly been applied to analyze mobility (Gudmundsson 2000, 189; Oldrup, 2000). Unfortunately this tradition has also been marked by a tendency to reject the impact on social behaviour of physical spatiality.

The main focus within this approach has been on finding solutions to social problems such as obtaining as high mobility as possible, reduction of risks related to the adverse effects of transport, including pollution, health, noise, etc. Within the last decade in the western world this paradigm has attempted to solve traffic problems by capacity extension, based on the rationality that improved traffic flow involves reduction of time consumption and less pollution. Furthermore, the focus has been on how people are choosing their means of transportation with individuals regarded as rational actors, who are profit maximizing in relation to factors such as time, comfort, and economic cost, where their behaviour is dependent on equilibrium between these factors (Oldrup, 2000; Gudmundsson 2000; Tennøy 2004, 29-33).

The neo-classical approach combined with a positivistic science perspective is also the ontological foundation of many transport planning tools such as demand forecasting, transport modeling, and cost-benefit analysis. These tools are designed to predict the future traffic development and to evaluate the socio economic benefits (and costs) of alternative solutions for coping with the predicted traffic problems, e.g. predicting the effect on the overall travel, as a result of a densification of the urban area or a more sprawling development. This is done by model calculations, based on the positivistic idea that the world can be explained by casual laws. Results from such models have been used to argue against the compact city, as a mean to reduce the energy related traffic (Mackett 1998; Tennøy 2004; Nielsen & Fosgerau 2005; Næss 2005; Næss 2006c).

In spite of the fact that in many cases traffic related externalities with a physical dimension are taken into consideration, at least to some degree, the economic paradigm has a tendency to deny or at least ignore the influence of land-use and urban-structures on the transport development. In addition, within the neo-classical tradition some segments claim that the field of competition between public transport and private car traffic is small and can be disregarded. Those who own a car will use it despite any changes in the urban structures or in the public transport system (Tennøy 2004, 30). Based on this perspective forecasted congestion problems have mainly been attempted solved by capacity expansion. Such capacity extension is based on the rationale that this will only influence the travelling routes not land use patters or modal split. This market oriented planning paradigm associated with segments of the neo-classical tradition is termed 'predict and provide' (Owens 1995; Tennøy 2004, 31).

Contrary to this, the Compact City Model is associated with a 'predict and prevent' and integrated transport orientated discourse, where physical structures are regarded as having effect on the travel behaviour of the road users. From this we can see, how the system of thought attached to segments of the neo-classical paradigm associated with a market orientated and demand based focus, frames traffic problems in a manner which is incommensurable with underlining assumptions of the Compact City Model and is thus likely to be associated with knowledge filtering.

It should be noted that not all segments within the economic tradition can be associated with 'predict and provide'. Some of the strongest criticism levelled towards this paradigm, concerns induced traffic and generated traffic and also originates in an assumption about actors, act in accordance with the principles of the 'Economic Man'.

Litman (2007) defines 'generated traffic' as additional vehicle travelling resulting from road improvements of a particularly road. 'Induced travel' is defined as increase in the total vehicle kilometres travelled, compared to what would have occurred without the road improvements. This means that the term 'generated traffic' includes diverted traffic from other routes or time of travelling, and the term 'induced traffic' only includes extra vehicle kilometres travelled resulting from projects that increase road capacity.

The theoretical assumption behind induced traffic is based on the relation between demand and supply. It is assumed, that in congested road networks there exists a latent demand for car-travelling. Any increases in road capacity (supply) will lower the generalised cost of car-travelling in terms of time-costs Consequently it will increase the demand of the good "car-travelling" and will result in a shift from other modes of transportation to the car. This positive feet-back loop will go on until the road-network becomes congested again (Norman & Lem 2001, 2; Tennøy 2004, 29-30; Jespersen 2008). According to the Down/Thomson hypothesis a new equilibrium between public transportation and private car-travel will be established, when the generalised-cost of travel of the two travel types are equal (Morgridge 1997, 5-7).

The notion that increased road capacity lowers the generalised travelling cost by car, that it increases the amount of traffic and at same time increases the possibilities of urban sprawl, squares well with the assumptions underpinning the Compact City Model about the dialectic relation between urban structures, land use, transportation systems and travel behaviour.

The assumptions, that the individuals are behaving in accordance with the principles of 'economic man', involve that within the neo-classical tradition, it is assumed that the market will ensure an optimal use of resources, and that the market is assumed to be self-regulating, or regulated by the "invisible hand". This assumption is also evident within Neo-liberalism. In accordance with the system of thought within the neo-classical paradigm, neo-liberalism begins with an atomistic conception of society, seeing men as rational actors, who are the best judges of their own private interests. Neo-liberalism contains of neo-classical economic theories, some rightwing liberal political philosophies, as well as political rhetoric, which make public regulation of the economy and the social development, appear as inefficient and unwanted. Instead, the objective for the state is reduced to securing competition through legislation and display of force (Fainstein & Fainstein 1971).

Within the planning theory the neo-liberal paradigm takes the form of Lindblom's incrementalism. Incrementalism is based on the same atomistic conception of society as neoliberalism. According to Bengs (2005) the communicative turn within planning theory is also part of the set of rules, norms, and bureaucratic procedures supporting the neo-liberal state. These two types of planning paradigms will briefly be elaborated on below.

The incremental planning model advocates planning in small steps, which is not necessarily coordinated into a unified whole. Instead the objective of the planning authorities is to create the setting for negotiation between individual actors, and to enforce the outcome of these negotiations (Fainstein & Fainstein 1971). Also this assumption attached to the system of thought within the neo-classical tradition is incommensurable with the Compact city Model because it has made some devotees of the tradition not only reject the effect of urban structure's impact on travel, but argue against land-use planning in general. It is e.g. argue that urban planning is an intervention in the mechanisms of the free market and involve a less optimal use of the land. Sceptics about the desirability of land-use planning levelled from an incremental perspective will be discussed further in section 4.3, where counter-arguments also will be presented.

As mentioned, several authors have linked the communicative turn within planning theory with neo-liberalism (Bengs 2005; Næss 2009).

Within the field of communicative planning several prominent theorists (Forester, Healey, Innes) take point of departure within critical theory, and the Habermasian perspective on communication. This perspective aims at counteracting communicative distortions and reveals false consciousness standing in the way of the fair provision of public goods (Sager 2005). It can be argued that communicative planning is future seeking rather than future defining. Or by other words communicative planning orientates on the process instead of the outcome. It is especially the focus on process, that has made critics of the communicative turn claim, that it is linked to neo-liberalism, or at least that the prevalence of communicative planning theory is linked to the prevalence of neo-liberalism. As Bengs (2005) puts it:

"I think one such reason could be found in the prevalence of neo-liberal ideology, and in particular in the need to establish social institutions consistent with the neo-liberal society, that is to say, institutions that match and advance the free flow of investments and development. A new planning regime with a minimum of predefined restrictions and guidelines and ample possibilities for striking deals on the local level is in conformity with the neo-liberal ideals" (Bengs 2005)

In accordance with neo-liberalism, communicative planning theories aim at decentralisation of decisions. One can, however, question whether all stakeholders have the same resource to participate in the planning process. Despite the Harbermarsian communicative ideal, power may, in many cases, distort the process, and exclude particular types of relevant knowledge or groups. This is being reinforced by the fact, that some devotees of the communicative turn do not value expert knowledge higher than layman knowledge (Næss 2009a). It can be argued that incrementalism and to some extent communicative planning are types of planning practice or governmentality associated with advanced liberal governance (see section 2.2.6). In section 6.1 it will be discussed, how the system of thought attached to neo-liberalism is structuring law and practice within planning of land use and infrastructure at the benefit of urban sprawl.

3.3. Sum up discussion

In this chapter it was shown how particular meta-theoretical assumptions are embedded in particular disciplines, and how some of those are incommensurable with the underlining assumptions of the geographical approach and the compact city theories. They may hence involve knowledge filtering. The classical sociology tends to neglect the influence on social behaviour of the physical spatiality. The micro-economic tradition also seems to ignore the influence on travel behaviour of physical spatiality. The neo-classical approach combined with a positivistic science perspective is also the ontological foundation of many transport planning tools such as demand forecasting, transport modelling, and costbenefit analysis, which to some extend are associated with the predict and provide paradigm. This paradigm is incommensurable with the underlining assumptions of the compact city strategy. Also incrementalism, which is related to neo-liberalism, is conflicting with the underlining assumptions of the Compact City Model.

The geographical approach and the compact city theories can be argued to originate within a relative conception of space, and can hence be criticized for not containing spatial determinism. However more resent approaches within the geographical tradition have in a multi disciplinary approach combined elements from different conceptions of spaces, as well as aspects originating within the sociological and economic traditions.

4. Does urban structures matter? - The actual academic dispute

After having presented the different meta-theoretical assumptions held by the geographical, sociological and economical traditions, and their implications for understanding the link between urban structure and travel behaviour, we now come to the question; What does the State-of-the-art research within the field of the impact on travel of the urban structures show about this potential relation? Or in other words, what is the relevant knowledge of the impact on travel of the urban structures?

As the above chapters have shown, travel is intersecting in very diverse aspect of the social and physical/spatial world, and that diverse academic disciplines have theorized different aspects of mobility based on different meta-theoretical assumptions. Such a complicated issue as the potential relation between urban structure and travel can not be grasped through one single method or academic discipline, but calls for a multitude of methods and an interdisciplinary research approach.

Different studies on the potential link between urban structures and travel have been approaching different aspects of the potential link and by diverse methods. But this doesn't mean that all of the approaches applied are equally valid when investigating the potential link, and it doesn't mean that the diverse aspects, which have been investigated, have always been approached multi-disciplinary. As it has been hinted through this report, there exists an academic dispute regarding the impact on travel of urban structures. A reason for this dispute is associated with the fact that different studies have investigated different aspects of the potential relation of urban structures and travel, and have applied different approaches and measures. The result of a study is, of course, highly dependent on *how* the study is conducted, *what* has been studied including the study scale, and besides the *context* the study object is part of. In Appendix a more detailed discussion of the validity and reliability related to different methods and measures used investigate urban structures impact on travel.

In the following it will be argued that state-of-the-art research within the field of urban structures' impact on travel indicates that population density and the location of residences, workplaces and service facilities relative to the centre structure of a city or metropolitan area does influence travelling distances and the distribution of transport between different modes. Thus, urban containment and densification are clearly preferable to spatial expansion of cities and urban sprawl, if the aim is to contribute to environmentally sustainable mobility.

Even though according to Holden (2007) there seems to be a strong support in the academic literature for the idea that land-use planning does matter in determining the level of energy consumption (Holden 2007, 142), this is still a contested issue. Holden (2007) summarizes the critique against compact land-use strategy as follows:

- Claims that engine technology, taxes on gasoline and driving, and tolls are more effective measures for reducing energy consumption than urban planning (Gordon & Richardson 1989; Boarnet & Crane 2001)
- 2. The assertion that socioeconomic and attitudinal characteristics of people are far more important determinants of travel behavior than urban form. Critics taking this position assert that the importance of form is highly overestimated in empirical studies (Stead et al., 2000)
- Doubts about the assumption that proximity to everyday services and ones workplace will contribute to reducing travel in a highly mobile society (Owens 1992; Simmonds & Coombe 2000)
- 4. Assertions that the relationship between non-work travel, especially long-distance leisuretime travel, and urban form has been neglected (Titheridge et al., 2000)
- 5. The assertion that travel preferences rather than urban form influence travel behavior, that is, that people live in city centers because they prefer to travel less, not that they travel less because they live in city centers (the 'self-selection bias) (Boarnet & Crane 2001)
- That planning decisions are seen as difficult and expensive ways to influence travel behavior. Market pressures for decentralization out of cities are always likely to be stronger influences on city development (Banister & Hickman, 2005).

As it can be seen from the above, the scepticism is not only about the truth claim put forward by the geographical approaches and the compact city theories. The scepticism is also towards the importance of this effect, and besides concerning the feasibility of implementing a strict land-use planning. As argued in section 2.2.2 de-structuring of a knowledge or truth claim can also be related to questioning of such issues. Needless to say that this does not involve that criticism of the compact city model is illegitimate or irrelevant. As mentioned previously the pioneer research was based on simple research methods and did not include issues related to many of the above points of critique in the investigations. However, more resent research within the field of urban structures in relation to travel behavior has included these possible biases in their research design, and has still concluded that urban structures matter. The issue becomes problematic when stateof-the-art knowledge is filtered at the benefit of more un-credible knowledge and used as to legitimate urban sprawl. The above presented criticism against the truth claims of the Compact City theories, will be enlarged in the following of this chapter, and besides counterarguments will be presented, going into more details with the methodical and the empirical foundations of the truth claims - both those of the compact city devotees and the sceptics. The following discussion will be structured by first discussing questions concerning the truths of different urban structures impact on travel. Next issues concerning the importance of this potential effect will be discussed, and last issues concerning the feasibility of carrying through a compact city planning in practice will be discussed.

4.1. Truth

In the following different urban structural variables' impact of travel will be discussed. The urban structural variables vary in a scale from the strategic level to the neighbourhood level. The urban structural variables which will be discussed are: regional settlement patterns, overall population size of cites, overall urban population density, local density and residential location, workplace location and street designs. It can be argued that public transportation, road capacity and parking opportunities are missing in the following presentation, but they have been left out because of space and time constraints (for a discussion of the influence of such factors on travel behaviour (see e.g. Næss 1997; Næss 2003). The above presented points a criticism which concerns the truth of the compact city theories will be included in the following presentation

4.1.1. Regional settlement pattern

The debate on urban form development patterns and sustainability has mostly been concerned with the discussion of a concentrated vs. a sprawling urban development pattern. This debate is focused on the city level and not the regional level. Instead the discussion regarding sustainability and settlement patterns at the regional level is related to the issue concerning centralization vs. decentralization. In other words, will the need for transport of goods and people will be less if the urban development is concentrated within one larger city in the region, or will it be less if urban growth is distributed to a number of smaller local communities around the main city? (Næss 1993, 188; Høyer 2002, 183).

The research made into the subject, concerning which regional development patterns are least energy demanding in relation to transport, does not reach the same conclusions, neither model simulations nor empirical based studies. According to the English geographer Susan Owens, the answer to the question concerning which regional settlement patters are least energy demanding in relation to transport, a centralized or a decentralized one is depending on the mobility level of the society.

From a theoretical point of view she argues, that societies marked by low mobility, structures characterised by smaller, dense cities or urban areas can be preferable to reduce the travelling distance and the magnitude of transport. Or in other words a decentralized regional settlement pattern is preferable when the mobility level is low. In this situation each city must be as self-sufficient with workplaces and service facilities as possible. Because of the low mobility level there will be little cross-transport between the selfsufficient cities (Owens 1992, 90). In accordance with this, co-location of workplaces and residents within specific parts of a larger town can be preferred when the mobility level is low.

According to Owens (1992) the preferred settlement patterns are different in relations to transport related energy savings, in a society marked by a high mobility level. In such situation people would choose their residential location based on other rationales than minimising distance to work. There would be an extensive cross-traffic between the different parts of the city, if they contain workplaces, and between the different smaller towns, if they are not located too far from each other. In a situation marked by high mobility, Owens argues that concentration of residents and workplaces in larger urban areas can be preferred (Owens 1992, 90).

But differences in mobility level or cultural and socioeconomic preconditions are not the only factors which may explain why the research reaches different conclusions into the question regarding regional development patterns and sustainability. Different studies have applied different methods and used different definitions of regions. The population size and size of the defined region can be expected to influence the regional travel behavior. This is because it has the consequence that the distance between the urban areas is generally shorter, and it is reasonable to assume that the average distance to a regional centre is also shorter, thus making cross-traffic more likely. Besides, studies focused on difference in travel behavior of rural vs. urban residents have been used in the debate concerning a centralized vs. a decentralized regional development pattern.

Also within empirical research into the issue different studies have reached different conclusions. An analysis of travel data surveys from Denmark showed that the longest driv-
ing distances were among inhabitants of rural areas and small villages (Christensen 1996; from Johansen and Næss 2003).

Banister (1992) reaches a similar conclusion, based on a survey of six parishes in South England. He found that the inhabitants in the most rural parishes had the longest driving distances and highest level of car use, while the residents in the most urbanized parishes were marked by lower travelling distances, and a higher level of the trips was taken by foot. However, the material indicates that the fuel consumption per capital in the largest city, London is likely to be less efficient than medium sized towns.

On the other hand research by Reijo Martamo (1995) in Finland, who mapped the distance between residence and workplace dependent on residential location, showed that the longest average commuting distances was found in the catchment areas surrounding the largest urban areas, and not in the remote rural districts. This result was also evident in data from travel surveys in Norway (From Høyer 2002, 184). Underpinned amongst others by these results it has been argued that a settlement pattern with several smaller and medium sized cities is preferable in relation to energy conservation (e.g. Næss 1997; Høyer 2002).

It can though be argued that comparing travel distance between people residing in areas with a different degree of urbanization or central location at the regional level (as the above mentioned studies), is most interesting in relation to the discussion regarding differences in rural and urban transport behaviour. But it is not in itself a god indicator when it comes to the answer of the question whether a mono-centric or poly-centric regional development pattern is preferable to a transport related energy conservation perspective. This is because people who reside in the soundings of an urban centre can travel longer or shorter distances than those who reside in the relatively more remote areas, both in centralized and polycentric regions. Hence they do not reflect if the overall transport related energy consumption is lowest in a centralized or decentralized region. To answer the question it is more interesting to compare travel behavior between regions with different degree of centralization or decentralization.

Næss (1993) has, as part of the research project "Energy and Built Environment" investigated transport related energy consumption in relation to distribution of residents at the regional level in 15 Swedish commuting regions, using a bi-variate and multi-variable regression analysis. The variables included in the analysis were urban area density, average income level, population size of regions and degree of centralization of residential structures at the regional level. The analysis showed that a high level of urbanization contributes to increased energy consumption. Besides, the energy consumption increases when a large amount of the population in the region is residing in the regional centre or close to the centre. This indicates that a decentralized urban settlement pattern at the regional level is favourable compared to a centralized pattern with one major city. In a country characterized by a high mobility level, as Sweden, these results seem a bit surprising from the theoretical point of view put forward by Owens (1992), and it should be noted, though that the energy data the survey was based on may be unreliable.

A different conclusion was reached in a study comparing travel distance of people residing with different distance to the regional centres of three former counties in Denmark (Northern Jutland, Ringkøbing and Vejle), with different degree of centralization. In accordance with Martamo's study in Finland the study showed that those residing in remote areas travelled shorter distances than the residents of the near surroundings of a regional centre, in all three counties. But opposite what has been concluded based on Martamo's study this analysis showed, that the most centralized county (Northern Jutland) had the lowest average travelling distances and the most poly-centric region (Vejle) had the longest averaged travelling distances, also after controlling for several socio-economic variables in a multi-variable regression analyses (Johansen and Næss 2003). These results underpin Owens' theoretical statements.

From the above it can be seen that there is not consistency between empirical studies on regional settlement patterns and travel behaviour. The study of Swedish regions may be based on more unreliable energy data than the study of the three Danish Counties. However the definition of commuting regions may be more credible in the Swedish study, than the one from Denmark, which is defined in accordance with county borderlines and not actually commuting regions.

That a centralised regional settlement pattern is beneficial, compared to a polycentric pattern in relation to reduction of energy consumption for transport, can however be underpinned by results form particular studies applying qualitative interviews, showing that people for most purposes prefer to choose the best facilities, rather than minimizing travelling distances as it will be shown in section 4.1.4.

4.1.2. Overall population size of cities

City size is a variable which has been investigated in relation to energy consumption for transportation. From a theoretical point of view it can be argued that city size both increases and decreases energy consumption. It can be argued that travelling distances within small cites are shorter in average than within larger cities, because they usually cover a smaller area. However larger cities often have sub-centres which decrease the travelling distance for some purpose, and have better supply of public transportation. In addition it can be argued that the development trends towards centralisation of retail, offices, public and private service, etc. within the larger cities increase the need for intercity transportation in the smaller cities. The issue of city size is hence closely related to the issue of regional settlement patterns.

Breheny (1995) draws the conclusion that there is poor evidence for the assumption, that urban structures influence travel behaviour based on a comparison of travel survey data in British cities of varying population sizes. However, as the below discussed studies will show, the number of inhabitants is not a well suited indicator, if the purpose is to investigate whether urban structures influences the amount of travel.

As part of the above mentioned research project "Energy and Built Environment", Næss (1993) included city size as an variable in a bivariate and multi-variable regression analysis, investigating 97 Swedish urban areas above 10 000 inhabitants, in relation to energy consumption at aggregated level. Due to strange anomalies in the fuel data a sensitivity analysis was conducted, where towns which fuel data appeared least reliable were excluded. Two out of five sensitivity analyses showed that city size had a significant effect on fuel consumption: the bigger population of the city the lower fuel consumption per capita, but this effect was not as strong as for population density and income level. Næss (1993) however warns against drawing too far-reaching conclusions regarding city size and transport, because, as it was mentioned above, data indicates that a large population within a commuting region contributes to an increase in energy consumption for transportation.

In another empirical research project attached to "Energy and Built Environment" Næss, Sandberg & Røe (1996) made a more in-depth study of a sample of 22 Nordic towns, in relation to energy use for transport, by conducting bivariate and multi-variable regression analysis including proportion employed within manufacturing, building and transportation trades, several socio-economic variables and several urban characteristic variable amongst others city size. The study showed no relationship between energy use per capita for transport and the population size of the cities. The study showed however that the population size of a city may influence on which urban form characteristic appears to influence energy use for transport.

Based on the above study it can be argued that city size may influence on energy consumption indirectly, but is not a good indication in itself for the relationship between urban structures and travel behaviour.

4.1.3. Overall population density of the urban area

Theoretically, the energy use for transport could be expected to be influenced by the overall population density in two ways. Firstly, a development with high population density involves that the average distance between residence, workplace and service facilities becomes shorter, compared to a more dispersed development. Secondly, the population density can be expected to influence the modal split. A high population density facilitates more frequent departures and shorter distances to public transport stops, hence making public transport more attractive. In addition, dense urban areas usually have narrow streets and low parking capacity, making car use less attractive. Furthermore, the shorter average distances due to high population density imply that a larger range of facilities can be reached by foot or by bike than in less dense developments.

Several studies have also found a significant effect between overall urban population density and energy use for transportation. The most well-known study within the field of land use and transportation was conducted by the Australian researchers, Peter Newman and Jeffrey Kenworthy, who in 1989 published the analysis "Cities and automobile dependence" on urban form and energy consumption. This study compared 32 major cities around the world, focusing on energy consumption and different urban structural factors, and concluded that the dominant explanatory factor for travel patterns which involve high level of transport, car dependency, and gasoline consumption, is the density of the cities, especially the population density. However, the results of the analysis and its theoretical foundations have been contested and heavily critiqued from several disciplinary angles, especially micro-economics (see e.g. Gordon and Richardson 1989; Gordon 1997). Gordon and Richardson (1997) e.g. argue that the findings from seven large-scale national household surveys present a consistent story of the containment of metropolitan area commuting times. However, travel time is not very well suited as an indicator of the amount of transport, as travel speeds vary considerably between different modes of travel and, in many cases, also with the time and place of travelling (see Appendix).

Also other studies show that over all population density of an urban area influence energy use for transport. Næss, Sandberg & Røe (1996) found e.g. by applying a multiple regression analysis, in the above mentioned study of 22 Nordic towns, a relationship with a significance level of 0,032 between the overall population density and energy use for transport, after controlling for several socio-economic variables. Also the results from Næss (1993) shows that urban population density has an effect on energy use for transport, about same magnitude as the above mentioned study, after controlling for several socio economic variables.

Gordon (1997) claims that there is rather little evidence that more or less compact forms of development within a functional urban region are energy saving. Besides a reexamination of Newman and Kenworthy's data set (see section 4.2.2.), Gordon (1997) based his statement regarding the existences of rather little evidence concerned with urban densities and energy use for travel, on an analysis of 193 English functional urban regions. In contrary to the above mentioned studies he found no evidence that land saving patterns of population distribution within a functional urban region has any effect on travel behaviour (Gordon 1997, 241).

Gordon does, however, not specify in which way densities were measured in his study of the English functional urban regions. The manner in which density is defined within an urban region will influence the results. It can e.g. be expected that development on the fringes of a city, concentrated to few compact residential areas separated by green fields, will be more beneficial in relation to energy use for transport than if the development where evenly distributed over a given area. This is because the travel distance becomes shorter at the local level, and because its neighbourhoods are easier to facilitate with public transport. If continuous, undeveloped areas within the defined functional urban regions are included in the area sizes, this may mask the effect of population density on travel behaviour at a local level (Næss 1997, 65-66).

The above mentioned conclusions of Nordic studies concerning the relationship between density and energy use for transport are based on the amount of urban area per capita, regardless of administrative boundaries. Undeveloped urban areas are besides excluded from the defined area size, where only continuous urban areas are included. This definition reflects better the effect of density on the local level, but the effect of larger undeveloped areas within the city contributions to increasing the internal distances between facilities, may not be reflected in this definition (Næss 1997, 65-66).

In addition the Nordic studies attached to the research project "Energy and Built Environment" are based on all sorts of travel, excluding air and sea travel, while Gordon's analysis is only based on journeys to work data, which consists of about a quarter of the total distance travelled in western countries (Næss & Strand 1997). This strengthens the reliability of the Nordic studies compared to Gordon's analysis.

4.1.4. Density of residential area and relative location to the urban centre and sub centre

The above section presented how a city's overall population density impacted on travel. In this section I am going to discuss the population density at a local level and the residential location relative to the city centre's and sub-centre's influence on travel behavior and energy use for travel. According to Næss (1997) a disagreement has existed within the international debate on sustainable urban form concerning whether a centralized or decentralized location of residents is to prefer.

Based on Christaller's central place theory, (see section 3.2.1.), a dense centralized development pattern can be argued to be favourable. The dwelling's location relative to the urban centre and nearest sub-centre is assumed to influence the travel distance because it is here the widest range of workplaces, service functions, and cultural entertainment are located, historically. In addition the city centre is usually the main node for public transportation, and the historical centre is usually marked by narrow streets, which make car driving more troublesome. Hence inner-city residents could be expected to make shorter daily trips than their outer-area counterparts, and a high proportion of the trips can be reached by foot, bike or public transportation. Based on a similar manner of reasoning it can be argued that dense residential areas facilitate catchment areas underpinning a greater diversity of facilities within walking and bike distance. It also facilitates more frequent departures and shorter walking distance to public transportation.

Some studies have also found that concentration of development in the city centre showed no significant difference in travel behavior compared to a dispersed development. Rickaby, Steadman and de la Barra (1992) made e.g. a study based on a model simulation of five different development scenarios for an archetypal English town, consisting of 100.000 inhabitants, during a twenty years period. In three of the scenarios development was placed within the existing urban area, and in the two others development was taking place as sprawl. The result showed minimal difference between the different scenarios both in relation to modal split and energy use (Rickaby et al 1992).

Simmonds and Coombe (2000) have also made a model simulation which compares the transport consequences of one or more compact city scenarios with a trend scenario reflecting recent changes in land use distribution. This study also shows minimal difference in travel behaviour between the investigated scenarios.

However, transport models do not capture the actual influence of urban structures on travel, but reflects the in-built assumptions, the model is based on. Hence they can not be used to evaluate the truth of knowledge claims. In addition, when taking into account transport models' generally biases related to reflecting land use's impact on travel, and taking into account problems with reflecting means which reduce traffic. The reliability of the results of these studies is questionable (see Appendix).

Despite the mentioned scepticism, there is rather strong empirical evidence within the literature that residents located in the city centre in fact travel shorter average distances and travel more often with public transport and non-motorized modes of transportation. Several studies, have found an effect of residential location relative to the urban centre on travel, after taking socio-economic factors into account. Table 3 summaries the result of four studies of different Nordic cities with varying population size. It can be seen that the expected weekly travelling distance with motorized modes of transportation, increase with the resident location distance's to the city centre, despite of population size.

Urban area	Increase in expected weekly travelling distance with motorized modes of transportation, by residential location in different distances from the city centre, compared to a residen- tial location in the city centre.				
Residential location's dis- tance to the city centre	4 km	8 km	12 km	20 km	40 km
Greater Copen- hagen	6	14	30	76	95
Greater Oslo	23	54	84		
Aalborg	25	49	74		
Fredrikshavn	61	73	73		

Table 3 (from Næss and Jensen 2005, 428)

Owens (1992) has argued, as earlier mentioned, that the level of mobility may determine whether a centralized or a decentralized urban development pattern is most sustainable (see section 4.1.1). However, it has also been found that inner-city residents travel shorter distances and drive less car than people residing in the outer area, in Hangzhou metropolitan area in China (Næss 2007a), and Santiago in Chile (Zegras 2006), which both have remarkably lower rates of car ownership than average western counties.

From the above discussion it could be seen that there are rather strong and consistent evidence from statistical analyses that the residential location relative to the urban centre influences travel behavior in the manner that inner-city residents travel shorter average distances and carry out a larger proportion of the travel with public and non-motorized transportation modes. However, the statistical material can not in itself determine, if this is due to casual mechanisms related to residential location, and it does not throw light on how and why such potential casual mechanisms work (see Appendix).

In order to do that qualitative research is needed to obtain an understanding of the rationalities behind the choice of location for activities and means of getting there. This has been done by Næss in two in-dept studies of residential location relative to the city centre's effect on travel in Copenhagen metropolitan area (Næss and Jensen 2005) and Hangzhou metropolitan area in China (Næss 2009b) respectively.

When people are making a choice it is normally based on a balance between several rationales. Some of these can be conflicting, and the result will normally be context specific. The studies in Hangzhou metropolitan showed that the respondents based their choices of location mainly on the following two competing rationales.

- 1) Choosing the best facilities, including sub-rationales of
 - Choosing facilities where the instrumental purpose of the activities can best be met
 - Choosing facilities where social contacts can be maintained
 - Choosing facilities matching the interviewees' cultural, esthetic and symbolic preferences
 - Variety-seeking
- 2) Minimizing the friction of distance, including the sub-rationalities of
 - Minimizing the spatial travelling distance
 - Minimizing travel time
 - Minimizing the stress or physical efforts of travelling to the destination
 - Minimizing economic expenses associated with the trip

Similar rationales were detected in the Copenhagen study. However there was not found as strong emphasise on choosing facilities where social contacts can be maintained. For both studies it was found that for most travel purposes the respondents emphasized the possibility to choose among facilities rather than proximity to those. These results imply that the residential location relative to the urban main centre, (where the highest variety and most specialist facilities usually are located), is more influential on the average travel distance, than the distance to the closet facilities. Emphasize on rationalities associated with choosing the best facilities underpins the advantageous of a compact – centralised urban-development pattern compared to a dispersed – polycentric pattern.

Compensatory mechanisms

Against the idea of the compact city, some authors have agued that the energy savings from reduced travelling distance due to a central residential location are being outweighed by compensatory mechanisms, such as longer leisure trips in weekends and holidays. The arguments concerning compensatory mechanisms are levelled from three different theoretical foundations. Two of these are associated with compensatory mechanisms as a surplus phenomenon; the third one is concerning compensatory mechanisms as a deficient or escape phenomenon (Næss 2006b). For a more detailed description of the theoretical foundation for the hypotheses about compensatory mechanism see e.g. Næss (2006b) or Holden (2007).

As it can be seen from table 3, that the difference in average weekly travelling distance among inner and outer-city residents is not levelled out by compensatory mechanisms. But table 3 dos not tell anything about the existence of such mechanisms. Several studies have included specific analysis on the existence of compensatory mechanisms in their investigations.

The study by Næss & Jensen (2005) in the Copenhagen metropolitan area shows some indications of compensatory mechanisms. The statistical analysis showed that people living in dense areas in fact travel less often to natural areas, than people residing in the suburbs. Although this was countered by a slightly stronger and opposite tendency of longer traveling distances when visiting natural areas. However this additional travel distance to green areas outside the city makes up only a small proportion of the transport within the leisure category.

Another indicator of compensatory mechanisms would be an increase in long holiday trips especially flights abroad. Because airplane travel is a fuel intensive mode of transportation, compensatory mechanisms manifested through more frequent flights, would contribute more to a levelling out the difference in energy consumption for transport between inner and outer-city residents.

With reference to frequency of airplane travel the analysis showed, that although socioeconomic factors had the greatest influence, both the location of residence relative to the city centre of Copenhagen (p = 0,024) and local area density (P = 0,039), had a significant effect on the frequency of such trips. Also a study by Holden (2007) in Oslo Metropolitan Area shows that living in residential areas with high density housing or near the city centre corresponds to higher energy consumption by plane.

These results can imply that there is some compensatory effect attached to a dense and central residential location. However it is not enough to have a statistically significant relation in order to establish, if there exists a casual relation (see Appendix). Theoretical arguments about how this relation works are also necessary. In a more detailed analysis, of the data from Copenhagen, including indicators of the theoretical mechanisms, the result showed that none of these indicators had a significant effect on the frequency of flight trips (Næss 2006b, 215-216). This means that the material didn't show any support for the theoretical explanations concerning compensatory mechanisms in the form of more frequent flight trips, neither as a surplus nor a deficient based phenomenon. From

my point of view it would also be rather surprising, if urban structures had a direct casual effect on the amount of flight trips.

Instead it is more likely as Næss (2006b) suggests, that the found relation between frequency of flights and residential location relative to the city centre and local area density might be associated with a metropolitan lifestyle, especially prevalent among young students and academics, who have preferences for both an inner-city living and for travels abroad, and not due to an effect caused by urban structures (Næss 2006b, 216).

Even though the above studies show some evidence of compensatory travel mechanisms and this indicates that such mechanisms cannot be totally disregarded, none of the studies find any support for the idea of constant laws, where changes inside or outside the transport system as well as in the generalized travelling cost automatically result in a new equilibrium. It is important to note that even though compensatory mechanisms may have an effect, this effect is not based on any universal law. This statement is also underpinned by the fact that some studies have found no indications of compensatory travel mechanisms (e.g. Næss and Jensen 2004; Næss 2007a).

It is also important to consider, what the implications for planning are, if there exist mechanisms between dense residential areas and the frequency of flight trips abroad. Does it mean that cities should be built less dense to decrease the amount of air travel, or is the implications rather that measures should be taken to reduce the amount of air travel by other mechanisms such as by economic means. If the objective is to reduce transport related CO_2 emissions it is obviously the latter which is the more rational decision.

4.1.5. Location of workplace

With changes in the business structure involving decline in polluting industrial production it has become possible to mix dwellings with workplaces within the 'boom' sectors such as knowledge and service. In the debate on where it is most optimal to locate workplaces seen from an energy conserving perspective, two different strategies have been advocated; centralisation of workplaces in the city centre and decentralisation to the urban outskirts or the suburbs (Næss 1997, 83-85).

On one hand it is argued that centralization of workplaces is most beneficial because the accessibility by public transport is usually highest in the central parts of the city. In addi-

tion, congestion and scarcity of parking space in downtown areas may cause a number of potential car commuters to leave their car in the garage at home.

On the other hand it is argued that locating firms in the outskirts of the cities will reduce the commuting distance because these areas are marked by a high ratio of people engaged in active employment, compared to amount of workplaces. By mixing dwellings and workplaces in suburbs, it has been argued that more people will have the possibility of short commuting distances.

According to Owens (1992) the mobility level of the society is also on an urban scale determining which of the two development patterns generates least transport and hence demands least energy (see section 4.1.1.). Decentralization of workplaces to the outskirts may be beneficial in a society marked by low mobility. However in a society marked by a high mobility level, it is more likely that people will chose workplaces based on other rationales than distance minimizing. In such situation it is likely that decentralization of workplaces to the suburbs will increase commuting distance by increasing the distance to the city centre and by generating cross traffic between the suburbs, instead of reducing them.

Within a Scandinavian context, several studies have shown that average commuting lengths and the number of people travelling to work by car are lower among employees of workplaces in the city centre than among those working at the outskirts of the city (Næss & Sandberg 1996; Hartoft-Nielsen 1997). Despite both studies show that average commuting distances are reduced by workplace location in the inner-city, the difference in commuting distances is not great. Both studies however show that the workplace location within the urban structure influences remarkably on the modal split.

Peter Hartoft-Nielsen's research in the Copenhagen area shows that 10-25% of the employees at offices in the inner city travel to work by car, whereas the proportion of car travelling is 70-85% among employees at offices located far from commuter train stations in the outer town areas. The proportion of car travelling is 40-60% among employees at offices located maximum 1 km from nearest commuter train stations. In addition the study shows that employees at offices near a local commuting train station travel less by car than employees at offices near major nodal points of the public bus system. The difference in car driving between inner and outer parts of the city is, however, considerably less in the provincial towns than in the capital area, due to the lower congestion level,

more ample parking provision and lower quality of the public transport services in the provincial towns (Hartoft-Nielsen 1997).

Hartoft-Nielsen's Copenhagen study did, however, not include socio-economic factors in the analysis. Such factors were included the analysis of employees' journeys to six work-places in Greater Oslo by Næss & Sandberg (1996). The result showed that the relation-ship between the distance from the workplaces to downtown and the modal split was still strong when controlling for a number of other factors that may influence the commuting pattern, among others car ownership, sex and income.

Both studies hence show that inner city location of workplaces reduces energy use for commuting trips, by reducing travelling distance and more importantly by influencing the modal split to the benefit of public transportation. In addition it was shown that work-place location near a local commuting train station involves less car driving than work-place location at sites with good accessibility by public buses.

Næss & Sandberg (1996) however argue that the conclusion should be modified. They argue that the transport consequences of the location of visitor-attracting activities will vary with the degree of specialization of the function in question. The more specialized the function is and the larger hinterland from which the visitors come, the more favorable a central location will probably be. For visitor -attracting, non-specialized functions with a primarily local catchment area, a decentralized location mixed together with residential areas seems to be the most favorable from an energy point of view. Examples of this kind of function are grocery shops, primary schools, kindergartens, post offices and branch offices of banks. Also business which generates heavy traffic is most suitably located near the major road network at the outskirts of the city, in order to reduce the amount of heavy traffic in the city centre. For other workplaces i.e. businesses which are not visitor - attractive directed towards a local catchment area, a central location seems to give the lowest energy use for transport.

4.1.6. Street designs

Within the field of the built environment and travel, street designs have been emphasized by some authors as an urban structure variable, which is important concerning travel behavior. The main focus within the American literature has been to contrast travel demand among two or more neighbourhoods that are rather similar except from their urban design characteristics (see Appendix). Especially the difference between traditional neighbourhoods with gridded street patterns and post World War Two suburban neighbourhoods types marked by many cul-de-sacs streets.

From a theoretical view, a grid-like street pattern promotes non-motorized modes of transportation and accesses to public transportation by creating more direct routes and by offering alternatives to travel along roads with heavy traffic. On the other hand, grid patterns also increase the accessibility for cars by offering more direct routes and by dispersing the traffic. This means that it is difficult from a theoretical point of view to establish which mode of transportation gain the relative most advantage (Cervero 2003). This may also be reflected in the results of the studies which have investigated street design's influence on travel, which are week and inconsistent.

Krizek (2003) found in a study at a neighbourhood scale of residential relocation's effect on travel behavior, that when households relocate and change their neighbourhood accessibility (an index bundling local density, land-use mix and street design measures), their travel behaviour changes as well, after controlling for socio-economic factors. A weakness associated with this study is that no attempt is made to isolate the effect of the specific urban-structural variables. This makes it impossible to identify the effect of the individual factors. It could be that the found effect was only due to local density and land use mix and not to the street design. This bundling of variables involve that detailed information is lost.

Boarnet and Sharon Sarmiento (1998) use travel diary data for Southern California residents to examine the link between land use patterns at the neighbourhood level and nonwork trip generation for a sample of 769 individuals. The number of non-work automobile trips that an individual makes in a two-day period is modeled as a function of sociodemographic variables and land-use characteristics. The travel diary data are linked to information about population density, land use mix and street grid patterns near each travel diary respondent' s place of residence. The results of the regression model showed that the land use variables are statistically insignificant in all but one of the specifications, and they conclude that evidence on the link between land use and travel behaviour is inconclusive. However, distinct from travel distances, there is less theoretical reason to believe that the daily number of trips will be lower among inner-city dwellers than among residents of outer suburbs (see Appendix). According to Cervero (2003) most studies of trip frequencies have concluded that the daily number of trips varies only modestly, if at all, between different types of neighbourhoods.

Boarnet and Crane (2001) did find some evidence that gridded street patterns are associated with fewer non-work automobile trips, however, this relation was only weak (Boarnet and Crane 2001, 96-103). Zegras (2006) also found only a modest effect of grid structure on reduction in automobile use.

In the study of residential location and travel behavior in the Copenhagen area, Næss and Jensen (2005) also included the street design in a multi- variable regression analysis. When macro-level urban structural variables which were excluded from the analysis, the result showed a strong effect of street design on travel distance on weekdays after controlling for socioeconomic and other non-urban structural variables. In areas with grid structure the amount of travel was less than in areas marked by other types of street designs. This was only the fact, however, when other, more relevant urban structural variables were excluded from the analysis. In addition all areas marked by grid structure in the investigation were located within 9 km from the city centre, and the effect of street designs disappeared after controlling for the distance to the city centre (Næss and Jensen 2005, 359). The study also showed that the amount of transport by car was greater in areas with grid-like patters, than other street designs, after controlling for relevant socio-economic factors, attitudinal factors, distance to city centre and the distance to nearest train station. Næss and Jensen (2005) suggest that it may be due to specific characteristics of some of the investigated areas with grid-patters, that facilities car travel. This is, however, speculative and the observed effect of street pattern on car use may be due to multicollinearity between car-use and the residential location relative to the city centre, and not due to the design of the street patterns (Næss and Jensen 2005, 363-364).

From this section it could be seen that there is not consistent evidence concerning street designs' impact on travel behavior, and if such effect exists at all. There is not much evidence to support that street patterns have a strong influence on travel. Besides none of the above mentioned studies, which found some support, have controlled for the distance to the city centre. It is likely that the modest effect, which was detected, also would disappear in these studies if such control was conducted.

4.2. Importance of urban structures concerning energy reduction for transport

From the above section it was shown that there exists rather strong empirical evidence and theoretical arguments to underpin the truth claim that urban structures impact on travel behavior and that a densification and centralization strategy is beneficial from a transport fuel saving perspective. But as some critics have levelled, just because urban structures have an effect on travel behavior this doesn't mean that this effect is stronger than other mechanisms which also influence on travel behavior. Or by other words, it has been claimed that there exists other mechanisms which are more efficient to obtain the goal of energy reduction in the transport sector. Based on that, the following section will discuss the importance of urban structures in relation to energy consumption for transport.

4.2.1. Which urban form characteristics are most important?

In Appendix it is shown that different studies about the urban structures' impact on travel have focused on different scales, ranking from the strategic to the neighbourhood level. Within Europe the focus has mainly been pointed towards the strategic level, as opposed to the USA, where it has mostly been at the neighbourhood level. When discussing the importance of urban structures compared to other means of reducing energy consumption for transport, it is relevant first to discuss which urban structural variables can be expected to be most influential on travel. It should be noted that the answer to this question is context specific, (e.g. the effect of residential location relative to the urban main centre, in a polycentric city can still be expected to have an influence on travel, but not as strong as in a mono-centric city). Because of such factors it is not possible to make a crosscomparison between results from multivariable regression analyses from different studies focusing on different scales, and then make a ranking. However, based on results from individual studies which have included several different levels of urban structural characteristics in a multi-variable analysis, it is possible to discuss which urban form characteristics have the strongest effect on travel behavior, and to discuss if there is any consistency between the results of these studies. This limits the number of studies for comparison because most studies have only investigated a few urban structural variables, and usually only at one level. This is especially a problem associated with the American literature, because, as far as I am aware, no studies have included both street designs and residential location relative to the central business district in the same investigation.

The above mentioned in-depth study of residential location and travel in the greater Copenhagen area, by Næss and Jensen (2005), did include several different urban structure variables associated with different scales of the built environment. As discussed in section 4.1.6., the result shows that the relation between street designs and travel disappeared, when controlling for the distance to the city centre. Instead the multi-variable analysis shows that the four urban structure variables which had the greatest effect on travel was the residential location relative to the city centre, residential location relative to the nearest second order centre, residential location relative to the nearest train station and density of residents and workplaces in the local area (Næss and Jensen 205, 422).

In the analysis of the built environment and motor-vehicle ownership and use in Santiago in Chile, Zegras (2006) also found that the distance to the central business district had fairly strong effect on automobile use, and the street structure only had a modest effect. Based on these two studies, the residential location has a much greater impact on travel than street designs. Of course two studies are not enough to draw any general conclusions, especially not when none of these are from the U.S., where the studies claiming such effect mostly originate. However, in my opinion it would be rather surprising, if the opposite relation has found that street designs had a stronger effect on travel than the distance to the city centre. The theoretical argument concerning, how residential location relative to the city centre influence travel is much stronger than the arguments concerning street patterns' impact on travel. Also the empirical evidence on residential location's effect on travel behavior appears stronger.

4.2.2. Are socio-economic and attitudinal characteristics of people more important determinants of travel behavior than urban form?

Against the importance of urban structures impact on travel it has been claimed that the effect of urban structures on travel is highly overestimated in empirical studies (see e.g. Stead et al., 2000). Instead it is claimed that socioeconomic and attitudinal characteristics of people are far more important determinants of travel behavior than urban form.

Gordon and Richardson (1989) have e.g. criticized Newman and Kenworthy's (1989) analysis for not taking socio-economic factors into account. That observed differences in travel behaviour under different urban structural conditions is due to differences in socio-

economic and attitudinal characteristics of the residents and not due to influences of the physical environment, is a general critique, of the idea that urban structures influence travel. It is reasonable to assume that differences in travel behaviour are, e.g., influenced by the standard of living in the country or region in which the investigated city is located and the standard of living is varying considerably between cities in USA and Asia. By not including other factors than urban structures, it is very likely that Newman and Kenwor-thy's analysis becomes overestimated, and it can be criticized for containing the same kind of spatial determinist perspectives as the relative concept of space was criticized of (see section 3.1.2.).

Gordon (1997) has made a re-examination of 26 of the 32 cities from Newman and Kenworthy's (1989) data set, for which he could obtain additional information on prices, incomes as well as public transit availability. His analysis shows that the effect of overall urban densities on energy use for transport is reduced almost by a factor three (Gordon 1997, 239-241).

Based on Gordon's re-examination of Newman and Kenworthy's data, the criticism regarding overestimation of urban density's effect on energy use for transport by omission of relevant socio-economic variables from the analysis seems rather just. However even though the effect was reduced, the result still indicates that overall urban density has an effect on transportation energy use.

It can be argued, that those claiming, that there exists inconclusive evidence concerned with urban structures' impact on travel, based on the argument, that the socio-economic and attitudinal characteristics of people are far more important determinants of travel behaviour than urban form, and the importance of urban structures are highly overestimated in empirical studies, overlook that most studies carried out on the subject during the last two decades have included several non-urban structural factors, such as demographic socio-economic variables. Some studies have also included attitudes among respondents (Næss 2009b). As shown above, most of these studies still find that urban structures have a significant effect on travel.

It is true that some socio-economic variables, such as education, income level, and car ownership have a rather strong effect on travel, and some studies have found that the effect of these are stronger than the included urban form characteristics. However, some of these variables may themselves be influenced by urban structures. In recent years there has been called attention to the fact that car ownership in itself is influenced by urban structural conditions (Giuliano & Narayan 2003). Theoretically this can be explained from a time-geographical perspective. In that respect the location of the dwelling within the urban structure influences the residents' need for having private motor vehicles at their disposition (see section 3.2.1.).

Zegras (2006) found in the analysis of the built environment and motor-vehicle ownership and use in Santiago in Chile, that the decision of households to own cars was mainly dominated by income, especially the decision to purchase the first car. Nonetheless several built environment characteristic, (dwelling unit density, diversity and distance to the central business district), was detected to have some influence on the choice regarding owning two or more vehicles (Zegras 2006, 8).

Similar results were detected in Copenhagen by Næss and Jensen (2005). After controlling for the most relevant socioeconomic and attitudinal factors their analyses showed that residential location has some impact on car-ownership. Those, who reside in the periphery, have higher rates of car-ownership than those, who reside in the inner-city. Also in the study of Hangzhou, the relative distance to the city centre showed some effect on car ownership after controlling for several socio-economic factors (Næss 2007a, 306-315).

If car ownership in itself is influenced by residential location, this means that including it as a control variable in multi-variable regression analysis (as usually done) involves a kind of "over-control", and the results must be regarded as conservative estimates.

If such gray-zone variables were left out the analysis of the Copenhagen area, the result shows that the effect the on urban structural variables generally become stronger as it can be seen from figure 2. Especially the difference in the amount of transportation by car between inner and outer-residence is affected and to a lesser degree extends the travelling distance (Næss 2009b).



Figure 2. Average expected travel distances by car related to the residential location relative to the city centre, with and without gray-zone variables (from Næss 2009b)

Also the Hangzhou study shows a general increase in the effect of urban structures if the gray-zone variables are left out. However the change in the effect is modest in Hangzhou when you leave the gray zone variables out and not so strong as in the Copenhagen study. This properly reflects the difference in car ownership between the two cities (Næss 2007a, 315).

Against this, it can be argued, that the observed difference in car ownership between inner and outer residents, just as well may be due to people with preferences for a cardominated lifestyle settling in areas matching their travelling preferences and not due to an effect caused by urban structures. This raises the issue of self-selection, which will be discussed in more details in the following section.

Before doing so it is relevant to make some reflections about what the above discussion implies for planning. From the discussion it could be seen that many socio-economic factors have a fairly strong impact on travel. This could imply that the most effective manner of managing travel behavior is through means that regulate socio-economic factors. However, it is reasonable to raise doubts about the feasibility, or acceptance of regulating some of these factors in a direction, which the above studies showed to be beneficial. As an example some studies showed, that the education level influenced the amount of transport by car. However this doesn't involve that it is acceptable to reduce the education level in order to reduce the amount of motorized travel. Likewise with e.g. sex. Obviously there are several socio-economic characteristics which can be regulated through economic means, such as car-ownership. It has been argued that the efficiency of applying economic means as a tool to reduce energy consumption for transport is higher than through spatial planning. This issue will be discussed further in relation to the expected energy savings due to an urban densification and centralization strategy in section 4.2.4.

4.2.3. Do people self-select into areas matching their travel preferences?

Researchers working within a microeconomic tradition have considered the so-called 'self-selection problem' a source of error when comparing travel behavior among residents living in different parts of an urban area. A number of authors hold that the possibility that people base their choice of residence partly on preference for a particular travel mode precludes any firm conclusions about the nature and the extent of the causality between the built environment and travel behaviour (see, e.g., Boarnet & Crane, 2001; Krizek, 2003; Cao *et al.*, 2009).

The self-selecting issue does not contain arguments against the truth claim regarding urban structures' impact on travel. If there were no such influence from the built environment, people who prefer to travel by non-motorized modes might as well settle in the peripheral part of the metropolitan area, with poor supply of public transportation, workplaces and service facilities. Or in other words, if urban structures didn't influence travel, people would be unable to self-select into quarters matching their travel preferences.

That urban structures matter to travel behavior after self-selection is controlled for, has been confirmed by various studies. Cao *et al.* (2009) reviews 38 empirical studies using nine different methodological approaches. In sum, virtually all of the studies reviewed found a statistically significant influence of the built environment measures on the travel behaviour variables of interest remaining after self-selection was accounted for.

In spite of that it can be argued that the residential self-selection issue may be a source of exaggerated estimates of the influence of urban structure on travel behavior, if unaccounted for. This is because it might be, that people with strong car oriented travel preferences, when moving to inner-city areas, will not necessarily change their travel behavior in accordance with the residents in these areas, residents who are self-selected into them because the residential areas matches their preferences for walking, biking or public transportation. Cao *et al.* (2009) e.g. argue, based on their reviews, that it is difficult to assess the strength of the autonomous influence of the built environment relative to the influence of self-selection, or even to ascertain whether that autonomous influence is 'large enough to matter' on its own terms. But they suspect that the contribution of urban structures is, in most cases, relatively small compared to the contributions of socio-demographic and unmeasured variables.

Næss (2009b) argues against this based on evidence from the above mentioned studies in the metropolitan areas of Copenhagen and Hangzhou. As mentioned, the qualitative interviews indicate that most of the interviewees' rationales for activity participation, location of activities, choice of travel mode and route choice contribute to a higher amount of motorized travel among outer-area residents than among inner-city dwellers (see section 4.1.4). This holds true also when taking self-selection of residents to particular types of neighbourhoods into account.

Drawing on quantitative data from Copenhagen Metropolitan Area, the paper shows that significant relationships between residential location and travel exist regardless of travel-related residential preferences. To illustrate this, the respondents are divided into two groups, with respect to whether their travel preferences match the characteristics of the residential area they are living in or not. Respondents prioritizing proximity to public transport, workplace and/or shopping opportunities could be considered living in neighbourhoods matching with their travel preferences, if they live in the inner distance belt and mismatching, if they live in the outer three distance belts, and especially in the two outermost. Conversely, residents who do not consider proximity to public transport, workplace and/or shopping opportunities important, could be characterized as matching with their travel preferences if they live in the suburbs and mismatching, if they live in the inner part of the four distance belts. The difference in average distance travelled by car between residents living in areas matching and mismatching their travel preferences can be seen at figure 3.



Figure 3. Mean travel distances by car on weekdays among dissonant ('mismatch') and consonant ('match') residents living in different distance intervals from the city centre of Copenhagen. N = 1793 in total (of which 861 'match' and 932 'mismatch'), varying from 401 to 526 in the different distance intervals (from Næss 2009b)

From figure 3 it can be seen that peoples' travelling preferences influence the average travelling distance by car. People with car orientated travel preferences, who reside in the city centre, travel longer distances by car than those who reside in the same area with preferences for walking, biking and public transportation. It is equal to residents living in the outer three distance belts. However, travelling distances by car rise with increasing distance from the dwelling to downtown Copenhagen among both the matching and mismatching group. In addition, respondents living less than 6 km from the city centre and who can be characterised as mismatching, travel on average less by car than respondents in any of the outer distance belts, respondents who can also be characterised as mismatching, but who do emphasize proximity to public transport, workplace and/or shopping as important criteria for their choice of residence. As Næss (2009) argues: if self-selection was the main reason for geographical differences in the amount of travel by car, one would hardly expect to find such a pattern. In that case, the opposite relationship would be expected when comparing mismatching residents across the distance belts. Also, when controlling for a number of demographic, socioeconomic and other characteristics of the

respondents including car ownership and attitudes to car travel, effects of residential location characteristics are found on the amount of car travel both among those, who consider proximity to public transport, workplace and shopping opportunities important and among those, who do not. The analysis, however, showed that the effects of the residential location variables are relatively modest compared to the effects of some of the nongeographical variables. Within both groups of respondents, much of the difference between outer-area and inner-area residents in car travel is related to differences in car ownership and attitudes to car driving.

This could underpin the statement by Cao *et al.* (2009) that the contribution of urban structures is, in most cases, relatively small compared to the contributions of socio-demographic and unmeasured variables.

However, as it was discussed in the above section, car ownership is in itself influenced by urban structural conditions. To some extent this also applies to transport attitudes. This involves that the impact of urban structure on travel tends to be underestimated if car ownership, attitudes to car travel and transport-related residential preferences are all included as control variables along with more traditional demographic and socioeconomic variables. As Næss (2009b) argues: These effects are probably at least as strong as the effects going in the opposite direction, related to the self-selection issue.

Despite the fact that the above-mentioned studies showed that urban structures matter even after taking self-selection into account, the self-selection issue is still worth a short discussion in relation to what it implies for urban planning. In my point of view the fact that people to some extent self-select into neighbourhoods matching their travel preferences, increases the importance of planning, rather than indicates that planning is doomed to failure. If the objective is to reduce car traffic, and if there exists a latent demand for built environment characteristics attached to both inner- and outer-city residential living, regulating the supply of the respective residential characteristics through spatial planning becomes of increased importance. In order not to fulfill the potential latent demand for an outer-city car orientated lifestyle, planning should avoid increasing the supply of such residential areas. Likewise, channeling residential development to transport reducing locations may release a latent demand for such way of living, and hence contribute to reduction of travel-related environmental impacts. That there, in fact, exists a latent demand for inner-city living can e.g. be reflected in the very high prices of central and inner-city residences in many cities (Barlindhaug & Nordahl 2005; from Næss 2009b).

4.2.4. Are economic means and technological improvements more efficient?

In section 4.2.2 it was shown that several factors, both urban structural and socioeconomic, had a fairly great impact on travel behavior. This could indicate that an efficient regulation of travel behavior must be based on a combination of economic means and land use planning. Despite this several authors have argued that the built environment is of minor importance, because economic means and technological improvements are more efficient regulations of travel behavior (see e.g. Gordon and Richardson 1989; Bruegmann 2008). In this section some of the problems will be discussed associated with basing policies, with the objective to reduce traffic related pollution, solely on economic and technical means.

Gordon and Richardson (1989) claim that 'a fuel tax would be much simpler, faster, more effective, and cheaper than rearranging metropolitan areas and/or major investments in transit in relation to reducing gasoline consumption'. I would argue that this discussion needs to include a time perspective in order not to become too simplified. Changing urban structures has a rather long timeframe. Because of that Gordon and Richardson have a point, if the objective is to make changes over night. Also road-pricing is a policy-tool that might be able to obtain immediate changes. However there are several problems associated with implementing tax on travel as well as the long time efficiency. First of all there has in general been rather little political support to implement such means. As Næss and Jensen (2005) argue: a partial explanation for this might be that the increase in the mobility level for most people in western societies, which has involved more freedom to choose between destinations and activities, at the same time has created a dependence of being highly mobile (Næss and Jensen 2005, 34). People still need to move around in the city in order to sustain several basic needs. Hence I agree with Høyer (2002) when he claims that an increase in economic costs of travel without any adaptation of the built environment will make the conditions for the short daily trips too complicated, and will with great likelihood be met with political resistance on a long term basis (Høyer 2002, 177). In addition there are also some social concerns, which have to be taken into account, when implementing economic means. If the tax on travel is independent of people's income level, this will involve that people with low income will be relatively harder taxed. The justice in this seen from a social equality perspective is questionable, especially if movement is seen as a precondition for sustaining some basic needs, but is of course up to politics decide upon. Another concern attached to the difference in income level between people involves that it can be difficult to establish a tax level which is high enough to have an impact on travel behavior of people with high income, and at the same time be within the limit of what is acceptable for people with low income.

It has also been put forward that technological improvements, such as increase in engine efficiency and research into fuel substitutions should be the focus of policy making, in order to reduce traffic related pollution not spatial planning (Brugemann 2008). Both of these are, of course, important elements in developing a more environmental sustainable urban environment, but it is unlikely that technological improvements within the transport-system can reach the goal alone.

The improvements in engine efficiency involve a lowering of the travel costs, which in many cases generate more energy demand. The development has actually pointed at more vehicles with more engine capacity, higher levels of performance and longer trips (Hill-man 2004, 35; Holden 2007, 173-174). These problems could of course be solved by substituting gasoline with another energy source. However this has rather long time-perspectives, before such alternatives are fully ready to substitute gasoline. Besides, many of the possible alternatives are also associated with several environmental and social problems.

Based on the above discussion I will argue that neither economic means nor technological improvements individually are adequate to obtain sustainable urban travel behaviour, even though they are important elements. However, this does not necessarily imply that considerable reductions of traffic related CO_2 emissions can be obtained through spatial planning. Because of that the following will contain a discussion about, how much energy and CO_2 reduction can be expected from implementing a strict land-use strategy.

The study from the Copenhagen metropolitan area by Næss & Jensen (2005) shows that the location-conditioned differential between the most peripheral and the most central among the investigated residential areas makes up 46–81 per cent of the energy used for domestic travel by the average Dane (excluding freight). Compared to Denmark's total energy use the per capita differential between the most peripheral and the most central locations of Copenhagen Metropolitan Area corresponds to 9.5 - 17 %. Denmark's total

inland CO₂ emissions amounted to 54.3 million tonnes. Based on this account, the location-dependent differential in CO₂ emissions between the most central and the most peripheral among the investigation areas corresponds to 7 - 12 % of the total CO₂ emissions per capita.

It is, however, not a realistic scenario that all future residential development is located in Copenhagen Metropolitan Area. In stead a scenario is estimated where all expected residential development during the region plan period, for Region Plan 2005, is located either to the inner of our four distance belts or to the two outer ones. In the regional plan it is estimated that construction of 80,000 new dwellings in Copenhagen Metropolitan Area will be needed during the period 2005–2017. Assuming an average occupancy rate of 2.15 persons per new dwelling, the new dwellings will be inhabited by 172,000 residents. If it is assumed that on average the inhabitants of Copenhagen Metropolitan Area do not deviate significantly from the rest of the Danish population in their CO_2 emissions. The calculated differences between the locational alternatives make up about 2.5 - 5 % of the total CO_2 emissions from the domestic travel carried out by inhabitants of Copenhagen Metropolitan Area. (Næss 2006a, 139-144)

Even though a strict land-use strategy can reduce the traffic related CO₂ emissions, it is important to have in mind that implementation of such strategy does neither involve that technological improvements and economic restrictions should be dismissed, nor that spatial planning alone can obtain an environmental sustainable urban development. I agree with Næss and Jensen (2005) when they claim that no single regulator can be expected to reduce the CO₂ emissions within the transport sector to a sustainable level. Instead a combination of technological improvements, economic, opinion-forming means etc. and spatial planning is needed if radical changes in travel behaviour are likely to occur (Næss and Jensen 2005 34). Or in other words: in order to reverse the trend in traffic development, caused by the interplay between increasing mobility level and transport demanding landuse configurations, policies must direct attention not only towards economic restrictions and technological improvements within the transport-system. Attention should also be turned towards on *why* people move as well as peoples' *need* to travel because of the physical location in space.

4.3. Feasibility - does planning matter in a marked based society?

Against the feasibility of implementing a dense and compact land-use policy, it has been argued that public regulations are inefficient and inappropriate. Or in other words, spatial planning is deemed to be counterproductive. These arguments are levelled from a neoclassical perspective including incrementalism, where all resources are regarded as scarce, and efficiency requires that the resources are allocated between competing users according to the criterion of maximizing social welfare (Klosterman 1985).

Within incrementalism individuals are in focus rather than the community, market and deregulation instead of planning, competition over coordination and supplying the demand, rather than restricting the demand. These underlining obligatory passages point are structuring meaning in a manner which is inconsistent with assumptions embedded in the compact city model (see section 3.2.3.).

Within this perspective Gordon and Richardson claim that the single objective of minimizing gasoline consumption makes no sense, and claim that compact land-use strategies emphasizing non- motorized modes of transportation rest on a Maoist planning methods (Gordon and Richardson 1989; 1997).

Gordon and Richardson, however, seem to argue from a fundamentalist conception of neo-liberalism, ignoring that public planning is also necessary in a market based society. Klosterman (1985) argues, based on neo-classical and liberal theory, that there is an implicit consensus about the need for public sector planning and intervention in the marked forces in order to perform four vital social functions:

"promoting the common or collective interest of the community, considering the external effects of individual and group action, improving the information base for public and private decision making, and considering the distributional effects of public and private action"

In line with Klosterman's argumentation, Bruecker (2000) argues that sprawl is only a resource problem to the extent that it results from markets failure. He identifies the failure to account for both public goods and externalities such as the benefits of open space, excessive commuting because of a failure to account for the social costs of congestion, and

failure to make new development pay for the infrastructure costs it generates, as three clear examples. He argues further that if the price on commuting was right, the spatial size of cities would decrease naturally.

Cervero (2003) also argues that sprawling urban development patterns are a result of under-pricing of traffic. If the price on traffic was optimally more compact, mixed-use and walking-friendly built environments would evolve. However, for political and institutional reasons, policy tools to set the price on traffic right such as road pricing have failed to move very far beyond theory. Because of that he argues that restricting sprawl through spatial planning is hence equal to correcting failure of the market, and may be the next best solution.

In addition it can be argued that urban structures are associated with great inertia, hence the conditions for the theoretical arguments concerning equilibrium between present landuse and travel-cost are not fulfilled.

Contrary to Gordon and Richardson's argument about the inefficiency of public planning, Fogelsong (1996) has shown that urban development based solely on the mechanisms of the market reduces the possibilities for capital accumulation. Uncoordinated land use may e.g. increase the costs of establishing the necessary infrastructure. A city like Oslo, which has succeeded in bringing urban sprawl to a halt through location and land use planning, has not combated economic growth, but has used the planning legislation in order to regulate the market forces in a manner that benefits urban densification.

Based on the above it can be argued that Gordon and Richardson seem to forget that the market conditions for land use and transport are not perfect, but are associated with several failures, which benefit urban sprawl and require remedies in the form of location and land use planning, even in a market based society.

As mentioned in the introduction, changes in the business structure with increase in knowledge and service businesses and decrease within industrial production have made many centrally located sites available for urban regeneration. The new type of businesses demands less floor-space, which increases the possibilities for densification. In addition, the new type of businesses usually pollutes less on a local scale, and can hence be combined with dwellings.

4.4 Sum up discussion

This chapter has shown that urban structures matter to travel, also after taking the arguments of the critics into account levelled against the truth, importance and feasibility. It was shown, that some of the studies, which found no or weak influence of the built environment on travel, have investigated other urban structural variables or travel outcome measures than those, which could be expected to have the strongest effect on travel.

The state-of-the-art knowledge within the field of land use and transportation planning shows: There is not consistency among the empirical studies on either centralized or polycentric, regional settlement patterns that are less energy demanding. Nevertheless, the mobility level and the distance between the urban areas within the region are likely to influence on the question. It was also shown, that city size is not a precise indicator for travel behaviour. High overall, urban density reduces energy use for transport. Residential and workplace locations within the urban structure influence travelling distance and modal split. Street design's influence on travel is weak and inconsistent. Of the different investigated urban structural variables residential location relative to the city centre seems to have the strongest influence on travel.

In addition, it was shown that location and land use planning are important in order to reduce the need for transport, but must as well be combined with social, economic and technical regulations in order to obtain radical reduction in CO_2 emissions within the transport sector.

It was also argued, that urban densification through spatial planning is feasible in a marked based society. Within a market based perspective it can actually be argued that urban sprawl is a result of market failures, and hence justifies urban planning.

5. Knowledge filtering of urban structures within the academic arena

In the above chapter it was shown that the state-of-the-art knowledge within the field of land use and transportation confirms that urban structures matter to travel behaviour, after taking the arguments of the critics into account. This chapter will deal with the research question attached to power and filtering of relevant knowledge about urban structures' impact on travel within the academic arena. Although the existence of doubt of knowledge claims, that the built environment matters to travel, may favour status quo, criticisms of the compact city model is neither illegitimate nor irrelevant. The problematic issue occurs when state-of-the-art knowledge is filtered at the benefit of more un-credible knowledge and used to legitimate urban sprawl. As it was shown above, some of the studies, which have found no or week influence on the built environment on travel, have investigated other urban structural variables or travel outcome measures than those, which could be expected to have the strongest effect on travel. In the following, it will be shown, how results from unreliable studies are confirm-structured and recycled in literature reviews, used to de-structure knowledge claims about urban structures, impact on travel.

Different cases involving attempts to de-structure of anti-sprawl knowledge claims through de-reification will be discussed. This is done by assessing such knowledge claims by such strict criteria for credibility, that they can be termed 'junk science'. These high criteria for scientific credibility are, however, only applied selectively and are not used to evaluate the pro-sprawl arguments.

In chapter 3 it was shown how meta-theoretical assumptions embedded in the classical sociology and economic tradition were incommensurable with those underlining the compact city model. In the end of this chapter it will be shown, how qualitative knowledge on urban structures' impact on travel is excluded from leading American positivistic based journals.

5.1. Recycling of old unreliable knowledge in literature reviews

As argued in Chapter 4, criticism of the compact city model is in some cases neither illegitimate nor irrelevant. The problematic issue appears when state-of-the-art knowledge confirming urban structures' impact on travel is filtered away to the benefit of more unreliable knowledge obtaining other conclusions. Because of that, analysis of power and knowledge filtering within the academic arena starts with the issue of the recycling of old unreliable knowledge in literature reviews claiming weak or no relation between urban structures' impact on travel.

In a book on sustainable urban form, Frey (1999) advocates moderate densities and decentralized urban developmental patterns and raises doubt about the relationships between urban form and travel. Frey (1999) concludes that results from several research projects on the relation between transport, urban form and energy use are inconclusive (Frey 1999, 25). To underpin this statement a study by Banister (1992) is referred. This study finds inconclusive evidence about the degree of urbanisation influence energy consumption for transport (see section 4.1.1.). However city size is an imprecise indicator for the expected relation between urban structures and travel (see Appendix). The conclusion about inconclusive results is hence based on old unreliable knowledge.

Gordon (1997) claims based on an analysis of correlation between transport and population density within functional urban regions in England, that 'there is rather little evidence that more or less compact forms of development within a functional urban region are energy-saving'. Gordon repeats some of the criticism that has been put forward by several authors against Newman and Kenworhty's (1989) pioneer study within the field of urban structures' impact on travel. However, except for his own and for Newman and Kenworhty's study, he does not reference any other studies. Hence, he appears to be unaware of the empirical evidence that has been published in the 1990s strengthening the hypothesis that urban structure does actually influence travel. Gordon also seems to ignore the solid theoretical foundations on which the assumptions of a relationship between urban structures and travel are based (Næss & Strand 1997).

In addition, his own analysis is based on an imprecise indicator for the relationship between urban structures and travel (see section 4.1.3). It can hence be argued that his conclusion involves filtering of relevant knowledge and instead recycling of more unreliable knowledge.

Recycling of proven unreliable knowledge in literature reviews, because the credibility of the source has not been carefully examined, can be regarded as confirm-structuring of false consciousness. One can, of course, only speculate about whether or not the inclusions of unreliable knowledge without critical reflecting about the validity are conscious or unconscious. This will be discussed further in section 7.2.

Whether or not the act of referencing unreliable knowledge is conscious or unconscious, such acts of confirm-structuration involve that the impression of doubt about the existence of relations between urban structures and travel is recycled. The existence of doubt about urban structures may involve that location and land use planning is regarded as less important among policy makers as a tool for obtaining CO_2 reductions (see section 2.2.5.).

5.2. De-structuring of knowledge claims about urban structures' impact on travel through de-reification.

As shortly mentioned in section 2.2.5., one tactic for de-structuring knowledge claims about urban structures' impact on travel is associated with raising doubts about the credibility of research showing that such relationships exist and is of importance for urban planning. This is done by assessing the credibility of research showing that relations between urban structures and travel exist, using such high standards for validity and reliability that almost no scientific knowledge passes the test. Based on such strict criteria for credibility the critical scientific knowledge claims can be termed 'junk science'. This high standard for assessing scientific credibility is, however, only applied selectively and is not used to evaluate the advocated knowledge claim.

Gordon' (1997) article discussed above applies this tactic to some extent. He is e.g. criticizing old research for not including socioeconomic factors. This is of course not equal to evaluating conflicting truth claims by such high standards for validity and reliability that almost no scientific knowledge passes the test. However, he ignores a vast amount of research which *has* included such factors and still finds that urban structures matter to travel. In addition, the credibility of his own research is not critically reflected upon despite it is based on an imprecise indicator of the expected relation between the built environment and travel.

Indications of the use of the tactic concerning different standards for validity and reliability when evaluating competing truth claims is also evident in an article by Skjeggedal *et al.* (2003).

They claim that urban densification can entail shorter travelling distances between functions and reduce transport, but it can just as well involve the opposite. They underpin this statement by raising doubt about the credibility of research which shows that urban structures matter to travel behaviour and by claiming that, even if such relations exist, knowledge about such relations cannot be applied to predict if densification will reduce transport within a context of the future.

The studies which are given attention to in the article can, however, be characterised as very selective, and the authors ignore a vast amount of research based on more credible research methods, which also show that urban structures matter to travel behaviour. They e.g. reference some model simulations carried out in the early 1990's, which must be characterised as too optimistic regarding the expected benefits from dense urban development scenarios. The authors are, of course, right when they question the validity of such results from transport models, but they ignore the conclusions of more credible studies within the field. Instead, the only empirical study they refer to, besides their own, is one by Holden (2001). This study shows that the residential location within the urban structure only has a significant effect within one of three investigated areas. They don't make any critical reflections regarding why such relations are not found in the two areas. However, as Næss (2004b) argues, in one of the two cases, which didn't show any significant effect, the investigated residential areas were located at about equal distance from the city centre. Hence it does not show anything about the influence of residential locations within the urban structure on travel behaviour. In addition Skjeggedal *et al.'s* (2003) own investigation which is referenced does neither mention difference in travelling distance by car among residents living in the investigated areas, nor does it check for socio-economic factors.

From this it can be seen that Skjeggedal *et al.* (2003) give a lopsided impression of the matter. They only take contradicting evidence into account which they can label junk science, but ignores vast amount of research also contradicting their truth claim based on more credible methods. The credibility of the evidence which they present themselves is, however, not of a particularly credible character but this is not critically reflected upon.

It can be argued that Skjeggedal *et al.* (2003) raise the bar for scientific credibility to an unrealistic level when they reject the possibility of using existing knowledge about cause and effect within the field of urban structures' impact on travel to predict whether a dense urban development or sprawling suburban development will involve most transport in the future.

This indicates that they interpret prediction as a prophecy. It is, of course, not possible to make such precise predictions because it would involve that the social development is predetermined. This is not the case, and if Skjeggedal *et al.*'s (2003) argumentation was to be followed, this would imply that all existing knowledge of today is of no use tomorrow, because tomorrow is different from today. Hence all attempts regulate society would be doomed to failure and could hence just as well be abolished.

However, just because it is impossible to make exact predictions about the future, this does not involve that qualitative assessments about which developments are most likely to

occur as a result of implementation of specific initiatives are useless. Such estimations are vital for all forms of social and environmental regulation (Næss 2004a).

Despite that one cannot know with certainty in advance if the same effect, which has been observed between travel behaviour and residential location relative to the city centre in a city like e.g. Århus, also will influence travel behaviour in a city like Odense in the same manner, it can be argued that this is likely when it has been observed in a vast amount of studies in diverse cites.

In the book *Sprawl a Compact History*, Bruegman (2005) also attempts to de-structure knowledge claims, that are critical of urban sprawl. Bruegman takes a historical perspective on urban sprawl and the anti-sprawl movement. He admits that his book does not represent an attempt to be even handed in the treatment of evidence. Instead it focuses on the benefits of sprawl and the problems caused by reform efforts (Bruegman 2005, 11-12). He proclaims many features of sprawl as merits and argues, that anti-sprawl policies are counterproductive by nature. In addition, doubt is raised on the validity of a vast amount of research showing, that urban sprawl increases car travel. However, his one sided focus on benefits of urban sprawl lacks nuance and involves filtering of relevant knowledge.

Bruegman (2005) argues that sprawl is neither new nor particularly American, and it was in full force long before the advent of the private automobile. If sprawl is the outward movement of people at lower densities without any over-arching planning or control, then sprawl is as old as cities. He also argues that high density can cause more traffic problems than it solves. Bruegman (2005) claims that the real driving forces behind urban sprawl are increasing wealth and the democratization of society.

Crane (2008) characterises Bruegman's presentation of sprawl as something that happens. In its cold determinism, it is nigh universal and relatively unyielding to policy or prayers. When presetting sprawl as something almost predetermined or universal, those who are against sprawl can be portrayed as irrational, because they deny the nature of truth. In addition, by claiming that democratization of society is one of the 'real' driving forces behind urban sprawl, arguing against sprawl becomes equal to restriction of democracy.

Bruegman (2005) also uses the tactic mentioned above, the tactic concerning labeling inconvenient knowledge claims as junk science, in order to de-structure critical knowledge claims towards sprawl. He state as follows:

"Many of the things the critics of sprawl appear to agree on, moreover, are based on out-of-date or insufficient evidence" (Bruegman 2005, 5).

"If anyone taking the time to investigate any of the claims in detail, to check the footnotes of the impressive-looking reports, it is remarkable how often the assertions are based on simple and surprisingly obvious statistical errors or the source of information turns out to be simply another anti-sprawl tract or a sketchy opinion piece by a journalist. Nevertheless, when hundreds of these reports are collected, they create an edifice that can look quite solid, in part because it is so big that no single individual can ever examine very much of it in detail" (Bruegman 2005, 138)

From this it can be seen that Bruegman (2005) characterises most anti-sprawl knowledge claims as junk science. It almost seems as if he argues that the only reason this is not a public fact, is because the vast amount of junk science within the field. Despite he characterises most studies that show that urban structures matter to travel behaviour, as junk science, he does not refer to so many of such studies. Besides, as it will be shown below, he is selective when he uses the term junk science. It is only critical knowledge claims on urban sprawl that are critically evaluated, not the pro-sprawl knowledge claims.

Bruegman (2005) e.g. raises doubt about whether a sprawling urban form increases automobile use compared to a more compact urban form. This is done by referring to the debate between Newman & Kenworthy and Gordon and Richardson. Bruegman (2005) argues that Newman & Kenworthy's attempt to link low-density sprawl directly to pollution is highly problematic. To support this statement he refers to publications by Gordon and Richardson showing that commuting time in USA did not increase very much during the period from the 1960's to the 1980's, although urban density declined. However, as it is discussed in Appendix, travel time is an imprecise indicator for travel behaviour and travel related energy use.

Bruegman (2005) is hence only critical of the credibility of the anti-sprawl knowledge claim, but does not evaluate the credibility of the pro-sprawl knowledge claim, despite this is also based on a problematic methodological assumption. In addition, a vast amount of more resent and credible research studies within the field of land use and transportation, are ignored. Contrary to Bruegsman's claim about the existing of doubt increased car use as a result of urban sprawl, it was shown in the previous chapter that the state-of-the-art knowledge shows that inner-city residents on average travel shorter distances, and
carry out a smaller proportion of this travel by car, and hence use less energy for transport than their outer-city counterparts.

Bruegman (2005) also attempts to raise doubt about the fact that urban planning is a proper way to deal with issues related to the climate debate. In other words, he attempts to de-structure anti-sprawl knowledge claims based on environmental concerns.

He does not question that today the weight of scientific evidence suggests that human activity has played a significant role in current climate warming trends, despite he argues, that the effect is still very uncertain. He claims that urban densification is not in it self the solution to global warming, though it might turn out that this development strategy is more energy efficient, than low-density living. Instead he argues that technological innovations of foul sources should be in focus not transforming settlement patterns (Bruegman 2005, 149-150). However, as discussed in section 4.2.4 there are also several environmental problems related to many of the potential substitutes for gasoline as fuel. Hence reducing the need of transport is still a relevant issue for obtaining sustainable development, even though theological innovations within fuel sources take place.

Bruegman (2005) also claims that even though the issue of sprawl's effect of climate changes is important, this is not what really drives the anti-sprawl crusade. In stead, he claims that what is actually at stake, are much larger questions about planning and de-mocracy, aesthetics and meta-physics, and different class-based assumptions about what makes a good urban life (Bruegman 2005, 8). He argues that if environmental concerns were the real reason for combating sprawl, it would be much more rational to start by solving problems of water delivery and waste water treatment in the developing world, instead of focusing on long-term and still uncertain effects of global warming.

From this it can be seen that Bruegman attempts to create a narrative which de-structure the knowledge claims about the importance of sprawl's contribution to climate changes. He attempts to portray the sceptics of sprawl as only using environmental argument as part of an elitist driven conspiracy, with the real objective of forcing the ordinary citizen on a particular, and to some extent undemocratic form of living. His narrative is, however, very speculative and one sided, ignoring a vast amount of research which contradicts his speculations.

From this section it can be seen that the strategy pioneered by the tobacco industry, about de-reifying inconvenient truth claims by labelling them as junk science, also has been

applied with in the debate on urban structures' impact on travel. The standards for scientific validity are however only applied selectively, and as it has been seen much of the pro-sprawl arguments will not pass the test.

5.3. Exclusion of qualitative research from leading positivistic journals.

As discussed in section 2.2.3, within the academic arena, meta-theoretical assumptions and positions of theory of science prevailing within different disciplines, act as a kind of system of thought, which makes confirm-structure to knowledge claims, which are incommensurable with those assumptions, unlikely. Leading positivistic-based journals e.g. tend to exclude single case studies, because they are regarded as 'unscientific'.

In the following, it will be argued that in some cases qualitative knowledge about urban structures' impact on travel has been excluded from leading American positivistic based journals.

Travel is intersecting very diverse aspect of the social and physical/spatial world. Such a complicated issue as the potential relation between urban structure and travel can hence not be grasped through one single method or academic discipline, but calls for a multitude of methods and an interdisciplinary research approach.

Quantitative methods like statistical analyses cannot themselves establish that causality exists, but they can be used in an exploratory way, revealing patterns and relationships that might be a result of causal influences. And they may be used as part of the evidence for theoretically founded causal relationships. But statistical analyses do not show any-thing about *how* and *why* such potential casual relations function. In order to obtain knowledge about such relations, theoretical and qualitative approaches are necessary (see Appendix). Hence, the exclusion of qualitative knowledge at the benefit of quantitative knowledge is problematic, also in relation to urban structures' impact on travel.

Næss e.g. tells that he has experienced, that in order to get articles accepted within the American positivistically based planning journal, '*Journal of Transport and Land Use*', he was told to exclude or cut down the qualitative based parts of the articles based on arguments of space constraint. Instead the quantitative part was subjected to a stringent

control in relation to statistical procedures and had to be upgraded in order to be accepted (personal conversation with Næss 2009).

In addition there is a tendency among American literature on the issue of land use and transportation not to reference European studies. As mentioned in USA the debate on land use and transportation has centred on the influence of different neighbourhood characteristics such as street designs, rather than location within the urban structure, as has been the main focus within a European context (personal conversation with Næss 2009). The studies referenced in section 4.2.1, which included both residential location relative to the city centre and street designs as variables in the investigations, showed that residential location had a stronger influence on travel than street designs.

One can, of course, only speculate about why this is so. It might be that the American context with much more sprawling and polycentric urban development patterns is regarded to be too different from a European context, traditionally marked by a more centralised urban development pattern. Against this, it can be argued that location within the urban structure can also be expected to influence travel in a polycentric development pattern, despite the fact that the effect of location relative to the city centre may be reduced. Furthermore, the difference in the contextual point of departure between USA and Europe does not involve that knowledge about location within urban structures' influence on travel in compact and centralised cities, is irrelevant for strategic policy-making in an American context. If knowledge shows that the urban structures within traditional European cities, marked by more dense and centralised development patterns, generate less transport than the more polycentric and sprawling cities in USA, such knowledge is relevant because it underpins the argument that an alternative urban development strategy is beneficial in order to reduce traffic. Or in other words: such knowledge underpins the argument that future orientated urban development strategies should aim at centralisation and inner-city densification within an American context, despite the fact that a polycentric development pattern dominates in the present situation. Another explanation might be, that some kind of narrow-minded nationalistic perspective involves, that research from overseas is simply ignored.

5.4. Sum up discussion

From this chapter it could be seen, that mechanisms of power are involved in filtering relevant knowledge within the academic arena. It was detected, that old unreliable knowl-

edge was recycled in some literature reviews, and this is a type of confirm-structuring of falls consciousness. In addition, it was shown, how truth claims about the effect of the built environment were attempted de-structured by claiming, that it is advancing junk science. Besides, it was shown, how qualitative knowledge is excluded from leading positivistic-based journals, at the benefit of quantitative knowledge.

6. Political aspects - power and urban sprawl

When investigating different mechanisms of power and knowledge filtering in relation to the question about why plans and policies are conducted and passed, policies which are contrary to stat-of-the-art academic knowledge about urban structures and travel behaviour, one should be careful to claim that these are the only factors that can give an understanding of the paradox. A part of explanation might be that other conflicting objectives are regarded as more important among the policy-makers than carrying out a transport reducing land-use and transport policy. In such cases relevant knowledge about traffic and environmental impacts on sprawling urban development patterns may be part of the knowledge-base on which decisions are made, but based on a legitimate political process other conflicting objectives are decided to be more important than reducing the amount of traffic. This is not directly linked to mechanisms of knowledge filtering.

In a study about why plans are passed which increase traffic, Tennøy (2005) found some evidence to support that conflicting values and objectives may be part of the explanation, based on two questionnaire surveys in three municipalities in Norway: one among politicians and the other among planners. The results from the surveys showed that even though 51% of the respondents answered that reducing car-traffic was important or very important, this objective was ranked relatively low compared to other objectives. Besides, other objectives potentially conflicting with a compact land-use and transport reducing strategy were ranked higher. A majority of the politicians e.g. regarded conservation of green areas and peculiarly architectural characteristics to be more important than a transporting land-use policy. In relation to how important each of the two following conflicting objectives are, reduction of the car-traffic or increasing the accessibility for the cars, the analysis also showed a great difference between the left and the right wing within the political spectra. The left wing regards reduction of the car traffic as important.

Despite that compact land-use policies may be disregarded, based on a legitimate political process, where other conflicting political objectives are valued as more important, knowledge filtering through illegitimate mechanisms of power in some cases influence on which political objectives are regarded as important. This will be discussed further in section 7.1. The difference in notion between right and left wing politicians on the importance of reducing traffic, is however interesting, because it may indicate prevalence of different system of thoughts, where those attached to right wing are more likely to destructure knowledge claims about urban structures' impact on travel. This will be discussed below.

In the following different types of power and knowledge filtering within the political arena will be discussed. The analysis will deal with three different levels within the political arena: the level of planning law and practice, the ministerial level and the municipal level.

At the level of planning law and practice it will be discussed how a particularly system of though, re-structures law and practice within land-use and transportation planning at the benefit of urban sprawl and how this re-structuring creates system-biases seen from the perspective of the Compact City Model.

At the ministerial level the publication from respectively the Ministry of Environment and the Ministry of Traffic will be analysed, with the objective of investigation how the relations between urban structures and travel are framed within the two ministries. The Ministry of Environment is in charges of the planning law, whereas the Ministry of Traffic is in charges of the road law. Hence knowledge about urban structures' impact on travel is relevant for both ministries. The two ministries are however related to conflicting objectives, rationalities and disciplinary identities, which makes confirm-structuring of truth claims and the importance of urban structures' impact on travel less likely within the Ministry of Traffic.

At the municipal level two specific cases are dealt with, cases concerning actually assessments of different urban development scenarios and their traffic impacts. Here it will be shown how relevant knowledge about peripheral location and travel behaviour is not included in the work, but filtered cloaked in a Compact City rhetoric or in the blackboxing effect of transport model results.

6.1. Power and knowledge filtering within the level of planning law and practice

The analysis of power and knowledge filtering within the political arena begins with an investigating of how particular system of thought structures the institutional setting within the political administration and creates system biases, which benefit urban sprawl. I will here argue that within the national as well as municipal administrations, advanced liberal government and the system of thought attached to the neo-liberal paradigm and associated demand based planning approaches are structuring legislation and practices related to land use and transportation planning, in a manner which is likely to contribute to urban sprawl, e.g. by downplaying political objectives about reduction of the amount of car traffic and related pollutions, at the benefit of claimed cost-efficiency and economic growth. It can be argued that this is not necessarily directly linked to knowledge filtering. It can be fully legitimate for a democratic elected government to value economic growth at the expense of ecological degradation, if this is the pronounced political objective. The problematic issue becomes when the objective of economic growth becomes cloaked in rhetoric about environmental concerns, but without including relevant environmental impacts caused by the economic development.

6.1.1 Neo-liberalism and institutional constraint for implementation of the Compact City Model

In chapter 4 it was shown that much of the scepticism against the Compact City Model is levelled from the neo-classical way of reasoning, and that some of the assumptions underlining the Compact City Model are incommensurable with the system of thought attached to the neo-classical paradigm e.g. manifested in incrementalism (see section 3.2.3. and section 4.3.). It is, however, not only within the academic arena, but also within the political arena that the system of thought attached to the neo-classical/neo-liberal paradigms, are structuring meaning in a manner which makes confirm-structuring of the truth claim put forward by the compact city proponents less likely (e.g. through incrementalism). The incremental planning model had a remarkable impact on the planning system in USA already in the late 1950's, and two centuries later it also made its imprint on the Scandinavian countries (Næss 2009a). As Pucher (1990) has observed in his analysis about capitalism, socialism and urban transportation, and the socialistic countries in the former east-block had substantially different transportation systems compared to capitalistic countries like USA, marked by incrementalism. In USA and Canada the vast majority of urban travel is by car, whereas in the former Soviet Union public transport was almost completely dominating. In Western Europe policies have been somewhere between those of Eastern Europe and USA. Pucher also observers, that within cities in USA land-use controls have been relaxed, thereby allowing suburban sprawl, and housing policies have encouraged development of low-density, single family dwellings. Together, these two policies have led to such low-density and unfocused development that public transport is not a feasible mode of transportation for most American metropolitan areas.

Transportation, land-use and urban development policies have been much better coordinated in Western Europe, and have discouraged urban sprawl much more than in USA. Maybe a bit surprising that the coordination of land-use and transportation was very poorly coordinated in the former Soviet Union and East Europe. Since planning played such an important role in the regimes of the former East Block, one might have expected the opposite. To explain the observed differences between the investigated countries Puncher (1990) argues as following:

"Although some of this variation can be attributed to differences among countries in per-capita income and resource availability, much of the variation in urban transportation is due to public policy. Both directly and indirectly, governments in virtually all countries have expressed their preferences in urban transportation by differentially subsidizing and taxing various modes of transportation, and also by promoting or discouraging the types of land use and urban development that depend on and foster alternative transportation systems." (Pucher 1990, 292).

This shows how particularly political systems and their associated system of thought are more likely to de-structure the compact city model, than others. Those systems of thought prevailing on capitalistic and neo-liberal countries like USA and Canada are to a higher extent influenced by incrementalism are more likely to confirm-structure institutional setting, which benefits the car and urban sprawl and constrains coordination of a stringent and combined land-use, transportation and urban development policy. In the following the neoliberal currents' imprint on the Danish planning system and how this influence the conditions of possibilities for urban sprawl within the institutional settings will be discussed in the following .

6.1.2. Structuring of law and practice within planning of land use and location

The degree of influence of the incremental model on the planning systems within the respective Scandinavian countries has varied in the period from the early eighties up to now. In the beginning of this period the neo-liberal system of thought can be argued to be more significant in Norway than in Denmark. However, the planning system in Denmark has within the last 10-15 years been influenced by neo-liberalism to a higher extent (Næss 2009a). As it was shown in the introduction of this report, the recent urban development trends within the larger cities of Denmark are pointing towards continued urban sprawl. In the following I will argue that the system of thought attached to the neo-liberal paradigm has changed the institutional conditions of possibility within Denmark's planning system to the benefit of urban sprawl. The neo-liberal currents within the Danish planning system have made planning more oriented towards competitiveness and growth, especially after the Liberal-Conservative is in government in 2001, and has to a higher extent focused on accommodating the businesses' location preferences, rather than executing a stringent and combined land-use and transportation policy (Næss 2009a; Næss &Yao 2008).

In the following these institutional biases, seen from the perspective of the compact city model, will be elaborated. This is not only to describe the institutional constraint but also to give an understanding of the context within which particular planning documents which are analyzed below are formulated.

In 1997 the Danish Parliament passed a regulation of the planning law. It involved a provision with the objective to prevent sustained concentration of shopping-centers in the outskirts of the cities by regulating their size and location. This was done in an attempt to strengthen the city-centers and reducing the transport need. This law reform should also be seen as part of the then government's effort to promote urban renewal and regeneration at the expense of green-field development, in order to secure a robust infrastructure without needless urban sprawl (Miljø- & Energi Ministeriet 1999; Skov og Natur styrelse 1999) In the Governmental Announcement to Revision of Regional Plan 2001 from 1999, a combined land-use and transportation planning was recommended to the Counties, with a strong focus on location of actives and centralized dense development (Skov og Natur styrelse 1999).

As Næss (2009a) argues, this period's urban planning policy contained elements which discourage the neo-liberal currents within urban planning. He argues further that these initiatives to strengthen the national regulation of a combined land-use and transportation policy in order to prevent urban sprawl were meet with resistance. At the state level, the Ministry of Traffic and the Road Directorate were acting counter-productive, and at the local level a number of municipalities expressed great opposition against the national efforts to control the contents of the land-use planning.

As it will be discussed in section 6.2.1 below the Ministry of Traffic seems to frame location and land use policies as less important tools for obtaining CO_2 reductions within the transport sector.

At the municipal level the dispute was centered on the size and the location of areas the municipalities were allowed to set aside for urban development. Maskell (2001) claims that there exists a prevailing notion within the municipalities that their success only can be measured by the amount of surrounding farm land which have been impounded for urban development within a year. Jensen & Jakobsen (2001) argue that the principle within the Copenhagen Metropolitan Area of locating visitor-attractive businesses, in proximity to local commuter train station, hampers the economic development within the municipalities of Copenhagen West End. They suggest that principle of location in proximity to local commuting railway stations should be expanded to locations in proximity to public transportation in general in order to be able to compete for investments by offering attracting building sites. Jensen & Jakobsen (2001) however ignore what Hartoft-Nielsen (1997) has shown: that the amount of car travel generated by office businesses, is larger for locations with high accessibility by public bus than for location near new small local urban commuting railway stations (see section 4.1.5). Nevertheless this shows how some municipalities have economic interests which are conflicting state-of-the-art knowledge on urban structures' impact on travel. This will be elaborated in section 7.2.

The critics at the municipal level, of the national regulation of a combined land-use and transportation policy were backed by Local Government Denmark¹, which also desired less national regulation of land-use. For instance, in an article in the Danish planning Journal *Byplan*, two employees of Local Government Denmark claim that there exists rather little evidence to support that inner-city densification and mixed land use of dwellings and businesses, actually reduces regional and local need for travel (Green & Kock 2000, 154-156). In that way they ignore the vast amount of research which has been conducted on the issue, and they confirm urban structures' impact on travel.

From the above it can be seen that the neo-liberal currents and the focus on economic growth at the expense of public regulation were present before the government take over later that year. However the conditions of possibility of for knowledge filtering about urban structures' impact on travel were restricted by overriding planning regulations. Nevertheless, as it will be shown below, after the government takeover in 2001, these overriding planning regulations have been diminished by increased influence by incrementalism and have hampered the conditions of possibility for a stringent location and land use planning. Instead the conditions of possibility for knowledge filtering of urban structures' impact on travel increased.

In 2002 a bill was passed which transferred the legal competencies from the former counties to the municipalities to regulate the demarcation of land-use zones between urban and rural areas. Previously, the Regional Plans developed by the former Counties contained quotas for how much additional land the individual municipalities could set aside for urban development within the respective planning period. In addition the Regional Plans contained a considerably environmental perspective and were important policy tools for coordinating land use across the municipal borders. With the Regional Reform in 2006 the Counties were closed down and replaced by new Regions. Contrary to the former Regional Plans, the new Regional Development Plans mainly concentrate on generating economic growth and increasing competitiveness in the struggle for investments and tax payers. This decentralization of authority from the Counties to the municipalities has changed the condition of possibility in a manner which involves less coordination of land-use on a regional level than previously. These more neo-liberal institutional settings, with few

¹ Kommunernes Landsforening

overriding national or regional regulations, have encouraged increased competition for attracting investors, businesses and taxpayers between the different municipalities within the city regions. Land use planning can have an important role in the municipalities' strategy for attracting economic investments. If a municipality sets aside large outer-city areas, with high car accessibility, for urban development, this may appear as a competitive advantage in the struggle for attracting investments.

Such issues are e.g. evident in the development of business areas along bands of the motorway. A spot check made by The Danish Society for Nature Conservation shows that 12 municipalities have plan proposal in hearing, which contains plans for new business areas along the motorway, all in all equal to the size of 1.600 football grounds. The size of this area is likely to increase because 50 municipalities haven't had their plan proposal in hearing jet (Jerking 2009).

According to Næss & Yao (2008) there is not in the least in Copenhagen metropolitan area a competition for inward investments and in-migration of affluent taxpayers between a large number of suburban municipalities including two thirds of the entire metropolitan population. This way of acting is not a new phenomenon (see e.g. Jensen & Jakobsen 2001), but as Næss (2009a) argues the increased imprint by neo-liberalism has created an increased competitive mentality among municipal politicians and bureaucrats, which has contributed to more fragmented and incoherent urban structures. The above indicates that the disciplinary powers of the market associated with advanced liberal governance, where actors are disciplined to improve their competitiveness, to an increased extent is dominating as governmentality within land use planning in Denmark.

It is, however not only in the form of incrementalism, that neo-liberalism has made its imprint on the Danish planning system. In accordance to the communicative planning theory, there has been observed a shift from government to a more decentralised and adhoc based type of governance within urban planning in Denmark. There has been a tendency to increased emphasize on networking, where planners and representatives of the most influential stakeholder groups, especially from the trades and industries, thrash out agreements on different kinds of schemes (Næss 2009a). Also, this indicates a shift from bio-power to advanced liberal government as dominating governmentality (see section 2.2.6). I will argue, that such decentralisation of government to a type of governance, which does not value expert knowledge higher than layman knowledge, is problematic seen from a knowledge filtering perspective. As Owens & Cowell (2002) have observed,

that power is very likely to distort knowledge on urban structures' impact on travel (see chapter 1). A developer, who wants to construct a great outer-town shopping mall, may e.g. succeed in arguing, that this will not increase traffic demand compared to a central location. Hence it can be argued, that the conditions of possibility of knowledge filtering have been changed as a result of neo-liberalism's impact on the Danish planning system.

6.1.3. Structuring of law and practice within planning of roads

It is not only within planning of land-use that the system of thought attached to the neoliberal paradigm has changed the conditions within planning system to the benefit of sprawl. The currents of the neo-liberal system thought have perhaps been even more remarkable within the planning of infrastructure, especially the road system.

In section 2.2.6 it was argued that there has been a change in discursive framing of the debate on global warming, from sustainable development to ecological modernization, followed by a change in governmentality from bio-power to advanced liberal governance. It can be argued that within the transport sector there has also been a shift in governmentality from bio-power to advanced liberal governance. It can actually be claimed that the transport sector is the segment within society where advanced liberal governance has been confirm-structured to the greatest extent as dominating governmentality. The transport sector has thus functioned as a spearhead for the spreading of advanced liberal governance as the dominating governmentality, based on a recoding of the apparatus of bio-power. The shift in governmentality within the transport sector can be indicated by the following statement from the Ministry of Traffic:

"The organization of the transport sector has changed remarkable thorough the last 30 years. A bit simplified it can be said that there has happened a gradual transition from security of supply and stringent governmental management and regulation to an increased liberalisation and partial privatisation of the transport sector. Especially two overriding tendencies have influenced this development. First there has been a change in focus from national to a more international level. [...]. Second there has been an increased belief in competition as a means to increase effective-ness" (Trafikministeriet 2004, 13)

This increased belief in competition as a means to increase effectiveness, indicates that the disciplinary effect attached to advanced liberal governance has been confirmstructured to an increasing extent, and has influenced the very organisation of the transport system towards increased liberalisation.

Within advance liberal governance cost-benefit analysis is an important mechanism through which issues are evaluated in terms of profitability for society, and appropriated means of action are defined at the expense of political objectives and moral issues.

Within the planning of road and rail schemes there is a long tradition for applying costbenefit analysis in the assessment of public investment projects (Finanas Ministeriet 2001). As mentioned in section 3.2.3, cost-benefit analysis are founded in neo-liberal and market-based rationalities, and are based on the claim about the market as the most social optimal mechanism of resource allocation. Input data for cost-benefit analysis within the transport sector, are output data from traffic models, and is a concrete example of how advanced liberal governance recodes the apparatus of bio-power. Because transport models, as mentioned, have a tendency to systematically underestimate the amount of traffic especially in the long term (see section 3.2.3.). This involves that the time savings, which are often given a relative high value compared to environmental cost, become overestimated. When the long term effects are discounted into net-present value, this involves devaluation of long-term environmental impacts at the benefit of short-term economic profit. It can not be claimed that cost-benefit analyses systematically benefit road construction, at the expense of environmental and social concerns, e.g. in rural areas with a small amount of traffic and no latent demand, cost-benefit analyses may show that road construction does not pay. It can, however, be argued that cost-benefit analyses systematically benefit road construction in situations where there is a latent demand (Nielsen & Fosgerau 2005; Jespersen 2008). As it is most often within urban areas, that there exists a latent demand for transportation, it can be argued that cost-benefit analyses have a tendency to benefit road construction in urban areas cloaked in the name of social economic optimum.

This is a system bias associated with cost-benefit analyses seen from an anti sprawl perspective view, because new road-construction may lower the travelling cost and open up new low-density outward development, and hence contributes to urban sprawl.

Another manner in which the use of cost-benefit analysis can be argued to be associated with system bias seen from a Compact City perspective is, that these are only applied to assess the benefits and costs of getting from A to B, but are of no use to assess the benefits and costs of where to locate in A and B. In addition the location of A and B are not assumed to be influenced by changes in the transportations' system (the fixed matrix issue). Benefits associated with a densification and centralization strategy are not conducted within the present institutional settings. Or in other words, the benefits from reducing the need for travel are not valued, only the assumed benefits from lowering the travel time.

The widespread use of cost-benefit analyses within the transport sector goes well with the 'predict and provide' rationality which can be argued to prevail within the Ministry of Traffic, but according to Sørensen (2001) the increased market-oriented perspective, which has emerged within the Ministry of Traffic, is a result of unequal power relations between the Ministry of Traffic and the Ministry of Finance. Despite that 'predict and provide' go well with the use of cost-benefit analysis and may represent an institutional barrier for reduction of car traffic, the reason why the Ministry of Finance started to focus on social-economic optimising of infrastructure projects in the 1970's was a doubt about the reasonableness in continuing the dramatic increase in road-constructing, which had occurred in the 1960's and the early 70's, and which made urban sprawl possible (Sørensen 2001, 74).

The more economic growth oriented perspective, which has emerged in resent times, and how it forms a coalition with the 'predict and provide' based rationalities, is also evident in the Infrastructure Commission which claims that growth in traffic is strongly correlated with economic growth. A high quality infrastructure with high accessibility is regarded as important elements in the global competition for investments. In the report large capacity extensions of the motorway are recommended, based on doubtful traffic forecasts and transport model calculations (Infrastruktur Kommission 2008). These demand based planning tools reifies the dominating story line within the Infrastructure Commission, concerning facilitating the forecasted traffic demand, than with restricting the forecasted traffic demand. Land use planning is e.g. given very little attention in the report.

6.1.4. Sum up discussion

From the above it can be argued that the turn in governmentality from bio-power towards advanced liberal governance, which Oels (2005) observed within the climate debate, is also evident within land use and transportation planning. This e.g. manifested in decentralisation of authority to regulate land use zones, increased tendencies of governance and by increased use of cost-benefit analyses within the transport sector. The increased influ-

ence by advanced liberal governance, and the disciplinary forces of the market have involved that planning to an increased extent concerns with increase of competiveness and facilitating economic growth. It can be argued, that facilitating sprawl through spatial planning is actively being used as part of this growth strategy.

Neo-liberalisms' imprint on the Danish planning system can be argued to have changed the conditions of possibility on the benefit of urban sprawl. This is not the same as claiming that this is equal to filtering of knowledge about urban structures' impact on travel. However, it can be argued that the neo-liberal imprint has changed the conditions of possibility for knowledge filtering about urban structures' impact on travel. The previous overriding land use regulations, with quotas for how much land the municipalities could set aside for urban development functioned as an institutional constraint for urban sprawl. In other words it was an institutional practice which was made a non-decision issue within the municipalities. Furthermore with increased tendencies towards governance, developers and other powerful stakeholders can to an increased extent distort or exclude knowledge in the planning process

In addition it can be argued that despite the use of cost-benefit analysis originally was based on the objective of restricting the massive road construction in the 1960's and 1970's, the increased influence of neo-liberalism has in many cases squared well with the prevailing disciplinary notions among road-engineers about the benefit of the 'predict and provide' paradigm. With the impact of neo-liberalism, the institutional constraint on these disciplinary preferences has been transformed, making it more likely that attention to relevant knowledge about urban structures' impact is downplayed, or at worst filtered.

6.2. Power and Knowledge filtering at the ministerial level

Above it was shown that both within land use and transportation planning the neo-liberal system of thought have changes the institutional conditions of possibility at the benefit of urban sprawl. In the following a more detail investigation will be presented of how urban structures' impacts on travel are framed within the Ministry of Traffic and the Ministry of Environment respectively.

According to Sørensen (2001) an objective regarding optimising the traffic flow by improving the accessibility has been prevailing within the Ministry of Traffic and Road Directorate since it was established (Sørensen 2001, 67-74). Within the Ministry of environment the objective is sustainable development. These two objectives are incommensurable to the extent the objective about improving accessibility demands expansions of infrastructure with negative impacts on the nature, landscape and environment. Sørensen (2001) argues further that the collaboration between the two ministries has been marked by conflicts based on these divergent objectives and negative us-them constructions of the counterpart.

The different system of thoughts and disciplinary identities prevailing within the Ministry of Traffic and the Ministry of Environment can be indicated by the difference, within the two ministries, in framing of the importance of the implementing policies based on the Compact City Model, in order to reduce the transport related CO_2 emissions.

6.2.1. Framing of land use planning within the Ministry of Traffic

Technical rationalities associated with 'predict and provide' have a strong foundation within the Ministry of traffic, and this can also be argued to be an institutional obstacle for implementation and institutionalisation of the Compact City Model. As it will be discussed in the following there is a tendency towards framing urban structures impact on travel as less important. This does not involve that land-use and location policies isn't mentioned as influencing on the travel demand within the Ministry of Traffic, but the attention given to these issues are remarkably less than within the Ministry of Environment. Instead there is a tendency among the investigated publications from the Ministry of Traffic towards a framing of initiatives aiming at CO_2 reductions within the transport sector mainly within economic and technical perspectives.

To illustrate this, the following will present a discussion about how land-use and location policies are framed in two publications from the Ministry of Transport regarding strategies and initiatives for reduction of transport related CO_2 emissions. These two publications are: Restriction of the transport sector's CO_2 emissions – Possibilities and means, from 2000 and Traffic Account 2004

'Restriction of the transport sector's CO₂ emissions – Possibilities and means'

The Ministry of Traffic published a discussion paper in the beginning of 1999 about CO_2 reductions in the transport sector. This paper included, amongst others, location and land use planning as possible means (Trafikministeriet 1999). The publication of this paper was followed by a conference which showed that it was widely agreed that the present development trends within the transport sector were unsustainable. In 2000 the Ministry of Traffic published the report 'Restriction of the transport sector's CO_2 emissions – Pos-

sibilities and means', which consists of a compilation of different possibilities and means and their associated cost. Besides, the report evaluates which of the presented initiatives are most appropriate to take in action. This report can be seen as an indication regarding the extent to which Ministry of Traffic frames location and land-use planning as a less important policy tool, compared to technological and economic regulations in order to obtain CO_2 reductions within the transport sector.

Before the report 'Restriction of the transport sector's CO₂ emissions – Possibilities and means' was published, the Ministry of Finance recommended, based on the objective of socio-economic optimising, that the intermediate aim regarding stabilising the CO₂ emissions from the transport sector at the level of 1988 in 2005 should be dropped. This was e.g., advocated by the Ministry of Finance in its environmental assessment of the budget for 1999 (Trafikministeriet 2000, 29; Sørensen 2001). According to Sørensen (2001) the opposition within the Ministry of Finance towards the intermediate aim of CO₂ reductions in the transport sector was a logical consequence of the focus on socio-economic optimising within this ministry. This is because within this perspective sector goals are not optimal. Instead it was argued that the reductions should be done in those sectors of society where it is most cost-effective. The Ministry of Finance argued further, that because of the already high tax on CO_2 within the transport sector, reductions should be obtained in other sectors, where it is more cost-effective. Calculations from the Ministry of Finance showed that in order to fulfil the intermediated aim, the tax on gasoline should be raised to 10 DKR from 6 DKR. It is argued, that this would be equal to an extra cost of 750 DKR per month for an average family. As it is argued in the report, that this is not problematic for the wealthiest part of the population, but it is a high expense for less fortuned. It is, however, not discussed that the tax on gasoline could be income dependent. As argued in section 4.2.4 this would increase the effect of gasoline tax on travel behaviour, because it is likely to reduce travelling distance also among the wealthiest part of the population. This is important because it is this group, which travel the longest distances on average.

According to Sørensen (2001) the Ministry of Finance dominates the interplay between the two ministries, and the Ministry of Traffic goes along with the Ministry of Finance's initiative to abandon the intermediate aim. This argumentation is, e.g., adopted in the above mentioned report from the Ministry of Traffic 'Restriction of the transport sector's CO_2 emissions – possibilities and means'. This report is interesting in relation to knowledge filtering of urban structures' impact on travel, not because these effects are attempted de-constructed as false or excluded from the report, but because location and land use planning as a tool for obtaining reduction of transport related CO_2 emissions is filtered in the final recommendations, based on somehow self-contradicting arguments.

The fact that the Ministry of Traffic goes along with the Ministry of Finance's proposal to abandon the intermediate aim is expressed a couple of times in the report. In a section of the report concerning re-evaluation of the intermediated aim it is argued more in detail about why it is appropriate to abandon of the intermediated aim. As will be discussed below, the argumentation put forward by the Ministry of Traffic in this section is interesting in relation to knowledge filtering of urban structures' impact on travel because they are self-contradicting in relation to the arguments for excluding location and land use planning from the final recommendations.

It is argued that already taken initiatives regarding improvements of the energy-efficiency in automobiles will not have any effect until the period 2008-2012, and hence the intermediated aim for 2005 should be abandoned. It is argued that this is because it is more relevant to see the objectives about CO_2 reductions within the transport sector in a more long-term perspective, where the benefits of technological improvements can be utilized (Trafikministeriet 2000, 30).

The report investigates four different main strategies concerning CO_2 reduction within the transport sector. These four strategies are: traffic with less energy consumption, more and better energy-efficient transport options, energy consumption with less CO_2 emissions and reduction of the increase in traffic demand.

Despite that knowledge about technical and economic regulations are give most attention in the report, urban structures' impact on travel is discussed in the chapter about restriction of the travel demand, together with substitution of physical transport for transportation of information and restriction of the growth in traffic through economic means. It is stated in the report that:

"Land use together with physical and spatial location of transport-generating activities - businesses, dwellings and public service institutions – impacts on the amount of travel. At the same time, amongst others, the transport system's organization and design influences on where in the physical space people chose to locate their activities" (Trafikministeriet 2000, 95).

This expresses recognition of the dialectic relationships between land use and transport systems. In this section of the report it is also stated that appropriate location of trafficgenerating activities reduces the need for transport. In addition, two investigations on urban structures impact on travel behaviour are referred to, conducted by the research institute Forest and Landscape as part of the research program 'Sustainable urban structure, land use and transportation' (see e.g. Hartoft-Nielsen (2001) for a more detailed description of the studies). One of these investigations focuses on the Copenhagen metropolitan area and another on the Århus metropolitan area. Both studies show that inner-city residents travel on average shorter distances and conduct a lower share of their transport by car, compared to those who reside in the periphery. Despite that the effect of a national urban densification and centralisation strategy on transport-related CO₂ emissions are not quantified, the report refers to results of some calculations carried out by the Ministry of Environment and Energy. It is argued that this is a long-term strategy, because of the long life span of the existing building stock and because the annual growth in the building stock is small compared to the existing urban fabric. It is recommended that the spatial planning in the counties and municipalities aims at bringing the growth in urban area to a halt, (by regeneration of brown-fields and densification) and that new construction of offices and service businesses in the larger cities should take place in those areas which are best served by public transportation (Trafikministeriet 2000, 95-97). These recommendations seems to square well with the state-of-the-art knowledge about urban structures' impact on travel.

Despite the fact that location and land use factors are given attention and their effect on transport related CO_2 emissions are recognised, they are excluded from the final recommendations in the report. It is stated in the final chapter that:

"It has been chosen to exclude these initiatives which are considered not to have quantifiable impacts on the foreseeable future, together with the initiatives which are assessed not to be relevant to implement at the present moment" (Trafikministeriet 2000, 107).

Based on this statement it must be assumed that location and land use planning are excluded from the recommended policy tools because the effects on CO_2 reductions obtained from such planning tools have a rather long-term perspective. Instead, six other initiatives are selected based on the analysis of their cost-effectiveness. The recommended initiatives in the report consist of improvements of energy efficiency in automobiles, improvements of energy efficiency in other modes of transportation, observance of speed limits and more energy efficient use of vehicles, more and better energy efficient transport options, environmental management of freight traffic and electric cars. These initiatives are assumed to reduce the CO_2 emissions by 6-8 % in total in 2010. The improvements of energy efficiency in automobiles are assessed to reduce the CO_2 reduction with 2-4 %, whereas electric cars are assessed to reduce the CO_2 emissions by only $\frac{1}{2}$ % in 2010.

It is interesting that most of the advocated initiatives are concerning technological improvements, which increase the efficiency in some form or another. None of the recommendations are concerned with reducing the demand for transportation. It is also interesting that land use planning is excluded based on the time perspective. This is paradoxical, because at the same time it is argued in the report that the intermediate aim should be abandoned, since the impact on transport-related CO₂ emissions of already taken initiatives regarding improvements of energy efficiency in automobiles, has a rather long-term perspective. Despite the fact that an urban densification and centralisation strategy has a longer time perspective than ten years, it seems to be ignored, that if no initiatives are taken to halt urban sprawl and stop inappropriate location seen from an energy conserving perspective, these development trends will continue and increase the demand for transport further, and hence be counter-productive in relation to the obtained CO₂ reductions form improvements in energy efficiency. As mentioned in section 4.2.4., improvements in engine efficiency, involve a lowering of the travel costs, which may generate more energy demand, if no initiatives are taken to restrict the transportation demand as well. The development has actually pointed at more vehicles, with more engine capacity, higher levels of performance, and longer trips.

From the above it can be seen that despite the Ministry of Traffic confirm-structures' truth claims on urban structures' impact on travel in the publication discussed above, the ministry has a tendency to frame location and land use planning, as a less important tool

for obtaining CO_2 reductions, compared to technological and economic regulation. The arguments put forward by the ministry for giving a lower priority to location and land use planning is that the effects on CO_2 emissions are difficult to quantify and have a rather long-term perspective.

Despite that location and land use factors are recognized as influencing travel behaviour in the report Traffic Account 2004 from the Ministry of Traffic, it will be shown in the following, that planning of these as relevant tools for obtaining CO_2 reductions, is not given appreciable attention in the report. Instead the report represents an increased interest on liberalisation of the transport sector and reducing congestion in order to generate economic growth.

Traffic Account 2004

Whereas the publication discussed above is most focus on initiatives to reduce the transport related CO₂ emissions and their cost-effectiveness, Traffic Account 2004 represents a turn towards increased liberalism with increased attention on the quality of infrastructures' influence on the economic competitiveness of the society. Despite that the issue about CO₂ reductions in the transport sector isn't entirely excluded form the report, it is not given as much attention as in the report presented above. It seems that the argument, first put forward by the Ministry of Finance and later adopted by the Ministry of Traffic, that CO₂ reductions should be done in those sectors of society, where it is most costeffective, has been used to legitimize a decreased attention towards CO₂ reductions in the transport sector. Based on the argument on cost-effectiveness it is e.g. claimed that the CO₂ problems within the transport sector should not be ignored, but one should be careful of selecting initiatives for obtaining these reductions (Trafikministeriet 2004, 9). Instead, the focus is increased on transportations' role in society in relation to generate economic growth together with liberalisation of the transport sector (Trafikministeriet 2004, 11-14). Perhaps as a natural consequence of the increased attention around transport and economic growth, congestion is framed as an economic inefficiency (Trafikministeriet 2004, 7). In general there is not given much attention to location and land use planning as an appropriated means of action in the report. The report does, however, acknowledge that location and land-use factors impact remarkably on the amount of traffic. In a section of the report concerning diving forces behind the growth in traffic location, patterns are discussed together with economic growth, demographic variables and changes in patterns of production and trade. In this section it is stated:

"Location of dwellings businesses and service functions has a great impact on the amount of travel, which the development up to now also illustrates. The constantly improved transportation opportunities have underpinned a continued utility of advantage of specialising and economies of scale. With that an increased centralisation of both private and public service functions has occurred" (Trafikministeriet 2004, 38).

It is further argued that this centralisation of service functions in the larger cities together with location of shopping centres in the outskirts of the cities increases the demand for transport and the car dependency (Trafikministeriet 2004, 38-39). This is in line with the state-of-the-art knowledge within the field.

It is not only in relation to driving forces behind the growth in traffic that location and land use factors are mentioned as influential. In a chapter concerning accessibility and mobility, location and land use factors are also mentioned as influential. It is stated:

"The development within the accessibility is marked by the development within location patterns of businesses, dwellings and education institutions. The general location policy – as the spatial planning set up the frames for – is of course also important" (Trafikministeriet 2004, 45)

The report introduced statistical data on the relationship between city size and travel behavior, showing that in average people, who reside in small cities and urban areas, travel longer distances and conduct more of this transport by car, than those who reside in the larger cities, especially Copenhagen (Trafikministeriet 2004, 45). Unlike the report 'Restriction of the transport sector's CO_2 emissions – Possibilities and means' presented above, this report does not refer to any studies on the relationship between urban structures' impact on travel behavior, only city size. It is a bit surprising that despite the development within location and land use patterns is assumed to increase, the demand for transportation in the future, and spatial planning recognized as a frame for this development, the report does not give more attention to how spatial planning can be used to design urban structures in a less transport demanding manner. It is however stated that: "A location policy which promotes settlement in the larger cities rather than in rural areas will, all other things being equal, contribute to reducing the amount of transportation," (Trafikministeriet 2004, 46).

However the report does not mention if this centralisation policy should occur as urban sprawl or as part of an urban centralisation and densification strategy. As several studies have shown that though the travel distance by car is lower at an aggregated level in the larger cities, people residing in the catchment areas surrounding the larger cities are those with the longest travelling distances (se section 4.1.1.). It is neither discussed if these observed differences in travel behaviour could be explained by other factors, such as density. As it was discussed in section 4.1.2 city size is not in itself a good indicator of transport related energy consumption.

It is not only in the chapter concerning accessibility and mobility, that location and land use planning aren't mentioned, it is neither mentioned as an option in the evaluation of various policy tools in the chapter concerning congestion problems nor in the chapter about transport related environmental problems.

In the chapter concerning strategies for reduction of congestion problems, three strategies are suggested. These are road construction and capacity extension, better utilization of existing roads and reduction of the transport demand. In this chapter the Ministry of Traffic's 'predict and provide' rationality becomes evident. It is e.g. stated that construction of new roads and capacity extensions of existing roads are an expensive but usually also efficient solution to congestion problems (Trafikministeriet 2004, 64). And the effects of induced and generated traffic are not discussed in relation to capacity extensions as a tool for coping with congestion problems (Trafikministeriet 2004, 64-67). Road construction is expensive and if the extra capacity releases a latent demand, the assumed time benefits are often levelled out in the long term. Road expansion is hence not a beneficial in relation to obtaining CO_2 reductions (see section 3.2.3.).

Further more location and land use planning aren't mentioned in the chapter concerning traffic related environmental impacts including emission of greenhouse gasses. In a section concerning CO_2 reductions through limitation of traffic, it is stated:

"The growth in motorized transportation is connected with development in prosperity and location patterns, together with specialization of the employment and housing market. It

is hence related with positive welfare effects, which the individual values high and set up the limits for how much it can be expected to be obtained through influence on the demand for motorised transportation" (Trafikministeriet 2004, 82).

This statement seems problematic, because despite the fact that the development within location patterns is acknowledged to increase growth in traffic, it is hinted that only to some extend these development trends can be reversed. It is of course correct that present land-use and location patterns involve a high degree of car dependence, but the quotation seems to indicate that peoples' preferences will make it impossible or at least difficult to obtain changes in the demand for transportation.

This indicates a rather deterministic view on social development, and ignores that e.g. Oslo Metropolitan Area, as mentioned in the Chapter 1, has actively used spatial planning as a mean to control urban sprawl, and reduced the growth in traffic compared to other regions of the country.

Sum up discussion

From the presentation of the two publications from the ministry of traffic it can be seen, that urban structures are confirm-structured as having an impact on the travel demand and behaviour. However, location and land use policies are framed as less important or not mentioned at all. In the report from 2000 empirical studies on the urban structures' impact on travel were referred. These studies focused on the difference in travel behaviour resulting from the location of dwellings and workplaces. Despite attempts to quantify these effects to some extend, location and land use planning were still filtered, because these measures couldn't be quantified to an aggregated national level, and because the effect has a rather long-term perspective. This is despite the fact that in the report it is argued that the intermediated aim for CO_2 reduction should be abandoned, because a reduction strategy should be seen within a long time frame.

The report from 2004 represents an increased focus towards: congestion solving, the transport sector's role in generating economic growth and increased liberalisation within the transport sector. This report presents statistic relations between city size and travel behaviour, but does not discuss how different variables of urban structures influence on travel behaviour such as density and locations. This is interesting in relation to the problem formulation, because at that time, there existed several studies which showed that city size is an imprecise and week indicator compared to residential and workplace location

relative to the city centre. Despite the fact that location and land use factors are confirmstructured as influencing travel, no spatial planning strategies to reduce the transport demand are mentioned. Instead it is assumed that development with urban structures, in the future, to a higher extent will increase traffic demand. Besides, it is hinted that people's preferences will set up narrow limits for the feasibility of restricting development trends within location and land use, which generates an increased demand for transport.

6.2.2. The Ministry of Environment and framing of the Compact City Model

This section will contain a discussion regarding how location and land use planning are framed within the Ministry of Environment. Above it was shown that land use and location planning was framed as less important compared to economic and technological rationalities. Within the Ministry of Environment spatial planning is framed as important in order to obtain a more sustainable development. It can, however, be argued that there has been a shift within the Ministry in the manner the Compact City strategy is framed. The publications from the late 1990's are concerned with inner city densification, whereas a recent discussion paper published by the Ministry of Environment, frames the Compact City Model more as densification in the suburbs.

As it was discussed in the in section 6.1.2 the Ministry of Environment gave rather much attention to land use planning in the end of the 1990's, with emphasis on preventing sustained concentration of shopping-centers in the outskirts of the cities, and on strengthening the city-centers by promoting urban renewal and regeneration at the expense of green-field development. This was in order to secure a robust infrastructure without needless urban sprawl (Miljø- & Energi Ministeriet 1999; Skov og Natur Styrelse 1999).

With a new initiative concerning urban policies, the Ministry of Environment brought up cites of the future for discussion in 2008. In that context there was published a discussion paper with the aim of setting focus on planning of modern sustainable cities. This discussion paper is interesting in relation to knowledge filtering about urban structures' impact on travel because relevant knowledge of the likely impacts on the advocated densifications and decentralisation of workplaces to the suburbs is not included.

The modern sustainable city

The discussion paper 'the modern sustainable city' concerns urban development in relation to four subjects: dense, green, blue and healthy. Urban density is hence one of the four main subjects of the discussion paper, and is given a high priority. The report queries the desirability of current urban development trends from a perspective of energy conservation. Instead it advocates urban densification. It is written:

"Our way of constructing cities is developing in the same manner as in USA, where the cities' energy use is far greater than in the dense European cities. We must return to the denser cities and so create shorter distances between the functions of the city. Bicycle and public transportation become alternatives to the car. [...]. For that reason we must think in greater density, no matter how large or small a city or part of a town is" (Miljøministeriet 2008, 5-6).

Even though it is stated that densification is important in every urban context in the introduction, the section about densification is only concerned with densification in the suburbs. It is stated in the report:

"The suburbs are the youngest type of built-up urban area in Denmark. [...]. On the other hand the suburbs have within this short period become the most common type of residence in Denmark. [...]. It is here a large part of the development takes place. Because of that it is also here a great part of the solution to the modern sustainable city must occur" (Miljøministeriet 2008, 17).

It is argued that the suburbs are unsustainable, because of the great energy consumption in single family houses, and because those who reside there, usually have long travelling distance for reaching daily activities, which increases car dependency. In order to make suburbs more sustainable, densification and better service with public transportation are advocated (Miljøministeriet 2008, 19). More specifically it is stated about the densification strategy:

"There are several ways whereupon densification of the future suburbs can occur. Construct more dwellings per ha. Mix dwellings with businesses, when new suburbs are planned. Open the opportunities for greater density and mixing of dwellings, non-polluting businesses and retails, when industries re-locate from the many industrial parks, which exist in the suburbs. Then more people will have such short distance to work or the supermarket, that the bicycle becomes a qualified alternative to the car" (Miljøministeriet 2008, 19). From this it can be seen that the Ministry of Environment call into existence an urban planning paradigm from the 1970's regarding locating workplaces in the suburbs based on the rationale that it is here people live, and it will hence reduce the commuting distance. The Ministry of Environment, however, seems to ignore the criticisms of this paradigm. As mentioned in section 4.1.1, Owens (1992) argues that decentralisation of workplaces may reduce commuting distances in society marked by a low mobility level. However in a society marked by a high mobility level decentralisation of workplaces is very likely to increase the cross traffic between the suburbs instead of reducing the commuting distance, because people choose jobs based on other rationales than only distance minimizing.

Though the provision of public transport is suggested improved in the suburbs, the lines of the public transportation usually go towards the city centre. In commuting from suburb to suburb public transport may still appear as a less attractive alternative than the car.

Some facilities are, of course, reasonable to locate decentralised such as kindergartens, public schools, grocer's shops and post office. But as it was mentioned in section 4.1.4 two empirical investigations on peoples' rationales for choosing location of facilities, found that for most travel purposes, people emphasize the possibility to choose among facilities rather than proximity to those. This involves that although some facilities are being decentralized to the suburbs, those residing there will properly still choose many facilities located in or close to the city-centre. Because of that, decentralization of work-places to suburbs is likely to increase traveling distances, compared to centralisation in the inner city. If there is no option for inner-city densification, densification in the suburbs is of course more beneficial from an energy reducing perspective, than low density green-field development in the periphery.

Based on the above it can be argued, that densification and decentralization of facilities to the suburbs in the way, that it is advocated in the discussion paper, are very likely to increase traveling distances by increasing the distance to the city centre and by generating cross-traffic among the suburbs, unless radical measures are taken to restrict the mobility level. The discussion paper does, however, not mention any initiatives to restrict the mobility level as e.g. economic regulations. Instead it is prejudiced, that densification of the suburbs and from that following improved foundation for service with public transportation, is, in itself, sufficient to radically impact the modal split and to solve the problems of sustainability in relation to the suburbs of the future.

It can be argued that the way, the advocated densification strategy, is articulated is problematic seen from an energy conserving perspective, because such strategy is likely to increase the amount of traffic rather than reducing traffic, which is the articulated objective. As it will be discussed in section 6.3.1, the same issue is evident in the proposal for the Municipal Master Land-use Plan 2009 for Århus. This plan does however advocate leapfrogged green-field development, and does not contain an actually urban densification strategy.

It is very interesting that the focus within the Ministry of Environment on urban densification has been re-framed from the inner-cities to the suburbs, without articulating the likely negative impacts on the amount of transport. From this document study it is not possible to conclude what the reasons are for this shift, and which mechanisms of knowledge filtering have actually been in work.

If one might speculate about possible reasons for this shift in focus, it could perhaps be that within the Ministry of Environment it has become a mantra, that density reduces traveling distances and improves the conditions of public transportation. If this mantra has over time been disciplined into tacit knowledge, within the Ministry of Environment, it might be the natural suggested solution to the challenges of the suburbs in order to become more sustainable in the future, without reflecting on whether or not this strategy will actually lead to the desired results.

6.2.3. Sum up discussion

As it was shown above, the Ministry of Traffic has confirm-structured truth claims about urban structures' impact on travel, but has framed location and land use planning as a less important policy-tool, compared to technological and economic regulations, for obtaining reductions of transport related CO_2 emissions. Within the Ministry of Environment location and land use policies are framed as important in relation to obtaining these reductions. There has, however, been a shift in focus within the Ministry of Environment, from highlighting inner-city densification and regeneration, towards densification and decentralisation of dwellings, service and workplaces to the suburbs. Despite that density in most recent investigated publication from the Ministry of Environment is still in the centre of focus in order to obtain more energy sustainable cities, important traffic impacts on a decentralised densification strategy are not included.

Based on the above document analysis it is not possible to conclude about the actual reasons behind the difference in framing of urban structures' impact on travel within the two ministries. In order to do that, qualitative research into the different rationalities prevailing within the two ministries is necessary, together with information about the power struggles contained in the process leading up to the publication. I will, however, suggest some speculations about possible reasons. These speculations will be based on Sørensen's (2001) analysis regarding institutional barriers and potentials related to integration of environmental concerns in the traffic policies within the relevant ministries. As mentioned above, the collaboration between the two ministries has been marked by conflict. According to Sørensen (2001) this is caused by three circumstances: different objectives, efforts to secure own field of responsibility, and negative us-them relations.

The traditional objectives within the two ministries are conflicting. Within the Ministry of Traffic, the traditional objective is strongly related to a 'predict and provide' paradigm manifested by the road act, whereas the traditional objective within the Ministry of Environment is sustainable development manifested by the planning act. Increased road construction in urban areas benefits urban sprawl, whereas the planning legislation aims at restricting sprawl. On the other hand implementation of a stringent location and land use policy may involve physical restrictions on the accessibility of the car traffic, which is counter productive judged against the traditional objective of Ministry of Traffic. This is likely to increase the negative us-them relations. Another reason might be that among the staff, different disciplinary identities prevails within the two ministries, which further contributes to negative images. This will be elaborated in section 7.1.

The struggle between the two ministries about securing their own field of responsibility, which involves some kind of territorial behaviour, may also be part of the explanation, why the Ministry of Traffic frames location and land-use policies as less important, despite the fact that it has confirm-structured urban structures as influential on the travel demand. Location and land use planning are regulated by the planning act. If the Ministry of Traffic framed spatial planning as important in relation to obtaining CO_2 reductions within the transport sector, it would lose control with the policy making process, and the Ministry of Environment would then be at the head of the table. Based on that, it can be argued that it is possible that the Ministry of Traffic frames spatial planning as less im-

portant, because it regards itself as the best to take care of problems related to traffic, and hence struggles to secure its own field of responsibility.

That the Ministry of Environment wants to obtain a kind of territorial control with their own field of responsibility is likewise a possible explanation, why only spatial planning is dealt with, and economic and technological regulations aren't mentioned in the resent discussion paper 'the modern sustainable city' from the Agency of City and Landscape.

6.3. Power and knowledge filtering at the municipal level

At the municipal level two cases concerning actual assessment of different urban development scenarios and their impact on travel, will be analyzed, in relation to power and knowledge filtering. These two cases are the proposal for Århus Municipality Master Land use plan 2009 and Aalborg Municipality's revision of the traffic- and environmental action plan from 1998. In both cases relevant knowledge about urban structures' impacts on travel is filtered, but through different mechanisms.

6.3.1. Proposal for Århus Municipal's Master Land-use Plan 2009 – framing of density and travel behaviour

In the following, it will be argued that the proposal for the Municipal Master Land-use Plan 2009 for Århus Municipality and the Environmental assessment of it, articulates, cloaked in a Compact City rhetoric, an advocated urban development strategy containing extensive leapfrog development as beneficial in relation energy conservation within the transport sector, compared to development in the outskirts. The two alternatives are, however, based on different presumptions, which systematically benefit the leapfrog scenario compared to the outskirt scenario. Furthermore important traffic impacts of decentralisation of workplace and retail to the leapfrog urban development areas are not included in the assessment. In addition it is interesting to note that no development alternative involving massive central and inner-city densification has been included in assessment of the master land use plan proposal.

In section 6.1 it was argued, that increased imprint by neo-liberalism on the institutional settings within the planning system with fewer overriding national or regional regulations, has encouraged increased competition for attracting investors, businesses and taxpayers between the different municipalities within the city regions. If a municipality sets aside large areas in the outskirts, in order to please businesses with preferences e.g. high car

accessibility, it might be a competitive advantage in the struggle for economic growth. The proposal for the Municipal Master Land-use Plan 2009 for Århus should bee seen in this context. It is e.g. stated:

"The City Council regards it as decisive for a continued positive development in the region and part of the country, that Århus brings the development of national and international competitiveness into full focus and speed" (Århus Kommune 2008, 6).

The Municipal Master Land-use Plan 2009 aims at strengthening Århus' position as the main city of West Denmark, and takes its point of departure in an urban development strategy, which is supposed to ensure that Århus is capable of facilitating the future growth while maintaining its character as a well functioned and attractive city (Århus Kommune 2008, 5). The above mentioned growth orientated perspective is also evident in the spatial planning strategy, expressed in the environmental assessment report, where it is stated:

"Planning under the concept 'West Denmark's main city' aims at securing the conditions of life in Århus Municipality, where it is central that Århus can generate growth and prosperity, secure education and opportunities. [...]. However, the content has mostly character of intention, which does not in itself represent any concrete initiative or action, which will have direct consequences. These exist in other subjects of the planning, subjects, that deal with concrete guidelines and directions, which are supposed to implement the intentions, as e.g. the urban development strategy. This opens up for knowledge based business in the city centre by urban regeneration of central areas, and by setting aside business areas with good accessibility for the traffic in the outskirts of the municipality..." (Århus Kommune & COWI 2008, 8).

From this it can be seen that being willing to fulfil businesses' location preferences, also for peripheral locations, is part of the growth orientated strategy. This is also evident in the Master Land Use Proposal where it is stated:

"There should ... always be room on green fields for establishing of firms within industry, store, trade, service etc. like there should always be room for new types of test-centres and development departments" (Århus Kommune 2008, 9).

It is not only location factors that are regarded as central in the growth strategy. Infrastructure is also articulated as important. It is e.g. claimed that the City Council regards it as decisive for the competitiveness of Århus and the whole growth area surrounding it, that the infrastructure is upgraded and renewed (Århus Kommune 2008, 16).

At the same time Århus aims at becoming sustainable by obtaining the status as CO_2 neutral within 2030. It is argued, that in order to reach the objective of becoming sustainable, a compact urban development strategy is important, because such development strategy lowers the energy consumption in houses, reduces travelling distances, improves the conditions for public transportation, and saves land (Århus Kommune 2008, 12-13).

The two objectives of economic growth and sustainability can be claimed to be conflicting in the manner, they are articulated in the report. This is because a sustainable urban densification strategy, with the aim of reducing the amount of traffic and save land, is incommensurable with setting aside extensive green-field areas in order to accommodate businesses' location preferences for sites with good accessibility for car traffic in the outskirts of the city.

The urban development strategy in the proposal for the Municipal Master Land Use Plan is based on the assumptions, that Århus will grow with around 50.000 extra workplaces, 10.000 - 15.000 new student places and 50.000 new dwellings, corresponding to about 75.000 extra inhabitants until 2030. According to the report this is only a moderate increase in growth rate compared to the last 10 - 15 years (Århus Kommune 2008, 5). The urban development can take place in two ways; by urban regeneration and through urban expansion on green-fields. In order to accommodate the expected urban growth, two different urban development alternatives are assessed; the so called main-alternative and the 0-alternative. For both alternatives urban regeneration of centrally located brown-fields has first priority. It is assessed, that urban regeneration can contain about 15-20.000 dwellings and 35.000 workplaces, which is equal to about 35 % of the dwellings, and 70 % of the workplaces. In addition those areas set aside in the municipal plan 2001 are contained in both scenarios.

The difference between the Main-alternative and the 0-aternative is, that they are based on two different principles for urban expansion. The 0-alternative focuses on organic and successive urban growth in continuation of the existing city, whereas the Main-alternative is based on leapfrogged development with new, and more self-sufficient cities and larger urban areas (Århus Kommune & COWI 2008, 10-11). The differences and similarities between the two different scenarios can be seen below at figure 4.



Figure 4. Illustration of the Main-alternative and the 0-alternative. The hatched areas are not included in the 0-alternative, and the black areas are not included in the main alternative (from Århus Konnue 2008).

An estimation of the size of the areas set aside for urban expansions shows that the Mainalternative contains about 400 ha more than the 0-alternative. The 0-alternative is, however, expected large enough to accommodate the expected growth for the next 12 years, where the plan is in force. It is assumed in the report, that the difference in size between the two alternatives doesn't impact on the rate of development, and the main-alternative hence has a longer term perspective (Århus Kommune & COWI 2008, 13). As it is stated in the environmental assessment, the planned expansion of the urban area is relatively large compared to the existing urban area of Århus Municipality, which in 2006 covered about 16.500 ha. In the main-alternative about 3.400 ha for urban expansions are planned, from that 1.400 ha contains of remnant spatiality of areas planned in somewhat greater detail than the rest of the land set aside for urban development. In addition 1.000 ha, are put aside for new towns and urban expansion, and another 1.000 ha, are sat aside as areas of perspective. All in all this is equal to an increase of the urban area by about 20 %. It is though expected, that the development of this is expected to spread over a longer period than the plans time frame of 12 years (Århus Kommune & COWI 2008, 16).

Another difference between the two alternatives is the assumed density. The Mainalternative is assumed to be more densely developed than the 0-alternative. It is claimed that it is easier to realize a dense development strategy in new towns and larger urban development areas, because here you can built denser in the centres, whereas urban expansion in continuation of existing cities to a large extent will be developed in areas already marked by an open – low character. Based on architectural rationalities it is argued, that because coherence of a built up area's character is usually desirable, development in these areas will also be marked low density (Århus Kommune & COWI 2008, 14).

In addition it is claimed, that development in new larger areas can be arranged more appropriately in relation to the areas' functions and design, because the new towns are thought developed with a centre containing a mix of functions (schools, shopping opportunities and workplaces), and hence increases the opportunities for local self-sufficiency. Contrary to that it is argued, that because the 0-alternatives involve expansion of areas already marked by mono-functional use, urban expansions in continuation of these areas are assumed also to be of a mono-functional character, and the existing functions are not always planned with a view on later expansions (Århus Kommune & COWI 2008, 14).

Despite the fact that it is assumed that the main-alternative is the most dense of the two alternatives, it is not specified how much denser the main-alternative is. It is argued that several factors influence on how dense the actual development is going to be. Here the promotion of dense development through active spatial planning by Århus Municipality is mentioned, but also factors which Municipality of Århus doesn't influence are mentioned, such as the housing market, housing preferences, economic conditions etc. (Århus Kommune & COWI 2008, 14).

Although it is recognized, that the pre-assumptions about higher density are associated with uncertainty, this pre-definition is in many ways decisive for the assessment of the two alternatives in relation to traffic, accessibility and consumption of land. It is e.g. argued, that despite the Main-alternative sets aside larger areas, it will still occupy less land compared to the 0-alternative, if the two alternatives' capacity was made equal. This is because of the difference of the assumed density in the two scenarios (Århus Kommune & COWI 2008, 16).

In relation to the two alternatives' impact on traffic, it is recognized that the distance to the city centre has a great influence on the amount of travel, because a high amount of the trips have their destination there (this squares well with the state-of-the-art knowledge about the effect of the built environment on travel). It is also recognised, that the leap-frog development in the main-alternative will increase the overall travelling distance to the city centre by about 1/8, compared to the 0-alternative (Århus Kommune & COWI 2008, 40). However the longer overall travelling distance to the city centre in the main-alternated by two means: partial local self-sufficiency in the new towns, and transfer of traffic from the car to alternative modes of transportation (Århus Kommune & COWI 2008, 40).

In order to obtain a high degree of self-sufficiency in the leapfrogged urban development areas as it was described above, the main-alternative aims at decentralisation of dwellings, workplaces, retails, services, etc. It is argued that this will reduce the commuting distances and the length of shopping trips, because people residing in the new towns will choose local functions to a high degree. It is also argued that the reduced travelling distances to local functions will promote walking and biking (Århus Kommune & COWI 2008, 41). In addition it is assumed, that the establishment of a new light railway with stations in the planned new suburban settlements, with relatively high density in the centre, will influence the modal split, which to some extent will compensate for increased energy use related to the longer travelling distances to the city centre in the main-alternative (Århus Kommune & COWI 2008, 41).

The environmental assessment states, that it is difficult to come up with an unambiguous conclusion about which alternative is the most beneficial seen from a traffic perspective, and much depends on how great an influence on the modal split the establishment of the light railway will have, e.g. to which extent Århus Municipality succeeds with its objective about dense development in the new suburban towns. It is, however, estimated that

despite the longer distances to the city centre of Århus, the Main-alternative will to a higher extent than the 0-alternative reduce the amount of travel by car traffic, and will increase the amount of travel carried out by public transportation and non-motorized modes of travel (Århus Kommune & COWI 2008, 41). The Main-alternative is hence estimated to lower the transport related CO₂ emissions, compared to the 0-alternative.

In the following it will be argued, that this estimation is likely to be wrong. Despite that it is recognized, that the above estimation is associated with uncertainty, important traffic impacts of the Main-alternative are not included in the assessment of the two alternatives. Similar to the Ministry of Environment, it seems, that Århus Municipality calls into existence an urban planning paradigm from the 1970's regarding locating workplaces in the suburbs based on the rationale that most people live in the suburbs, and locating jobs to these areas will reduce the commuting distances (see section 4.1.5). The amount of cross-traffic, which the new suburbs are likely to generate in a highly mobile society, is not critically discussed in this case.

As presented in section 4.1.5. Hartoft-Nielsen (1997) shows, that location of offices in proximity to local commuting railway stations reduces the amount of car commuting compared to offices location in proximity to nodal points of the public bus system. This study underpins the environmental assessment's claim about greater potential related to the main-alternative for transferring car traffic to public transportation. However, as it will be discussed below, an alternative containing massive central and inner-city densification will properly, to a high extent, improve the condition for a light-rail system, rather than the main-alternative.

Despite the fact, that it is recognized, that the success of the light railway depends on many factors, it is not discussed that the location of the suggested new suburban towns in the Main-alternative are close to the main roads of the overall road-network. This location involves, however, that it is doubtful whether the new light railway can compete with the car in a manner, which has such a great impact on the modal split that it compensates for the longer travelling distances, unless other means are implemented to restrict the level of mobility.

It can also be argued against the pre-assumption about higher density in the Mainalternative, which determines the assessment of the two alternatives in relation to traffic impacts and consumption of land at the benefit of the Main-alternative. If the assumed
density was equal to the two alternatives, the 0-alternative would have appeared as the most beneficial. The architectural argument about the desirability of homogeneity in the building character of an area could be compromised, if the Municipality was serious about the objective of obtaining CO_2 neutrality.

The large capacity of the main-alternative also indicates ignorance about the fact, that it is likely that new centrally located areas will become available for urban regeneration within the year 2030. This is the year the capacity of the main-alternative is expected to be filled up. However Oslo Municipality has shown that by only setting aside small areas for development in the master plans, these limited possibilities for urban expansion have increased the motivation of developers for embarking on brown-field regeneration schemes (Næss & Yao 2008). Despite the Municipality of Århus actively can use the planning legislation to promote a dense development within the new leapfrogged urban development areas, setting aside such large areas with great supply of outer-city location as in the main-alternative, may involve, as Hartoft-Nielsen (2002) argues, that it becomes difficult to promote inner-city regeneration.

In addition, as stated in the environmental assessment, the actual density of the development areas is also influenced by factors, which the Municipality cannot control, such as e.g. economic conditions. If the leapfrogged urban development areas do not obtain high enough density level to underpin high quality service of public transportation, this will increase car dependence further.

Based on the above it can be argued, that the Main-alternative advocates urban sprawl through decentralization of dwellings and workplaces to new suburbs. Instead of reducing CO_2 emissions, which is one of the two main objectives of the plan, the Main alternative is very likely to increase travel related CO_2 emission by increasing the distance to the city centre, and by generating cross-traffic among the suburbs.

As mentioned above the urban development strategy is based on two partially conflicting political objectives, regarding economic growth by accommodating outer-city location preferences of residences and businesses, and sustainable development through urban densification and centralization. Despite that the Main-alternative is articulated as a combination of the growth and densification strategy, with emphasis on densification strategy, it can be claimed that Main-alternative to a high extent represents the objective of economic growth cloaked in a Compact City rhetoric.

It is also interesting that no alternative involving massive inner-city densification has been developed, although such development has high priority in the master land use plan proposal. One can question, whether the proposed inner-city densification strategy common for the 0- and the main-alternative, really is based on a massive densification. As mentioned, it is assessed that urban regeneration can contain about 15-20.000 dwellings and 35.000 workplaces, which is equal to about 35 % of the dwellings and 70 % of the workplaces.

In collaboration with some students at DTU Hartoft-Nielsen (1999) has worked out an alternative to the proposal for Århus Municipal master land use plan from 1999. In sum the alternative proposal focuses on the establishment of a modern tram system, something alike the light railway system combined with an objective regarding economize on inclusion of green-fields for urban development. This is suggested realised through a massive densification strategy. In accordance with proposal for Århus Municipal master land use plan from 1999, DTU's alternatively assumes, that until 2030 Århus will grow with 40.000 inhabitants, 30.000 workplaces and 30.000 dwellings. In the DTU alternative plan, this growth is contained in the proposal, including only 262 ha green-fields for urban development. In comparison Århus Municipality's proposal contained 2.500-3.000 ha new areas for urban development. DTU's alternative plan can be argued to be too optimistic, when it is claimed that the proposed strategy can reduce the amount of car travel within Århus Municipality with 53 % compared to the Municipality's proposal. Anyhow, DTU's alternative plan shows, that a much more massive inner-city densification strategy is realistic, than the one articulated in the proposal for Århus Municipality's master land use plan 2009. It can be argued, that it is problematic that such alternative is not included in the environmental assessment, because it is such a strategy, which is likely to reduce transport related CO₂ emissions the most, compared to the two assessed alternatives.

Even though it seems that advocacy for urban sprawl is cloaked in a compact city rhetoric, it can be argued, that it is positive, that a transport model hasn't been applied to assess the traffic impacts of the two development scenarios, because this reduces the blackboxing effect. Although the pre-assumptions made in the assessment of the two alternatives systematically benefit the main-alternative, these assumptions are presented in an open manner in the environmental assessment, which makes a critique possible.

6.3.2. The third Limfjord Crossing - transport models and knowledge filtering

In the following it will be discussed how a transport model has been applied in Aalborg Municipality's revision of the traffic- and environmental action plan from 1998 to analyse the feasibility of reducing the demand for a third road crossing over the Limfjord in the Aalborg area through land-use planning, and improvements of the public transport system. The model results have been used to legitimise the exclusion of these planning tools from the further planning process, which continues to focus on different alternatives for road capacity expansions in the Limfjord section.

The case of the Limfjord Crossing has a rather long history, which dates back to the beginning of the nineteen seventies (Nordjyllands Amt *et al.* 2006, 7 & 167). During this period different alternative road crossings have been investigated in several publications. The Road Directorate, which previously had resigned from the project, entered again in the so called phase 2, which in 1996 ended up with land reservations for four different alternatives.

In the following debate earlier investigations were criticized for not working in a sufficiently great detail with urban structures and the future urban development in relation to the future need for expansion of the road system, and for not including alternative initiatives to reduce the amount of car traffic e.g. a local railway. Based on that there was in 1997 established a planning panel. This resulted in that Aalborg City Council in 1998 decided to revise the traffic- and environmental action plan for the municipality. The work with the revision of the traffic- and environmental action plan included, besides a general revision of the plan, investigations about the traffic impacts of different urban development alternatives and improvements of the public transportation system. This reassessment is, as mentioned above, based on the results of transport model calculations.

The transport model calculation about expected reduction in car traffic through improvements in the public transportation system showed that such improvements could not postpone the construction of a third Limford crossing. The model calculation showed that confiscation of the Limfjord Bridge's road capacity for bus lanes only would reduce the amount of cars crossing the Limfjord with 0,5 %. Most of the car traffic would seek towards the Limfjord Tunnel instead.

In the investigations concerning the feasibility of reducing the demand for a third Limfjord crossing by reducing the need for travel through spatial planning, three different urban development alternatives were included.

- 1. Business as usual, continuation of the development as it is planned in the Master Land Use Plan.
- 2. Sprawling city, which includes a decentralized urban development.
- 3. Concentration of urban development along local railway stations.

It is expected for all scenarios that the amount of dwellings will increase with 10 % in 2015 compared to level of 1997. It was assumed that the traffic would grow by 2% annually within the same period (Aalborg Kommune *et al.* 1998, 15). The distribution of new dwellings within the three alternatives can be seen in table 4.

Urban development	Alternative 1 (in %)	Alternative 2 (in %)	Alternative 3 (in %)
South of Aalborg	13	13	17
Aalborg	61	57	50
Nørre Sundby	15	15	15
North of Nørre Sundby	11	15	18
Total	100	100	100

Table 4. Distribution in % of residents on different parts of Aalborg. (from Aalborg Kommune et al. 1998,)

The conclusion was that both the sprawling scenario and the alternative involving development along the local train lines only had a marginal effect on the traffic situation compared to the business as usually alternative. The reason, stated in the report, is that a radical change in patterns of settlement and choice of workplace doesn't occur in the relative short planning period investigated (Aalborg Kommune *et al.* 1998, 53). Based on the model result it is concluded in the report that neither improvements of the public transportations system nor spatial planning can reduce the need for a third Limfjord road-crossing.

This conclusion and the foundation it is stated upon, is however linked with several problems, which not all are discussed in the assessment.

The model is old and very simple. It is stated it the report that the model does not contain a module to calculate the modal shift between public transportation and car traffic, but two separated modules. Because of that additional investigations in order to calculate changes in the modal split have been conducted, at TU-data, but didn't give satisfactorily results. Because of that manual corrections of the model results have been made, which cause some uncertainty about the credibility (Aalborg Kommune *et al.* 1998, 13).

The different investigated urban development scenarios are besides defined in a strange and suspicious manner. In the alternative involving urban development along local railway stations, a higher share of dwellings is placed north of the Limfjord as it can be seen from table 4. Taking this into account it is not surprising that the alternative doesn't show any difference worth mentioning in the fjord crossing traffic, compared to the sprawling city alternative.

It is also a bit strangely that no alternative involving inner-city densification has been included in the assessment. Seen in the light of the theoretical and empirical studies discussed in section 4.1.4 and section 4.2.1 the distance to the city centre is one of the most important urban structure variables in relation to travel behaviour. As discussed in chapter 1, there exists such large centrally located brown-fields which could be regenerated for urban development, that the expected urban development within Aalborg in the period from 2002-2014 could be contained 2 $\frac{1}{2}$ times (Hartoft-Nielsen 2002). It would hence not be unrealistic with an alternative containing the entirely expected growth in dwellings and workplaces in the city centre, apart from polluting and heavy traffic generating businesses.

The result showing that reduction of road capacity on the Limfjord Bridge only has marginal effect on the amount of car traffic crossing the Limfjord, indicating that the transport model doesn't include the effect of induced traffic. It is unlikely that people will accept to be stock in tailbacks on a daily basis. In such situation people would likely choose another destination or mean of transportation or in the long term changes location of residence.

Taking the above into account together with the general bias' attached to such transport models, (e.g. their poor property of reflecting means which reduces traffic appropriated, see Appendix), the exclusion of the integrated transport and land-use scenario can be claimed to be based on invalid assumptions.

One could also question why the transport model is applied in the investigations when the results anyhow have to be corrected manually. The assessment could just as well have

been based on qualitative estimations, based on theoretical arguments. Such qualitative estimation can of course also obscure the-state-of-the-art knowledge about urban structures' impact on travel, as it was shown in the above section. However such qualitative assessments often reduce the black-boxing effect, and are less expensive to carry out.

However the results from the transport model have be used to reify the dominate storyline about increased road capacity, in crossing of the Limford, is needed to avoid a future traffic situation with unacceptable congestion and emission levels. The model results can be used to argue that it is 'scientifically' proven that a third road crossing is the only rational solution to the forecasted traffic problems. Based on the model calculations critical knowledge claims about exclusion of alternative means to solve forecasted congestion problems can be disregarded or de-structured.

6.3.3. Sum up discussion

From the above it can be seen that relevant knowledge also is filtered at the municipal level. In the case of the proposal for Århus Municipality's master land use plan, it appeared that an economic growth strategy involving extensive leapfrogged urban expansion was the pre-preferred alternative, but this was cloaked in a compact city rhetoric. Besides, a massive densification scenario was not included in the assessment.

In the case of the Third Limfjord Crossing it was shown, how a transport model was used to reify the already dominating storyline regarding the need for road expansion in order to avoid great congestion levels causing massive emission. However, the model was based on invalid assumptions, and it involved filtering of state-of- the-art knowledge of urban structures on travel.

7. Discussion

From the two previous chapters it can be seen that within the academic and political arenas multiple forms of power are involved in filtering relevant knowledge about urban structures' impact on travel. In this chapter I want to discuss the observed mechanisms within the two arenas, in relation to each other as well as in relation to the research question in general. This discussion will mainly be focused on *how* and *why* relevant knowledge about urban structures is filtered, distorted or framed as less important in the cases investigated in this report.

7.1. Knowledge filtering within the two arenas' influence on one another

In chapter 6 it was discussed, that part of the explanation to the fact, that plans and policies, contrary to the-state-of-art knowledge about urban structures' impact on travel, are conducted and passed, is that other conflicting policy objectives are regarded as more important. Knowledge filtering within the academic arena may, however, influence on what is regarded as important objectives within the political arena.

Within the academic arena, filtering of state-of-the-art knowledge at the benefit of unreliable knowledge, which shows, that urban structures have a week or no effect on travel, may create the impression that the scientific community is deeply divided on the question, whether urban structures matter. The notion of doubt has been reinforced by the attempt to de-reify and hence de-structure knowledge claims related to the compact city model. This is done by claiming, that the compact city theories are advancing junk science. (e.g. Bruegman 2005; Skjeggedal et al. 2003). As it was discussed in chapter 2, the existence of doubt about the truth of a knowledge claim, in a non alarming situation, may help to dissipate the will to action among political leaders and to sustain status-quo. This strategy is pioneered by the tobacco industry, and has also been applied to fighting the battle against climate change regulatory policy. In all probability the strategy has been applied deliberately in these two cases. Below, I will elaborate, if this also might be so within cases dealt with in this project. However, the use of the tactic within the climate debate may also influence on how important policy makers regard a compact city strategy. This is because one of the major claimed benefits of the compact city model is that it decreases energy consumption for transport, and hence reduces emissions of greenhouse gasses.

In previous chapters, it was discussed how disciplinary practices within the education system, involve that meta-theoretical assumptions might become part of professionals' tacit knowledge and disciplinary identity. Some of these meta-theoretical assumptions are associated with reductionism, and are incommensurable with underlining assumptions of the compact city model. The disciplinary training of students within the academic arena is, of course, relevant to the political arena, because it is here the officials are usually educated. If students within relevant disciplines for urban planning are disciplined to disregard urban structures' impact on travel or frame such relations as less important, this is

of course likely to involve that these students will also de-structure such knowledge claims, when becoming staff of the political administration.

When an organisation like the Ministry of Traffic or the Ministry of Environment hires new staff, it will properly, consciously or unconsciously, choose people with values and perspectives, which square well with the values held by the organisation. Likewise, if a planner is going to apply for a job within national political administration, a planner who regards herself or himself as environmental orientated, it is likely that he/she will apply to the Ministry of Environment. A planner, who regards road construction as an important task within society, will likely apply to the Ministry of Traffic. In other words, both employer and employee self-select to some extent.

This involves that the prevailing professional objectives, notions, value and cultures are likely to be reproduced within the two ministries. This is problematic not only in relation to filtering of knowledge about urban structures' impact on travel and its practical implications of in terms of possibility to influence on the amount of motorized traffic in cities through land use planning. It is also problematic in relation to obtaining sustainable development in general. As it was seen, it was not only within the Ministry of Traffic relevant knowledge about means to reduce the energy consumption for transport was filtered. The discussion paper 'the modern sustainable city' published within the Ministry of Environment did not include any suggestion to reduce traffic through technical or economic regulations. It seems that relevant knowledge about policy issues, which demands intersector planning, is filtered within the line-ministries. This is a serious institutional barrier for obtaining sustainable development. It can be argued that these negative us-them constructions, which Sørensen (2001) observed to dominate the relationship between the two ministries, are important to break down, in order to avoid the territorial behaviour in relations to the respective fields of responsibility. This leads to reductionism and knowledge filtering.

7.2. Why is relevant knowledge filtered?

In the following, I will elaborate on, why knowledge about urban structures' impact on travel is filtered. In that respect, I will mainly focus on the issue weather the filtering of knowledge about urban structures' impact on travel is conscious or unconscious? It will be argued, that answer probably includes a combination of conscious interests and more unconscious cognitive held beliefs.

It is obviously in the interest of some actors that knowledge about urban structures is filtered. At the municipal level, both developers and municipalities can have financial interests in filtering relevant knowledge on traffic's impact on urban sprawl. As discussed, the fact, that some municipalities actively use spatial planning as a means of attracting investments and setting aside large areas in the outskirts with high car accessibility, may be regarded as a competitive advantage. Likewise, businesses which attract a lot of people like offices, workplaces or large shopping centres, which prefer an outer-town location with high visibility and accessibility may also have an interest. The neo-liberal system of thought's restructuring of the Danish planning system has, as mentioned, involved a decentralisation of decision making and authority to regulate land use zones to the municipalities. This has been combined with increased focus on infrastructure as a means of competition. Hence the conditions of possibility have been widened for filtering of knowledge about urban sprawl, based on financial interests. However, financial interest may also involve, that knowledge about urban structures' impact on travel is confirmstructured as very important. Of course municipalities and developers can also have financial interest in building very densely in the city centre. If a municipality wants to sell central located building sites, e.g. harbour areas, it can sell to a higher price, if it allows high density. Likewise, developers can make a larger profit, if they are allowed to build up very dens areas. This shows that financial interests can work in the direction of both inner-city deification and urban sprawl. That such opposite forces are actually in work can be indicated in the resent development within the Copenhagen Metropolitan Area. The density has increased within the inner city municipalities of Copenhagen and Fredriksberg, while it has decreased in the outer part of the metropolitan area (conversation with Næss 2009). This indicates, that knowledge about urban structures' impact on travel is more likely confirm-structured by actors, who benefit from such development.

A city like Aalborg has also worked out local planes for regeneration of large central located brow-fields. Regeneration of an old goods yard located right next to the main busand train station is e.g. based on arguments concerning its unique location in relation the main nodal point of public transportation system. Nevertheless, at the same time the Municipality advocates great expansions of the road and parking capacity at the outer-town relief centre 'City Syd' in order to accommodate preferences from IKEA, which wants to establish itself in the area.

This shows, how personal interests and power are likely to influence on what type of knowledge is confirm-structured. Because the conditions of possibility have been ex-

tended in the planning process for powerful stakeholders to distort knowledge about urban structures' impact on travel, it is at the same time likely, that relevant knowledge is filtered because such knowledge is regarded as inconvenient based on personal interests.

In the following, it will be argued that neo-liberalism is likely to form a discoursecoalition with other disciplinary identities, which benefit urban sprawl. Despite this, these disciplines are not necessarily linked to economic rationalities. It can be argued, that neoliberalism has changed the conditions of possibility of knowledge filtering, based on cognitive held beliefs as well.

The decentralisation of authority for land use demarcation and increased focus on road construction as a result of neo-liberalism, has nevertheless, not only increased the condition of possibility of framing urban development within an economic growth perspective. It has also become possible to advocate urban sprawl based on other disciplinary held beliefs or preferences. Within segments of the architectural tradition, new towns are e.g. regarded as an ideal for urban development. Such ideals are not constrained by the institutional setting in the same manner as before the decentralisation of authority for land use demarcation. Also the conditions of possibility for fulfilling disciplinary preferences related to 'predict and provide' orientated road engineers, have increased. Neo-liberalisms' impact on the conditions of possibility within the Danish planning system involves that urban sprawl to a higher extent can be framed and legitimised by highlighting esthetic arguments or arguments concerning optimising the traffic flow. At the same time this may involve that knowledge on urban structures' impact on travel is put in the background or filtered. This shows how cognitive held believes also can be related to knowledge filtering. It can be argued, that there might be formed a discourse coalition between these disciplinary traditions, based on a story-line about the beneficial of urban sprawl.

At the ministerial level it was shown, how different objectives, values and cultures prevailing within the respective ministries, influence on how urban structures' impact on travel is framed and how import land use planning is regarded as a means to obtain CO_2 reductions within the transport sector. This also, shows that knowledge filtering is probably caused in the interplay between interest, values and discursive held beliefs.

Within the ministry of traffic it appeared, that the traditional objective about securing accessibility, prevalence of technical and economic rationalities combined with a kind of

territorial control with their own field of responsibility, involves that land use planning is framed as less important policy tool.

The above mentioned mechanisms of knowledge filtering related to interest and cognitive held beliefs are of course not a democratic problem per definition. If it is a pronounced political objective to facilitate urban sprawl at the benefit of transport related environmental impacts. In such case framing of sprawl as beneficial based on economic or architectural arguments, or arguments concerning optimizing the traffic flow, it is not problematic from a democratic point of view. However, this is usually not the case. Environmental concerns are often articulated as important in policy documents. The democratic problems occur, when urban sprawl strategies are advocated based on financial or ideological reasons. But advocacy is cloaked in arguments of environmental impacts on the urban sprawl strategy. As it was discussed, this can be argued to be the case in the proposal for Århus master land use plan 2009. It is also problematic, when the Ministry of Traffic filters relevant knowledge, about how land use planning can actively be used to obtain reductions of CO_2 emissions within the transport sector, when the objectives decided by the government are to reduce such emissions.

Within the academic arena the answer to the question, whether filtering of relevant knowledge is conscious or unconscious, is probably also a combination of the two aspects. Different disciplines and faculties often struggle about the same funds set aside on the budget for research, and have hence an interest in emphasising own research at the expense of others.

Skjeggedal *et al.* (2003) articulate dissolution of urban structures' impact on travel as a result of increased mobility. This might reflect some cognitive understanding, that is incommensurable with the compact city model. The result of their own study fits to this notion about decreased impact of urban structures on travel. They, however, reference other studies, which are based on much more credible research methods, and still find a significant effect, but they do not discuss the findings of such studies (e.g. Næss & Jensen 2000). This shows that they must be aware, that they excluded such inconvenient knowledge claims. It is probably a rather general characteristic of human kind, that knowledge claims, which do not fit into one's interpretation horizon, are more likely to be ignored than those which match.

Bruegman (2005) is, however, so one-sided and speculative in his attempt to de-reify knowledge claims related to the compact city theories, that he must be fully aware, that knowledge, which does not fit into his de-structuring narrative, is excluded. There is no doubt, that Bruegman's personal values are pro-sprawl and pro-car. It is likely, that his personal beliefs to himself justify the means, he applies to advocate these values, which he regards as being under attact, lead by the followers of the compact city model.

8. Conclusion

In this chapter I want to sum up the findings and, and I want to answer the problem formulation, which was:

Which mechanisms of power are involved in the filtering of relevant knowledge regarding urban structures' impact on travel and its practical implication in terms of possibility to influence the amount of motorized traffic in cities through land use planning?

The findings of this report are as follows:

Within the academic arena it was shown, how meta-theoretical assumptions functioned as systems of thought, making de-structuring likely of knowledge claims incommensurable with these underlining assumptions. Within the classical sociological and economic traditions there has been a tendency to deny the physical spatiality's influence on social action, based on such meta-theoretical assumptions. Within the education system students of such disciplines are disciplined to confirm-structure these meta-theoretical assumptions, and they may become part of professional tacit knowledge in time. There are, however, limits to the effect of disciplinary powers within the education system. In addition, it was shown, that meta-theoretical assumptions associated with particular segments within the sociological and economic traditions, square well with those underling more resent conceptions, about how urban structures impact on travel. This of course shows that such disciplinary praxis on should be regarded in any deterministic manner. Anyhow, that meta-theoretical assumptions embedded particularly in the economic and neo-liberal traditions, are actually likely to involve, that attempts of structuring knowledge claims about urban structures' impact on travel, are met with de-structuration. This can be seen from the fact that most of the criticism levelled against the compact city model is levelled within the economic tradition. In addition, the demand based transport models related to the 'predict and provide' paradigm is often founded in economic theory. Results from such models have been used to argue against the claimed reduction of car traffic related to the compact city model. This is despite their poor capacity reflects influence on travel as a result of changes in land use and the transportation system. Such demand based transport models are likely to involve filtering of relevant knowledge within both arenas, but the black-boxing effect is probably more likely to reify the results within the political than the academic arena.

It was also shown, how positions within theory of science involved, that relevant knowledge was filtered from leading academic journals. Qualitative knowledge about urban structures was e.g. excluded at the benefit of quantitative knowledge.

Another mechanism of knowledge filtering within the academic arena is the recycle of old invalid knowledge. Confirm-structuring to invalid knowledge in literature reviews can be argued to be equal to diffusion of false consciousness.

It was also shown, how knowledge claims related to the compact city model is attempted de-reified by assessing the knowledge claim by such high criteria of scientific reliability, that the knowledge claims can be labelled junk science. These high standards for scientific reliability were, however, only applied selectively. It was, however, shown that many critical knowledge claims on the compact city model were based on studies, that have focused on other aspects of the built environment and travel outcome measures, than those, which from a theoretical point of view, could be expected to have the strongest influence on energy consumption for transport. It can hence be argued, that the attempts at de-reifying knowledge claims on urban structures' impact on travel, in the investigated cases, involved filtering of relevant knowledge.

Within the political arena political systems act as a type of system of thought, which structures meaning in a particular manner. The system of thought attached to neo-liberalism has re-structured the institutional settings within land use and transportation planning, at the benefit of urban sprawl. This decentralisation of authority to demarcate land use zones between rural and urban areas from the former Counties to the municipalities is not necessarily directly related to knowledge filtering, but may represent a shift in political preferences with increased emphasise on competition at the expense of coordination. However, the conditions of the possibility of knowledge filtering of urban structures' impact on travel have been changed as a result of increased impact from neo-liberalism and advanced liberal governance as dominating governmentality. With increased tenden-

cies to networking and governance powerful stakeholders may, to a higher extent, be able to distort relevant knowledge about urban structures' impact on travel. The municipalities may also set aside very large peripheral areas for development without including knowledge, which shows that this is counterproductive to objectives about CO₂ reductions within the transport sector. Despite the impact of neo-liberalism on the Danish planning system is not necessarily directly linked to knowledge filtering of urban structures' impact on travel, this perspective may be involved in such process, where relevant knowledge is obscured or filtered. In situations, where a latent demand exist for travel within urban areas, the recoding by cost-benefit analysis of results from transport models, which do not take the effect of induced and generated traffic into account, involves that road construction systematically is benefited, at the expense of environmental and social concerns. Results from cost-benefit analysis can be used to reify road construction as the most social optimal solution, cloaked in the name of scientific objectivity and social economic optimum. In such situations the neo-liberal system of thought is directly linked to filtering of urban structures' impact on travel. This is because increased road capacity causing reductions of travel time in the short term, facilitates low density outward urban expansion, which increases travel demand in the long term. The decentralisation of authority to demarcate land use zones, may involve, that, to a higher extent, outward expansion of cites takes place as a result of increased road expansion and increased willingness to consider businesses' location preferences for outer-town sites with high car accessibility.

At the ministerial level it was shown, that, despite knowledge claims about location and land use patters were confirm-structured as having an impact on travel, there are great differences in how important planning of these factors are regarded. In the late 1990's within the Ministry of Environment there was a strong focus on inner-city urban renewal and restriction of outer-town shopping centres. Despite densification still has a high priority within the Ministry of Environment, there has been observed a resent shift in focus from the inner-city towards the suburbs. It is advocated, that jobs are decentralised, but it is not discussed, that this might generate extra traffic.

Within the Ministry of transport land use planning was confirm-structured as having an impact on travel demand, but it was filtered as an appropriated means of action for obtaining CO_2 reductions. It is, however, mentioned that concentration of the population in larger urban areas is beneficial seen from a transport reducing perspective, but without dis-

cussing, if this concentration should take place as centralised or peripheral development. Besides, it is not taken into account that state-of-the-art knowledge within land use and transportation shows, that city size is an imprecise indicator for travel behaviour. The Ministry of Traffic also presents a rather deterministic view on social development, indicating that location and land use planning are doomed to failure because of peoples' preferences for outer-city living.

At the municipal level it was seen, how relevant knowledge about urban structures' impact on travel has been excluded from the assessment of traffic impacts related to different urban development scenarios. In both cases the urban development alternatives included in the assessment, were premised upon unequal assumptions, apparently favouring pre-preferred solutions. In the case of the proposal for Århus master land use plan 2009 it appears, that an economic growth strategy, manifested in massive expansion of the urban area, is the pre-preferred alternative, but this is cloaked in a 'compact city' rhetoric. However, relevant traffic impacts of decentralization of workplaces to new suburbs are not discussed. Besides, one can question, why a massive inner-city densification strategy is not included as one of the evaluated alternatives, when high density is claimed to have a high priority in the proposal.

In the case of the Third Limfjord Crossing, results from transport model calculation were used to de-reify knowledge claims on land use planning and improvement of the public transportation as a realistic alternative to constructing a third road crossing of the Limfjord. Instead, the model results reified the dominating storyline if increased road capacity is necessary in the crossing of the Limfjord, if not a scenario involving massive tailbacks and high levels of CO_2 emissions are going to be reality in the year 2015. The model is, however, very simple and out of date. Taking this into account together with the suspiciously draw up of the assessed alternatives, the exclusion of land use planning and improvements of the transport system as realistic alternatives are based on unreliable foundation and involves filtering of relevant knowledge.

All in all, this project shows, that power and knowledge filtering are relevant in order to get an understanding of, why plans and policies are conducted and passed which are contrary to the state-of-the-art knowledge within the field of land use and transportation. However, this project has focused selectively on power and knowledge filtering of urban structures' impact on travel. The cases, which have been dealt with, all involve filtering of knowledge. This one-sided focus on knowledge filtering does not give a realistic picture of the current situation. In many cases relevant knowledge is properly part of the decision base, and in some cases decisions and plans are passed, which are in accordance with the state-of-the-art knowledge about urban structures' impact on travel. Such an example is e.g. Finger plan 2008 for the Copenhagen Metropolitan Area (Landsplanafdelingen 2008).

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Appendix

The appendix deals with the issue of how the possible link between urban structures and travel has been investigated

Validity and reliability of different methodological approaches

To investigate the potential relation between urban structures and travel is a complicated issue and can not be grasped through one single method or academic discipline, but calls for a multitude of methods and an interdisciplinary research approach. Table 5 shows different methods of analysis, urban form and land-use measures, travel outcome measures, preconditions and other distinctions, which have been applied to investigate the link between urban structures and travel.

Methods of analysis	Urban form and land-	Travel outcome measures	Contextual precondi-
1	use measures		tions and other distinc-
			tions and issues
Theoretical Studies	Strategic level	Travel outcome-measures	Contextual precondi-
• Logical and		• Travel time	tions
theoretical con-	Local level	• Travel frequency	• Different con-
siderations		Travel distance	ceptions of sus-
• Model simula-	Neighborhood level	• Modal split	tainable urban

tions	 Travial related 	davalonment
uons	• Travel related	development
	energy con-	• Context spe-
Quantitative	sumption	cific knowl-
empirical studies		edge
Descriptive	Type of travel	Aggregated vs. disag-
• Multi-variable	Productive trips	gregated data
• Time-series	Reproductive	
	trips	
Qualitative empirical	Caretaking trips	
studies		
Mix of different methods		

Table 5. Different methodological approaches which have been applied to investigate the effect of the built environment on travel behaviour.

As the table shows, different studies on the potential link between urban structures and travel have in fact been approaching different aspects of the potential link and by diverse methods. But this doesn't mean, that all of the approaches applied are equally valid, when investigating the potential link, and it doesn't mean neither, that the diverse aspects, that have been investigated, always have been approached multi-disciplinary. As it has been hinted through this report, there exists an academic dispute regarding urban structures' impact on travel. A reason for this dispute is associated with the fact, that different studies have investigated different aspects of the potential relation of urban structures and travel and applied different approaches and measures. The result of a study is, of course, highly dependent on *how* the study is conducted, *what* has been studied including the study scale, and besides, the *context* the study object is part of. The following presentation is supposed to give an understanding regarding, why different studies reach different conclusions by discussing the validity and reliability of different methods and measures shown in table 5.

Contextual preconditions

The first contextual precondition, which will be discussed here, is that different studies can of course reach different results, because the cities investigated are different. From a theoretical point of view it is reasonable to assume, that the importance of location relative to the urban centre differs, dependent on whether the investigated city is mono- or poly-centric. Traditionally, the European cities are marked by a high concentration of facilities downtown, whereas American cities traditionally are more poly-centric. This contextual precondition can explain some of the difference in the American and European debate on urban structures' impact on travel with focus on the neighbourhood and strategic level respectively. Such difference in contextual preconditions does, however, not involve, that distance to the city centre can not be expected to influence on travel behaviour, but the effect might be reduced.

Studies on urban form and sustainability can also reach different conclusions, dependent on whether the focus is on local or global traffic-related environmental impacts as e.g. noise pollution and particle emissions vs. emissions of greenhouse gases (Holden 2007, 145). Studies can also reach different conclusions dependent on, whether the focus is solely on traffic related environmental impacts, or if other environmental factors are included as well, such as green areas and biological diversity within the city, e.g. in combination with the utility of local alternative energy sources (Høyer 2002, 167).

Different aspects of sustainable development are associated with different urban designs. Sustainable development is a very normative and broadly defined concept. This means, that it involves a lot of different aspects, and it is opening up for different interpretations of the concept. Hence it opens up for conflicts about, which aspects of sustainable development are most important. Advocates of the dispersed city as a superior sustainable urban-form are often arguing from a perspective of integrating the city in the local environments circulations, with focus on local self-sufficiency and waste and water management related to the discourse on eco-villages (Høyer 2002, 167). On the other hand advocators of the compact city are mainly arguing from an energy and green-field conservation perspective (Holden 2007, 143; Høyer 2002, 167-168).

These two different conceptions of sustainable development have been detected to be present in Denmark and Norway respectively by Næss & Yao (2008), who in a comparative study of the metropolitan areas of Hongzhau, Copenhagen and Oslo, are stating, that the Norwegian professional and political discourse on urban sustainability has evolved around the issue of avoiding urban sprawl, based on a green-field and travel-related energy conservation perspective. This is related to the compact city theory. In Denmark on the other hand, the discourse on sustainable urban development has to a larger degree evolved around the concept of city ecology or eco-villages, characterized by the local circulation of substances, that are mentioned above. Within this discourse the travelrelated environmental impacts are not given much attention. That the dominating discourse on sustainable urban development in Denmark has evolved around the concept of city ecology, is interesting in relation to this project's problem standing, because the hegemony of this discourse can contribute to knowledge filtering regarding urban structures and travel, more associated with the compact city.

Different methodological approaches

As it was noted above, travel is a complex phenomenon, which is claimed to be intersecting in diverse aspects of the social and physical spatiality. This entails, that the potential link between urban form and travel needs to include a lot of different aspects in the methodological framework.

The methodologies, which have mainly been applied to study the potential link between urban form and travel, can be divided into two different main categories: theoretical and empirical studies, which can each be divided into subcategories. Different methodological approaches have different advantage, but this doesn't mean, that they are equally valid, when investigating the potential link between urban structures and travel.

Theoretical studies

Theoretical studies provide explanations or hypotheses about expected causal relations. Meaning that theoretical studies try to explain why and how urban structure affects travel, which off course is of vital importance for understanding the potential effect of urban structures on travel, to overcome the weakness of purely description of empirical data, whiteout reflections about course and effect.

As it was evident from the discussion in chapter 3 about disciplinary traditions' different and conflicting meta-theoretical foundations, the academic literature doesn't unambiguously clarify whether, to which degree, urban physical structures influence travel. But as it was also evident from the discussion, a lot of different aspects of the social and the physical spatiality are likely to influence travel. This means, that theoretical studies must combine insight from different disciplines, previous empirical research, as well as dailylife and common-sense experience.

Model simulations

One specific kind of theoretical studies is hypothetical studies, This often involves the use of model simulations. The first studies on urban structures' potential effect on travel were based on model simulations. The advantage of this approach is, that it can give insight in different scenarios, based on simplified theoretical assumption about casual relations between the factors included in the model. This means, models can't be used to explain behavior, but only to see, how predefined behaviour will manifest, when applied to different alternative situations, or in other words, this means that model-results will always be determined by the predefined assumptions, and the models can't be used to evaluate whether these assumptions are truth or not. Neither can models be used to detect, if there exist other causal relations than the assumed ones. In this way the assumptions become of vital importance for the models, and the pitfall of basing studies solely on model simulations involves, that the complex relation between human action, physical structures and travel are reduced to the variables included in the model (Boarnet & Crane 2001, 39; Høyer 2002, 169-170).

For the reasons mentioned above, it can be argued that model simulations are unsatisfactory in academic disputes on conflicting truth claims based on different assumptions, which is the case concerning urban structures' impact on travel. Anyhow, results from model simulations, have been used to argue both for and against the effect of urban structures on travel, though mostly against.

The most common model applied to investigate the link between urban-structure and travel is the four-step transport-model. Some of these four-step models have been supplemented with micro-economic theory (see section 3.2.3). As mentioned above, model simulations only reflect the predefined assumptions, and because of that the validity of these assumptions are of vital importance. I will here present and discuss the methodological framework of these models and argue, that basing conclusions of the (missing) link between urban structures and travel solely on model simulations, is very problematic, because of the models' missing capacity to reflect important cause and effect relations properly.

Though this Appendix is meant to serve as a knowledge base about different methodologies and their validity, applied to investigate the link between urban structures and travel within the academic arena, this discussion is also relevant as a knowledge base for political arena, because the actual planning in the municipalities in some cases has been based on calculations made by means of these transport-models.

As a point of departure, traffic models are built on traditional economic theory concerning the relationship between demand and supply. In this context supply is defined as accessible infrastructure e.g. system of roads and public transportation. The demand side of transport is determined by land use, settlement, and socio-economic conditions for those, who live and work in the area. The choices made in the model are based on profit maximizing and rational actors (Tennøy 2004, 25) (see also section 3.2.3).

The first computer based transport-model was developed in the in 1956, and consisted of a four-step procedure to calculate the traffic. This four-step model is still the foundation for traffic models used today (Mackett 1998, 94). Before proceeding the four steps, the research area is divided into a number of zones dependent on the level of details relevant to the study. The steps in the model are explained below:

- Step 1: Calculation of trip generation, how many trips have starting- and ending point in each zone. This calculation is based on how many people live in the zone, some characteristics of the inhabitants, type of workplaces and other activities located in the zone.
- Step 2: Calculation of the trip distribution among the different zones, either based on projections of known empiric data about traffic patterns, or based on calculations from gravitation models (see section 3.1.2). The result of this is an origin/destinations- matrix (OD), which shows the amount of trips for each zone to all the other zones.
- Step 3: Modal-split (distribution among means of transportation) is calculated for trips between each of the zones. This calculation is primarily based on the quality of the different means of transport and socio-economic characteristics of the individuals in the zones. This method is usually based on projections of empirical data, competition on time and/or costs between different means of transportation for each of the zone pairs.
- Step 4: Routes of car- and public transport are distributed at the available infrastructure in the model-area, based among others on available routes, travelling time, travelling distance and travelling cost for each alternative.

• Some models also include a step 5, which describes the hours of travelling

In the model, steps 1-3 are used to describe the traffic demand, and in step 4 the travelling supply is described. Step 2 and step 3 are using the cost of travel, which doesn't only include monetary costs but also time costs of travelling. These costs are combined into one single measure called "generalised cost". that means, that all the calculations can be based on one single (monetary) unit (Tennøy 2004, 25-26; Næss 2005, 50; Mackett 1998, 92-93; Noland and Lem 2002, 3).

Based on this framework, simulations of different urban development scenarios have been modelled to asses the traffic impacts of these different scenarios. But as mentioned above model calculation only reflects the assumptions stored in the model and can't be used to valuate, if these assumptions are true of false. In the following, it will be argued, that the validity of many assumptions stored in the classic four-step model is problematic, when investigating the link between urban structures and travel and the effect of such link.

One of the most criticized issues adduced on the four-step transport models is, that they aren't, in a proper manner, capable of reflecting important cause and effects. Transport models show little sensitiveness towards means, which reduce the traffic volume e.g. reduction of road capacity or parking space, traffic congestion, improvements of public transportations, improvement of walking and biking facilities, and densification and location strategies of future land-use changes (Tennøy 2004, 33).

This means, that the four-step model is very problematic, when investigating the link between urban structures and travel and the truth claims about the effect of the above mentioned traffic reducing means, put forward by the compact city advocates, because this effect would be systematically underestimated. The models' systematic underestimating the effects of these traffic reducing means, is mainly caused by the models' incapacity to reflect land-use changes and modal-split distribution. And because car-ownership and land-use are treated as exogenous variables, the changes in the available infrastructure aren't affecting those factors (Tennøy 2004, 33).

Traffic models' incapacity to reflect effect on travel caused by change in land-use in a realistic manner are usually attached to step 1, trip generation, and especially step 2, trip

distribution, in the four-step traffic model. Errors occurring in assessment of trip generation usually occur, because the models don't disaggregate between travel behaviour of different types of workplaces in the respective zones. E.g. a consultant firm or craftsmen usually make more trips out of the house during the day than a normal production firm, but this is often not reflected in the models (Tennøy 2004, 33; Næss 2005, 2).

Step 2 in the model, the trip distribution between the zones, is especially problematic in relation to reflecting land-use and location of activities' impact on travel behaviour. This is because the model is based on wrong assumptions about the link between patterns of location and transport behaviour. Model calculations based on gravity models usually assume, that work trip generation is largest between zones with many inhabitants engaged in active employment, and zones with large amount of workplaces nearby each other. Usually, the differences between the kinds of labour skills demanded by the workplaces and differences between the labour skills supplied by the inhabitants in the nearby zones aren't taken into account. Hence a model simulation of a scenario with mixed land-use of workplaces and residents in the outskirts of the city will show a reduced work-trip distance, even though this it not necessarily the case. Another problematic issue associated with the models' calculation of the trip distribution, as a function of land use, is that the point of departure and the arrival of a trip are always assumed to be in the middle of a zone without taking into account the actual location of activities within the zone. It is also problematic, that trips made inside a zone normally aren't included in the calculations either. This is especially problematic, because the division of the study area into zones is often much more fine-meshed in the central part of the study-area than in the outer-part. This means that longer distances can be travelled in the outer-part without crossing a zone compared to the central part (Næss 2005, 2-3). This also has the consequence, that the travelled distance in the outer-part of the urban region is underestimated in the models.

All in all this means that the four-step model has a tendency to systematically underestimating the traffic effects of locating facilities in the outskirts of the city compared to a location in the central part. Consequently it would undermine - based on un-valid assumptions - the truth claim of the compact city, that central and dense location, reduces the overall travelling distance.

But it is not only problems associated with reflecting the difference in travel distance between the inner- and outer-parts of the city, that make the four-step model problematic in relation to investigating the link between urban structures and travel. The Compact City Model's claim of energy efficiency is not only related to reduced travelling distance, but also to the fact, that a densification and location strategy will encourage more energy efficient modes of transportation like walking, biking, and public transportation. The problem is here, that the models are especially poor at reflecting the competition between private car and public transportation. According to Tennøy (2004) there has been found clear evidence, that the models systematically underestimate the possibilities for a shift from private car to public transportation through improvement of the public transport system. Besides, and probably even more problematic, the classic four-step model is criticized for not assessing the share of non-motorized traffic in a realistic manner, but ignores or underestimates it.

Many traffic models are based on the assumption, that the field of competition between public and private car traffic is small and can be disregarded. This means, that improvement of the public transport-system isn't going to affect the car-traffic volume to an appreciable degree in the models (Tennøy 2004, 30). Many models are also based on a similar assumption concerning, that increasing the road capacity will only affect choice of route, but not of destination, mode of transportations, time of travelling etc. This is termed in the fix-matrix issue (Mackett 1998, 97; Litman 2007, 9).

Several studies have, however, showed that extending road capacity for congested roads will impact on travel behaviour in several ways, which often results in generated and induced traffic (see section economic tradition). To reflect generated traffic in traffic models it is necessary to incorporate feedbacks, which reflect the impact, congestion has on travel behaviour, and long-term transport- and land-use systems.

Because the dynamic relationship between demand and supply and the field of competition between different modes of transportation are not taken into account in most models, it means, that they have a tendency to systematically underestimate the effect of means, that can reduce the volume of car-traffic as e.g. improvement of the public transportation or reduction of (car) available infrastructure, and that the long term effect of induced travel has on land-use and travelling patterns is ignored.

All in all, the above discussion has showed, that the validity of assumptions the four-step model is resting on, is associated with many problems, when investigating the link be-

tween urban structures and travel, because the models don't catch up important causes and effects concerning: land-use and location relative to the urban centre's impact on travel, the relative competitive powers of different modes of transportation and the effect on modal trip distribution, and besides the supply of infrastructure's effect on the (longterm) demand for car-travel.

Empirical studies

Empirical studies have the advantage of investigating people's actual travel behaviour, but this doesn't mean ,that the question about validity is less complex. Empirical studies can be done in different ways. Here descriptive studies, multi-variable regression analysis, qualitative interviews and studies over time will be discussed.

Descriptive studies

The first empirical studies on urban structures' impact on travel were descriptive studies. Descriptive studies can provide hard data about the real behaviour in different situations, e.g. the difference in mode choice, travel distance, etc. between downtown and suburban dwellers. This can e.g. be done by comparing travel diary data for the two areas. But entirely descriptive studies can't explain, why people travel as they do, and the degree of impact caused by different potential influencing factors. If studies e.g. base the conclusion, that urban structures matters entirely on a description of difference in travel behaviour between different neighbourhoods, based on differences in the neighbourhood, physical structure characteristics, other potential influencing factors such as difference in income level, household composition, attitudes etc. are ignored and the conclusion becomes either over- or underestimated, dependent on the effect of the other influencing factors are reinforcing or impairing the effect or urban structures. The simplicity of pure description may mask important interactions between factors, that explain the actual behaviour (Næss 1995; Boarnet & Crane 2001, 44-47). To overcome some of these problems a multivariable regression analysis can be applied.

Multi-variable regression analysis

A multi-variable regression analysis is a method, which can be applied to expose the degree of influence between a potential casual factor and an effect variable, when controlled for other investigated potential casual effects (Næss & Jensen 2005, 86). This method is particularly suitable for investigating urban structures' impact on travel when controlling for non-urban structural potential factors, such as socio-economic factors and attitudes. But this doesn't mean, that no methodological problems are associated with the regression model.

Bias can occur both as a result of the omitting of relevant control variables and as a result of the inclusion of irrelevant control variables (e.g. variable, that are themselves strongly influenced by residential location). In addition, it is important to choose the most relevant urban structure variables, i.e. the variables that from theoretical considerations one might expect to influence travel behaviour, rather than to influence urban characteristics, that are less likely to influence travel to any extent worth mentioning.

Even though multi-variable regression analyses are well suited for identifying the degree of impact from a lot of different potential casual factors, they can't be used to clarify, if there really exists a casual relation between the potential casual factors. A multi-variable regression analyses can be used to identify, if there is co-variance between two potential cause-and-effect factors included in the analysis, when the part of the variation in the effected variable attributes to other investigated variables is 'subtracted'. But just because there is co-variance, this doesn't necessarily mean, that there exists a casual relation between the two variables in question. This means that a multi-regression analysis can only hint at causal relationships, they can point out possible and maybe plausible causal relationships, and hence be helpful to direct further research. However, they cannot demonstrate, that any causal effect exists, or clarify the rationalities underpinning these potential casual relations or determine, which way the potential causality goes. This has to be judged based on logical and theoretical considerations.

Another problem associated with this kind of statistical analysis is, that land-use and urban form measures are often represented on nominal measurement scales, whereas other explanatory and control variables, as e.g. socioeconomic variables, are often measured on richer ratio measurement scales. According to Cervero (2003) this gives socio-economic and other control variables a predictive edge in statistical analysis.

Statistical analyses like the multi-variable regression analysis may also be faced with difficulties in separating out the unique contribution of every single specific land-use or urban structure variable to travel outcome measures. This is because, there tends to be high multicollinearity between many urban form and land-use characteristics. E.g. most dense neighbourhoods have multiple land-use, gridded street and limited parking. Besides, the neighbourhood density tends to be correlated with the relative distance to the city-centre. This also means, that interactive effects between co-present urban form and land-use measures become difficult to capture (Cervero 2003, 120).

All in all, this means that a multi-variable regression analyses isn't suitable for answering questions about *if, how* and *why* these potential casual relations are operating. These limitations are also reflected in the fact, that the actual behaviour is also influenced by factors, that can't be quantified into a regression model, e.g. how people socially construct their surroundings. To overcome this problem, qualitative interviews can be applied.

Qualitative interviews

Qualitative interviews can reveal more complex and more thorough information than quantitative methods. Qualitative interviews are suitable for investigating questions concerning the motivations for and purposes of actions, and the meaning, that social actors ascribe to their physical surroundings. This e.g. applies to questions concerning the rationalities behind the location of activates, mode choice, residence etc. The limitation of the qualitative methods is, that it's poorly designed for investigating degrees and strength of casual relations, as was the advance of the multi-variable regression analysis. Besides, sample size is normally small and may not be representative of the population of interest, and the respondents can be biased by social desirability, memory etc.

Another way of studying the potential link between the built environment and travel is by comparing situations at different points in time, as before-after-studies, time-series analysis and studies based on retrospective questioning. Causality of in time studies may be established from logical inferences, e.g. the cause must have occurred before the effect, but studies are over time still faced with several problems.

Retrospective questioning involves direct questioning of what the effect of changes in urban structures, land-use and/or location has been on respondents' travel behaviour. Like qualitative interviews, this approach may contribute with valuable knowledge about the rationalities behind the possible changes in travel behaviour, according to the respondent (e.g. the process of residential and travel choices). Nevertheless, this approach is faced with the same limitations as qualitative interviews in general, but the memory aspect is more likely to be source of bias related to retrospective questioning (at least, if it concerns changes in large scale urban structures' impact on travel, because of the relative long time frame for these changes to occur).

Before and after studies can be used to investigate travel behaviour in relation to changes in urban structures or location. According to Jason & Cao (2008) the classical 'before after random-assignment control group experimental design' is impractical because of its prohibitive costs, ethical deficiency, and/or political impossibility (Jason & Cao 2008, 2). Instead, studies have compared travel behaviour before and after work-place relocation or compared changes in travel behaviour of people moving to an environment substantially different from their previous neighbourhood (Næss 1995; Cao *et al.* 2009).

Time-series analyses may apply statistic tools like the regression model, but investigate changes over time based on sequences of measurements, that follow non-random orders. According to Næss (1995) time series analyses are associated with several difficulties, except from studies of the n neighbourhood level. First of all, changes in large scale urban structures have a rather long time frame, and because of that it becomes problematic to separate the effect of urban form changes from multitude social, cultural economic and political changes taking place in the same period of time (Næss 1995). Of more practical reasons it can be hard to engage respondents to be involved for such a long time period.

The just presented discussion showed, that no single method was able to catch all potential aspects of the potential link between urban form and travel. Hence, this calls for a mix of different approaches and methods to compensate for their respectively weaknesses to make the conclusions more valid. But just because the applied method of a study is valid, it doesn't mean, that the result also is valid. This brings us to the questions regarding the measures applied to studying the potential link between travel and urban form in relation to energy consumption.

Measures of urban structures' influence on travel

When investigating urban structures' effect on travel it is not only necessary to consider carefully, how to investigate the potential link to make the studies more valid, but it is just as important, which indicators are applied to measure this potential link. Because of that, the following is concerning the question of the validity of different applied measures. In **Kommentar [pn1]:** Du bør måske angive kilde for dette udsagn (det er ikke mig!)
this discussion it can be relevant to distinguish between travel outcome measures and land-use measures, as effect and cause respectively.

Urban form and land-use measures

Another reason why different studies reach different conclusions is, that the attention has been pointed at different urban-structural and land-use factors. Figure 5 shows different scales of urban form and land-use measures investigated ranging from the strategic level to the neighbourhood level.



Figure 5. The different scales urban structures' impact on travel have been investigated (from Stead and Marshall 2001)

The many urban-form and land use measures, that have been focused on in studies about urban structures and travel, can be grouped in different ways. Næss (1997) differentiates between the following urban structural factors: regional settlements pattern, city size, population density for the city as a unified whole, geometrical form, residential areas' density and location within the city, location of workplaces within the city, location of retail and other service functions, public transportation, road capacity and parking opportunities.

Boarnet & Crane (2001), who are belonging to sceptics regarding urban structures' impact on travel within the American debate, make another grouping of the urban-form and land-use measures in a review of the American literature on the issue. They distinguish between the following categories: density, extent of land-use mixing, traffic claiming, street and circulation pattern, jobs-housing and/or land-use balance, and finally pedestrian features.

The different manners of categorising urban form and land use measures, which potentially impact travel, put forward by Næss and Boarnet & Crane, reflect that there exists a difference in focus between the European and American academic debate on these issues. Within the American academic literature the focus is on the neighbourhood level with main focus on the difference between New Urbanism vs. conventional suburb. This means, that the debate mostly concerns what is the most optimal street design, grid or conventional suburb style, and does not concern location relative to the metropolitan centre, which is given much attention within the European academic debate, focusing more on the strategic level (Næss and Jensen 2005, 61).

Theoretically, it is reasonable to assume, that location within the city has a stronger effect on travel than street designs in the suburbs or fringes of the city (see section 4.2.1).

In order to increase the validity it is important to make sure, that the applied measures of urban-form and land-use are the ones, that theoretically could be expected to influence travel. Some studies have drawn conclusion of an absent or inconclusive relation between urban structures and travel, based on comparison of travel data from cities of different population size. Size is, however, not a valid measure for density, and it is hard to argue theoretically, why population size should be the most decisive urban characteristic for urban structures' influence on travel (Næss 2005, 61).

Travel outcome measures

As it was important to carefully consider the urban form and land-use measures applied, it is just as important to consider, which travel outcome measures are applied, and which kind of travel type is focused on, when environmental impacts of travel in relation to urban structures are investigated. Focusing on different aspect can generate different results, and not all travel-related aspects are influenced by urban structures. Because of that, it is of course important, that the measures and travel purpose investigated theoretically are influenced by urban structures.

In a systematic way Stead and Marshall (2001) have written a review paper on urban form and travel behaviour studies from the 1980- 2000. The travel outcome measures, they identified applied to investigate the link between urban form and travel, are travel distance, journey frequency, modal split, travel time and transport energy consumption.

When investigating the travel related energy consumption it is problematic to base the conclusions on travel time and frequency. The reason for this is, that travel time can be reduced in the inner city by average shorter travel distance to wide range of activities. However, travel time within the inner city may also be increased due to larger congestion levels and slower means of transportation, such as public transport, bike and foot. In the outer-city, travel time may be increased due to longer travelling distances, but it may also be decreased due to faster travel speed.

This shows, how one urban structural variable can have two or more causal influences upon a particular transport-related variable. These effects may amplify or counteract each others. If they counteract each others (as in the example of residential location and travel time), the net effect may be close to zero, and it may appear as if there is no causal relationship between residential location and travel time. But, in reality, there are two oppositely working mechanisms.

Likewise a higher travel frequency in compact cities does not necessarily entail higher travel related energy consumption, because proximity and high degree of accessibility can generate many short trips without the total travel distance or energy use exceeding the one of the dispersed city.

This means, that travel time and frequency aren't suitable measures for travel-related environmental impacts in relation to urban structures. Instead is it reasonable to assume a direct relation between travel distance and energy consumption (Høyer 2002, 170-171; Næss & Jensen 2005, 60-61). This relation is, of course, influenced by transportation mode amongst others.

Travel mode is, of course, also important for the amount of transport related energy consumption. Different travel modes use different amount of transport. It is hence important to include this aspect as well. As it became evident from the above, it is important for the validity how travel is measured, when investigating the potential link between urban structures and travel. It also applies to different types of travel purposes, because not all types of travel are potentially influenced by urban structures.

According to Bertil Vilhemson, individual travel can be divided up in three different main categories by travel type: productive trips, reproductive trips and recreational trips. The productive travels are including: work, school and business trips. Here it is reasonable to assume, that it is only the school and work trips, which are influenced by urban structures. The reproductive trips are involving: shopping of everyday necessities, caretaking trips as e.g. bringing and picking up children in kindergarten, and besides it involves trips to different service facilities. Within the reproductive trips it is also reasonable to assume a rather high degree of influence from urban structures, but with a great disparity between the different types of trips. Recreational trips include long holiday and weekend trips, but also shorter trips as e.g. a trip to the cinema, sports arrangements or pay a visit to friends. The long recreational trips, which normally cover the far most part of the overall travel distance within the category of the recreational trips, are not directly assumed to be influenced by urban structures, while the shorter recreational trips can vary with urban structural factors (Høyer 2002, 172; Næss 2006, 17). Even though it is reasonable to assume, that the long recreational trips are not directly influenced by urban structures, a hypothesis of compensatory recreational trips has been put forward. In sum this means, that people, who travel less on an everyday basis, as e.g. downtown dwellers, will compensate for this by longer or more frequent recreational trips. This means, that the hypothesis of compensatory travel suggest an indirect effect between urban structures and the long recreational trips (Høyer 2002, 173; Holden 2007; Næss 2006). This hypothesis was discussed further in section 4.1.4.

From this we can deduce, that productive trips are assumed to a high degree to be influenced by urban structures, while recreational travels are assumed to be determined only to a minor degree. The reproductive trips can be regarded as something between bound and unbound by urban structures. This entails, that when investigating the potential link between urban structures and travel, it is especially data about the production and reproduction trips, which are relevant to focus on. If the dataset only contains the sum of the total travel and hence not divided into categories, the direct relation between urban structures and travel can be expected to be less significant. If the data only contains information about the recreational trips, this relation is, of course, expected to be even lesser significant. On the other hand, if the data only included information about the productive and reproductive trips, the potential effect of compensatory mechanisms is not included. This means, that to obtain a great degree of validity, the data must contain information about the overall travel, but divided into trip categories (Høyer 2002, 173-174).

The discussion in Appendix has shown, why different studies reach different results and that not all methods and measures are equally valid, when investigating the potential link between travel and urban structures. Besides, the contextual preconditions are important to clarify, because different preconditions can yield different results. This discussion is meant as a base for the next chapter, which goes into details with the actual academic dispute about urban structures' impact on travel. In this discussion it will be argued that much of the scepticism levelled at the truth claim of the compact city theory is based on un-valid approaches.