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The motivation underlying adolescents' intended time-frame for driving licensure and car ownership: A socio-ecological approach

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ABSTRACT

This study focuses on the adolescents' intended time-frame for obtaining a driving license and purchasing a car, as the delay of these decisions will likely affect the amount of travel and transport externalities. Semi-structured interviews with 50 Danish adolescents were analyzed by means of deductive–inductive thematic narrative analysis based on the socio-ecological approach. The results show three groups in line with the market-diffusion model: intended early car users, intended early license holders and later car users, and intended late license holders and car users. The first group are car enthusiasts who associate cars with high instrumental, affective, symbolic, and relational values, have car-oriented social networks, and imagine a car-oriented lifestyle. The second group are car pragmatists, who associate cars with high instrumental and relational values, perceive car expenses as a barrier, and imagine a car-oriented lifestyle only in the long-term. The third group are car skeptics, who have low interest in cars and imagine a cycling-oriented future. Policy implications concern (i) promoting shared-responsibility among individuals, public bodies, communities and policy makers towards a sustainable future, (ii) applying a policy-package comprising complementary policy measures to target the three identified groups, (iii) relying on social networks for knowledge propagation and success of policy measures and educational campaigns, and (iv) promoting a tangible future vision based on sustainable modes.

1. Introduction

Car-oriented behavior and attitudes are shaped from early childhood. A high share of elementary school children are being driven by their parents (Arbour-Nicitopoulos et al., 2012) and even though these shares decrease in secondary school, the prevalence and importance associated with the car as a travel mode to school and leisure activities is far from negligible even in bicycle-oriented countries (Van Goeverden and De Boer, 2013; Sigurdardottir et al., 2013). Several studies conducted in Europe, among others in bicycle-oriented countries, show that, when asked about their future, both children and adolescents indicated their intentions to obtain a driving license and own a car as adults (Baslington, 2009; Line et al., 2012; Kopnina and Williams, 2013; Sigurdardottir et al., 2013).

The aforementioned studies did not address the intended time-frame for these future decisions. Yet, understanding the time-frame for obtaining a driving license and buying a car is far from trivial, and the literature shows evidence of different trends across countries. On the one hand, favorable intentions towards driving license and car ownership often materialize into car-oriented travel already at the driving licensure age (Line et al., 2012). In several countries (Finland, The Netherlands, Spain, Latvia, Poland, Israel), the share of young drivers from their respective age groups has increased (Sivak and Schoettle, 2012). On the other hand, in several countries (U.S., Canada, Sweden, Norway, Germany, U.K., Japan, South Korea), the share of driver license holders from their respective age groups has decreased over time (Sivak and Schoettle, 2011, 2012). Car availability and car use were also lower in the beginning of the millennium than in previous decades in France, Germany, U.K., Norway and the U.S. (Kuhnimhof et al., 2012).

The importance of understanding young people's underlying motivations for obtaining a driving license and buying a car lies in the fact that delaying these decisions will likely affect future travel amount, transport mode use, car ownership, traffic safety, and transport-related environmental impact (Sivak and Schoettle, 2012). When the car is the only available transport mode, delaying licensure and car ownership could lead to transport poverty which is strongly related to social exclusion and limited employment and life opportunities (Lucas, 2011; Martens, 2013). Upon adequate provision of transit and bicycle infrastructure, delaying licensure and car ownership could lead to higher use of sustainable travel modes, and thus generate potential benefits in terms of energy

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and fuel savings, safer traffic, and pollutant reduction without the negative effects of social exclusion (Kaplan et al., 2014; Martens, 2013).

This study extends the current body of knowledge by exploring and investigating the motivating factors behind the time-frame for obtaining a driving license and owning a car. Previous studies provided statistical evidence for reduced car-dependence among young adults from aggregate national statistics (Kuhnimhof et al., 2012; Sivak and Schoettle, 2012) without providing empirical evidence about the rationale involved in delaying licensure and car ownership and the joint nature of these two decisions (Sivak and Schoettle, 2012). This study treats the two decisions jointly and provides empirical evidence for the rationale underlying their time-frame.

To study the rationale underlying the time-frame for adolescents intentions to obtain a driving license and own a car, we applied a broad socio-ecological perspective that combines intrapersonal, interpersonal, institutional, community and policy domains. The conceptual framework was introduced by McLeroy et al. (1988), who provided a general description and a definition of each domain, within the context of health programs. Baslington (2008) proposed a theory of travel socialization, and applied it to mode choice behavior of children, that is not directly derived from McLeroy's theorem, but is compatible with it because it acknowledges the importance of social networks on travel behavior. Sigurdardottir et al. (2013) developed McLeroy's general framework by defining the factors included in each domain and estimating their relative importance within the context of mode choice. Both studies, addressed mode choice intentions of children and adolescents while neglecting the time-frame for these decisions.

The data consisted of 50 in-depth interviews with 15 year-old adolescents recruited by Statistics Denmark. Deductive–inductive thematic narrative analysis was applied for interpreting the underlying constructs expressed in the narratives from a socio-ecological perspective. The elaborated close-ended model proposed by Sigurdardottir et al. (2013) served as a guiding framework for the design of the open-ended semi-structured interviews and the qualitative narrative analysis. The intrapersonal domain included travel experience as a car passenger, general interest in cars, financial awareness, environmental concern, and instrumental, symbolic, affective and relational values associated with having a driving license and owning a car. Instrumental, symbolic and affective values follow the definition by Steg (2005). The instrumental value is related to the ability to achieving low-end goals (e.g., arriving from an origin to a destination) and high-end goals (e.g., gaining accessibility to employment or housing opportunities). The symbolic value refers to the ability to gain social status or prestige, and the affective value is related to general interest, positive feelings of enjoyment and attraction building. The 'relational value' refers to the degree to which a person regards their relationship with significant others as important, which is related to social inclusion, support and self-esteem (Leary, 2005). In this study, the car relational value was revealed by the willingness to engage in chauffeuring and joint travel to non-joint activities. The interpersonal domain comprised travel norms and interactions with family and peers. The institutional domain included the role of the media and school programs in supporting and promoting sustainable travel modes. The policy domain focused on the perceived environmental efficacy and the effect of car restrictions on the individual's quality of life. The community domain related to the perceived role of the car in adulthood and transport quality.

The study was conducted in Denmark as a suitable case-study because data from the Danish national travel survey show a significant delay in driving licensure and car assimilation by the market segment of young adults; the proportion of 18 and 35 year-old Danes who hold a driving license are, respectively, 65% and 91%; 23.7% and 50.6% of commuting trips by young adults in their twenties are conducted, respectively, by bicycle and car, and these percentages shift to 19.4% and 62.7% for adults in their thirties. These percentages remain roughly steady until the retirement age (Sigurdardottir et al., 2013).

2. Methods

2.1. Data source

Data consisted of 50 in-depth semi-structured interviews with 15 year-old adolescents randomly drawn by Statistics Denmark from a representative sample of adolescents who answered a large-scale survey (Sigurdardottir et al., 2013). The interviews that took place in June and July, 2011, were performed at the participants' location of convenience, were recorded, and lasted on average about 40 min.

The participants were from 33 communities spread across the Capital Region of Denmark, which spans across 2850 square-kilometers and has 1.9 million inhabitants (about one third of the Danish population). The communities represent a variety of transport and urban development conditions, comprising urban, suburban and rural municipalities with population densities ranging between 260 and 10,500 inhabitants per square kilometer, residential and mixed land-uses and varying levels of transit provision from car-oriented to transit-oriented communities. Among participants, 50% were female, the average household size was 3.8 persons, 24.0% of households had at least one parent with a university degree, and 32.0% of adolescents aspired to pursue higher education. In terms of car accessibility, 56.0% had access to one car, 38.0% to two or more and only 6.0% had no access. All the adolescents had a bicycle in the household, 14.0% had a monthly transit pass, 74% perceived access to cycling paths from their home as 'good' or 'very good', and 72.0% assessed access to transit similarly. The figures were similar to those obtained in the larger sample of adolescents who answered the large-scale survey (for details see Sigurdardottir et al., 2013). The sample size is within the recommended range of twenty–fifty participants for in-depth narrative analysis of semi-structured interviews with grounded-theory (e.g., Guest et al., 2006) and its demographics reasonably agree with a representative sample of 15-year olds in Denmark.

2.2. Thematic narrative analysis

The current study applied a deductive–inductive thematic-analysis on the basis of the socio-ecological model as a tool for pattern recognition across qualitative data. In deductive narrative analysis, a 'top–down' approach is taken by searching for theory-driven themes, while in inductive narrative analysis the themes emerge spontaneously from the data (Braun and Clarke, 2006). While the semi-structured interview was loosely based on the socio-ecological model, the themes in each domain emerged from the data for extending and refining the socio-ecological model through the analytical theme search process.

The methodology consisted of five steps (Braun and Clarke, 2006). Firstly, the narratives were repeatedly read while searching for recurrent key themes that capture important aspects related to the research question. Two researchers performed the reading separately and then compared the key concepts for consistency. Next, the dataset complexity was reduced by referring to key questions and identifying keywords and concepts. Due to slang use, extensive use of generic second-person for referring to oneself, and fragmented nature of the teenagers narratives, grouping and sorting the data units into themes was conducted manually with the aid of thematic tables. Then, an iterative

deductive–inductive procedure for searching, identifying and reviewing the themes was implemented, and the themes were regrouped in a theory-driven manner. This procedure allowed attaining data-driven patterns that were theoretically grounded and easily identifiable.

3. Results and discussion

The analysis differentiated three groups on the basis of their intended joint time-frame for obtaining a license and owning a car, and each group was analyzed within the socio-ecological framework. The time-frame for obtaining a driving license and buying a car and the group prevalence in the data follows the market-diffusion model (Rogers, 1962), also known as the market-adoption-lifecycle model previously applied in the contexts of technology and health (Moore, 1991; Rogers, 2004). According to the model, market diffusion propagates from the early adopters, through majority adopters, to the laggards with different rationale underlying the time-frame for product adoption by each group, as represented in Fig. 1.

The first group (12%) exhibits strong intentions to obtain both the license and a car early in the near future, and is characterized by *car enthusiasm*. The second group (70%) shows intentions to obtain the license at an early stage and a car at a later stage, and is characterized by *car pragmatism*. Namely, they associate practical value with having a driving license in the near future and having a car at a later stage. The last group (18%) exhibits intentions to obtain a driving license and a car at a later stage, and is characterized by *car skepticism*. Namely, they doubt the immediate and future need for obtaining a license and a car. Table 1 provides a comparative overview of the three groups, and shows that while some motivations may overlap across groups, each group is characterized by a unique combination of socio-ecological motivations.

3.1. Intended early car users: car enthusiasts

Adolescents with strong intra-personal motivation for obtaining a license, owning and driving a car as adults, are car enthusiasts. They exhibit positive attitudes towards cars, show high interest in cars, and associate high instrumental, affective, symbolic, and relational value to cars.

The interest in cars is manifested by reading car magazines, sharing their interest with family and friends, daydreaming about cars parked on the street, and paying attention to car advertisements. They can identify top gear, expensive and affordable cars by brand and model.

The instrumental value of obtaining a driving license and having a car is related to achieving high-end goals of gaining travel independence and increasing spatial opportunities, and perceiving the car as a 'must have' and a fundamental need for their life.

The affective value of cars is expressed as a positive feeling towards a driving license as a source of happiness and life opportunities, and as affection for cars, motorcycles and tractors. Car enthusiasts have a clear image of their dream car down to their preferred brand, model, color, features and accessories.

The symbolic value of the car reflecting financial status, prestige, and hip and cool self-image, is manifested through the excitement to have expensive, pretty, and new or pimped-up cars. Adolescents associate driving with a positive self-image and impression on others and like the attention from driving around in a cool car with loud music. While they have realistic estimates of car purchase prices and are aware of the air pollution generated by cars, they do not perceive these as barriers to car ownership.

The relational value of the car is related to cars as socializing means. Adolescents have a positive experience as car passengers, are keen to engage in chauffeuring activities for friends and younger siblings, as well as to drive around with others in long-distance trips and as stand-alone leisure activity. They are eager to drive and imagine themselves driving instead of their parents. Some have already tried to drive motorized vehicles in parking lots or fields.

The families of car enthusiasts are highly car-oriented, with parents and older siblings encouraging car use passively and actively. Passive encouragement consists in parents serving as role models for high car-dependence, reading car magazines, engaging in car maintenance activities, and enhancing the adolescents' relational value of the car by driving them around. The children are driven to joint activities with their parents, their own leisure activities, and occasionally school. Active encouragement consists in parents gifting driving lessons, rewarding non-smoking behavior, or accumulating savings for car purchase at the age of 18. In particular, fathers stimulate car interest by discussing car technological advancements and allowing adolescents to drive agricultural or construction machinery under their supervision. Older siblings (both male and female) show a general interest in cars and car repair, have a driving license and a car available. They chauffeur their younger siblings as a mean of socialization, share their car affection and experience regarding the advantages of being able to drive, and pass-on their first vehicle when they leave their parents' house. When thinking about their own family in the future, car enthusiasts imagine a household with two cars, and multiple uses including commuting, shopping and chauffeuring children. They choose car-oriented friends and obtaining a license at the age of 18 is a social norm in their networks. Their friends share intense car interest, going to car shows, being fascinated

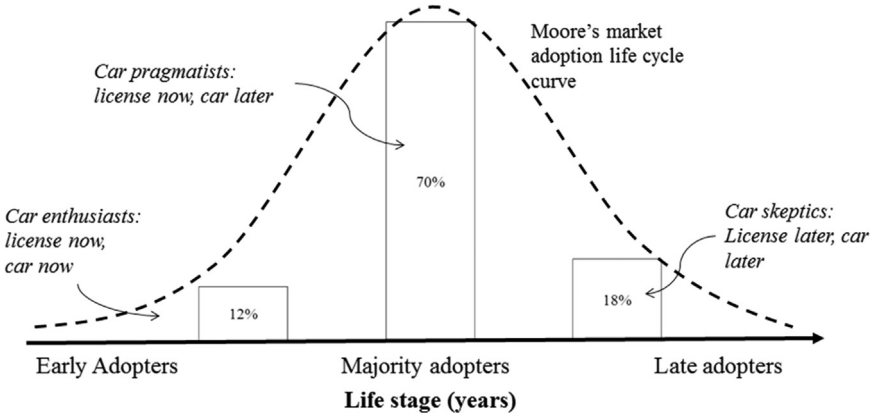

Fig. 1. The car adoption life-cycle among young adults.

Table 1
A comparison between the three groups.

Intentions and motivation	Car enthusiasts	Car pragmatists	Car skeptics
Intentions			
Intended time frame for driving license	Early	Early	Late
Intended time frame for having a car	Early	Late	Late
Demographics[a]			
Percent male (%)	50	48	55
Residence – city (%)	0	14	45
Residence suburban (%)	50	57	33
Residence rural (%)	50	29	22
Father drives to work (%)	66	71	50
Mother drives to work (%)	67	60	38
Intra-personal domain			
Intrumental value of the car/license	High	High	Low
Affective value of the car/license	High	Moderate	Low
Symbolic value of the car/license	High	Moderate/high	Low
Relational value of the car/license	High	High	Low
Experience as car passengers	Positive: enjoyment, thrill, time saving, convenience	Positive: time saving, convenience	Negative: motion sickness, lack of air and space, boredom
Inter-personal domain			
Parents/siblings as role models	Highly car-oriented	Mixed role models	Cycling or transit oriented
Conversations in the household	Thrill of driving, car technology and aestethics, gifting driving lessons	The need to obtain a license, car-related financial burden	Health and environmental conservation
Child chauffeuring	High extent	Upon request or following clear rules	Limited extent
Peers interest in cars/license	High interest	Compliance with social norms	Low interest
Institutional domain			
Recall of themes and key words in school programs or classes	Low	Low	High
Environmental concern	Low environmental concern	General but not transport-related	General and transport-related
Perceived effect of the programs	Ineffective	Effective 'eye opener'	Mixed opinions about effectiveness
Attention and recall of informal information sources	Car magazines and advertisements	Cars on films and TV series	The scouts for environmental concern
Community and policy domains			
Future vision	Flying cars, driverless cars, electric cars	Electric cars, fuel-efficient cars	Electric/solar cars, better transit provision
Emission reduction – car technology	The focus should be on other industries	High	Moderate
Emission reduction – human behavior	Low	Low	Moderate and requires government intervention
Willingeness to accept car restrictions	Low but they are willing to use car sharing and electric cars	Flexible and adapt to mild restrictions and improvement of cycling and transit infrastructure and services	Willing to contribute with their behavior while hoping that other would do the same
Percieved emotional impact of reduced automobility on the quality of life	Negative both in the short- and long-term	Negative only in the long-term mostly effect on child care	Little or no impact on perceived quality of life, opportunities or child care

[a] The sample size is too small to be considered as a representative population sample.

with luxury cars and having daydreams about their future car. Together with their friends, car enthusiasts discuss their intentions to obtain a license and the car brands that they could possess.

Car enthusiasts show little knowledge about transport-related environmental impacts, as they perceive them as intangible and thus of lesser concern. Additionally, they say that school programs to encourage non-motorized modes are ineffective because of the strong car-oriented norms in their surroundings. In contrast, car enthusiasts are very attentive to car advertisements in the media. They remember visual and textual content, perceive car advertisements as good information sources, and identify themselves with the positive image of cars.

Car enthusiasts envision a car-oriented future with automatic driverless cars, verbal steering control, flying cars, electric cars, and more environmentally friendly cars. Some also do not think that cars pollute so much and that the focus should be on reducing the pollution from other industrial sectors before focusing on the car industry. Car enthusiasts associate not having a driving license with strong negative emotional impact and perceived lower mobility, limited work opportunities, and reduced quality of life. They have difficulties to imagine their future without a car, although they are willing to borrow or share a car.

3.2. Intended early license holding and late car use: car pragmatists

Car pragmatists associate the license with the practical reason of being able to drive, as an important skill, as a status symbol for being 'cool' and as a stepping stone towards adulthood. They associate cars with high instrumental and relational values, and moderate affective and symbolic values.

Car pragmatists differ in their degree of interest in cars. Most car pragmatists can identify a brand with being expensive or affordable, and can name the brand of their parents' car. Some also subscribe to car magazines, read car advertisements, speak about cars with their friends, and notice cars in the media, but others declare to have little knowledge or interest in cars.

Car pragmatists associate high instrumental value to obtaining the license and using the car for achieving low-end practical goals of traveling to activities or locations, and high-end goals of gaining travel independence and increasing the spatial opportunity space. While they are willing to use other transport modes dependent on their travel ease and availability, they view the car as important for increasing their travel convenience by saving travel time, having schedule flexibility, and traveling comfortably. The instrumental value of the car decreases due to difficulties to find parking, driving stress, need to refuel, and car-related costs. While car pragmatists are chauffeurred by their parents, they perceive obtaining the license as a mean to gain travel freedom and independence.

Car pragmatists associate chauffeuring as part of their role as future care-givers. Particularly girls associate the need to have a car with the need to transport young children and pets. Several adolescents are keen to share the driving burden of their parents in long-distance family trips, grocery shopping and chauferring younger siblings. A few car pragmatists link having a car to having a job.

Car pragmatists associate esthetic value to cars rather than high affective value, by describing cars as cool or nice to have, rather than saying that they love cars. They are aware of the car reflecting financial status, cool lifestyle and own self-image, but they are not attracted to large size, fast or expensive cars and some of them perceive driving those cars negatively. They rather have a small, functional, fuel-efficient, safe and reasonably priced family car that suits their needs. Most do not have a preferred brand, but a few have a particular car type in mind. A few girls refer to small retro cars, which they perceive as cute and feminine, and a few boys refer to sport cars or expensive brands, although recognizing that such dream cars are not realistic. Car pragmatists are aware of the financial burden associated with taking driving lessons and having a car, in terms of the purchase price and fuel costs. In the cases where older siblings bought a car, car pragmatists consider their siblings' tradeoffs between owning a car and other lifestyle decisions.

The families of car pragmatists are moderately car-oriented, and parents moderately encourage car use. Passive encouragement to car use consists of mixed role-models including one parent being more car-oriented, and the other parent being more flexible in travel choices and using mainly the bicycle and/or transit. The share of male and female parents as primary car users are similar. In some households, the parents tend towards moderate car use and favor the use of alternative modes. The reasons provided by the adolescents are financial concerns, parking scarcity and transit availability, and to a lesser extent environmental concerns. The parents discuss car expenses openly and exhibit frustration over fuel prices.

Active encouragement to car use consists in parents offering to pay the driving lessons, and chauffeuring children to leisure activities, although most of the adolescents cycle to school. Some parents engage in chauffeuring upon request and provide the impression it is effortless. Other parents have clear rules about chauffeuring, mainly during the evening, in places with low transit availability or far from home, and in harsh weather. Some parents carpool with others.

Older siblings generally hold a driving license, and either have a car or borrow the family car on a regular basis. Many car pragmatists mention obtaining a license or using the car as a strong subjective norm. They believe that most of their friends would like to obtain the driving license once they turn 18 and have a car in the future.

Car pragmatists say that they only learn a little bit about environmental conservation at school and that they do not remember much about what they have learned, but they recall the focus not being on transport. A few refer to the information that they learned in school as an ‘eye opener’ and mention being happy they could make a difference with their own behavior. They mention the need to save energy, reduce pollution from power plants, save water, and recycle paper, but they do not know or think much about car-related emissions. When asked specifically about “bike-to-school” programs, they remember such programs in elementary school, and relate them to health concerns. Some mention car-oriented cultural norms in the media in films, television series, and advertisements.

Car pragmatists envision greater use and higher number of cars. They also hope that in the future cars would become more environment friendly through technological advancements: electric cars, fuel-efficient cars and alternative fuels. They do not believe in voluntary behavioral change because of the difficulty for people to change their car use habits, and associate car restrictions with low acceptability due to limiting travel freedom and the central role of cars in people's life. Instead, they suggest encouraging transit use through improving its coverage, expanding the metro and reducing the fares. Eventual restrictions should be very mild and allow people to use the car according to their needs, for example restricting car ownership to two cars per household, and limiting car use on Saturday or Sunday. Nevertheless, some mentioned that if restrictions were imposed, they would adapt their travel behavior.

Car pragmatists think that in the case they would not have a driving license or a car, in the short term they can continue to cycle or to use transit, and they are unsure about the effect or perceive little to no effect on their quality of life. Some car pragmatists mention that they would be happier to use the car occasionally, so they could stay in shape to avoid the stress of daily car use, while others say using the car would increase their travel freedom and make their life easier and happier. In the long run, they cannot imagine their life without a car, as their quality of life would be reduced if they would not use the car for chauffeuring, or if they would live in the countryside. Several believe that the social norm obliges them to have a car.

3.3. *Intended delayed license holding and having a car: car skeptics*

Car skeptics have weak intra-personal motivation for obtaining a license or owning a car as adults. They are unfamiliar with car brands, do not have a dream car in mind, and focus on practical aspects (i.e., functionality, size, cleanliness, efficiency). They do not feel the immediate need of having a car because they associate limited instrumental value to the car as a mean to reach activities or locations. Their daily travel needs and travel independence are accommodated by cycling and transit, and they perceive the car as an occasional travel mode for long-distance trips, countryside trips, and trips under time constraints or stormy weather.

Some are aware of the value to cars for representing wealth or cool lifestyle, but associate low importance to it. Rather, they associate a cool lifestyle with traveling around the world, living abroad or buying a boat. Car skeptics associate limited relational value to the car for child chauffeuring, but they can imagine themselves using a cargo-bike for this purpose. They do not consider cars as means of socializing and prefer to avoid chauffeuring friends.

Car skeptics are aware of air pollution generated by cars, driving lesson fees and fuel expenses. Environmental and financial reasons are key in their choice to continue to cycle and use transit. They do not have a good experience as car passengers, and associate car trips with motion sickness, boredom, lack of air and space.

The families of car skeptics are environment- and health-oriented, and talk at home about recycling, focusing on efficient use of resources, engaging in fitness activities and limiting car use

because of environmental concerns. The parents and older siblings discourage car use both passively and actively. Passive discouragement consists in the parents serving as role models by making limited use of the car, only for long-distance family visits and in bad weather. The parents commute by bicycle or train and drive to work occasionally, engage in very little chauffeuring of children, and thus reduce the adolescents' car use and the associated relational value. Although the parents engage in child chauffeuring for young children, chauffeuring decreases and the children are expected to gain travel independence while growing up.

Most older siblings of car skeptics cycle as their primary transport mode and exhibit a significant delay in obtaining a license or buying a car. Siblings who are in their early twenties do not have a license and do not plan to obtain one soon, and those in their thirties obtained the license and bought a car in their late twenties. The social networks of car skeptics comprise mainly friends who mostly cycle. Car skeptics do not discuss the possibility of obtaining a license or driving a car with their friends, and they believe that the majority of their friends have low interest in cars or obtaining a license in their early twenties. One car skeptic shares his environmental concern with environmentally conscious friends.

Most car skeptics are aware of educational programs in their school that promote health, environmental awareness, and the use of non-motorized transport. They recall keywords such as global warming, climate change, and CO_2 emissions, and they are aware of the negative environmental impact of cars. They recall also particular classes and teachers focusing on environmental conservation, and remember programs such as “bike to school week”. Only a few do not remember much from the school programs, admit that they are not interested in them, and exhibit general environmental concern rather than transport-related. The role of the scouting movement and the media as an information providers emerges among car skeptics, although their influence as passive or active agents is unclear from the narartives.

Car skeptics envision a future in which technological advancements would lead to more environmentally friendly cars such as electric and solar power cars, and in which there will be higher incentives to use transit because of wider supply and lower fares. Some car skeptics believe that car restrictions should be imposed by legislation, but others oppose them and believe in voluntary behavioral change without government intervention. Car skeptics believe in environmental efficacy and they are willing to contribute their part with the hope that others do the same. Nevertheless, they believe that a national effort is required for advancing towards a more sustainable future. The possibility of not having a driving license is not associated with negative emotional impact and car skeptics do not perceive that their mobility, opportunities or quality of life would be lower without driving license and car. They imagine themselves cycling and using transit on a daily basis as adults, including for child chauffeuring.

4. Conclusion

This study is pioneer in exploring the motivation underlying adolescents' intended time-frame for obtaining a license and purchasing a car in Denmark and the role of the inter-personal, institutional, community and policy domains as facilitators of this motivation.

Considering the qualitative nature of this study, a word of caution for policy implementation is warranted. The results serve as an indicative or diagnostic tool, rather than a statistical analysis of the prevalence of the identified themes across the population. Additionally, the results cannot be generalized to regions with development densities outside the considered range. Last, adolescents are in the initial stages of adopting new travel patterns and developing habits, and hence they are still open to change. Nevertheless, studies show that car-oriented intentions of adolescents lead to car-oriented behavior upon transition to adulthood (e.g., Line et al., 2012).

Bearing these limitations in mind, the analysis reveals three groups that differ in their intended time-frame for obtaining a license and owning a car, and in their motivation for this time-frame: car enthusiasts, car pragmatists, and car skeptics. The groups and their prevalence are compatible with the market-diffusion model.

The results stimulate thoughts about policy implications. The results from the three groups suggest that expading circles of social networks at the family and the community may have a larger role in shaping the adolescents' travel habits. Most adolescents extensively and accurately recall the travel patterns of their parents, siblings and peers and transport-related conversations. The extent of child chauffeuring is a prevalent motivator for increasing the car instrumental and relational values and developing car dependence. The results also suggest that school programs aim at creating a socially supportive environment for sustainable travel for children are less effective. Most of the interviewed adolescents have a low level of recall of the material learned in school programs and are less concerned about sustainable transport in comparison with energy saving or recycling. The interweave of intra-personal, inter-personal, institutional, community and policy motivations underlying the intended time-frame for license holding and car ownership raises a need for a shared-responsibility approach. According to the shared responsibility approach there is a need to address the role of social circles in encouraging non-motorized travel behavior, the role of social support systems in promoting shifts towards sustainable modes, the need to bridge the gap between policy makers and road users by addressing the acceptability and the effectiveness of policy measures aimed at encouraging the use of sustainable modes. The shared responsibility approach is already implemented in Denmark in the context of traffic safety (Danish Road Safety Commission, 2012) and a possible policy direction would be to extend the approach also for encouraging sustainable travel patterns. Examples for policy measures that could form part of the shared-responsibility approach are policy measures aiming at encouraging travel independence and sustainable travel from childhood, for example by mitigating parental concerns and using incentives to promote cycling and transit use during joint family trips. As part of the shared responsibility approach, it is also important to increase the effectiveness of educational programs and national campaigns by involving the child social network.

Secondly, the results show that the groups vary in terms of their percieved acceptability of policy measures aiming to delay car use, their potential effectiveness and their impact on the perceived quality of life. The groups vary in their acceptability of behavioral and technological policy measures aiming at restricting car ownership and use. While car enthusiasts largely reject behavioral solutions, car pragmatists are a-priori willing to accept mild car use restrictions provided adequate cycling and transit infrastructure, and car skeptics would likely continue the use of sustainable modes as adults. Car enthusiasts do not consider financial or environmental concerns as barriers for car use, associate cars with high affective, symbolic and relational value and as means to attain life-opportunities, and associate low acceptability with restrictions on car travel. It is important to further investigate the extent to which the views of this group are related to residing in rural car-oriented communities and whether this group could potentially react positively to car-sharing, and technological solutions. Car pragmatists seem to be the most motivated by financial concerns, the car instrumental value in

terms of travel convenience, and the car relational value for child care. According to the narratives, car pragmatists associate higher perceived acceptability to 'carrot' rather than 'sticks' policy incentives. Nevertheless, financial policy measures along with changes in the supply and competitiveness of various travel modes, and policy measures for decoupling the car from care-giving activities (e.g., child chauffeuring) and perceived life opportunities (e.g., employment, education, housing, leisure), could have a potential effect on this group's behavior. Car skeptics already use sustainable modes and the main challenge is in preserving this behavior in adulthood, possibly by providing ample, high quality and integrated cycling and transit infrastructure and services at the community and regional level. While policy packages and their acceptability have been previously explored (e.g., Shiftan et al., 2003; Wang et al., 2014), the results show that policy makers should consider their discussion from the perspective of delaying the time-frame for car use. Based on their acceptability of policy measures, imposing only restrictions on car travel could encourage the car enthusiasts and the car pragmatists to self-select into car-oriented residential areas in the metropolitan fringe. Providing only technological solutions could deter the skeptics from continuing to cycle due to growing traffic and reduced perceived safety. Therefore, the results suggest that both restrictions on car travel, improving cycling and transit infrastructure and technological solutions for low-carbon vehicles would be more effective then implementing solely behavioral or technological solutions.

Last, all three groups imagine highly car-oriented future although the study is conducted in an area with a widespread cycling and transit infrastructure. Because the envisioned future serves as a beacon for transport decisions and intentions, efforts could be directed to finding new ways to increase the visibility of cycling- and transit-oriented initiatives through participatory planning processes, social media and marketing campaigns.

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