

VEHICLE DESIGN FOR ELDERLY CHINESE DRIVERS: A CULTURE-SPECIFIC TRAVEL NEEDS MODEL

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ABSTRACT:

This research explores the current and future travel needs of older Chinese drivers. A methodological triangulation consisting of interviews, logbook and co-discovery was used to collect multiple forms of data and explore the research question. This study developed an initial concept model to identify older drivers' travel needs. Vehicle meaning reflects users' needs and gives a tangible expression about users' experiences. The model demonstrates that the Chinese culture acts as a dynamic link among travel need factors. It is envisaged that the proposed model can play an important role in the design process to help designers to better understand the relationship between culture and design. The application of the model will focus on concept vehicle design as a representative example.

Keywords: Elderly vehicle users' needs, Vehicle meaning, Culture, Design

1. INTRODUCTION

The World's population is growing older. As in Europe, North America and Australia, older Chinese comprise the fastest growing segment of the population (United Nations 2001). At the same time, China has experienced tremendous growth in the number of motor vehicles in recent years. Therefore, over the next 30 years, the significant increase in the older population will place new and growing demands on transportation systems in China. However, it is surprising that little effort has been made to study local elderly vehicle users' needs within the Chinese cultural framework (Ban et al. 2005).

The aim of this research is to explore the travel needs of Chinese older drivers in order to assist designers to better understand current and future users' needs. Different researchers have recommended possible ways to improve safety with respect to older drivers in Western countries (Meyer 2004; OECD 2001). The literature review demonstrates that the foci of this research has been on restrictive policies, road design standards and training programs. The available evidence shows that this research and its outcomes cannot significantly assist automotive designers to design a concept vehicle that will satisfy older drivers' needs within the Chinese culture (Zhao, Popovic and Ferreira 2007). Therefore, from the user-centred design perspective, this study was conducted to research the future travel needs of elderly vehicle users within the Chinese cultural framework.

2. ELDERLY DRIVERS IN CHINA

Mobility is critical to the well being of older people. It is essential for people to travel to various destinations in order to maintain their quality of life. The empirical studies of travel patterns show that classical stratum variables (income, professional status) have become less important than age (Scheiner and Kasper 2005). The older drivers' aging process is not only a physiological process in which biological systems undergo changes (Fozard 2000), but it is also a social process in which a person changes involvement in activities (Cutler and Hendricks 2001). These changes have direct effects on travel needs of elderly vehicle users. However, few research projects have considered social process changes for older drivers in different countries (OECD 2001).

The differences between the current and future travel patterns of older people will arise from three sources: the age effect, which is related to the aging process; the cohort effect, which is related to each generation's experiences; and period effect, a set of influences common to all generations at a given time (OECD 2001). Tomorrow's older generation will be different from today's, as successive cohorts have distinct experiences, reaching old age in different socio-cultural contexts. Future older generations will travel more miles than before, due to changes in lifestyle and driving behaviour (Hakamies-Blomqvist, Siren and Davidse 2004).

China's automobile market posted very rapid growth in recent years due to demographic, urbanization and economic impacts (Riley 2002). World-class cars are being produced in China, but the designs and the technology contained in them are imported by the joint venture partners, and Chinese designers are still given little opportunity to contribute to their designs. Recently, the automobile industries are aware that the aging populations are more and more potent as a consumer force in the marketplace. However, there are limited data to direct designers and the automobile industry in the effective design and integration of new technologies, especially for older drivers.

Few efforts have been made in studying vehicle design from a socio-cultural perspective. It is worth noting that masculinity, youthfulness, speed, status and power are deeply embedded in the traditional cultural images of cars and driving (Siren and Hakamies-Blomqvist 2005). Therefore, the cultural imagery of cars and driving excludes older people. Moreover, the linkages between automobility and national identity are multiple, including the geographies of 'roadscape'; driving practices, styles and cultural activities carried out in cars; types of journey; the range of representations which centre upon cars; and the affordability of vehicles and roads (Edensor 2004). From this point, older persons living in different cities/countries will experience different local contexts, which lead to their unique travel behavior and which identify their relevant nationality status. As a result, product design and manufacture should realize the localization of product planning strategy in order to meet the local users' demands (Zhao, Popovic and Ferreira 2007).

Current design research for older adults focuses on the relationship between high technology and older users. Inclusive design principles suggest that products designed for inclusivity are designed for usability and accessibility (Keates and Clarkson 2003). However, traditional usability and accessibility methods neglect social issues because they are too concerned with task-based issues such as performance rather than activity (Oulasvirta 2005). In the real world, inclusive

design underestimates the differences in the patterns of daily life in different cultures and, therefore, will fail to meet the aging population's culture-specific needs.

3. DESIGN FOR NEED

In psychology, 'need' refers to demand, desire, interest, and motivation (Belgasem 1987). The unique character of human needs and motivations should be societal, psychological and cultural. From the design point of view, Krippendorff (2006) conceives motivations as arising with the exploration of the opportunities that artifacts afford users in specific cultural contexts.

Maslow (1987) establishes a hierarchy of basic human needs. For this pyramid model, lower needs must be satisfied before higher needs emerge (Fig.1). He insists that human behavior/activity is determined by his or her most urgent need. According to Popovic (2002), human activity and user-artifact interaction are the foci of design. Therefore, designers should explore human need because it can define a user's activity. Based on Maslow's theoretical model, Jordan (2000) also develops a hierarchy of user needs from a human-centred design perspective: level 1 – functionality, level 2 – usability, level 3 – pleasure (Fig. 1). However, the hierarchy of human need is contested. Baumeister (2005) suggests that social motives may be just as basic and powerful as physiological needs. It seems that the disadvantage of Maslow's theory is to apply one hierarchy to everyone within every cultural context (Rowan 1998). For different domains, each person's needs should probably be recognized and reconstructed as dynamic rather than static.

The design of technological artifacts is a cognitive activity that can be characterized as problem-solving activities undertaken by individuals (Simon 1969). Designers need to assess how technological products can support and transform knowledge about the users' needs and activities (Oulasvirta 2005). Thus understanding can be informative (providing useful research findings), predictive (providing tools to model user behavior), or prescriptive (providing advice regarding how to design or evaluate) (Rogers 2004).

It is important to note that some design theorists try to define 'need' from a socio-cultural point of view. Fry (1992) conceives 'need' as a result of being in the world: 'Need comes to us from the world rather than from us; it is the given-to-us demand of the culture into which we are born and grow.' The human system of needs in every culture is a binding unity of material and symbolic

correlates (Leiss 1990). The human-being, the world of the human-being, need and design have to be considered simultaneously (Fry 1992).

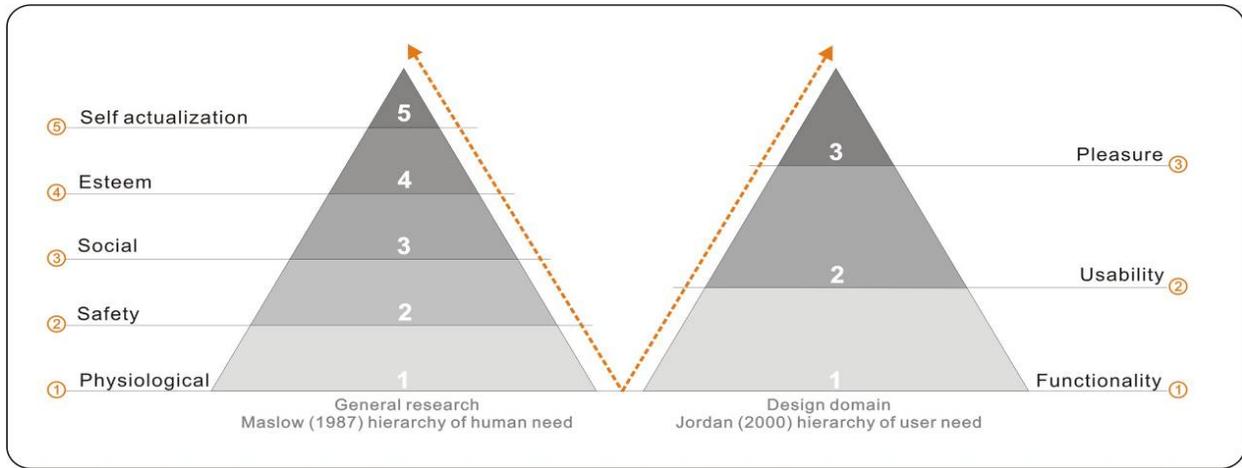


Figure 1: Hierarchy of human need in different domains

4. PRODUCT MEANING AND CULTURAL CONTEXT

Products can have different values and meanings for users. Current studies attempt to generate a coherent understanding of human needs from the socio-psychological dimensions. However, few researchers have ever discussed the relationship between human needs, products and meanings. Therefore, artifacts meaning is a relatively untouched issue, and exposes a hole in the knowledge field of user needs (Chapman 2005).

Some researchers conceive the meaning-making process as a psychological development in terms of the emergence of the self as a meaning making (Kegan 1982) and semiotic subject (Shweder and Sullivan 1990). It is worth noting that current research conducted by Fuhrer (2004) argues that cultural developmental psychology processes include culture (as action opportunities) which individuals experience as agents of their own meaning-making activities or practices to cultivate their selves. Cultural mediation occurs as a unit of social-cultural structure referred to as context, situation, activity or practice. In other words, culture places limits on individual behavior, while at the same time offering opportunities.

According to Fuhrer (2004), identity as a meaning-making practice refers to people’s use of cultural artifacts as opportunities to structure I –world relationship. Artifacts are both models of the self as well as opportunities for further development. In this way, artifacts serve to give tangible

expression (through signs) to users' relationships, experience and values. Meaning lies in self as much as in culture. Meaning is neither the stimulus artifacts nor the individual self, but rather lies in the coming together of the self and artifacts in the particular cultural context. For example, for vehicle design purposes, vehicle meaning can be constructed differently according to different users' cultural backgrounds. However, if cultural difference leads to meaning-making difference, why do drivers who live in different cultural context drive similar vehicles designed by multinational vehicle manufacturers? This question needs to be explored through focusing on the difference in user-artifact meaning in different cultural contexts.

From the design point of view, Chapman (2005) argues that artifact meanings change significantly in relation to their contextual surrounding and cultural environment. Designers must embrace this unpredictable quality as it enables artifacts to reflect multiple users' needs. According to Chapman, artifact meaning can be divided into three essential characteristics which include polysemy (a given object can mean many things), contextual sensitivity (a given object can have different meanings in different context), and consensus (object meaning should be shared by people in order for them to communicate about the object).

Krippendorff (2006) defines design as cognitive interfaces that enable reconstruction of intended meanings. Meanings related to products can reflect human behavior, needs and lifestyle (Antonides and Raaij 1998). Figure 2 illustrates that meaning is structured by users' experiences and artifacts' meanings reflect detail of user needs. That is, the meaning of artifacts can be an echo of human needs (Zhao, Popovic and Ferreira 2007).

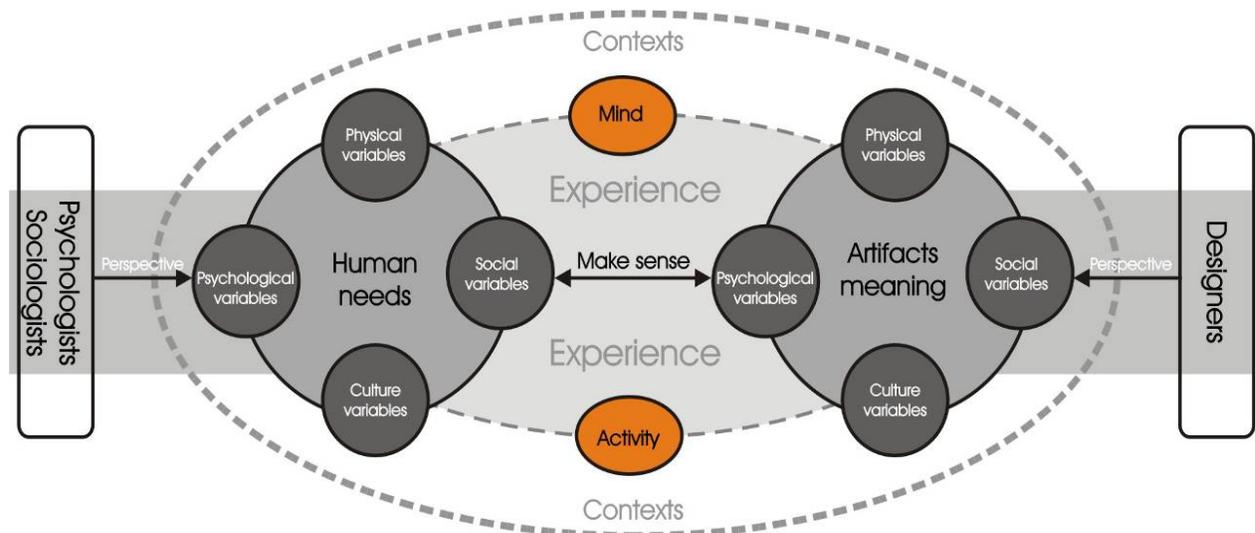


Figure 2: Relationship between human needs and artifacts meaning (Zhao, Popovic and Ferreira 2007)

5. EXPLORATORY STUDY

5. 1. RESEARCH DESIGN

An exploratory study was conducted to investigate the travel activities of current middle-aged and older drivers, and predict the Third Age generation's future travel needs within the Chinese culture. This qualitative research is divided into two sections (Section A and Section B) in relation to the two objectives: (1) to investigate present older and middle-aged drivers' travel activities and needs; (2) to explore and forecast older Chinese drivers' future travel needs.

To ensure validity of the research methods, a data triangulation approach consisting of co-discovery, interviews and logbooks was employed to collect multiple forms of visual and textual data. It is envisaged that this study will predict older Chinese drivers' future needs based on the comparative data. Table 1 summarizes the detailed structure of the research design.

Table 1: Experiment structure summary

	Section A	Section B	
Objective	To explore and forecast older Chinese drivers' future travel needs	To investigate present older and middle-aged drivers' travel activities and needs	
Data collection method	Co-discovery	Interview	Logbook
Time	One hour	Half an hour	One week
Data collection technique	<ul style="list-style-type: none"> - Following the structured topic list, two participants discuss their future lifestyle relating to vehicle use. - Participants need to imagine and draw their future car and explain their sketch each other. 	<ul style="list-style-type: none"> - Semi-structured questions to clarify participants' experiences and activities related to vehicle use. - Use of digital video to record the products and accessories in the participants' vehicle. 	<ul style="list-style-type: none"> - Structured travel diary to explore participants' daily travel activities and travel patterns.
Equipment	<ul style="list-style-type: none"> - Digital video recorders are used to record verbal and visual data. - Pencils and papers are prepared to support participants' sketches. 	<ul style="list-style-type: none"> - Digital audio recorders are used to record verbal data. - Digital video recorders are used to document products. 	<ul style="list-style-type: none"> - Three pages structured the log books are given to participants.
Participants	<ul style="list-style-type: none"> - Eighteen middle-aged drivers (45-59 years old) - Eighteen drivers (60 years old and above) <p>A simple screening of potential participants was conducted to make sure that the participant pool covered different gender, educational background and occupation.</p>		

5. 2. ANALYSIS

Grounded theory (Strauss and Corbin 1998) was employed to analyze the qualitative data. Atlas.ti software was used in the coding and data analysis. The analysis started with the open coding of

the co-discovery, interview and logbook transcriptions case-by-case. This was essentially a detailed examination of the data for identifying, naming, categorizing and describing patterns in the text. This study produced a description of (i) social practice for maintaining quality of life, (ii) travel activity adaptation, (iii) local context, (iv) vehicle meaning for the users and (v) vehicle property of user aspiration. From these five themes, 15 codes were generated. Table 2 shows detailed information for the coding framework. In order to identify the significant themes and categories, frequency of categories and sub-categories were compared.

Table 2: Coding framework

Theme	Property	Code	Interpretation parameters	Example
(C1) Social practice for maintaining quality of life	Social activity for maintaining daily routine	SAL	Regular patterns of activities that represent habitual behaviors and social affinities in daily life	'When I am retired, the family will be the centre for my life. Travel relates to go to hospital, shopping centre ...'
	Social role adaptation	SRA	Social position and responsibility adjustment or change involved in the aging process
	Social acceptability	SAP	Identification of social group membership
	Social accessibility	SAS	Age-related cognitive and physical capability
(C2) Travel activity adaptation	Travel modes	TMD	Older people's travel activities related to selection of transport mode	'...it is possible to take the subway, ...'
	Travel patterns	TPT	Reliable samples of actions, tendencies, models or other observable characteristics of older people's travel activities
(C3) Local context	Socio-economic factors	SEF	Background and environment that relate to local trade, industry, policy
	Local geography factors	LGF	Local natural features that affect transportation conditions	'There are many problems i.e. traffic jams and no parking places in the city.'
(C4) Vehicle meaning for users	Social meaning	SMN	Psychosocial significances incorporating user experience, identity building and social display when humans interact with artifacts	'... older people don't care about status or class which can be seen by their car when they are retired.'
	Practical meaning	PMN	Functional and physical factors that relate to product benefits and values	'Vehicle just likes a house which can carry a lot of necessary stuff.'
	Cultural meaning	CMN	Sense of coming together of the users and artifacts in the particular cultural context	'...my family needs a driver during the Chinese Festivals such as Qingming Festival (Traditional Tomb-sweeping Day). All of members of my family need to pay respects to my parents at their tomb, so we need a vehicle.'
(C5) Vehicle property of user aspiration	Economy	ECM	Vehicle properties that relate to cheap and efficient use or purchase
	Structure	STT	Physical vehicle properties of construction and configuration
	Function	FCT	Vehicle properties that enhance the physical action of users	'... it should have auto transmission;'
	Aesthetics	ATS	Emotional factors that induce appreciation of beauty in vehicle properties and driving interactions

Current travel activities were used as a comparative reference framework because seeing into the future is easier if researchers have a clear view of the current situation. Future need is an abstract concept through which human beings bring symbolic order to the present and meaning to past endeavours (Press and Cooper 2003). The comparative analysis helps to produce an interpretation of the interrelationships among the categories and builds a theoretical model for the future travel needs of older Chinese generations.

6. RESULTS AND DISCUSSION

6. 1. INTERRELATING THE THEMES

According to grounded theory (Strauss and Corbin 1998), researchers should locate a phenomenon within the full range of macro and micro conditions in which it is embedded and trace the relationships of subsequent interactions through to their consequences. Therefore, a conditional/consequential matrix was devised to explore the interrelationships between themes (Fig. 3).

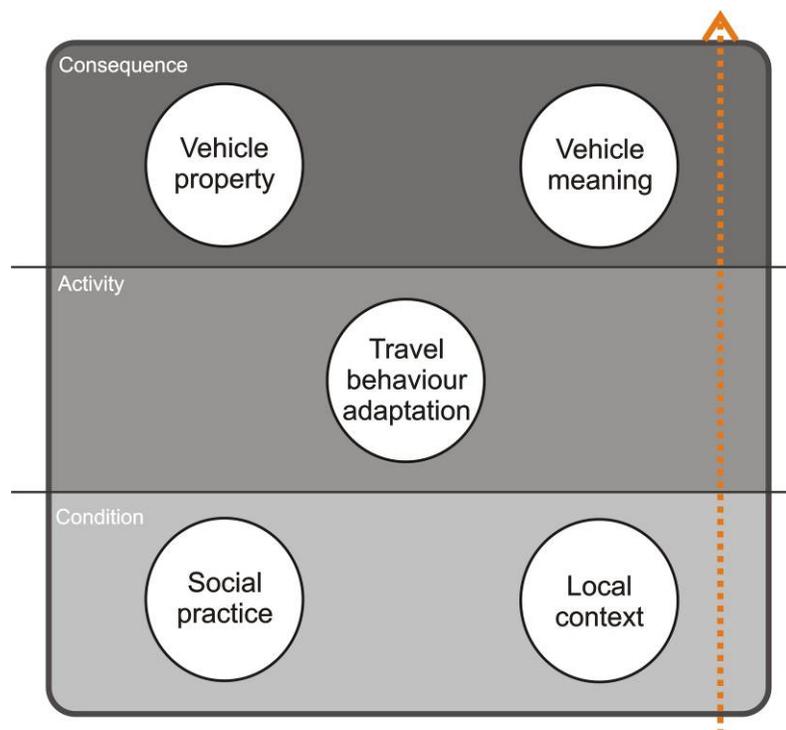


Figure 3: Conditional/consequential matrix

Following the initial coding system, conditions involve social practice and local context. Activity includes strategic actions, routine habits related to travel patterns and activities. Consequences can be defined as outcomes of activities related to the travel behaviors and patterns. For this research purpose, consequences are represented by specific vehicle's properties and meanings (Fig.3).

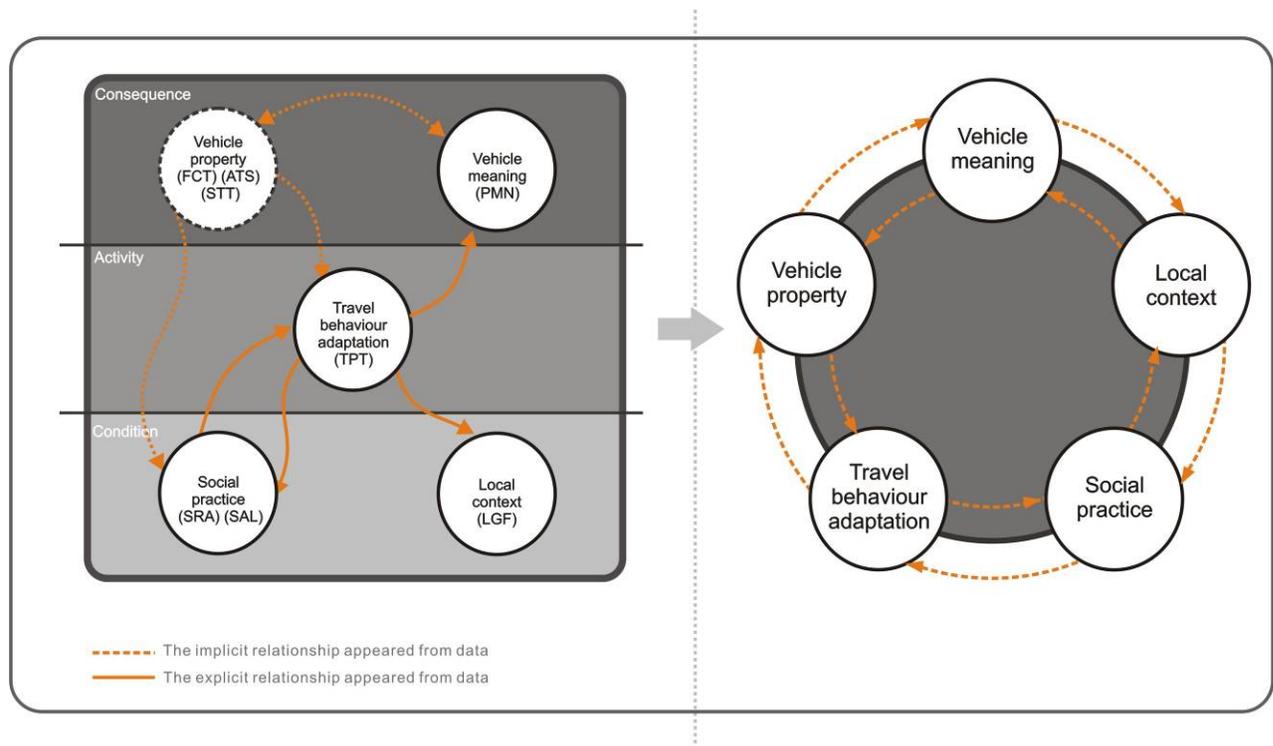


Figure 4: Circularity interrelationship model development

The themes and categories were entered into a conditional/consequential matrix (Fig. 4) to map out the connection among them. This study found that there is an interactive network among the factors that influence travel needs. For example, the following data suggests that the future need for reinforcing family relationship (SAL) is related to making a long distance tour (TPT) to the countryside (LGF). Such travel activity adaptation is based on future older generations' social role adaptation (SRA). For this reason, vehicles should be designed as tools for carrying materials (PMN) that support long distance travel behaviour (TPT) and social role adaptations. Such practical meaning (PMN) indicates that vehicles should have particular properties such as reliable quality (FCT), solid form (ATS), and compatibility space (STT).

I can imagine that my child becomes adult, and he does not need my help. And then, my wife and I will drive to the countryside for a couple of weeks. We will carry all of necessary stuff during the trip. We need a car to help us to do these things.

Based on the above understanding, a dynamic circularity model was developed to illustrate the interrelationships among the five themes (Fig. 4).

This study shows that vehicle meaning is one of the most significant categories. The theme and categories were related to their sub-categories to form more precise explanations about vehicle meaning and travel phenomena. An axial coding process was used to organize and identify the interrelationship between categories and sub-categories. Figure 5 shows the detailed structure of vehicle meaning for the participants.

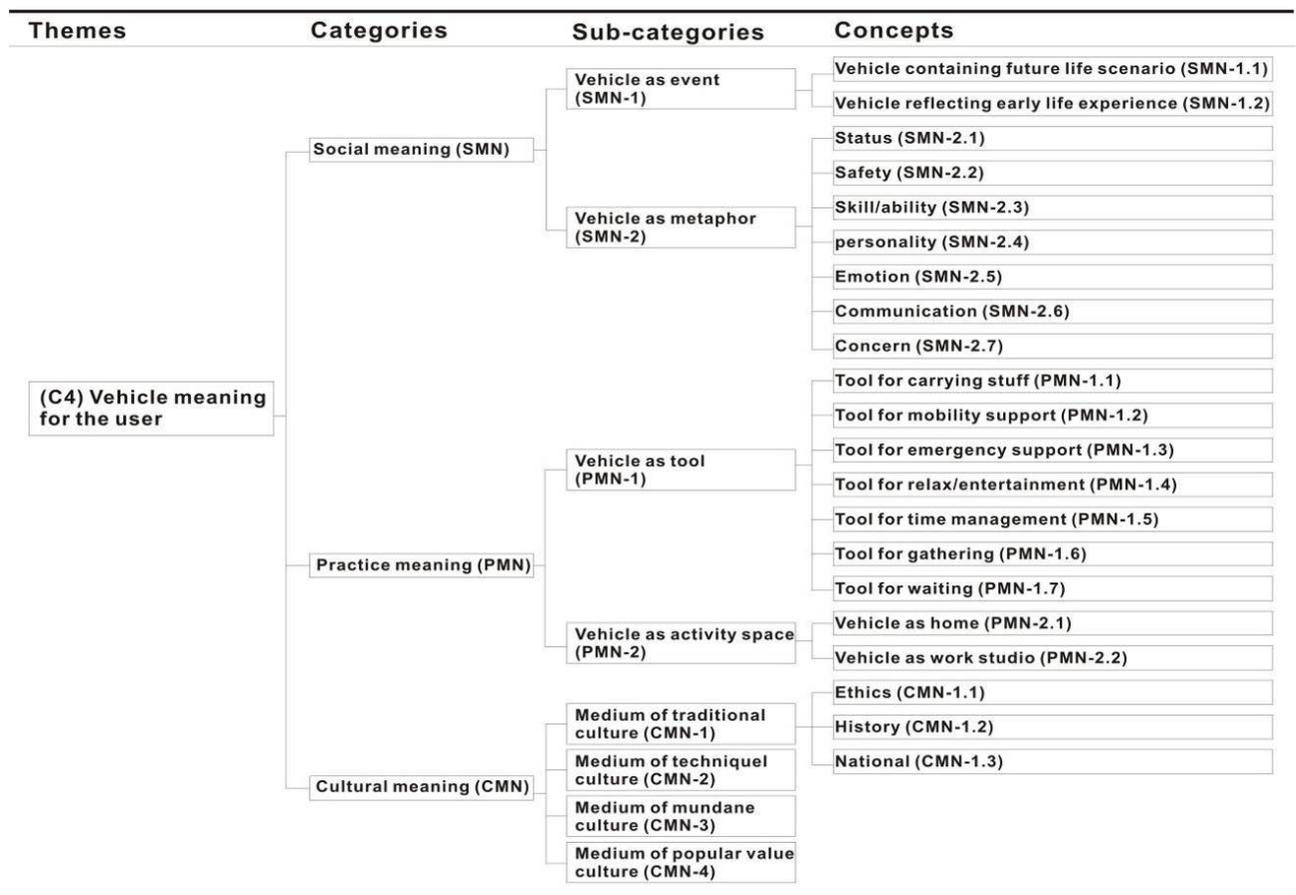


Figure 5: Vehicle meaning categories

6. 2. SOCIAL MEANING

Social meaning for the vehicle involves two categories which include vehicle as event (SMN-1) and vehicle as metaphor (SMN-2). Figure 6 illustrates that vehicle as metaphor (SMN-2) is the important social meaning for both age cohorts. Moreover, future older generations emphasize this factor more than contemporary elderly people. The vehicle as metaphor (SMN-2) for the Chinese

drivers contains different concepts such as status, safety, skill, personality, emotion, communication and concern (Fig. 5). Vehicle as a metaphor of status is most frequently mentioned by the participants. In addition, most metaphoric meanings can be connected with other themes and categories through the conditional/consequential matrix.

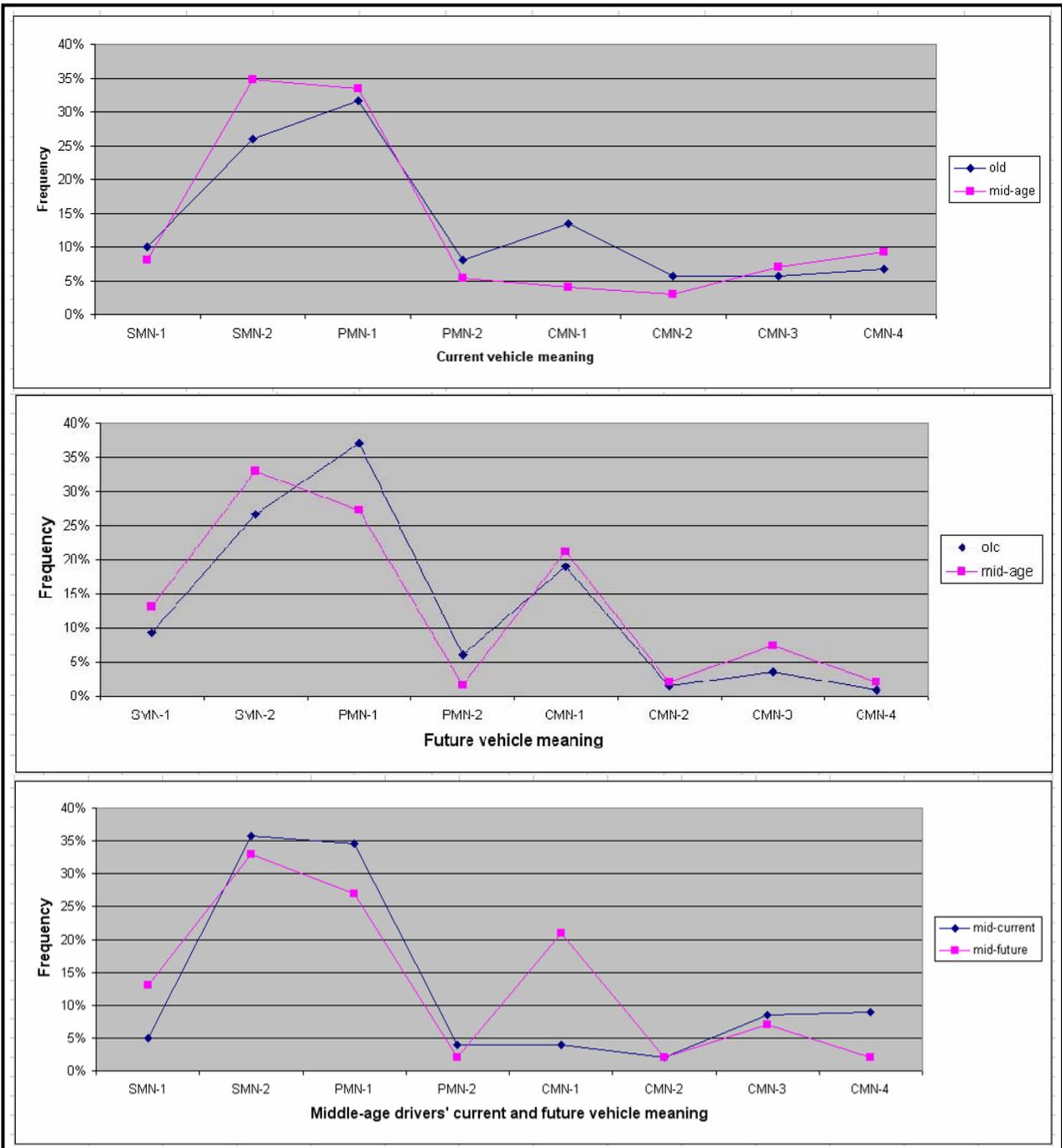


Figure 6: Integrated comparisons of vehicle meaning factors

For example, many participants believe that a vehicle's model and brand (STT and ATS) can reflect the driver's taste and status (SMN-2), which can help to construct class, cohort and age identity (SAP) (Fig. 5, 6 and Table 2). The social meaning, such as social role/status identity, can be achieved by the use of appropriate shape, scale, colour and texture. Such a symbolic system should come from local culture and link with users' experience to construct the meaningful self-artefact interrelationship.

In addition, vehicle as a metaphor of emotion (SMN-2) is related to older participants' social practice and experience. This point suggests that designing for future older vehicle users should focus on a study of their current lifestyle and early life experience; this can give designers valuable information to guide design for future needs. The following example shows the interrelationships between vehicle as a metaphor of emotion and social practice experience:

I am happy when I am driving. I do not feel tired when I am driving. I think that vehicle just likes a big toy for me... This idea roots from a dream in my childhood. My family's financial condition was not good when I was a child. I played with a small clay vehicle toy which just cost 5 cent RMB. I looked it as my heart and play it in the drawer. At that moment, I could not imagine that I would have a real private car in the future. So, I love this vehicle very much.

Although both age cohorts show a similar tendency regarding vehicle meaning's sub-categories (Fig. 6), they interpret the same sub-category differently. For example, the vehicle as event (SMN-1) reflects current older drivers' early life experience. However, the middle-aged vehicle users prefer that the vehicle reflect their future life scenario (Fig. 5). In the following case, the vehicle's social meaning is associated with the vehicle's compatibility framework property, social role adaptation and travel patterns:

I will have some dream before I retire, because I have spare time to imagine a lot of dream. So, the small car cannot contain all of my dreams. I believe that this car is just like a dream container. ... if I am retired, I will take 1-2 months to take a tour each year. If the destination is not far away, I will drive the car to the countryside with my wife, and maybe my child and grandchild ...

In addition, the middle-aged drivers (the future older generation) interpret the same sub-category differently when they imagine their future lifestyle. For example, they currently look on a vehicle as a symbol of class and gender identity. However, when they imagine their future lifestyle, the middle-aged drivers want to use the vehicle as a metaphor of cohort and age identity. The concept of the vehicle as a metaphor of concern (SMN-2.7) (Fig. 5) can be interpreted as using the vehicle to look after their children in the present and their older parents and themselves in the

future. Such interpretations refer to the vehicle accessories' design guidelines which include features such as emergency and safety support accessories for the future vehicle.

6. 3. PRACTICAL MEANING

The practical meaning category can be divided into two sub-categories which include vehicle as tool (PMN-1) and vehicle as activity place (PMN-2). Vehicle as tool (PMN-1) is more important than vehicle as activity place (PMN-2) for both age cohorts (Fig. 5). However, when comparing at concept level, this category shows different patterns between present and future needs for the middle-aged drivers who will potentially become older drivers in the next decade (Fig. 7).

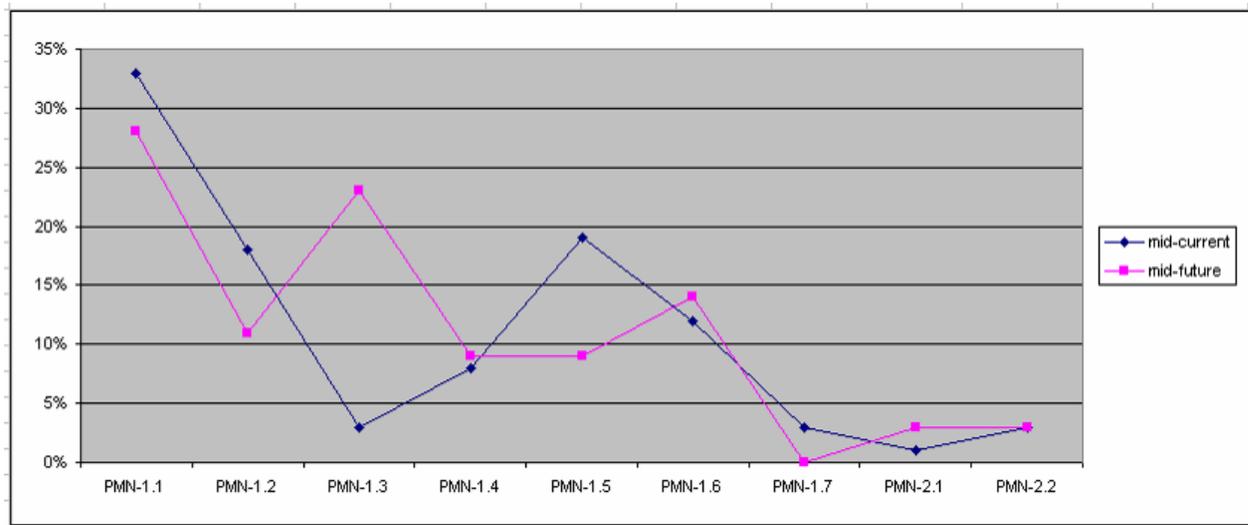


Figure 7: Comparisons of future older drivers' practical meaning concepts

Vehicle as tool is often assigned to carrying things (PMN-1.1), which can be linked to the need for a compatibility vehicle framework. This particular need is generated by the participants' social practice and experience within the Chinese context.

Vehicle as tool for emergency support (PMN-1.3) and time management (PMN-1.5) show significant differences between middle-aged vehicle users' current and future travel needs (Fig. 7). In their present lives, the middle-aged drivers look on the vehicle as a time management tool (PMN-1.5) because they need drive to work everyday. However, when they imagine their retirement lifestyle, these participants prefer looking at the vehicle as an emergency support tool (PMN-1.3) due to age-related capability decline. In the following data segment, the vehicle's

particular social meanings (vehicle as metaphor of safety and concern) and practical meaning (vehicle as tool for emergency support) are generated due to social accessibility influence.

...there should be a toilet bowl in my car. It can solve the sanitation problem. In addition, there should be some hooks in order to hang transfusion facilities. If there are these facilities in the vehicle, older people maybe feel safety when they drive this car. In case of facing emergency, they can get some tools to solve it. You know, I am old; I am worry about my health condition.

Both age cohorts explain that they need a vehicle to gather extended family members (PMN-1.6) (Fig. 7) in order to reinforce family relationships (SAL) and adapt to social role changes (SRA). This demonstrates that Chinese cultural traditions which emphasize interdependence and harmony have played a major role in shaping patterns of generational assistance and the expectations that generations have of each other (Hareven 2001).

These initial findings demonstrate that practical meanings related to vehicles can reflect future older vehicle users' social practice/lifestyle. On the other hand, social activity and experience help users to form a vehicle's practical meaning in order to respond to their particular practical needs. This interactive process can generate detailed knowledge about vehicle properties which will assist vehicle design innovation.

6. 4. CULTURAL MEANING

Chinese older vehicle users pay more attention to the traditional cultural meaning (CMN-1) related vehicle usage (Fig. 6). In this study, traditional cultural meaning involves ethics, history and nation.

I need a big camping car. A group of people... they probably drive several camping cars to travel together. In the destination, these camping cars compose a circle space that looks like a Chinese yard. We can celebrate the Chinese new year in this yard... you know, camping car can carry my family, my friends, a group of people...

Although culture is an intangible element, cultural meanings are not only in people's heads: rather, they are ideas that are shared by social actors. Cultural meanings have some public manifestations and therefore must be somewhat observable (Trice and Beyer 1993). In the above segment, cultural meaning can be observed by older people's activities such as gathering extended family members, celebrating traditional festival and travelling by groups. It also can be interpreted by the compatibility vehicle framework such as big camping car, which provides

tangible property to support vehicle users' collective social activities within the Chinese cultural context.

This study shows that traditional cultural meaning emerges and interacts with social role adaptation (e.g. adaptation for maintaining ethical principle), social acceptability (e.g. cohort identity), social activity (e.g. maintaining hobby) and local geography factors (e.g. city fabric). Meanwhile, it can be achieved by the specific vehicle properties (e.g. compatibility vehicle framework). It is worth noting that middle-aged drivers are more concerned with traditional cultural meaning when they are retired. Therefore, Chinese traditional culture plays an important role in constructing the future aging generation's travel needs.

7. CULTURE-SPECIFIC TRAVEL NEEDS MODEL

In conclusion, the initial findings from this study show similar themes between current and future travel needs for both age cohorts. This demonstrates that the local cultural context is a significant factor in shaping current middle-aged and older drivers' travel needs because both cohorts use the artifact (vehicle) within the same cultural context. The structure of culture provides stable and consistent reality experiences for the users (Allan 1998). The local culture not only affects current travel needs for both groups, but also influences their future travel needs.

However, different patterns emerge between the two participant groups when compared at the category level. For example, when imagining their future life, middle-aged drivers are concerned more about social acceptability (SAP) and social meaning (SMN) than older drivers. Older drivers pay more attention to social accessibility (SAS) and practical meaning (PMN) than middle-aged drivers. This demonstrates that future Chinese older vehicle users (middle-aged drivers) seek self-identity through using artifact (vehicle) within the global markets. However, the fact is that users living in Beijing use the same Volkswagen or BMW designed by multinational carmakers as those living in London, due to the automobile industry's globalization process (Zhao, Popovic and Ferreira 2007). Identity is constructed, reconstructed, or socially co-constructed through particular local culture (Krippendorff 2006). Therefore, local culture plays an important role to inspire artifact (vehicle) innovation by the use of appropriate form, color, texture, structure and function, through which self-identity can be achieved.

The meaning of a vehicle reflects human needs and focuses more sharply on specific needs and their direct implications for design. Future older Chinese drivers' needs should include reference

to latent variables such as vehicle meanings (Zhao, Popovic and Ferreira 2007). The product meaning is about the roles that artifact play in users' lives. It is about the artifact attachments and stories reflecting humans' abstract psychological needs.

An initial concept model was developed to identify older Chinese vehicle users' travel needs. Figure 8 illustrates that the future older generations' travel needs might be shaped by the interrelationships among five themes (social practice, local context, travel behaviour adaptation, vehicle property and vehicle meaning) through intangible Chinese culture. Vehicle meaning variables play an important role in older drivers' travel needs. Therefore, they can be the foci of the vehicle design research. Chinese traditional and contemporary cultures play a dynamic role in linking these factors and shaping older vehicle users' travel needs. The vehicle serves to give a tangible expression to users' experience, activity of interactions, and self-identity (Zhao, Popovic and Ferreira 2007).

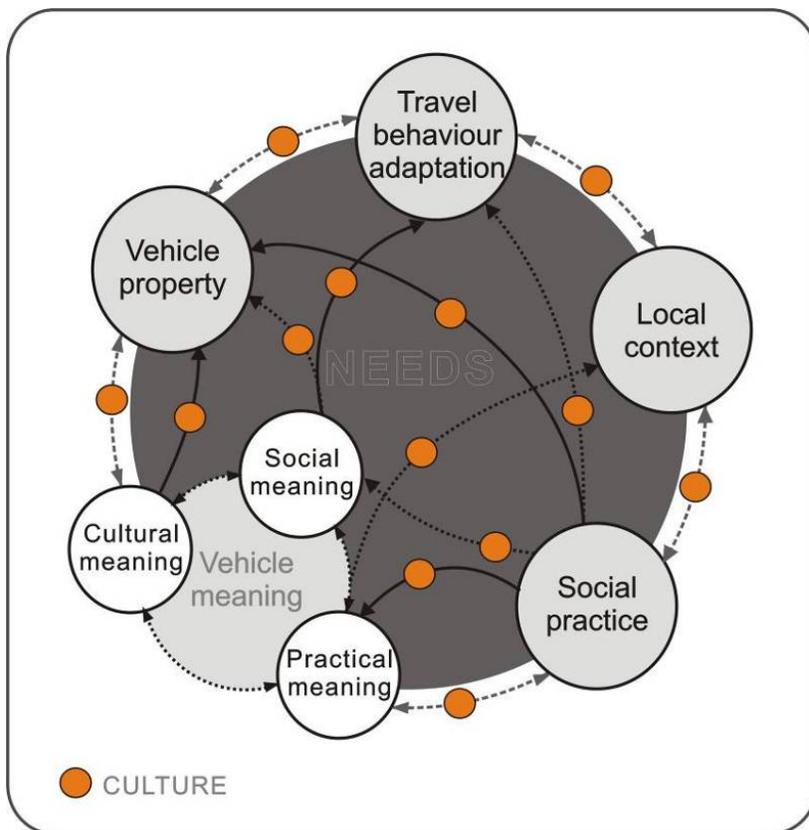


Figure 8: Conceptual model of culture-dynamic travel needs

This model can be used to identify needs related to vehicle usage within the Chinese culture. This model suggests an approach to the collection and structuring of user research information from

the cultural context and vehicle meaning perspective. It is envisaged that the proposed model can play an important role in the design process in order to help vehicle designers to better understand the relationship between culture and design.

8. CONCLUSIONS AND FURTHER RESEARCH

This study explores the travel needs of older Chinese drivers in order to assist designers to better understand current and future users' needs. Vehicle designers need to apply socio-cultural science to understand what the vehicle means to the aging population in particular cultural contexts.

Further work will focus on application of the initial concept model. This application will focus on a representative example of concept vehicle design. Concept vehicle design as an outcome of this research will serve as a bridge between theoretical research and design practice. It is worth noting that, by using the resultant culture-specific insights about older drivers' travel needs, designers will improve their overall innovation process to assist in increasing the quality of older adults' lives.

REFERENCES:

Allan, K. 1998, *The meaning of culture: moving the postmodern critique forward*, Praeger Publishers, London.

Antonides, G. and Raaij, W. F. V. 1998, *Consumer behaviour: a European perspective*, John Wiley & Sons Ltd., Chichester, England.

Ban, L., Belzowski, B. M., Gumbrich, S. and Zhao, J. 2005, *Inside China: The Chinese view their automotive future*, The University of Michigan Transportation Research Institute (UMTRI) Office for the Study of Automotive Transportation (OSAT), IBM Institute for Business Value, viewed 24th May 2007, <<http://www.ibm.com/services/us/index.wss/ibvstudy/imc/a1017907>>.

Baumeister, R. F. 2005, *The cultural animal: human nature, meaning, and social life*, Oxford University Press, Inc., New York.

Belgasem, R. T. 1987, 'Human needs and building evaluation: an approach to understanding architectural criticism', PhD Dissertation thesis, University of Pennsylvania.

Chapman, J. 2005, *Emotionally durable design: objects, experiences and empathy*, Earthscan, London, UK.

Cutler, S. J. and Hendricks, J. 2001, 'Emerging social trends', in R. H. Binstock and L. K. George (eds), *Handbook of Aging and the Social Sciences*, 5th edn, Academic Press, San Diego, vol. 3, pp. 462-480.

- Edensor, T. 2004, 'Automobility and national identity -- representation, geography and driving practice', *Theory, Culture & Society*, vol. 21(4/5), pp. 101-120.
- Fozard, J. L. 2000, 'Sensory and cognitive changes with age', in K. W. Schaie and M. Pietrucha (eds), *Mobility and Transportation in the Elderly*, Springer Pub., New York, pp. 1-44.
- Fry, T. 1992, 'Against an essential of 'need': some considerations for design theory', *Design Issues*, vol. 8, no. 2. Spring, pp. 41-53.
- Fuhrer, U. 2004, *Cultivating minds: identity as meaning-making practice*, Routledge, East Sussex.
- Gergen, K. 1991, *The saturated self*, Basic Books, New York.
- Hakamies-Blomqvist, L., Siren, A. and Davidse, R. 2004, *Older drivers - a review*, VTI report 497A, Swedish National Road and Transport Research Institute, Linköping Sweden.
- Hareven, T. K. 2001, 'Historical perspectives on aging and family relations', in R. H. Binstock and L. K. George (eds), *Handbook of Aging and the Social Sciences*, fifth edn, Academic Press, San Diego, vol. 3, pp. 141-159.
- Jordan, P. W. 2000, *Designing pleasurable products : an introduction to the new human factors*, Taylor & Francis, London.
- Keates, S. and Clarkson, J. 2003, *Countering design exclusion : an introduction to inclusive design*, Springer, London New York.
- Kegan, R. 1982, *The evolving self*, Harvard University Press, Cambridge, MA.
- Krippendorff, K. 2006, *The semantic turn: a new foundation for design*, CRC Press, Boca Raton.
- Leiss, W. 1990, *The limits to satisfaction: on needs and commodities*, rev. edn, Marion Boyars, London.
- Maslow, A. H. 1987, *Motivation and personality*, Third edn, Harper & Row, Publishers, Inc., New York.
- Meyer, J. 2004, 'Personal vehicle transportation', in R. W. Pew and S. B. V. Hemel (eds), *Technology for Adaptive Aging*, The National Academies Press, Washington, D.C., pp. 253-281.
- OECD 2001, *Ageing and transport: mobility needs and safety issues*, Organisation for Economic Co-operation and Development, <<http://ntl.bts.gov/lib/24000/24400/24470/2675189.pdf>>.
- Oulasvirta, A. 2005, 'Grounding the innovation of future technologies', *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments*, vol. 1, no. 1, pp. 58-75.
- Popovic, V. 2002, 'Activity and designing pleasurable interaction with everyday artifacts', in W. S. Green and P. W. Jordan (eds), *Pleasure with products: beyond usability*, Taylor & Francis, London, pp. 367-376.
- Press, M. and Cooper, R. 2003, *The design experience: the role of design and designers in the twenty-first century*, Ashgate Publishing Limited, Aldershot.
- Riley, K. 2002, 'Motor vehicles in China: impact of demographic and economic changes', *Population and Environment*, vol. 23, no. 5, pp. 479-494.
- Rogers, Y. 2004, 'New theoretical approaches for HCI', *Annual Review of Information Sciences and Technology*, vol. 38, pp. 87-143.

- Rowan, J. 1998, 'Maslow Amended', *Journal of Humanistic Psychology*, vol. 38, no. 1, pp. 81-92.
- Scheiner, J. and Kasper, B. 2005, 'A lifestyles approach to investigating residential mobility and travel behaviour', in K. Williams (ed.), *Spatial planning, urban form and sustainable transport*, Ashgate Publishing Limited, Hampshire, pp. 42-60.
- Shweder, R. A. and Sullivan, M. A. 1990, 'The semiotic subject of cultural psychology', in L. Pervin (ed.), *Handbook of personality: theory and research*, Guilford, New York.
- Simon, H. A. 1969, *The sciences of the artificial*, MIT Press, Cambridge, Mass.
- Siren, A. and Hakamies-Blomqvist, L. 2005, 'Sense and sensibility. A narrative study of older women's car driving', *Transportation Research Part F: Traffic Psychology and Behaviour*, vol. 8, no. 3, pp. 213-228.
- Strauss, A. L. and Corbin, J. M. 1998, *Basics of qualitative research : techniques and procedures for developing grounded theory*, 2nd ed. edn, Sage, Thousand Oaks.
- Swigart, T. F. 2000, 'Intelligent transportation systems and the older driver: an auto industry perspective', in K. W. Schaie and M. Pietrucha (eds), *Mobility and Transportation in the Elderly*, Springer Publishing Company, Inc., New York, pp. 299-313.
- Trice, H. M. and Beyer, J. M. 1993, *The cultures of work organizations*, Prentice Hall, Englewood Cliffs, N.J.
- United Nations 2001, *World Population aging: 1950-2050*, United Nations, <www.un.org/esa/publications>.
- Zhao, C., Popovic, V. and Ferreira, L. 2007, 'Elderly Drivers' Needs: Methodological Approach and its Application to the Educational Context', paper presented to Connected 2007 International Conference on Design Education, University of New South Wales, Sydney, Australia.