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# Understanding Older Vehicle Users:
An Interpretative Approach

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## Abstract

Future adaptations in vehicle design should be linked in some parts to the age-related changes often faced by the older users. The aim of this research is to investigate the multiple age-related changes of Chinese older vehicle users in order to assist designers to better understand current and future older users' needs. Although qualitative interpretative approaches have rarely been applied in the field of traffic gerontology research, they are widely used in current design research to explore persons' lived experiences, behaviours and emotions. Therefore, this study employed qualitative research methods consisting of observation, interview, travel logbook and co-discovery to explore older vehicle users' travel needs. The interpretative analysis confirmed that multiple methods such as interview, travel logbook, and co-discovery are useful to gain a holistic understanding of older drivers' travel needs. However, the one journey driving observation cannot provide valuable categories to explore older users' multiple travel needs due to daily living context absence in the one trip experiment. It is clear that the useful methods for determining research for older users will depend on the product. The findings demonstrate that Chinese future older generations are more concerned about their age-related differences from social and cultural perspective rather than physiological perspective. Social and cultural context play important role to shape older vehicle users' future travel needs. From design a point of view, understanding the social activity and cultural context surrounds older vehicle users should make it possible to predict older drivers' needs related to vehicle property.

### Keywords

Older Vehicle Users; Cultural Context; Social Context; Vehicle Design; Qualitative Research

Mobility is critical to the well being of older people. It is essential for maintaining attributes of personal choice and independence, familiar habits, and lifestyle. Although aging is accompanied by decline of strength, the needs of the elderly and disabled users are different (Donaghy, Poppelreuter, & Rudinger, 2005). Design is a crucial instrument for successfully fulfilling older

people's mobility need. In China, the number of older personal vehicle owners is increasing dramatically in the urban areas. This will place new and growing demands on transport systems in the future. The vehicle designers need frameworks for making transitions from theoretical understanding Chinese older vehicle users to design implementation. There is evidence that extensive research has been conducted into older drivers' road safety and vehicle design issues in the Western countries (Coleman & Harrow, 2000; Herriotts, 2005; OECD, 2001); however, systematic data on the Chinese cultural framework are largely absent (Zhao, Popovic, Ferreira, & Lu, 2006).

This study attempts to explore the current travel activities of middle-aged and older vehicle users within the Chinese cultural framework and predict the future older users' travel needs. Comparing with current older drivers, current middle-aged drivers are the major vehicle user population in the China and they will potentially become the younger-old vehicle users and compose a significant vehicle market section in the next decade. Therefore, target users groups of this study have been identified in the future new aging generation (current middle-aged users). Other groups are employed to be comparing reference groups during the data analysis. This paper focuses on discussing the research methodological issue in which an interpretative approach is proposed.

## Older vehicle users

The literatures show that understanding older vehicle users and their age-related changes could be viewed in three aspects which include physiological, social and cultural dimensions.

### *Physiological dimension of age-related changes*

There are lot of research projects conducted to study older vehicle users' age-related changes and improve road safety issues from physiological perspective. Some researchers (Anstey, Wood, Lord, & Walker, 2005; Hakamies-Blomqvist, Siren, & Davidse, 2004) looked at older vehicle users as a general cohort and identified three interconnected areas of deficiencies, which include (i) sensory, (ii) cognition and (iii) motion. These areas are related to three facts about aging:

1. Speed of behaviour becomes slower at older ages.

2. The interrelationships among elements of sensory and cognitive performance increase with older age.

3. With older age, skilled performance requires relatively more sensory information from the environment than is the case in younger persons.

From the physiological and biological perspective, these studies believe that human beings have common physiological capabilities, and most of older people might experience homogeneous age-related changes. However, it is worth noting that these age-related changes should be variable, based on changes of context (Fozard, 2000). The importance of age differences in reserve capacity for design applications needs to be critically evaluated on a case-by-case basis.

### Social dimension *of* age-related changes

The aging process can be defined as 'not only a physiological process in which biological systems undergo changes, but it is also a social process in which a person changes involvement in activities and obligations' (Meyer, 2004). The relation between mobility and quality of life is complex (OECD, 2001), not only spatially but also socially, demographically and economically diverse (Rees & Lyth, 2004). Transport has a clear social function and satisfies particular social-psychological desire (Donaghy et al., 2005). The relevant literatures demonstrate that linkage between older people and their mobility needs within the social dimension is not well understood.

The age variable is the most important predictor for a thorough examination of the influence of lifestyle on mobility (Scheiner & Kasper, 2005). The value of the concept of lifestyles for transport research lies in differentiation of social structures by subjective patterns of explanation, aim of activity, leisure preference, value orientation, and culture affiliations. Therefore, the current trend of transport research shifts from the trip-based to the activity-based approach. The activity-based approach analyzes travel as daily or multi-day patterns of activity which related to and derived from differences in lifestyles among the population (Kitamura, 1998). It is clear that this framework involves a richer, more holistic social context factors.

### Cultural dimension of age-related changes

Aging populations are strongly related to the culture variables (Atchley & Barusch, 2004). Culture provides the context within which aging population's life is lived at a particular time and place. Interpretations of age-related changes involve culture (Fry, 1999). Therefore, cultural dimensions remain central to understanding of older vehicle users' experiences. The older vehicle user as a subject imposes his or her wants on the object and defines the vehicle's uses according to his or her own needs. Simultaneously, the user is defined by the vehicle's particular way of responding to the user's needs. That is a vehicle is used by many and for many purposes. It is no longer only a machine for travelling through space, but a car that is 'constructed' to overcome a variety of other daily life problems. According to such discussion, the older vehicle users who have uniqueness of demand due to age-related physiological and social differences will define car usages as particular cultural meanings. However, Siren and Hakamies-Blomqvist (2005) state that masculinity, youthfulness, speed, status and power are deeply embedded in the traditional cultural images of car and driving. It is clear that cultural meaning of cars and driving invariably excludes older people.

## Current approach to study older vehicle users

There are two research approaches known as qualitative and quantitative research. The qualitative approach is supported by a constructivist/interpretivist philosophy. It believes that knowledge is subjective and can only be understood through the researcher interacting with the focus of the research in a personal yet biased inductive process (Miles & Huberman, 1994). Qualitative methods such as interviews can help fill the gaps left by quantitative techniques (Clifton & Handy, 2003). In the qualitative approach, theories are inductively developed to form a deep understanding of the

meaning of the data, collected within a rich context-bound setting (Creswell, 2003).

Traditional transportation studies rarely approaches travel behaviour from a social constructivist perspective, the qualitative research might remain unreachable. However, some researchers (Clifton & Handy, 2003; Gardezi et al., 2006) claim that qualitative research is vital to understand the complexity of transportation activity which rests upon the subjective beliefs and behaviours of individual person. Qualitative studies of travel behaviour have produced important insights about the future trend of travel needs, aging populations in car-dependent environments, growing levels of motorisation in developing countries, non-work travel activities, and so on (Clifton & Handy, 2003). The interpretative research tradition may provide an alternative to the traditional transport research approaches to study local older vehicle users. Within the interpretative research tradition, the primary focus of phenomena is on the meaning structure of lived experience (Schutz, 1945).

## Research methodology

Based on the above understanding, the empirical experiment was designed to investigate current middle-aged and older vehicle users' travel activities and predict future Chinese new aging generation's travel needs. The qualitative research methods consisting of co-discovery, logbook, interview, and observation were employed to collect multiple forms of data to ensure the reliability and validity of the research. According to Galtung (1990), the non-verbal data obtained from observation and sketch are more valid but less reliable, among other reasons because replication is less feasible. The verbal data is more reliable, but less valid. The data collection techniques generate textual and visual data to ensure the reliability and validity of the research (Table 1).

Table 1: Data collection sources

| Forms of data | Type of data | Definition of type of data | Function |
|---|---|---|---|
| Textual | Co-discovery transcription | Structured iterative protocol generated by two participants' discussion which related their future lifestyle. | Textual data used to explore participants' future travel needs |
| | Interview transcription | Semi-structure interviews consisting of asking open-ended questions related to participants' travel needs. | Textual data used to investigate participants current travel needs |
| | Travel logbook | Dairy reports written by participants about their current daily travel patterns and behaviours. | Textual data used to investigate participants current travel needs |
| Visual | Sketches in co-discovery | Images and sketches generated by participants to illustrate the ideas about their own future car. | Visual data used to explore participants' future travel needs |
| | Video in interview | Images of objects which used or taken by participants in their private car. | Visual data used to back up interview textual transcription data analysis |

| | Video in the driving observation | Video data used to record the participants' behaviour related to car usage | Visual data used to explore participants' current travel activities |
|---|---|---|---|

## Maximum variation sampling

Different qualitative methods require different minimum sample sizes. Morse (1994) has recommended that grounded theory studies should include about 30 to 50 interviews. Therefore, this study gathered 36 responses from two types of Chinese participants: eighteen middle-aged vehicle users (45–59 years old) and eighteen older vehicle users (60 years old and above). A simple screening of potential candidates was conducted to make sure the participant pool covered different genders, educational backgrounds and occupations. Such in-depth rich information from a small number of people will be valuable to explore research questions (Patton, 2002). According to Coyne (1997), in-depth information can be achieved through purposeful sampling strategies. Sample size in qualitative research may refer to numbers of persons, but also to numbers of co-discoveries, interviews, logbooks and observations conducted or numbers of events sampled (Sandelowski, 1995).

## Co-Discovery

The co-discovery protocol was employed to investigate the future older vehicle users' travel needs. During the experiment, participants were divided into eighteen groups (two participants per group) (Figure. 1). The co-discovery consisted of two stages which lasted one hour. In the first stage, the participants needed to discuss and imagine their future lifestyle and social activities related to vehicle using for about 30 minutes. In the second stage, participants were asked to design their future vehicle using pencils and papers within 20 minutes. This technique produced sketches that describe images of the participants' concept (Figure 3). In the design research, sketches and drawings were used as one of the generative techniques to elicit people's past experience and dreams of the future, and to express people's thoughts about the product's scenario of use (Sleewijk Visser, Stappers, Van der Lugt, & Sanders, 2005). The sketches drawn by users might help researchers and designers to explore design features which users desire to get and identify users' unmet needs related vehicle using. Following the sketch, two of participants explain their sketches to each other. Such retrospective verbal reports immediately after drawing helped the participants to determine the meaning of the drawing. The digital video cameras were used to record this process.

Figure 1: Co-discovery

### Logbook

The second primary data collection technique was a travel logbook. In order to investigate the present older and middle-aged vehicle users' travel needs, participants were asked to fill three pages of a diary about their daily travel activities on Tuesday, Thursday and Sunday. These three days which are selected from one week include work day and week end to ensure validity and reliability. The intent was to obtain a holistic picture of the participants of daily travel activities with emphasis on portraying the everyday experiences of individuals. Comparing with traditional trip-focused travel dairy which concentrates on quantitative study of travel patterns such as distance of trip and time of travel (Clifton & Handy, 2003), this study designed a structured activity-travel logbook to conduct in-depth investigation with the context. In the logbook, the participants needed to report their daily travel scenario such as journey course, trip purpose and number of people they travel with and affiliation, and other activities during the journey. The travel logbook generated textual data for daily travel patterns and scenarios with related user needs and habits.

### Interviews

Interviews generated data about current travel activities of middle-aged and older vehicle users. They helped the researcher to define what behaviour should be taken into account and pointed to the need for activity diaries rather than travel diaries (Clifton & Handy, 2003). Individual interviews were administered and they lasted for around half an hour. All interviews were conducted inside the participants' vehicles. This setting provided context that were relevant aspects of users' travel experiences that might help design researcher to understand those preferences in a meaningful context. The semi-structured questions were employed to explore participants' experiences related to vehicle using. The interviews were audio-recorded and transcribed. During the interview, video was taken to document the accessories of vehicle, the products in vehicle, and the informant's activities. These visual data generated a wealth of data related to the vehicle context and might be used to back up and clarify the textual and verbal data.

## *Observation*

To explore the current vehicle users' travel activity, observations were conducted inside and outside participants' private car. During 40 minutes observations, the participant was asked to perform specific tasks which involve using the control, seeing parking, using the boot, and so on (Figure. 2). The DV camera was used to collect the observation data.



Figure 2: Observation

## *Coding framework*

The coding procedures were useful to establish both descriptions of the users' experiences with vehicles and to develop a framework for further vehicle design. By analysing the travel activities of two age cohorts in their daily lives and comparing these data, patterns about future older vehicle users' travelling needs emerged. The analysis started with the open coding of the textual data generated by co-discovery, interview and logbook transcriptions on a case-by-case. This was essentially a detailed examination of the data for identifying, naming, categorizing and describing patterns in the text. This produced five themes which involved 17 categories (Table 2).

Table 2: Coding framework

| Themes | Codes | Categories |
|---|---|---|
| Social practice for maintaining quality of life | SAL | Social activity for maintaining daily routine life |
| | SRA | Social role adaptation |
| | SAP | Social acceptability |
| | SAS | Social accessibility |
| Local context | SEF | Socio-economic factors |
| | LGF | Local geography |
| | LCT | Local customs |
| Travel activity adaptation | TPT | Travel patterns |
| | DBV | Driving behaviour |
| Vehicle meaning for users | PMN | Practical meaning |
| | SMN | Social meaning |
| | CMN | Cultural meaning |
| Vehicle property of users aspiration | ECM | Economy |
| | STT | Structure |
| | FCT | Function |

| TNG | Technology |
|-----|------------|
| ATS | Aesthetics |

## Results and discussion

The higher frequency rate of occurrence of a particular category shows its significance to the vehicle users travel needs. This study identified five significant categories which include social activity for maintaining daily routine life (SAL), practical meaning of vehicle (PMN), social meaning of vehicle (SMN), cultural meaning of vehicle (CMN) and structure of vehicle property (STT). The data show that constituents involved in the travel activities and needs are closely related to the assignment of these five core categories. Beyond age-related physiological impairment, changes of social lifestyle context play the important role to affect future Chinese older vehicle users' travel needs. For instance, the Participant 12 (Table 3) related social activity for maintaining leisure lifestyle such as travelling by group (SAL) to the specific structure of vehicle property such as compatibility capacity (STT). He views the vehicle as tool for peer gathering (PMN) not only for the social purposes, but also for concerning each other (SMN) during the long distance trip. In such context, leisure travelling can be defined as collective social activity in which vehicle reflects interdependence cultural value in the China (CMN). Similarly, the Participant 2 (Table 3) indicated that particular vehicle meaning such as vehicle as tool for carrying staff (PMN) and vehicle property such as protection assist facility (STT) can support future older user maintaining his leisure hobby (SAL). These findings suggest that designers should go beyond physical vehicle property and focus on integrating vehicle property, vehicle meaning, travel activity, social practice, and local context to inspire design innovation.

Table 3: Statement on linkage of core categories

| Participants | Statements |
|--------------|------------|
| Participant 12: | I don't like coupe because it's an exclusive vehicle, which means it is impossible to sit three or more people in the small car. You know, older people need bigger space for his/her peers when they are travel together. Cause we can look after each other while enjoying the journey. |
| Participant 2: | My hobby is antique collection. I would like drive to the countryside or flea market to collect antiques when I retired. So I need a vehicle which can not only carry these artworks but also protect these treasures when I am travelling in the countryside. |

This study found that social practice and local context form the macro-level of the social and cultural context of older users' travel needs. Any changes of these context factors can lead to the change of travel needs meanings. For instance, although most prior researches highlight the older drivers' safety need from age-related physiological point of view, this study suggests that older vehicle users interpret safety meaning differently due to different context. Firstly, the vehicle as safety tool is related to relying un-blind-spot device to guarantee driving safety (Table 4: Participant 7). The left sketch in the Figure 3 illustrates concrete shapes to interpret this point from the user's point of view, in which the vehicle has a narrow back A pillar, big windshield and windows to achieve un-blind-spot characteristic. Secondly, the safety meaning is

interpreted as using solid material and accessories to protect older user, and using smart technology to ensure the vehicle security (Table 4: Participant 29). These attributes can be easily identified from participant's sketch (the right picture in the Figure 3). Thirdly, the older user emphasizes vehicle's safety meaning by depending on the health emergency support facility to remedy age-related capability decline (Table 4: Participant 11). Fourthly, urgent maintenance support device can be used to enhance the driving safety on the freeway (Table 4: Participant 32). Lastly, the vehicle as safety tool is defined as using communication device to avoid urgent accident during the long distance travel (Table 4: Participant 5). From design perspective, all these interpretations on vehicle as safety tool comprise the implicit or explicit physical vehicle parameter to fulfil vehicle users' multiple-safety needs. These different meanings of safety need depend on participants' social practice and local context changes.
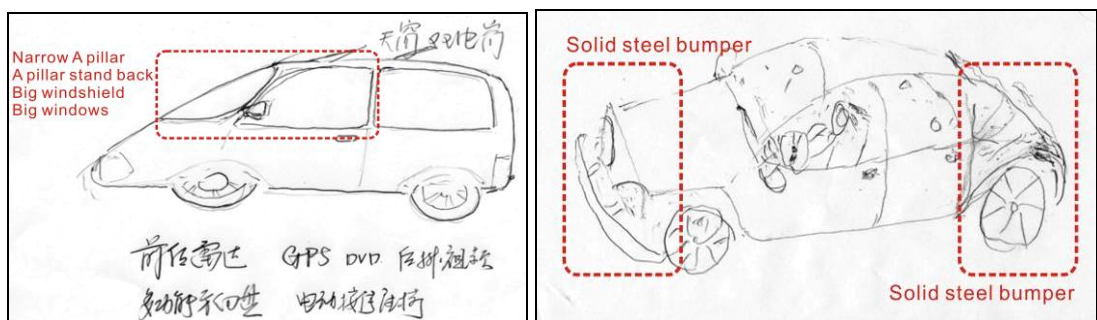


Figure 3: Participants' sketches on the vehicle as tool for safety

Table 4: Statement on different meanings of safety need

| Participants | Statements |
|---|---|
| Participant 7: | I will have good view if the car has wide windshield. The A pillar should be narrow to make sure driving safety, especially during the traffic jam. |
| Participant 29: | The steel bars should be designed within the both doors. The bumper should be solid. I feel safe if the car have these things. I do not like the small cars such as QQ because it is not safety. Its' fibre glass bumper is easily broken. …I am old and have bad memory, so I do need an automatic lock to avoid forgetting lock the door. |
| Participant 11: | It is safety if there is a medicine-chest in my car. Maybe I have some health problem when I become old. |
| Participant 32: | It is so dangerous if tyre broken during the journey. So I think that a compact tyre air-pressure meter and air pump are useful for the elderly driver. |
| Participant 5: | I need walkie-talkie device in my future car. If my car is broken in the freeway, I can call the emergency number and get the help. … It is also useful when a few of my extended family cars travel together. |

The importance of the macro-level context becomes clear when utilizing concept model of travel needs identify to analyze data segments (Figure 4). For example, both participants in the Table 5 present the same vehicle property such as cuisine facility (STT-2.11) and vehicle meaning such as reflecting traditional food cultural custom (CMN-1.4). However, two participants present different social practice and local context categories

which form macro social and cultural context. The context presented by Participant 28 (Table 5) involve health attributes (SAS-1.0), cohort identity (SAP-1.1), local food ritual (LCT-2.2), and travel service (LGF-2.1) (Model A of Figure 4), whereas, the context expressed by Participant 2 (Table 5) contain maintaining leisure travel (SAL-1), maintaining social network (SRA-2), and travel scenery (LGF-2) (Model B of Figure 4). Therefore, the different travel needs are generated based on different conditions and context. The Participant 28 (Table 5) needs a utility vehicle because the in-vehicle cuisine accessory is functional and necessary tool to maintain his good health condition due to his age-related capability decline and bad condition of local travel service (Model A of Figure 4). The participant 2 (Table 5) states that cuisine facility can support him to enjoy the leisure travel. Therefore, it can be defined as comfort need based on such context (Model B of Figure 4).

Table 5: Statement on relationships between context and needs

| Participants | Statements |
|---|---|
| Participant 28: | I need a water heater in the car especially during the long distance trip such as leisure travel to countryside. You know, it is so useful for the elderly driver like me because most of Chinese older guys have stomach problem. We can not drink the cool water. Moreover, the unheated water in the countryside contains lots of bacteria which are harm to our health. |
| Participant 2: | The comfortable car should have multiple functions such as accessories to support cooking and sleeping. For example, elderly people will enjoy cooking during the leisure travel. It must be exciting when a group of older guys cooking and having the dinner together in the nature. |
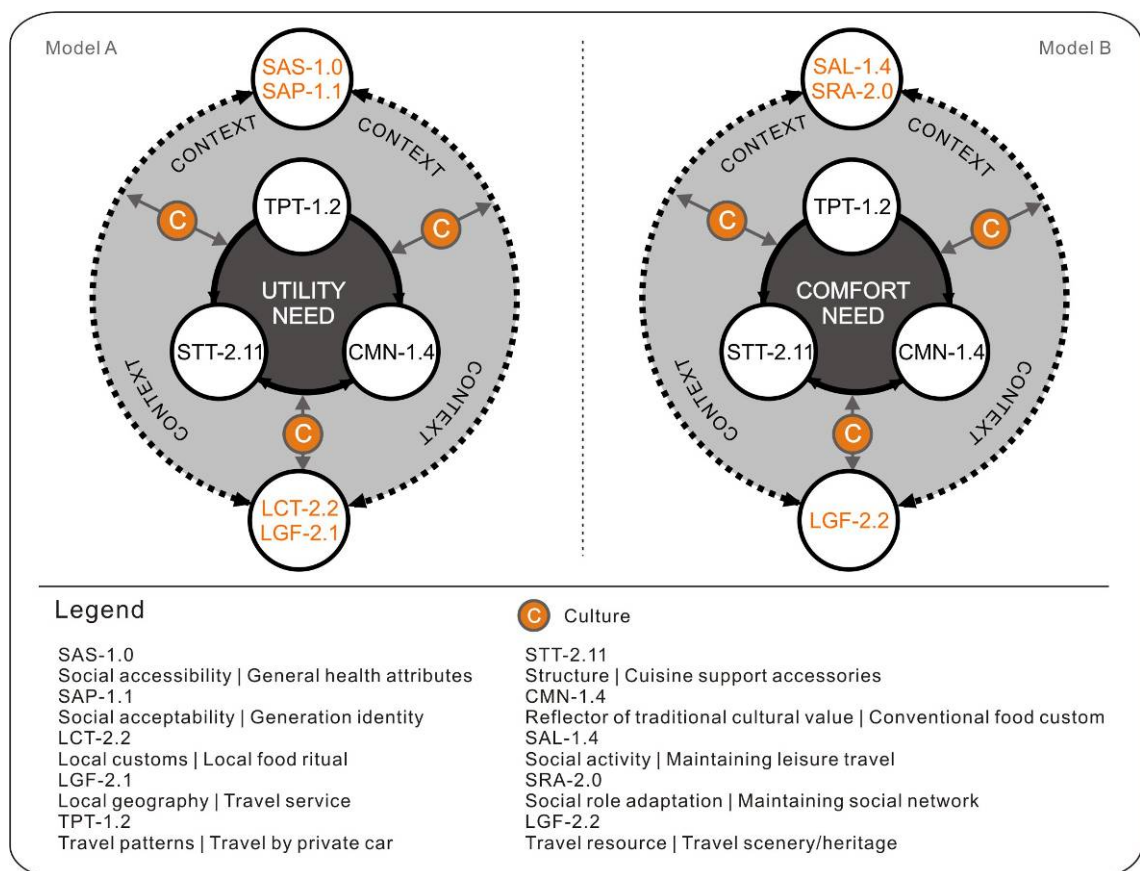


Figure 4: Concept model of travel needs and importance of context at macro-level

Clearly, it is impossible to identify the detail of users' need without considering changes of relevant social and cultural context. That is vehicle innovations can not only just focus on the vehicle property and vehicle meaning in isolation to fulfill the future old users' needs. The social and cultural contexts which include subjective culture generated by social practice and objective culture generated by local context play import roles to define the local users' needs. Better understanding of macro-level of social and cultural context might help designers generate novel vehicle features, functions, structures, and forms to fulfil future older users' unmet and potential travel needs.

When using the same coding framework (Table 2) to analyse visual data generated by observation method, this study found that the observation data could not convey enough valuable information to investigate older local users' multiple travel needs. For example, all of participants conducted similar driving behaviour during the experiment and most behaviours could only be coded as 'physical accessibility'. According to Silverman (2000), researchers must engage in an extended period of observation to entail immersion into local culture and provide the kind of daily lives contextual and comprehensive information. Study of social and individual activities related vehicle using is difficult to capture only through one trip observation because of insufficient of daily lives recourses and scarce of context involved in the simple one trip observation experiment. It is clear that the useful methods for determining research for older users will depend on the product. Traditional laboratory-based user research prefers the observational method of the user testing which get little information about macro-level of use context such as social activity and lifestyle. Considering that many complex technological products such as the personal vehicle are involved in the context of everyday activities, this study developed validated research methodologies which involve co-discovery, logbook, and interview to probe rich context of user-vehicle interaction. This methodological user research approach can be transfer to other types of design studies that require the explorations and assumptions of future target population in the particular social and cultural context.

## Conclusions and further research

Future adaptations in vehicle design should be linked in some parts to the multiple dimensions of age-related changes often faced by the older users. This paper discussed research methodological issues to ensure the validity and reliability of the further study. The research methodology aims to explore the richer, more holistic social and cultural context because Chinese older vehicle users' travel needs are context-dependent and experience based.

Further work will focus on transforming above theoretical understanding of Chinese older vehicle users and implement these findings into design. This research is significant as a new vehicle design approach will be developed which can integrate models of local older users' needs technologically, aesthetically, socially, and culturally. It might help designers getting the new knowledge to design concept vehicle for the future Chinese new aging population.

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