

Applying life history survey to capture biographical interactions of households' major mobilities over life course[†]

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It is expected that households' various mobilities are interrelated over life course, which has however been ill-understood. To fill in this gap, this study first conducted a web-based life history survey to investigate four major types of households' mobilities (i.e., residential, household structure, employment/education, and car ownership mobilities). In the survey, the information for describing each mobility biography includes the mobility frequency, timing, and the detail household, individual, spatial and housing factors. Based on such a rich data, a rule-based exhaustive CHAID analysis are conducted to understand people's mobility behavior in the life course as well as the interactions between different biographies. Furthermore, substantial state dependence and future expectation within the same domain as well as across different domains is identified when describing the occurrence and non-occurrence of the residential mobility and car ownership mobility.

Key Words : *life mobility, state dependence, future expectation, life story survey.*

1. INTRODUCTION

Many previous research have recognized that employment, residential, household structure and travel choices are not independent of each other, and individuals or households alter their lifestyle by collectively adjusting their varied dimension behaviors to land-use and transportation policies (Eliasson and Mattsson, 2000; Waddell, 2001). In this sense, once a transportation system is built or a land-use policy is carried out, it influences people's travel behavior and their lives in other domains (e.g., residential, household structure, housing, employment, and education) for a long time period (e.g., 10 years, 20 years, or even longer). Consequently, understanding people's decisions on travel behavior and lives from the long-term perspective is one of the most fundamental requirements to transport policy makers. In other words, the life course dynamic analysis which

links different domains of life together and sheds light on the mobility biography is required.

The life course approach has been applied by demographic and housing researchers in various research fields (Mayer and Tuma, 1990; Wissen and Dykstra, 1999). From their viewpoints, people's behavior can be explained by its continuity over life time and by specific events that involve major changes in other domains of life. Moreover, the life course is further subdivided into a series of trajectories which are comprised of a sequence of events and episodes (defining as the period between two consecutive events) in certain domains of life. The term 'mobility biography' is posed here to refer to the total of an individual's longitudinal trajectories over the life course in the mobility domain. To date, it turns to be the key interest of life course researchers to analyze the biographical interactions of different life course trajectories (Dieleman, 2001; Ommeren, et al.,

1999; Wissen and Dykstra, 1999). Essentially, the biographical interactions in the life course are two-fold: on the one hand, there is an intra-event or inter-episode interaction in the same domain caused by the historical experience or the future expectation. The mobility history and the different durations a person kept in former episodes are of some importance since prior mobility is strongly correlated to current mobility. Besides, in each episode, the future plan might also influence the decision on current period. On the other hand, the interaction between different domains sometimes exists. Events in one domain are frequently connected to changes in other domains. For instance, move to suburban area will increase the probability of car ownership change, and therefore the travel behavior.

In this paper, in order to study people's behavior from long-term perspective, the mobilities in residential domain, household structure domain, employment/education domain and car ownership domain (i.e., four main dimensions) are extracted from the life course so as to better understand individuals' behavior reactions to changes occurring in their personal and household life, professional career, spatial structures, as well as the travel modes. Since dealing with the life course dynamics needs a longitudinal data, a web-based retrospective life story survey covering the period of each respondent from 18 years old to now was carried out at the end of 2010 in Japan and 1000 valid sample was obtained. In the survey, for all domains, the mobility timing and frequency are asked and focusing on each episode, detail information is collected. Currently, behavioral mechanisms related to the mobilities over life course have not been clarified in literature, therefore, before developing any behaviorally-oriented models, it might be better to first explore such behavioral issues in a statistical way. With such consideration, aggregation analysis is first conducted to catch a general idea of the mobilities in the above four domain. After that, the rule-based exhaustive CHAID analysis is carried out to identify the dynamic biographical interactions by incorporating not only the state dependence but also the future expectation.

The remaining part of this paper is organized as follows. Section 2 elucidates the interaction mechanisms between residential mobility biography, household structure mobility biography, employment/education mobility biography and car-dependent mobility biography. The following section introduces the life story survey and the collected data. Thereafter, aggregation results are shown and explained in Section 4. Section 5 presents the exhaustive CHAID analysis for the dynamic biographical interactions. Finally, this study is concluded in Section 6 along with a brief introduction of

the behavioral implications of the above statistical analyses.

2. BIOGRAPHICAL INTERACTIONS BETWEEN MOBILITIES

It is argued in the life course approach that various domains of people's lives are mutually related with each other. It suggests that any mobility does not occur arbitrarily but has a certain relation to important key events in the life course that trigger such changes. Still now, many studies confirmed that a person's mobility biography has to be seen in the collective context of his or her residential biography, household structure biography, employment and education biography, and car ownership biography. Mobility in these biographies is further found intertwined with each other across the life course.

Residential mobility is special biographical moment, in which familiar routines are always broken (Scheiner, 2006). The consequences of it likely perform as the changes in the accessibility of opportunities, which include workplace, transport systems, retail and leisure facilities, relatives' places of residence and so on (Van Der Waerden et al., 2003). The motivation of residential mobility might be the change of household structure, or employment, or transport means. Alternatively, these changes could also be the results of residential migration. For instance, residential change was found closely corresponding with events in employment and household biography, such as household formation, child's birth or workplace change (Dieleman and Mulder, 2002). Concerning the relation with car ownership mobility, some efforts have been made to explain the residential mobility in the life course underlying travel demand (Scheiner, 2006; Van Ommeren et al., 2000; Lanzendorf, 2003, 2006). And such studies concluded travel behavior and long-term residential mobility as an intertwined decision flows within the life course. As an example, Scheiner et al (2006) argued that residential location is not only a pre-determined condition of individuals' travel behavior, but also an outcome of household decision and this decision manifests itself either in staying or in moving. Moreover, the travel behavior, travel changes and accessibility of opportunities may also be criteria or even constraints for residential mobility decision. Beige and Axhausen (2008) analyzed the residential mobility and the ownership of mobility tools by using a retrospective survey data covering the information from 1984~2005 for each respondent. They found a strong interrelation between two examined aspects of mobility.

Household structure mobility is strongly related with the age and generation, and this mobility is

usually reflected by the change of the household size, the number of children or the number of elder people. Such alterations have been detected to play a major role in the mobility of households. For instance, household mobility occurs considerably with the increase or decrease of the number of adult household members (Dargay, 2001; Mohammadian and Miller, 2003; Dargay and Hanly, 2004; Scheiner, 2007). Besides, household structure mobility is found usually concomitant with changes of residential location and job. Lanzendorf (2003) mentioned that presence of children in households and their age affect the assignment of household responsibilities, employment, the car availability and ownership and, ultimately, travel in a fundamental way. In particular, they argued that activity patterns of the parents will be altered greatly after the birth of a child. In fact, it has also been observed that long commuting trips, resulted from car ownership mobility, in turn lead to serious burdens for the commuter himself and his family which significantly lowers subjective well-being, health, and the fertility (Scheiner, 2007; Novaco et al., 1990; Stutzer and Frey, 2008).

Employment/Education mobility includes two types: one is a job/education pause and the other is a new job/education start. Some studies have shown that the effects of a job pause due to the birth of a child by women on travel are obvious, and these not only result in the activity pattern change for women but also for other household members (Lanzendorf, 2003). Another pause is the retirement which allows for a new arrangement of lifestyle choices. More free time makes the new time arrangements available which might also affect travel (Kaiser, 2003). New start of the job/education is probably concomitant with income increase which allows a broader range of travel options, or with location change which might require household/individual relocating to a residence nearby or buy a car to save the commute time without changing the residence (Lanzendorf, 2006). It is evident that the employment/education change is interdependent with travel behavior, household structure as well as the residential location. However, it should be noted that the above relation is not one-way, in other words, the availability of a car together with the household structure and residential location adversely affect the job hunting too. If no car is available or the residential location is far away or there are young children need to take care, the probability of finding an adequate job is limited to jobs in the vicinity or those are easy to access by public transport.

Based on the above interpretation, a complicated relationship structure is sketched out in our mind, and it seems that considering such interactions between the mobility in different domains can contribute to a

better understanding of individuals' behavior. Unfortunately, little has been done with respect to biographical interactions among the above four mobility domains.

3. SURVEY AND DATA

In order to study the main mobility decisions (including residential location mobility, household structure mobility, employment/education mobility, and car ownership mobility) over the life course, longitudinal data are required. Though the well-recognized measure is to conduct a panel survey and in this way the relatively high reliable data can be collected. However, panel survey is time-consuming to obtain enough information about long-term behavioral changes. As an alternative to panel survey, a retrospective approach is used which asks respondents to recall the past information. Based on retrospective reports, life history surveys have been developed and applied in social science to capture human behavior over the life course for many years (Belli, 1998; Belli et al., 2007; Freedman et al., 1988). Since the reliability of retrospective data is one key problem, some studies have argued that people tend to remember major events, such as residential moves or personal and familial events, better (Hollingworth and Miller, 1996). However, it is still difficult to completely remove the influence of memory. With the above considerations, a web-based life story survey covering the period of each respondent from 18 years old to now was carried out at the end of 2010 in Japan. This web survey was implemented with the help of a major web survey company in Japan (having more than 1.4 million registered panels) in November 2010. As a result, about 1,000 questionnaires were collected from the registered panels living in major Japanese cities, in which age gender and residential distributions across the whole population in Japan are guaranteed. The survey contents touch upon four domains in the life course: residential biography, household biography, employment/Education biography, and car ownership biography. In the survey, before answering detailed information related to each type of biography, respondents are asked to first report on the mobility times and the exact change timings of relevant events and a simplified matrix showing these timings is shown on a separate window for the ease of reporting detailed information later on. Subsequently, detailed information about each episode in every mobility biography is reported as follows:

(1) Residential biography: residing location, in come, house property, accessibility (here, refers to distance) to varied facilities (including JR, bus, primary & junior & high school, hospital, park, super-

market, city hall) in each episode;

(2) Household structure biography: household size, information for each household member in each episode (including age, gender, relation with householder);

(3) Employment/Education biography: job category, commute time to job/school, accessibility to job/school, travel mode in each episode;

(4) Car-dependent biography: car number, main user, car efficiency, purpose, and use frequency in each episode.

In addition to the above information, respondents are asked to report on how confident (10-point scale) they feel for the answer to some major question items with continuous values. Such confidence information can be used to reflect the reliability related to the reported information as well as the quality of retrospective survey. Besides, respondents' current life satisfaction and happiness are also investigated.

Note that we only ask the respondents to answer the mobility of residential location, household structure, job, and car ownership which continued at least one year. Moreover, at most the information of the latest four changes is collected. Based on the mobility timing, the duration for each episode is further calculated. For each individual the number of episodes is no less than 1 but no more than 5. In addition, because we have the above information of each episode in every mobility biography, that is to say, the attributes in the years between two consecutive mobilities will remain unchanged, accordingly, the lifestory data is further expanded to the panel data, in which the information of whether the mobility happens in each biography as well as the explanatory factors and attributes in each year is included. In this way, the inter-domain and intra-domain interactions can be easily captured. Considering respondents' different age, the observed period in the survey (i.e., from respondent's 18 years old to 2010) differs. According to our data, it is found that the oldest respondents are 69 years old, thus, during the expansion to panel data, totally 52 years is covered (1959~2010), while for respondents who is younger than 69 years old, only the available years is filled with the useful information.

4. AGGREGATION ANALYSIS

Before the in-depth analysis for the biographical interactions, the statistics of the data is first characterized and simple aggregation analysis is conducted.

Table 1 Distribution of the mobility frequency for each cohort in the life course

Mobility times	1940 cohort	1950 cohort	1960 cohort	1970 cohort	1980 cohort	Total
	10%	33%	31%	15%	11%	100%
Residential location mobility (Average mobility times: 2.3)						
Zero	10%	17%	9%	14%	28%	14%
Once	15%	16%	12%	24%	21%	18%
Twice	18%	20%	24%	23%	27%	23%
Three	14%	12%	16%	15%	13%	15%
>=Four	43%	35%	38%	24%	12%	30%
Household structure mobility (Average mobility times: 2.1)						
Zero	5%	10%	12%	21%	29%	16%
Once	10%	11%	17%	28%	37%	22%
Twice	8%	22%	23%	20%	15%	19%
Three	20%	21%	20%	15%	11%	17%
>=Four	57%	37%	28%	16%	8%	26%
Employment/Education mobility (Average mobility times: 2.5)						
Zero	20%	13%	11%	15%	23%	15%
Once	18%	18%	11%	19%	23%	17%
Twice	11%	14%	12%	10%	21%	13%
Three	11%	15%	13%	14%	18%	14%
>=Four	39%	40%	54%	42%	15%	42%
Car ownership mobility (Average mobility times: 1.6)						
Zero	36%	34%	27%	37%	55%	36%
Once	20%	12%	19%	24%	32%	21%
Twice	10%	7%	13%	13%	9%	11%
Three	5%	7%	11%	11%	2%	9%
>=Four	30%	39%	30%	15%	3%	23%

In Table 1, the distribution of mobility frequency for each cohort during the life course is listed out. Almost 90% of the population experienced the mobility of residential location, household structure, and employment/education, and the average mobility times are all around twice. In contrast, the car ownership mobility is not as frequent as the other three domains. Households without car ownership change in the life course accounts for 36% which is far larger than others. Thereby, focusing on this group, further aggregation is done and it is found that within this 36% population, only less than half people have never owned a car (166 individuals). In other words, more than 80% individuals are holding or used to hold car/cars.

Next, it might be curious how often the mobility occurs. Figure 1 shows the duration distribution of the residential, car ownership, household structure, employment/education episodes. A left-skewed distribution is clearly present for all these four domains. Overall 3,097 residential episodes, 2,482 car ownership episodes, 2,954 household structure episodes, and 3,314 employment/education episodes are observed in the sample. On average these episodes are 7.7, 9.7, 8.2, and 7.3 years long with a standard deviation of 7.8, 9.6, 7.8, and 8.6 years, respectively. About 70% of all the episodes are up to ten years long. For all these four domains, the most frequent episode is of 2~3 years long. In addition, the changes occurring during the life course are analyzed. Figure 2 displays the mobility timing of residential location, car ownership, household structure, and employment/education in the life course. Five years are grouped together. Obviously, there is peak period of mobility lying between ages of 20 and 35 years old for these four domains. The co-occurrence of mobility for residential location, car ownership, household structure, and employment/education can be captured

by the similar curves. In the light of car ownership, the curve is relatively even than other domains.

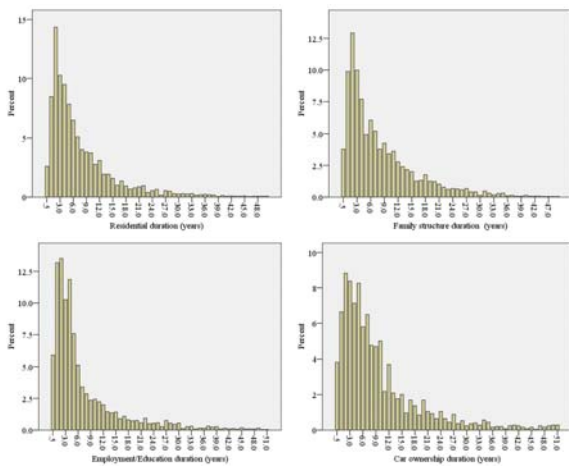


Fig.1 Duration distribution of the residential, household structure, employment/education, car ownership episodes

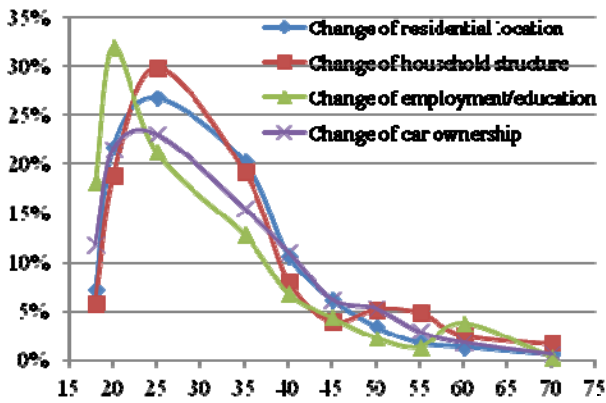


Fig.2 Mobility timing in residential, household structure, employment/education, car ownership during the life course

Figure 3 is the cross aggregation between mobility times in different domains. An evident synergistic relation between any two domains by considering their mobility times can be easily found. In other words, with the increase of the mobility times in one domain, the mobility will also rise in other domains, suggesting the co-occurrence of the four domains over the life course. Take the travel behavior which is car-dependent mobility here as an example, changes of residential location, household structure, and employment are all positively associated with the change of car ownership. Compared with the mobility of household structure and employment, the relation between residential mobility and car ownership mobility are less obvious. Based on these results, it is not difficult to understand there must be some interactions among different domains. The viewpoint that travel behavior should not be treated independently in the life course is proved again.

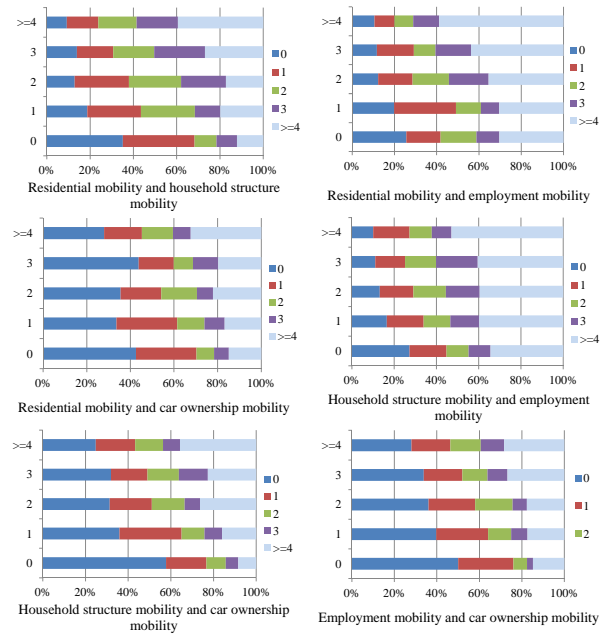


Fig.3 Cross aggregation between mobility times

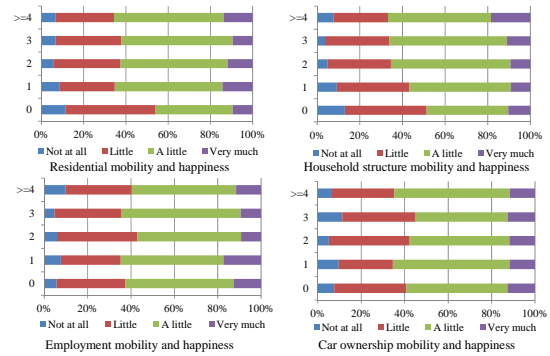


Fig. 4 Cross aggregation between mobility times and happiness

The relation between mobilities in the life course and the respondents' quality of life (i.e., QOL) defined by the current life happiness and satisfaction are studied here (see Figure 4 and Figure 5). The satisfaction and happiness are representing by 10-point scale, and they are also grouped into four items: not at all (0-2), little (3-5), a little (6-8), and very much (9-10). From the aggregation results, only the household structure mobility shows a positive relation with the current life happiness and satisfaction, meaning that more changes of household structure are more likely to be along with the high quality of life, while for other three domains, evident relation cannot be found. This might because respondents' current life happiness and satisfaction are mainly associated with current life instead of the whole life course.

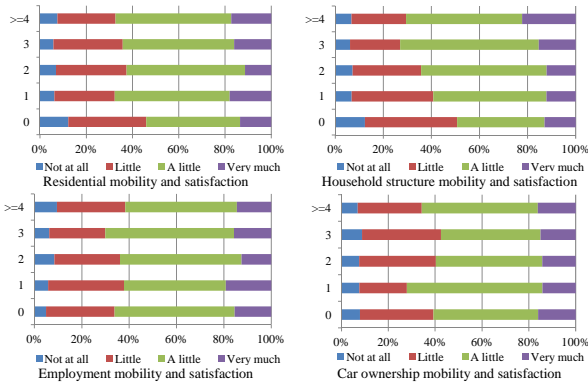


Fig.5 Cross aggregation between mobility times and satisfaction

5. DYNAMIC ANALYSIS OF BIOGRAPHICAL INTERACTIONS

It has been emphasized that there might be some interactions between different biographies. Consequently, the interactions between residential domain and the other three domains (i.e., household structure, employment/education, and car ownership) as well as the interactions between car ownership domain and the other three domains are studied here by adopting the rule-based exhaustive CHAID method. During the analysis, the household structure mobility and employment/education mobility are dealt with as exogenous variables to explain the other two mobilities, which do not influence the former two mobilities, but are mutually related with each other. Furthermore, the state dependence and future expectation over the life course are introduced to represent the influence of historical experience and the future decision/behavior on the current decision/behavior. It is worth mentioning that the state dependence and the future expectation can either occur in one biography, or occur across different biographies. In order to capture the state dependence and the influence of future expectation, the mobility occurrence in the former 25 years and the latter 10 year for each year is observed. 7 dummy variables are further defined for each mobility domain to denote whether there is any mobility happens in these 35 years period with an interval of 5 years. In this way, the dynamic biographic interactions can be identified to some extent. Hereafter, the occurrence of the mobility and the duration are analyzed in the subsequent analysis.

(1) Occurrence of Mobility

Focusing on the respondents who are available to the specific dummy variable(s), the percentage of the mobility occurrence in that time period in all the four domains when the residential mobility occurs or car ownership mobility occurs is calculated and the figures are listed in Table 2. The figures of the no mo-

bility case are given in Table 3. By comparing these two scenarios, it is shown that for the respondents who are experiencing the residential mobility in that year, the percentage of them who used to change their location, household structure, employment, and car ownership once or several times in the past, and also will change in the future 10 years is evidently greater than the percentage for the respondents who have no mobility in that year. Similar findings can be revealed for the car ownership mobility case. In these contexts, it seems that the state dependence and the future expectation not only in the same domain but also from other domains might be plausible.

After the descriptive analysis, two decision trees with maximum 10 tree depth are built up in which the occurrence and non-occurrence of residential mobility and car ownership mobility are regarded as the respective dependent variable, while the attributes in the other three domains together with the 7 dummy variables used to indicate the historical experience and future plans are set as explanatory variables. Due to the extremely complicated structure of the tree, an alternative way is adopted to understand the results (see Figures 6 and 7). By looking at the tree from bottom to up, the relation between different nodes is linked together and the arrow denotes the influential direction in the relation. Bearing in mind the focus of this study (i.e., biographical interactions), we merely draw the relation between those 7 dummy variables and the targeted mobility. While the household/individual attributes and other factors are not shown in Figures 6 and 7.

The interaction between the occurrence and non-occurrence of residential mobility and the other three mobilities is depicted in Figure 6. At a first glance, a complex relationship between different mobilities is found given the dense lines. The arc lines in the figure mean the state dependence or future expectation within one mobility domain, and the straight lines mean the influence of the mobility from other domains in different time periods on the targeted mobility (i.e., state dependence or future expectation across domains). As you can see, that, the occurrence and non-occurrence of the residential mobility is much related to its mobility experience in the past 25 years and also the residential mobility in the future 10 years. Besides, the influence come from the car ownership mobility mainly in (-5 ~ 10) years, household structure mobility in (-25 ~ 10) years, and employment mobility in (-15 ~ 10) years are apparent, especially from the employment mobility (see the most intensive lines). That is to say, the change of the employment/education in the past 15 years or the plan to change it in the future 10 years is the most influential to the residential mobility. Compared with the other two mobilities, the influence of car own-

ership mobility seems much less obvious and the state dependence between car ownership mobility and residential mobility only spans the near past. As

for the future expectation, the plan of the mobility in the next 10 years in these four domains are all found related to the current residential mobility.

Table 2 The occurrence of mobility in the past and future years of the mobility year

Dummy variables	Residential mobility occur				Car ownership mobility occur			
	Residential biography	Household structure biography	Employment biography	Car ownership biography	Residential biography	Household structure biography	Employment biography	Car ownership biography
f5to10	42.67%	51.31%	27.87%	27.36%	38.96%	38.96%	30.90%	45.88%
flto5	43.65%	50.94%	47.02%	32.49%	43.95%	41.70%	40.73%	29.15%
p1to5	49.76%	38.71%	44.94%	30.97%	39.45%	37.65%	42.71%	37.90%
p5to10	39.59%	31.78%	45.10%	28.64%	36.73%	35.35%	42.91%	46.57%
p10to15	28.94%	30.71%	45.65%	28.67%	37.30%	35.68%	39.64%	33.51%
p15to20	19.21%	23.42%	39.74%	29.74%	32.11%	33.52%	35.49%	29.30%
p20to25	17.33%	23.76%	35.15%	21.29%	37.79%	30.88%	43.32%	18.89%

Note: "f" means future, "p" means past

Table 3 The occurrence of mobility in the past and future years of the no mobility year

Dummy variables	Residential mobility not occur				Car ownership mobility not occur			
	Residential biography	Household structure biography	Employment biography	Car ownership biography	Residential biography	Household structure biography	Employment biography	Car ownership biography
f5to10	35.61%	32.40%	28.83%	26.99%	36.01%	33.64%	28.60%	25.73%
flto5	29.66%	30.51%	33.64%	26.63%	35.30%	31.67%	34.42%	22.23%
p1to5	34.66%	31.70%	34.32%	27.04%	35.81%	32.00%	34.80%	26.72%
p5to10	35.17%	32.06%	35.35%	27.80%	35.47%	31.84%	35.77%	26.76%
p10to15	34.62%	31.81%	35.39%	27.48%	34.10%	31.53%	35.87%	27.25%
p15to20	33.82%	31.75%	35.97%	25.63%	33.16%	31.22%	36.19%	25.67%
p20to25	32.33%	28.55%	37.10%	23.20%	31.46%	28.25%	36.74%	23.32%

Note: "f" means future, "p" means past

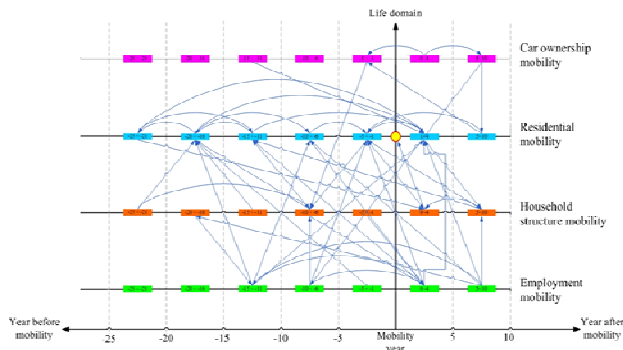


Fig. 6 The interaction between residential mobility and the other three mobilities

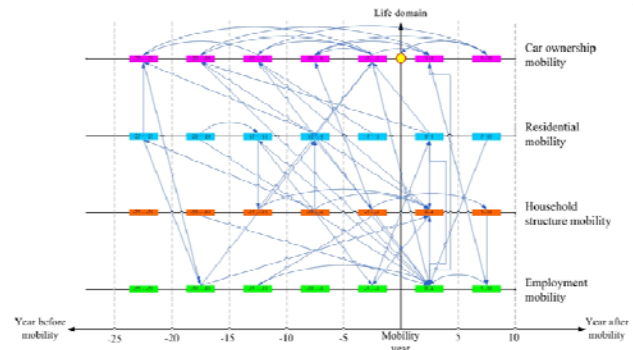


Fig.7 The interaction between car ownership mobility and the other three mobilities

The interaction between the occurrence and non-occurrence of car ownership mobility and the other three mobilities is shown in Figure 7. As with the case of residential mobility, a complex relationship is also found. The substantial intra-domain state dependence and future expectation is identified with a wide span ranging from 25 years before the mobility year to 10 years after. Meanwhile, the significant relationship between the current car ownership mobility and the residential mobility in (-25 ~ 10) years, household structure mobility (-15 ~ 10)

years, and employment/education mobility in (-20 ~ 10) years is clearly shown out. Furthermore, the car ownership mobility is more sensitive to the impact of household structure and employment/education mobility than the residential mobility.

Based on the above findings, it can be concluded that a strong state dependence and future expectation within the residential domain and between the other three domains and residential domain exists. This is also true for the case of the occurrence and non-occurrence of the car ownership mobility.

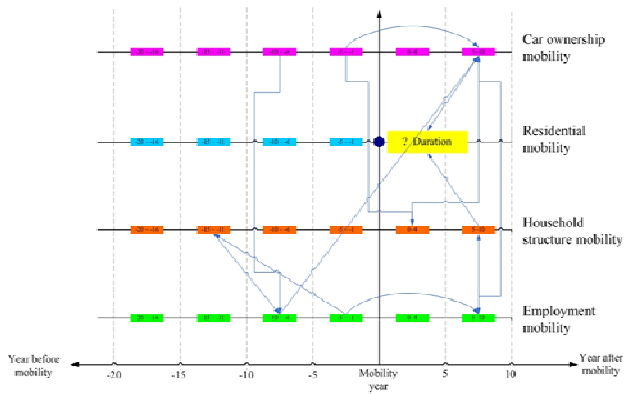


Fig.8 The interaction between residential duration and the other three mobilities

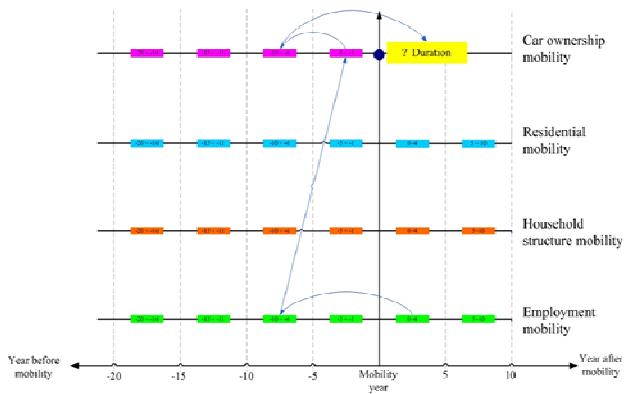


Fig.9 The interaction between car ownership duration and the other three mobilities

(2) Duration of Mobility

Compared with Figures 6 and 7, the relation between the duration and the past mobility experience or future expectation is much simpler. Figure 8 shows the interaction between the residential duration and the mobility state before the residential mobility in all four domains as well as the interaction between the residential duration and the future mobility in the other three mobilities. No intra-domain interaction is found here, in other words, the historical experience of the residential mobility do not affect the duration in the new residential location. While the influence from the other three domains still exists, but the temporal span is much narrower which mainly concentrates within the range (-15 ~ 10) years. Specifically, whether the car ownership mobility occurs in the past 10 years as well as the future is related to the duration of the new episode. Whether the respondents have a plan to change his/her household structure in the next 10 years after the mobility is also found influential. And the experience of employment/education mobility in the past 10 years before residential mobility together with the relative far future expectation might help determine the residential duration.

For the car ownership duration, it is shown that only the historical car ownership mobility experience

as well as the employment/education mobility in the (-10 ~ -5) years and the near future expectation play a role on the car ownership duration of the new episode.

Based on the simple structures in Figures 8 and 9, we have to say that the mobility duration is not significantly related to the state dependence and future expectation, neither within the same domain, nor across different domains.

6. CONCLUSION

When formulating long-term policies, changes of people's behaviors over the life course cannot be ignored. To predict whether policies could result in the aimed changes in future or not, policy makers are required to understand how people behave in response to policies under study as well as other factors over a longer time period. Unfortunately, only few studies have been done with respect to such longer time observations, due to the difficulties in collecting relevant data and representing relevant behaviors.

With such consideration, this study presents an additional effort to represent biographical interactions among residential mobility, household structure mobility, employment/ education mobility, and car ownership mobility, over the life course. In order to support the analysis, a web-based retrospective life story survey covering the period of each respondent from 18 years old to now was carried out at the end of 2010 in Japan, and 1,000 households provided valid data. Based on the data, aggregate analysis and the rule-based exhaustive CHAID analysis are further conducted and the obtained findings are summarized below.

First, a strong synergistic relation among residential, household structure, employment/education, and car-dependent mobility domains are captured by considering the mobility times in each domain. Therefore, the viewpoint that travel behavior should not be treated independently in the life course is confirmed.

Second, a substantial state dependence and future expectation is identified when describing the occurrence and non-occurrence of the residential mobility and car ownership mobility. Moreover, not only the first-order but also higher-order state dependence (or future expectation) exists. In contrast, the influence of the historical mobility experience in and out of the targeted domain and the influence of the future plan in other domains are not so significant when explaining the duration after the mobility. These findings emphasize the need for the dynamic model development which incorporates high-order state dependence and future expectation when dealing with the mobility occurrence issue, while for the duration

issue, this necessity is much weakened.

Third, the household structure mobility and employment/education mobility are found more influential to the residential mobility (car ownership mobility) than the car ownership mobility (residential mobility). This calls the scholars' attention to the joint analysis for the residential mobility/car ownership mobility and household structure mobility as well as the employment/education mobility.

As an attempt to deal with the life course dynamics issue, the study can to some extent capture the biographical interactions among residential mobility, household structure mobility, employment/ education mobility, and car ownership mobility. However, only statistically-oriented methods are adopted, for which the behavioral explanation is lacked. The development of the behaviorally-oriented models is left as a future research.

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