Mobility Design: Incorporating "Private" Public Space onto the Street for the City Conversion

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"Mobility design" is a new concept for urban design that pays attention to "slow" mobility such as pedestrians. In Matsuyama-city, Ehime, Japan, a street design is being discussed on the city conversion. In this paper, backgrounds and ideas of streets space redistribution peculiar to Japan are introduced. We also propose the methodology for mobility design which includes, 1) quantitative analyses of detailed flows in the city center using probe person data 2) text based approach with the data recorded in social discussions for understanding residents' private consciousness to streets. As the conclusion, the actually proposed design that reflects above analyses is presented.

Key words: Mobility Design, Street, Public Space, Probe Person Data, Social Discussion

1. Introduction

1.1 Mobility Design

The policies oriented for "slow" mobility are becoming main issues in the city planning. The concept of "mobility design", incorporating these ideas into urban design, is to make the principle of excursion flow. In Japan, the idea of "Mobility Design" has raised because of several challenges that Japanese cities are facing. In the present era, the cities of Japan are shrinking due to population decrease and high aging. The increasing financial difficulties due to rise in medical expenditures has fueled public awareness for human health and thus the need for walk-friendly city design. Car dependent community design will be not suitable for Japan due to the increasing number of aged and unsafe drivers. Consequently it is important to generate public space for pedestrians in the city center and let people walk more.

1.2 Street: "Private" Public Space

In Matsuyama-city, Ehime, Japan, a street design is under discussion on city conversion. This project is a new attempt of mobility design, but there are many difficulties.

"*Tenka-Orai*". This word indicates that streets once were the public space for pedestrians in Japan. Streets have played a central role of cities that have sometimes been used as "plaza" and received people's variable activities. Repeated disasters tend to change the city structure causing the buildings to be placed at greater distance. Moreover the rapid motorization of the society further widened the roads but left little space for the pedestrians. More account was given to the efficient flow of traffic in the street design and the needs of the pedestrians were mostly overlooked. Thus, with the passage of time, the use of streets as a public space has decreased, and now, the residents along the streets use the space privately.

As we all know, streets are public space for all. For the revitalization of city center weakened by population decrease and relocation of important facilities to suburban areas, it is important that public space is designed for pedestrians to induce valuable activities, and streets are the main issue on this concept. With the increase in the number of vehicles in decades, congestion and road accidents increased, resulting in the widening of the roads. But now as the vehicles are decreasing, the space can be utilized for public use. On the other hand, this use of extra space is strongly opposed by the residents along the streets due to being afraid of losing their private space. Under these conditions, how do we produce public space for pedestrians? In addition to the planning or design, it is also necessary to demonstrate the results of its implementation by using pilot program, quantitative data and simulation. Besides, accurately understanding the "private" space related to residents' lives also enables us to design streets considering their spatial characteristics.

1.3 Planning Method for Inner Areas

Lately, walking is attracting more attention in city planning due to the human health and revitalization of the city center. In the development of these policies, conventional distribution method is unsuitable because its aggregation unit is a zone of about one-kilometer square that is too large to understand pedestrian behaviors.

In this decade, however, GPS (Global Positioning Systems) technologies have made rapid progress. PP (Probe Person) survey proposed is the new method using an automatic position and time recording systems based on GPS and Internet communications. A mobile communication system was used to conduct an activity survey, but the problem with survey methods using PHS lies in the low positional precision (Asakura and Hato, 2004). In recent PP survey, GPS phone and web diary developed by Hato et al. (2006) are used, by which accurate travel information such as trajectories can be observed in real time and continuously. Besides, Hato (2010) proposed a method called BCALs (Behavioral Context Addressable Loggers in the Shell) that can measure its location, sound, air pressure and acceleration without any requirement of handling by respondents. Thus, PP surveys enable us to understand detailed travel behaviors at the level of inner zones. We use the PP data in order to grasp design constraints and propose the design method of detailed segment areas in a street.

The next Section includes some explanations of the project, street space redistribution, and proposals that grasp design constraints with quantitative data. In Section 3, we adapt the text-based approach to analyze residents' discussion. Discussion data is recorded audio data collected from workshops with residents. The participants had different opinions regarding the proposed plan based on their respective backgrounds but their opinions were changed under the influence of others' opinions. We understand the spatial characteristics of streets that include public and private space through the analysis of the participants' opinions. The actual design proposed after the discussions in Section 2 and 3, is introduced in Section 4. Some conclusions are included in Section 5.

2. Summary of Project and Arrangement of Design Constraints

2.1 Urban Design in Matsuyama

On the "*Hanazonomachi St.*" located in the central area of Matsuyama-city, Ehime, Japan (Figure.1), the project of street redistribution is on-going. Matsuyama-city has urban policies for the city center following the "urban planning for living by walk" based on the master-plan of city planning and the comprehensive strategy of transportation. To discuss the design concept of the entire central area, "Council for urban planning" is positioned as the parent organization of individual projects. Each project has a council individually, and mutual cooperation

among these councils is present for the development of projects (Figure.2). Street design of Hanazonomachi St. is also one of these projects, which started from the year 2011. It is intended to re-design car-oriented urban spaces based on the concept of mobility design, trying to create public spaces for pedestrians, and has workshops with citizens conducted on a monthly basis in addition to councils.



Figure.1 The Location of Matsuyama-City (the left) and the "Hanazonomachi St." (the right)

Master plan of Matsuyama city plannning

Basic ideas on city plannning

- 1. Compact and high-quality city structure
- 2. Substantiality of life environment
- 3. Development of regional core

Comprehensive strategy for transportation Basic policies of transportation

- Management of parking
- Redistribution of street space
- Network of bicycles

Council for urban plannning of Matsuyama city

"Urban planning for living by walk " : management of street space

	JR Matsuyama Sta.	Hanazonomachi St.	Ropeway St.	Dogo district	Central area
	Council	Council + Workshop	Council	Council	Council
-				projects cooperate with each other	

Figure.2 The Organization of This Project

2.2 Arrangement of Design Constraints

Hanazonomachi St. is a street with high accessibility to public transports, linking between "Matsuyama-City Station" which is the largest node of transportation in Matsuyama and "Horinouchi Park" around Matsuyama castle. It has width of 38 meters and the total length is about 400 meters. Trams run at the center, with two lanes in each direction, and having a service road called sub-road separated by a green median and a sidewalk, at each side (Figure.3).



Figure.3 Section of Hanazonomachi St. and Private Use Relation to Buildings along the Street



Figure.4 Basic Analyses of the Street

It can be regarded as the main street of Matsuyama due to its high potential in both the location and the scale. Hanazonomachi St. once used to be crowded with many passengers toward Horinouchi park from Matsuyama-city station, however, public facilities in the park moved to suburbs one after another due to the rapid motorization and subsequent easiness of people to visit the suburbs using their private vehicles. As a result, the passenger volume on the street decreased. While there are old shops and vacant stores at the east side of street, the west side has buildings redeveloped expanding to more than one plot, such as condominiums or a vocational school (Figure.4). As a result, the east and west of the street have totally different atmospheres. Generally, the design of the street tend to be unified per link, but as it is evident from figure 4, street should be divided into several zones depending on the relationship with the buildings along the street and its surroundings, and it is necessary to consider the detailed design rules for each zone.



Figure.5 (the left) The Plots of the Pedestrians Passing the street Figure.6 (the right) Activities observed on the Street and Relationship with Surroundings

In this project, we believe that keys of the design are appeared in people behaviors, so we analyze them using quantitative data and discuss street design based on the analysis. Figure.5 shows sample pedestrians' plots of coordinates through Hanazonomachi St. recorded as GPS data across multiple days. We used probe person (PP) data provided by Matsuyama PP survey 2007. The amount of points mean the presence of staying behavior, the slowness of the walking speed and the amount of activity, and points are divided by their colors representing trip purposes, Necessary (mandatory), Optional (private before mandatory) and Social (private). Even in one street, it can be seen that the purpose and duration of trips has large variation, so it must be designed taking into account the characteristics of each zone. Figure.6 shows how activities are conducted around the street, and where visited people park their bicycles and where to go. Like these, we believe that we can grasp design constraints by connecting surveys and quantitative analyses with the design of public space.

3. Analysis of Residents' Discussions

In this Section, we adapt the text-based approach to understand the structure of opinions using recorded audio data in residents' discussions. The data recorded in the 3rd workshop (June 27, 2012) is used in the analysis because the design idea changed largely after this workshop. For increasing the attendance of citizens, workshops were held two times in a day, 3 pm and 7 pm. The audio data from both these workshops are used in the analysis. Personal attributes of participants are shown at the left end in figure.7 and 8. In the former period, 3 shopkeepers on Hanazonomachi St. and a teacher of a vocational school joined, and in the latter period, a landowner, 2 shopkeepers not on this street, a resident in suburb and a college student attended.

First, we extract keywords by text-mining, the most frequent three words are "food-and-drink" (22 times), "build" (18) and "table"(12) in the daytime period, and "event" (25), "tourism" (17) and "sub-road" (13) in the nighttime period. The activity and event on Hanazonomachi St. in the time of the pilot program is the main topic, so the words, "food and drink" or "event", are frequent. On the other hand, the word "sub-road" directly related to street space is contained, which reflects the difference of consciousness to the street caused by that among backgrounds and positions of participants.

Thus, it can be seen that directions of the discussions are different, in spite of the same theme, just by looking at frequent words. Second, in order to get better understanding of the consciousness to street space and resistances to the proposal that residents expressed in the process of discussion with other participants, we extract keywords and analyze change of main topics and main speakers every minute (figure.7 and figure.8).

a) The daytime period

By and large, participant "A" speaks positively who manages an izakaya along Hanazonomachi St.. He regards the pilot program realistic and accepts it. Participant "B", who manages the shop on this street, is involved in this project from the beginning and speaks a lot.



Figure.7 The Flow of Topics in the Residents' Discussion at the Daytime Period

In this discussion, though participant "B" is anxious that events at the time of pilot program are related to only food-and-drink and propose the sale of goods in addition to it, participant "A" and facilitator have a heated

discussion about food-and-drink and thus the topic of discussion are not changed readily. As a whole, this discussion was related to only themselves from beginning to end. In this analysis, it is clear that shopkeepers, tenants of buildings along the street, take interest in programs or activities rather than street design itself, and discussions of the group made of similar people in backgrounds or occupations are tend to have a bias.

b) The nighttime period

While the main topic in the daytime discussion is about the pilot program from the beginning, in the nighttime period it is discussed about the plan proposed by designers at first. Participant "E" is a landowner along this street and feels uneasy against the probability of losing convenience or security as a resident, so in the discussion the words "sub-road" and "regulation" are often seen. Changing topics by the facilitator made the discussion expand to about the core and targets of events. Participant "G" and "H" who manage a food shop state opinions based on their experiences of commerce. Participant "I", a citizen of Matsuyama-city, proposed to set up a tourist information center and participant "J" who is a student of neighboring college argued the possibility of events associated with club activities of the university. These opinions are clearly rerated to their backgrounds or positions and have influences with each other. "E", a landowner and a resident, regards a sub-road as him private space and had resistance of losing it, but after changing topics to about the pilot program, accepted other opinions and give ones of himself on events. Thus, we argue that "E" regards the event space of the west side as public space.



Figure.8 The Flow of Topics in the Residents' Discussion at the Nighttime Period

From the analysis above, workshops play big roles to the changing of residents' opinions. Especially to the space "streets" in Japan, residents have consciousness as their private space, because they use street privately on everyday. In the analysis of residents' discussion with other participants, we understand the spatial characteristics of the street including private and public space that each person regards. Figure.9 shows the private uses seen in

this street, which are clear in discussions in addition to site analyses. The way of privately using is related to the building type, for example residents (1. in Figure.9) use privately sidewalk, service road and tree. They park their bicycles on sidewalk, call a taxi in service road and attend trees, so they think these space as their private space. We insist that it is difficult to design streets without understanding borders between private and public space, and it is concluded that the quality of social discussions is substantial for "private" public design.



Figure.9 Residents' Private Space on the Street

4. Dynamic Changing of Street Design

In Section 4, we introduce the actual design proposed based on the discussions in Section 2 and Section 3. The method to grasp design constraints using quantitative data introduced in Section 2, and in Section 3, we analyze the residents' discussion that the participants have the different opinions based on their respective backgrounds, and understand the border between "private" and public space.

Mathematical verifications played important roles to support the proposal in public space design whose design constraints are difficult to be decided. We could propose to decrease the number of lanes from 4 to 2 based on the verification of no congestion by micro traffic simulation. Besides, we analyzed the travel behaviors on streets using probe person data. In this proposal, small open space of grass and planting are set in the street and event space is placed the middle of the west side. The effects of these ideas were verified through the pilot program in October 2012 (Figure.10). There was no jam in traffic flow and some activities were seen at open space of the west side.



Figure.10 The Summary and Photos at the Time of the Pilot Program



Figure.11 The Plans of Vision of the Street Proposed by Designers

Residents' opinions from the discussion repeated to change the street plans. Above all, the plan proposed on and after July 2012 was quite different with the previous one. In the previous plan, activities and places were partly limited by specialists' ideas, such as staying and eating on deck or open space of grass and events that are held at the time of pilot program. For residents who have been living by mainly cars for a long time, it is often difficult to understand the way of using that specialists propose. On the other hand, the plan proposed on and after September includes the idea to make whole of the street flat and do away with the border between sidewalk and road, and in the plan we proposed the "base" that can accept various activities with remaining current traffic

functions and residents' private space (Figure.11). "Base" is the first step of our design, and it reflects residents opinions. We start introducing activities associated with buildings from the places that we obtain residents' consents and give images of activities on streets to them. It is shifted to dynamic showing of design through the pilot program to residents who have intense resistance with the change. As a result, this idea lead to realize the pilot program on October 2012.

5. Conclusion

In Streets, attracting attention as public space for pedestrians in Japan, public sphere and private sphere used by residents' are mixed, and the border between them is so ambiguous. For the design of streets, we should make the evidences and effects of the design clear under the concept of the mobility design.

In this paper, we proposed two methods for the mobility design. They are summarized that we

1) analyze quantitatively the detailed travel behaviors in the city center using probe person data and

2) adapt text-based approach with the audio data for understanding residents' consciousness to streets expressed in the process of discussion with others.

These methods are considered effective for mobility design, but it is also clear that residents' private use makes street design on city conversion so difficult. For higher precision of design at micro level, mature consideration is necessary in the way of surveys and discussions.

In this project, we proposed the plan that has difference of design rules between the west and east side of the street considering relationship with buildings and surroundings. The effects of these ideas were verified by the pilot program and now are on going towards realization.

6. References

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