

STUDY ON HYBRID PLANNING SYSTEM FOR NEW TRANSIT CONSTRUCTION AND URBAN DEVELOPMENT INTRODUCING PSYCHOLOGY ANALYSIS*

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1. Introduction

People realize various activities through kinds of transportation. Land use, which represents the chances or spaces for activities, is closely related to transportation, which serves for the derived demand of movement. Both of them are the most important physical conditions for regional and urban development. Many researches have been done on the behavior of people to collect more useful information for city planning. Psychology is the essential element included in each behavior. This article is trying to explain the relationship among behavior, land use and transportation by inducing social psychology.

The study is centered with the High Speed Surface Transportation (HSST) construction plan in Shiga prefecture. HSST has been developed as a new transit type for either inter-city or intra-urban transportation. One line has been constructed and put into use in Aichi World Exhibition, which is the first commercial application in Japan. HSST provides fast and quiet transportation service, which is good to the environment. And the maintenance and operation cost is lower compared to other traditional transits. Not only the lines, construction of stations and commercial or leisure plazas will be discussed.

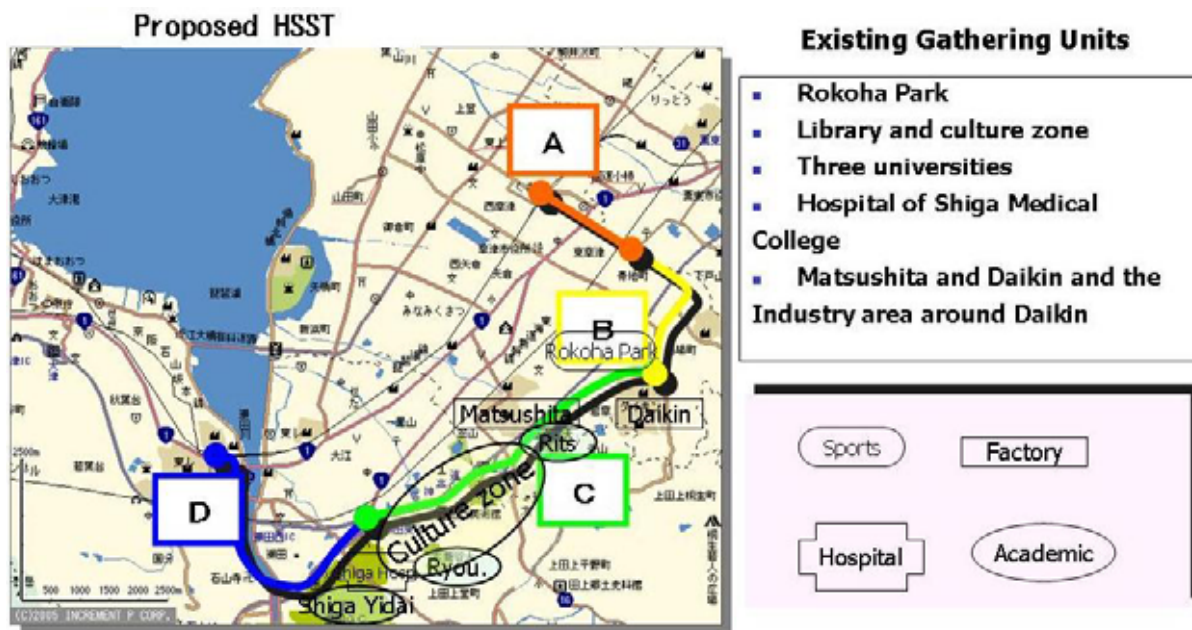


Fig.1 Proposed HSST Line and Stations

Kusatsu City is located in Shiga Prefecture, with a population of about 130 thousand and three universities: Ryokoku University, Shiga Prefecture Medical University, and Ritsumeikan

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University. The planned HSST line will connect these three universities and the residential area to be ended with JR Kusatsu and Ishiyama Station (shown in Fig.1), totally about 11 kilometers, and it is to be extended in the future. The target is to provide convenient, comfortable transportation with high service level to citizens and to promote the new transportation style.

This blooming city has an increasing population and supplies labors for Kyoto-Osaka-Kobe metropolitan. Provided with nice nature around Lake Biwa, more immigration is expected to be settled in this area. New transit is considered to be able to activate those nature resort spots. It will also satisfy the strong demand of inner mobility for the universities, hospitals, and factories and so on. Recently, more and more new shops have been opened in this area, which can be an evidence of commercial potentiality. All these facilities are located quite sparsely. Since bus network is not enough, and there is high volume of car use, causing congestions often. About 53.6% transportation are realized my car, only 27.1% taking railway or bus. Over 32.7% people did not think the bus network worked well. There is a strong desire for the development of new public transit system.

2. Theory of Related Social Psychology

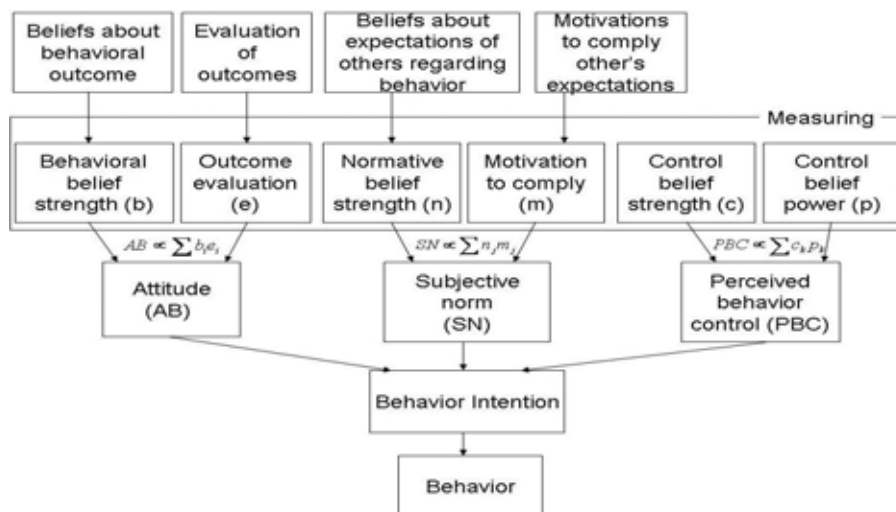


Fig.2 Frame of Psychological Analysis

In this study, acceptance and implementation of the new transit module will be evaluated using the Theory of Planned Behavior (TPB) (Ajzen & Fishbein, 1980) as a theoretical framework. TPB has been proved to be able to describe the psychological process to reach an intention, which is predicted to directly influence conduct of the behavior. The simulation frame has been shown in Fig. 2.

TPB postulates a set of relations among attitude, subjective norm, perceived behavioral control, and behavioral intention. Attitudes are a function of beliefs about the behavioral outcome and an evaluation of how those outcomes are desirable. Normative influences are what an individual believes others think they should do (normative beliefs) and how many individuals feel influenced by these social referents (motivation to comply). Perceived behavior control is perceived ease or difficulty in performing a behavior. Therefore, the model does not include any background variables, such as age, marital status, or education. These demographic variables are posited to indirectly influence behavioral intention and behavior through their interactions on the three elements mentioned above. Brief-based measure of each element is obtained by applying the expectancy-value formula to the measuring data.

3. Research Process and Results

The questionnaires were distributed randomly in residential area of the two cities and 152 samples were usable. SPSS was applied for descriptive, factor reduction and inferential analysis. The simulation structural equation

model (SEM) was made with Amos 5, shown in Fig.3. Four common model fit measures are used to assess the model's overall goodness of fit.

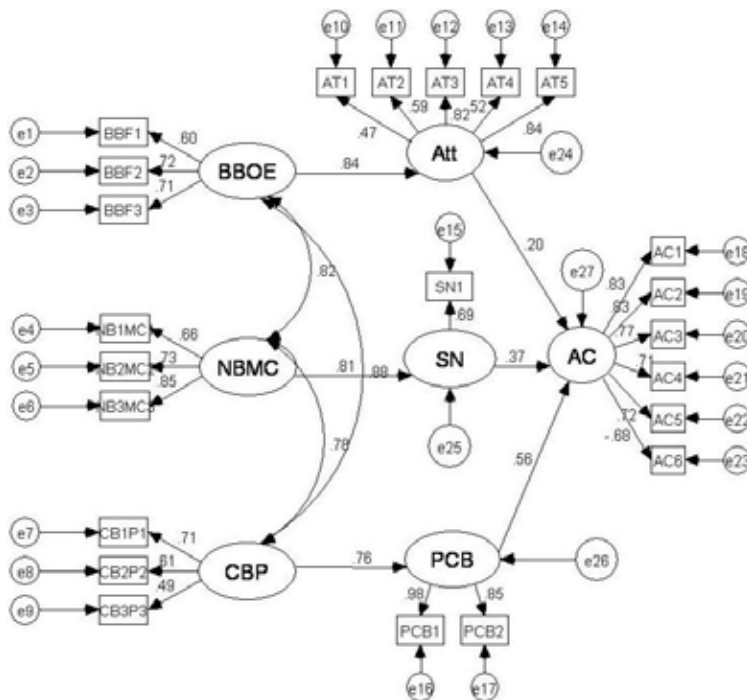


Fig.3 Simulation Model based on TPB

The third one is root mean square error of approximation, called RMS by Steiger and Lind, and RMSEA by Browne and Cudeck (1993). The RMSEA of this model is 0.094. The opinion recognized mostly is that a value of about 0.08 or less for the RMSEA would indicate a reasonable error of approximation and the model with RMSEA less than 0.1 is just acceptable.

The last one is The Bentler-Bonett (Bentler & Bonett, 1980) normed fit index, briefed as NFI. Since the scale of the fit indices is not necessarily easy to interpret (e.g., the indices are not squared multiple correlations), experience will be required to establish values of the indices that are associated with various degrees of meaningfulness of results. In our experience, models with overall fit indices of less than 0.9 can usually be improved substantially. In this case, the NFI is 0.777. As other measures show, this model still needs modified to be more practical.

4. Hybrid Planning System

The research above just shows the result related with new transit. The PCB contributes the most in explain intention of acceptance, although the correlative coefficients between these three components express close relationship. It means that most residents' decision of taking what kind of transportation facilities or choosing what kind of travel pattern depends mostly on the accessibility or service time or the position of facilities related to their trip. This corresponds with the close relationship between land use and transportation, as mentioned before. Land use, e.g. construction of new shopping center, will influence passengers' decision in using new transit or not.

The framework about related commercial and leisure spot will be concluded in the similar procedure. The utility function for residents and other visitors will be defined based on the frameworks of social psychology. We assume that when people get satisfied, they will take consumption behavior, support behavior (investment), and immigration behavior. And these behaviors will contribute a lot to the urban development and constructions of such facilities. So, we define maximizing the utility of people as the objective function in optimization model. Furthermore, there will be many constraints to ensure the feasibility of the construction from physical conditions

The first one is the relative chi-square χ^2/df . Wheaton et al (1977) suggest a ration of approximately 5 or less as beginning to be reasonable. In most research, however, the chi-square to degrees of freedom ratios in the range of 2 to 1 or 3 to 1 are the indicative of an acceptable fit between the hypothetical model and the sample data. For the model in this study, the relative chi-square is 2.321, which is considered to be reasonable.

The second fit measure is the comparative fit index, briefed as CFI (Bentler, 1990). CFI values close to 1 indicate a very good fit. The CFI of this model is 0.855, which tells that the model concluded can be considered to be good.

including area, financial conditions including total budget and so on.

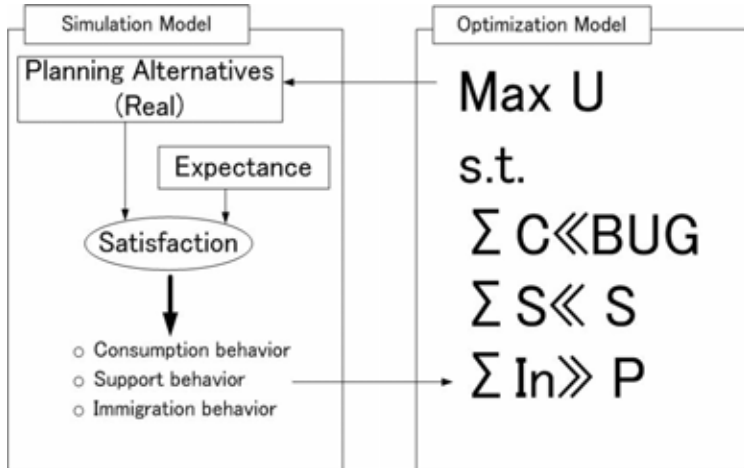


Fig. 4 Hybrid Planning System

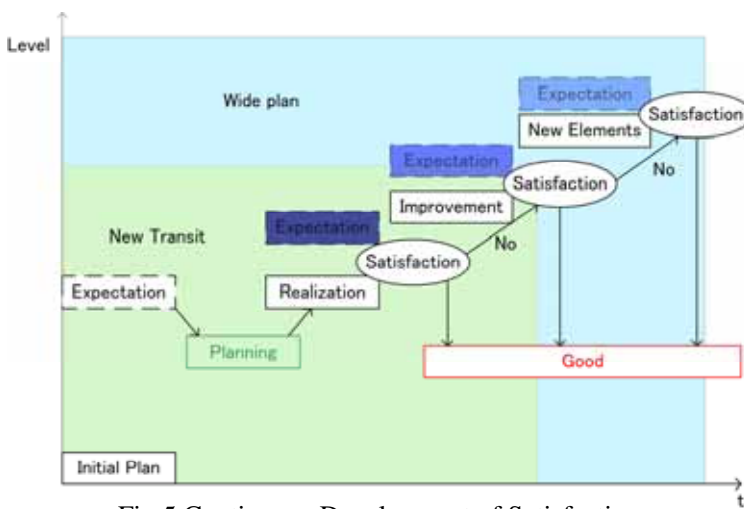


Fig.5 Continuous Development of Satisfaction

To judge how much people get satisfaction, it follows the expectance theory, which regards the satisfaction as the distance from expected level to real level. In the simulation model, planning alternatives are assumed to be constructed thoroughly, that's to say, planning alternatives represent the real level. Then we can predict roughly the proportion of satisfaction, which will help to the prediction of the volume in consumption, investment and immigration. The information simulates the effect of each planning alternatives and they will be feedback to the optimization model to tell us the direction to modify the plan. The simulation model and optimization model can be incorporated into such a cycle mechanism. We defined it the hybrid modeling system or hybrid planning system, as shown in Fig.4.

However, the expectance can hardly be satisfied at the first time. There will be usually a process of improving satisfaction level step by step. We design the stages to implement the construction from new transit, and step to wide plan including other facilities. And the planning time will be divided into several periods for simulation.

The contents of expectation will change most probably increasing according to the improving situation (shown in Fig.5), which is fairly difficult to capture. This will be also the target of further study.

5. Conclusions

This article introduces the hybrid planning system into transportation planning by the analysis from social psychological aspect. The similar methodology was successfully applied in finance distribution problems before. Practical analysis and data will be presented late as the research forwards to review the efficiency of the planning system in urban planning. It also investigates the applicability of the TPB in a Japanese Setting and identified the relationships among various components of TPB. TPB, as a psychological model theory, was widely used in the analysis of different human activities, e.g. health care, using of short message. This study is a meaningful experiment of inducing the theory into the practical study of regional planning.

Reference

- 1) Ajzen, I.: Action control: From cognition to behavior, in From Intentions to Actions: A theory of Planned Behavior, New York: Springer, pp.11-39, 1985.
- 2) Satoshi Fujii: Social behavioral theories for infrastructure planning: from attitude-based planning toward attitude-modification planning, Journal of JSCE, No. 688/IV-53, pp. 19-35, 2001