

**“Technical Research and Development for Road Policy Quality Improvement”  
Study Summary**

No.	Title	Principal Researcher
No.24-5	STUDY ON EVALUATION METHOD FOR WALKING SPACE FOCUSING ON PEDESTRIAN FACIAL EXPRESSION AND BEHAVIOR	Saitama Univ. Prof. Hisashi Kubota

The goal of the present study was to develop a new evaluation method for pedestrian environments based on pedestrians' expressions and the "system for evaluating walking space" using the degree of pedestrians' smile was developed.

### 1. Backgrounds and Objects

In recent years, pedestrian-friendly streets, such as pedestrian malls, have been planned in many cities. However, vehicle drivers and roadside merchants often object to the reallocation of road space for pedestrians. Thus, to facilitate such projects, planners must address these objections and provide evidence that pedestrian-friendly improvements are valuable. However, an adequate method of evaluating pedestrians' consciousness of, or happiness with, well-developed pedestrian environments has not yet been established.

In this study, we measured pedestrians' visually observable behaviors and expressions without their knowledge to determine whether these indicators could be used to evaluate pedestrian environments. Theoretically, this observable information could be obtained from all pedestrians in a targeted area, independently of their cooperation. If this information reflects the influence of walking space quality on pedestrians' feelings, it may serve as an impartial evaluation indicator. The goal of the present study was to develop a new evaluation method for pedestrian environments based on pedestrians' expressions and we develop "system for evaluating walking space" using the degree of pedestrians' smile.

### 2. Activities in Research Period

#### 2-1 Relationship between Smile and emotions

We reviewed studies related to the relationship between facial expression and emotions to verify the potential ability of pedestrians' "smile" for evaluation index of walking space.

#### 2-2 Analysis of Factors Influencing Smile by Observation on Variety of Streets and Long term Observation

##### 1) Analysis of Factors Influencing Smile by Observation on Variety of Streets

In order to analyze factors of streets that influence pedestrians' facial expression, we observed pedestrians on streets that are located in front of rail stations and gathered attributes of each street. Furthermore, we focused on the effects of spaces for bicycles on road-way, which have been prevailing in Japan. In 2013, we got data from 22 streets and in 2014 we increased the data into 54 streets.

##### 2) Analysis of Factors Influencing Smile by Long term Observation

We observed pedestrians on a shopping street for one month using CCTV camera and analysed the data of the expressions to simulate a process of using the "system for evaluating walking space" in practical use. Using the above data, we analyzed the influence of factors that fluctuate with the time. We supposed that the time of the day, weather, and the day may affect pedestrians's facial expression.

#### 2-3 Development of "System for Evaluating Walking Space"

We developed the "smile calculating system" and the "data base system" and combined them into "System for evaluating walking space". The system calculates pedestrians' smile and describe graph of trajectory of average "smile" scores in certain time interval. User can input attributes of walking space

on the PC window by the system.

We conducted questionnaire surveys and hearing surveys to municipal office staff who are in charge of community development and the shop owner and staff of the shopping street where we conducted the long term observation. We demonstrated the system for evaluating walking space and ask them to evaluate the user-friendliness and utility of the system. Furthermore, we tested the trend of misdetection by this system.

### 3. Study Results

#### 3 - 1 Relationship between Smile and emotions

We found that studies in social psychology have revealed that the smile and emotions have a relationship so it suggest that “smile” of pedestrians may become an applicable index to evaluate walking space.

#### 3 – 2 Analysis of Factors Influencing Smile by Observation on Variety of Streets and Long term Observation

##### 1) Analysis of Factors Influencing Smile by Observation on Variety of Streets

We conducted multi regression analysis using the data of pedestrians smile and road attributes gotten from 54 roads. The result showed that the existence of bicycle lane on road way, flower shops, and market place increase the degree of pedestrians’ smile. Two roads where bicycle lanes were developed were observed before and after the development, however, the degree of the smile were not stably increased. On the other hand, it was found that the higher the bicycle traffic volume on sidewalk, the lower the degree of pedestrians’ smile, and the wider the width of sidewalks, the higher the volume of bicycle traffic.

##### 2) Analysis of Factors Influencing Smile by Long term Observation

The analysis of the data gotten from a one month observation using CCTV camera suggests that the ratio of group pedestrians and the automobile traffic volume influenced the average of the degree of pedestrians’ smile. Moreover, the weather and the day may affected the degree of the pedestrians’ smile.

#### 3 - 3 Development of “System for Evaluating Walking Space”

From the results of questionnare surveys and hearing survey to municipal staff and shop staff and owners of the shopping street, we got generally positive attitudes toward the user-friendliness and utility of the system for evaluating walking space.

Using the recommended setting by manufacture of the facial expression sensor, the misdetection rate by this system was less than 10 %. However, in some case, a certain object of road construction could be mis-detected repeatedly.

### 4. Papers for Presentation

Satoh, M., Hoshino, Y., Kojima, A., Kubota, H., Study on Evaluation Method for Walk Space Focusing on Pedestrian Facial Expression and Behavior, JSCE Journal, D3, Vol.70, No.5. pp. I\_889-I\_905, 2014.

Satoh, M., Noguchi, H., Kojima, A., Kubota, H., Study on Evaluation Index for Walk Space Focusing on Pedestrian Smile, Proceedings of Infrastructure Planning and Management, JSCE, Vol.50, CD-ROM, 2014.

Sekiguchi, A., Kojima, A., Kubota, H., Development of “Evaluation System of Walk Space “Using a Smile, Proceedings of Infrastructure Planning and Management, JSCE, Vol.52, CD-ROM (in Printing)

### 5. Study Development and Future Issues

For prevention of misdetection of road constructions as facial expression, to add a function to limit the area for detection could be an improvement. With above improvement, the system could be used on variety of streets to keep or improve the quality of the streets for pedestrians.

### 6. Contribution to Road Policy Quality Improvement

The system could be used in each community to keep or improve the quality of the streets for pedestrians. If the system is prevailed, accumulated data from a variety of streets may give us rich information to consider the design code for good walking space.

### 7. References, Websites, etc.

none