Modeling place attachment of international students:

A spatial statistic using integrated questionnaire and mental map

Vita Fajriani Ridwan (Graduate School of Science and Engineering, Ehime University, vitaridwan@gmail.com)
Nobuhiko Matsumura (Graduate School of Science and Engineering, Ehime University, matsumura@cee.ehime-u.ac.jp)

外国人留学生の場所への愛着分布のモデリング―アンケートと認知地図を使った空間統計分析―
リドワン フィータ ファジェリアニ（愛媛大学 大学院理工学研究科）
松村 暢彦（愛媛大学 大学院理工学研究科）

要約

外国人留学生は、日本において新しい生活を快適に過ごすためには、新しい場所や周辺の人々との絆を築く必要がある。場所の愛着は人々が重要な場所と持つ絆であり、外国人にとって特に重要である。 本研究では、留学生の場所への愛着を分析するために、メンタルマップとアンケートを使った新しい調査方法を開発し、最小二乗法による空間統計を使ってモデル化した。ケーススタディとして愛媛大学の留学生 65 名を対象にした。その結果、日本語能力、日本での食生活の満足度、日本の生活スタイルとの相性、生活スタイルの変化度が、留学生の新しい場所への愛着を育む役割を果たしていることが明らかになった。

Key words

place attachment, mixed method, international student, mental map, questionnaire

1. Background of the present study

1.1 Place attachment

Place attachment is a bond that people have with an important place (e.g., Altman & Low, 1992; Giuliani & Fieldman, 1993). This attachment arises because of the influence of feelings, values, knowledge, cognitive, and social relations (e.g., Altman & Low, 1992; Manzo & Devine-Wright, 2013).

The terminology for place attachments differs according to scholars, such as place identity (Proshansky, Fabian, & Kaminoff, 1983), and topophilia or love of the place (Tuan, 1974).

There are previous studies that examine the concept of place attachment to a foreigner. Those studies used many aspects as the measurement, from the physical setting (Ng, 1998); emotions (e.g., Boğaç, 2009; Larsen, Larsen, & Harrington, 2016); and place dependence (Boğaç, 2009); and experience (Boğaç, 2009; Larsen et al., 2016). The previous studies used various methods from literature review (Ng, 1998); in-depth semiconstructed interview (Terrazas-Carrillo, Hong, & Pace, 2014); mixed methods questionnaire with a mental map (den Besten, 2010); and mixed questionnaires, semi-structured interview, and a mental map (Boğaç, 2009). Both of the previous studies with mixed methods used analytic techniques to analyze the data. However, research that explores the concept of place attachment to a foreigner in the international student context in Japan has not yet been undertaken, nor the mixed method questionnaire and mental map used place-based data (the concept of data depends on the place). In this section, the explanation of a suggestion for a place attachment model of international students is described, while the explanation of a suggestion to develop a new mixed method with a questionnaire and a mental map using place-based data (the concept of data depends on the place) is explained in the mental map section and the section of the focus of this present study.

Scannel and Gifford (2010) modeled place attachments in three dimensions. The first dimension was the actor who can be personal or community with their identities (e.g., language, culture, or nationality). In this study, international students are actors who have their own identity, one of which is nationality. Besides that, they also have languages (either spoken languages or foreign languages) used in communicating. Language is a communication medium that shapes the way we define the environment (Whorf, 1956). Di Masso, Dixon and Durrheim (2014), highlighted by the significance of language in person-environment relations. In Japan, spoken language (Japanese language) and written language are icons of Japanese identity. Japanese language is the first language in Japan and the language that is widely used both on and off-campus. Therefore, at Ehime University, international students at the beginning of their study, in order to survive during life in Japan, were encouraged to take Japanese classes and Japanese culture introduction classes. In the present study, we assumed aspects of identity (nationality and Japanese language skills) have a role in place attachment.

The second dimension described by Scannel and Gifford (2010) was the psychology process or the way actors relate to their environment. The psychology process consists of feeling, cognition, and habit. Japan is widely known for its culture and habits, one of which is food culture. Food for foreigners is `food` and a symbol of a different and new culture (Takeda, 2008). International students who have their own food culture commonly face cultural barriers related to food during staying

Japan. This situation could be one aspect that influences the feeling of international students to their new place. In previous studies related to place attachment and foreigners, Sthapit and colleagues (2017) revealed that positive emotions to food positively related to place attachment. This is why we assumed that satisfaction with eating habits during staying in Japan has contributed positively to place attachment.

International students, as part of personal mobility, have been processed to connect to new places. Following the model of Inalhan and Finch (2004), distinguishing three stages of change refers to mobility: pre-move, move, and post-move. In the last stage, post-move reflects the acceptance of a new environment. This condition is similar to international students when they far from their homeland and their community. They must adapt and become accustomed to their new environment, new culture, and new community, especially in Japan, where the physical setting, culture, and community are different. In this stage, international students sometimes experience to "changes in the way of life," to become "feeling fit well with life in Japan." In the model of Scannel and Gifford (2010), both are part of the psychological process. Following this reason, in the present study, we used both aspects ("changes in the way of life" and "feeling well with life in Japan") as the variables to model the place attachment.

The third dimension described by Scannel and Gifford was the place (2010). Among these dimensions, the place is the most significant. One aspect of this dimension is the physical place, which is defined as place dependence (Stokols, 1981). Where feelings towards a place reflect someone's feelings, whether it is positive (love or like), negative (hate or fear), and also ambivalence (Manzo, 2005). Accordingly, the present study used the concept of mental maps to international students by asking them to draw and mark places of interest which are related to their emotions (love, hate, and places that they want to change.)

1.2　Mental map

A mental map is a qualitative data collection in spatial science (Gatrell, Bierly, & Jensen, 2011). This method is interchangeable with cognitive mapping. In urban environmental studies, this method was introduced by Lynch (1960) in his seminal research about spatial behavior. A mental map is a common method to reveal people's perceptions about their environment (Gillespie, 2010; Lynch, 1960). This method also becomes a method to measure place attachment (e.g., Boğaç, 2009; den Besten, 2010).

There are two types of mental maps: a mental map using a printed map, and a traditional mental map using blank paper or a mental sketch map. The present study adopted the traditional mental map using blank paper because it is a common method to explore people's perception of their place (e.g., Gillespie, 2010; Matthews, 1984). Furthermore, a mental map using a printed map consisting of a basic network and existing placemark or landmark would lead the respondents to choose a particular place

(Brennan-horley, 2010), where it will distort the study's goal.

In previous studies about place attachment which used a mental map as the primary mode, those studies mixed a mental map with an interview (e.g., Brown, Raymond, & Corcoran, 2015; Lynch, 1960), questionnaire (Boğaç, 2009; den Besten, 2010), or focus groups (Larsen et al., 2016) as additional methods. These additional methods are used to understand the behavior, cognitive, and cultural meaning (e.g., Boğaç, 2009; Lynch, 1960), because, according to Matthews (1984), one of the disadvantages of a mental map is the difficulty to code then analyze. Commonly, study with a mental map uses analytic techniques to explore and interpret the drawings (Boğaç, 2009; den Besten, 2010), some use coding by designative rubric classification (e.g., Gillespie, 2010; Larsen et al., 2016), or apparaisive categories (e.g., Larsen et al., 2016; Matthews, 1984), and some with software spatial-based (Brown et al., 2015). Those previous studies with the coding system have focused only on physical elements, and the assessment only for mental map data. However, the assessment that combined the data from the additional methods (i.e., questionnaire, interview) with the mental map data has not yet been undertaken. Thus, in the present study, we modify the coding design. The present study classified and scored the object drawn in a mental map related to the level of feeling from respondents addressing to the place into four categories (see Table 1), then integrated with questionnaire data using the weighted mean center, and finally analyzing the data using the spatial statistic in ArcGIS.

Table 1: Concept of mental map and application in GIS

Level of feeling	Mark by colors	Category design[1]	The score of mental map[2]
Like or love	Blue	Level 1	4
Want to change	Green	Level 2	3
No feeling	No mark	Level 3	2
Hate or dislike	Red	Level 4	1

Notes: [1] Used in Google Earth, integrated data, and GIS. [2] Used in the integrated process as weight data.

Den Besten (2010) interestingly found out that some respondents (without ordered) drew their feeling with a symbol beside the drawn object in their mental map. Learning from that study, and following Matei and colleagues (2001), in the present study, used color pens to distinguish the feeling addressing the place. In difference, Matei and colleagues used a mental map with a printed map and asked the respondents to mark the area using different color pens (2001). The present study asked the respondents to make a mental map on a blank paper and draw and mark the object (place or thing) with different color pens.

1.3　Spatial statistic

Spatial statistics are a set of tools and techniques for creating models and describing spatial data which is better to under-

stand the factors behind a phenomenon (Scott & Janikas, 2010). The difference with traditional statistics is that spatial statistics are based on spatial directly in their mathematics (Scott & Getis, 2008). One analysis used in spatial statistics is regression analysis. This regression analysis (same as traditional) is used to model spatial relationships or spatial phenomena that occur, such as to understand the factors that influence (explanatory variables) of a phenomenon (dependent variable) to why a phenomenon occurs.

In the present study, in order to achieve the first aim, regression analysis in the ArcGIS desktop platform with ordinary least squares (OLS) was applied. OLS is global modeling, used to determine how explanatory variables explain the dependent variable or to find an adequately specified model. This analysis helps to achieve a set of variables with the lowest AICc and highest Adjusted R-Squared values that can be trusted when explaining the dependent variable.

2. Issues and objectives

The purpose of the present study was:

- To develop a new approach method based on place, using a mix of questionnaire and a mental map with a spatial statistic.
- To model place attachment of international students with five aspects: language, nationality, the satisfaction of eating habits, changes in the way of life, and feeling well with life in Japan.

2.1 The focus of present study

This section elaborates on the present study's position with previous studies about place attachment for two foreigner-related issues.

First, the approach used for model place attachment. This section focuses on exploring the present study's position with previous studies that used mental maps. Den Besten (2010), in modeling place attachment of immigrant children, used questionnaires, interviews, and mental maps, but that study applied the analytic technique to elaborate and explore the place attachment. The object was immigrant children who permanently lived in the place. Brown and colleagues (2015), also in modeling place attachment, used a mental map but mixed with an interview. That study applied PPGIS to model place attachment with landholders as the respondents (in other words, the respondent was not a foreigner). These studies, used mental maps to collect data, but the respondents or the analysis was different from this present study.

Moreover, data collection and data analysis from previous studies about place attachment focused on the respondent (people). Meaning the number of data depends on the number of respondents. Meanwhile, place attachment as a bonding is the perception of people to a place consist of three highlights: actor, physiological process, and place (Scannell & Gifford, 2010),

which in following the framework of Scannel and Gifford, the place is the vital part (2010). Accordingly, we tried to develop a blended approach to model place attachment based on the place in which every place consists of emotions, socio-demographic, and perceptions from respondents who chose the place. Thus, the present study adopted the older idea of the geography of conducting a mental map or a cognitive map. Although there are some previous studies which analyze the data depending on the number of places from mental map data (e.g., Gillespie, 2010; Larsen et al., 2016), the concept is apparaisive categories, and the analysis only for a mental map data. In the present study, we collected data from mental maps and questionnaires. We used data from mental maps and mixed with other variables from a questionnaire using weight mean center. In the analysis, a spatial statistic was applied. However, in this paper, the drawn place from the mental map was reviewed briefly.

Second, the explanatory variables were modeled for place attachment for a foreigner. The previous studies related to a foreigner by Ng (Ng, 1998) explored place attachment as one aspect of physical setting to immigrants in Canada (general). In other words, the focus of that study was the physical setting. Boğaç (2009) examined place attachment of refugees focused on the relocation to a new place issue. Terrazas-Carrillo and colleagues (2014) explored place attachment of international students and their living experience in their new environment, they focused on emotion of respondents regarding a special place in their school. Both previous studies, even if there is emotion/feeling as the measurement, differ from the present study. In the present study, we explored specific feelings related to food habits, changes in the way of life, and feeling well with life in Japan.

3. Method
3.1 The study area

Ehime University is located in the southern part of Japan, in Matsuyama City, Ehime Prefecture, Shikoku. It is one of the national universities in Japan with three campuses located in Matsuyama: the main campus is Johoku Campus (home to faculties other than agriculture and medicine); Tarumi Campus is the agriculture campus (where the faculty of agriculture is located); and Shigenobu Campus or School of Medicine (where the school of medicine is located). The university provides student apartments and dormitory facilities: Miyuki Student Apartments (located near Johoku Campus), Takusui Dormitory (located close to Tarumi Campus), and International House (located about 7 km south of Tarumi Campus, devoted to international students and researchers). Respondents for the present study came from both Johoku and Tarumi campuses. Mostly, the respondents live in student apartments and dormitory facilities from the university, and the others in apartments around the Johoku Campus and Tarumi Campus (see Figure 1).
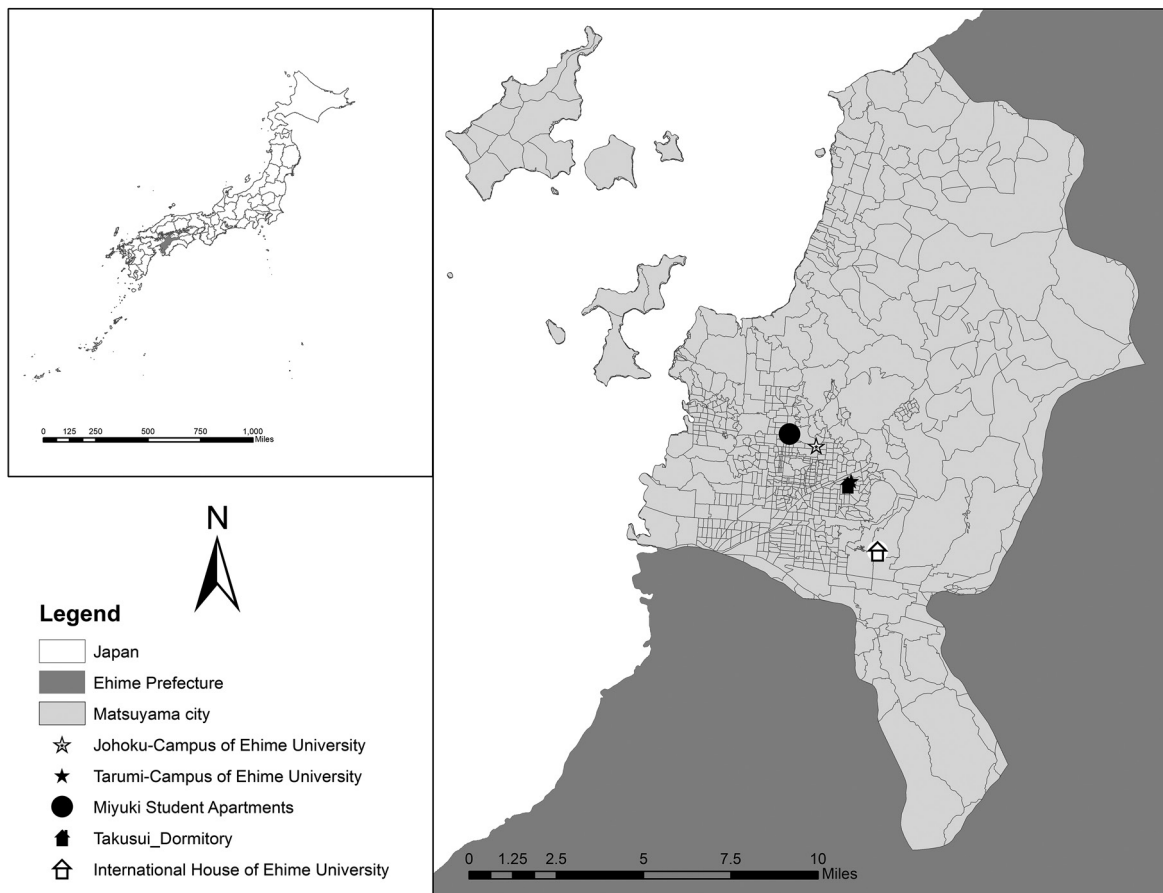
Figure 1: Location of research

3.2 Respondent

　68 respondents returned mental maps, and 103 answered questionnaires which are collected in this study. In this process, some respondents filled out the questionnaire then drew the mental map, but there are respondents who only filled out the questionnaire without drawing a mental map or vice versa. Because of data collection requirements, each respondent was asked to do two phases, filled out the questionnaire, and then draw a mental map. In the next process, we only used the data 65 respondents who completed the questionnaire and mental map. The respondents who met the requirements consist of 52.3 % female, and 47.7 % male. Mostly, respondents' Japanese language skill was low (50.8 %), with spoken language English (63.1 %). They come from Southeast Asia (50.8 %), East Asia (41.5 %), and the cluster age dominant at 20-24 years old (52.3 %).

　To define and distinguish the respondents and place in the data handling' process, this study used two types of ID. First, the respondent ID that defines each respondent who completed both the questionnaire and mental map. This ID is used to connect questionnaire data and mental map data from the same respondent. Second is the place ID that defines each place in mental map data. The same place drawn by different respondents represents one place ID. Place ID is used in the GIS process.

Table 2: Socio-demographic of respondents

	Choice	Frequency	Percentage
Cluster nationality	East Asia	27	41.5
	Southeast Asia	33	50.8
	Others	5	7.7
Spoken language	English	41	63.1
	Japanese	21	32.3
	Other	3	4.6
Japanese language skill	Fluent	3	4.6
	Daily conversation	27	41.5
	Low	33	50.8
	Not at all	2	3.1
Gender	Female	34	52.3
	Male	31	47.7
Cluster age	Under 19	2	3.1
	20-24	34	52.3
	25-29	9	13.8
	over 30	20	30.8

3.3 Instrument

　The present study used primary data consisting of a questionnaire and mental maps from random international students of Ehime University. Secondary data consists of Matsuyama

City's map (administration, roads, and blocks) from the website for National Land Numerical Information of Japan.

3.3.1 Questionnaire

The questionnaire was completed using google forms for two months from August 2017. The questionnaires were delivered to random international students by email. There were two versions of the questionnaires, the English version and the Japanese version (only for international students from East Asia).

The questionnaire consists of several groups of questions (see Table 3), starting from the international students' identity as the actor of place attachment (Scannell & Gifford, 2010). The identity item consists of socio-demographic characteristics, including cluster nationality and Japanese language skills. In the present study, two identities were chosen for detailed study (cluster nationality and Japanese language skills).

The measuring item of place attachment was extracted from the definition of place attachment as a bond that people have with an important place, either positive or negative (e.g., Altman & Low, 1992; Proshansky et al., 1983). It consists of four items using a Likert Scale format ranging from 1 (agree/disagree) to 5 (disagree/agree).

'The satisfaction of eating habits', 'changes in the way of life' and 'feeling well with life in Japan', in the present study, are applicable in the "cognition" stage of the psychological process. The item of 'satisfaction of the eating habits' is following Sthapit and colleagues (Sthapit et al., 2017). Both 'changes in the way of life' and 'feeling well with life in Japan' dimensions were newly added in the present study. Both of them are involved in familiarity and being accustomed to a new place. Both of them consist of one question with a Likert Scale format ranging from 1 (agree/disagree) to 5 (disagree/agree).

3.3.2 Mental map

The mental map was designed to know the sense of place, of international students, to the city where they live. This mental map was designed with a sketch model on blank paper (see Figure 2). In the present study, we asked respondents to draw and mark using color pens the locations or things of interest (see Table 1). This request refers to the bonding people have with a place (e.g., Altman & Low, 1992; Proshansky et al., 1983), and people understanding an image of the place (Lynch, 1960). In the present study, we modified Matthews' coding category design (Matthews, 1984) by using category related to the level of feeling from respondents addressing the place. That classifications are: the place that respondents love as level 1; the place that respondents want to change as level 2; the place that respondents draw without colors defined as places without feeling as level 3;
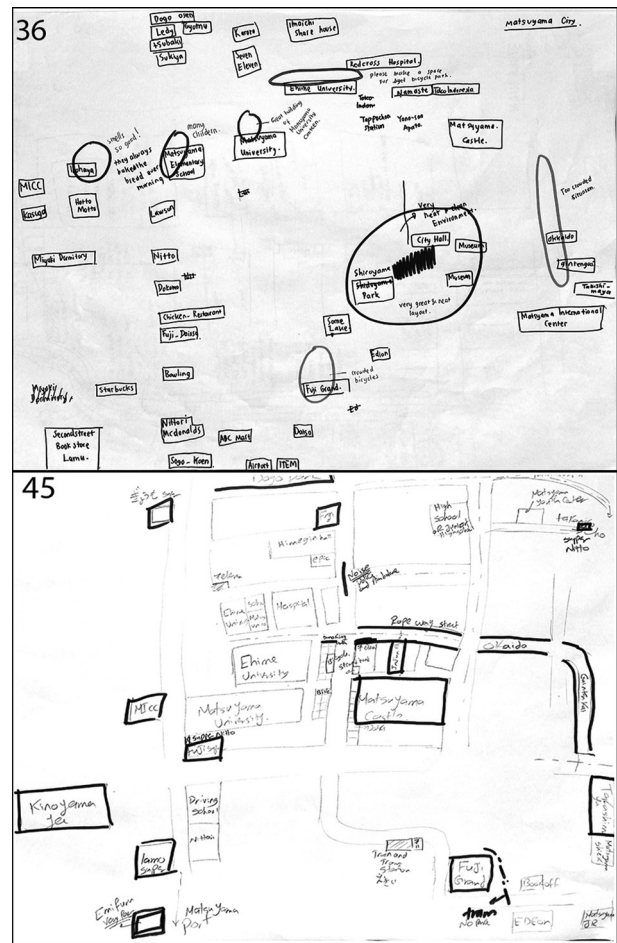

Figure 2: Sample of mental maps from respondent ID number 36 and 45

Table 3: Sumary of variables in questionnaire

Variable	Question	Mean	SD
Japanese language skill	Level of Japanese language skill	1.52	0.640
Cluster nationality	Nationality	2.52	3.197
The satisfaction of eating habits	Satisfied with eating habits in Japan.	3.74	0.923
Changes in the way of life	I have changed the way I live since I came to Japan	0.53	0.85
Place Attachment	Matsuyama is a boring city	0.7	1.13
	Matsuyama is a comfortable city	0.844	0.77
	I am attached to Matsuyama City	0.73	0.88
	Matsuyama City is pleasant city	0.8	0.86
Feeling well with life in Japan	I fit in well with life in Japan.	0.74	0.87

and the place that respondents hate as level 4 (see Table 1).

Mostly respondents drew their mental maps with all the contents following the order; however, a few respondents only drew the places/things that refer to two feelings. All these data were acceptable to use in this study as long as they can be confirmed and validated. There are 366 recorded data from 65 respondents consisting of places and things that were confirmed in this process.

3.4 Procedure

Figure 3 shows the general data processing schema during the study. The two main data collection types were: mental maps hand-drawn by respondents, and all variables in this study collected by the questionnaire. The workflow for dealing with these types of data included collection, collation, integration, storage, and analysis, each of which is described herein.

3.4.1 Data handling

First, the questionnaire was delivered using a Google form to the international students by email. In this questionnaire, there were some sections to explore each variable. The last section in the questionnaire was the mental map section. In the mental map section, we asked the respondents to come and gather in a room and draw their perception about Matsuyama City on a blank paper. After drawing the map with the places, the respondents had to mark the places/things that refer to their feeling (see Table 1).

Second, data were collected and processed using different software. Data from the questionnaire was processed by Excel, where dataset based the respondents. In this dataset, there are 65 data. Each variable was represented as the field. To understand the value of place attachment' variable, we used the average from four questions. This data was saved as "questionnaire. xlsx."

Data from mental maps after confirmed was transferred manually to Google Earth. Thus, we made the project "mental map.kmz" consisting of the respondent ID and the features. Each respondent ID was represented as a folder and collected the features. The feature was the place or thing that respondent drew and marked in mental maps. Every place/thing was repre-
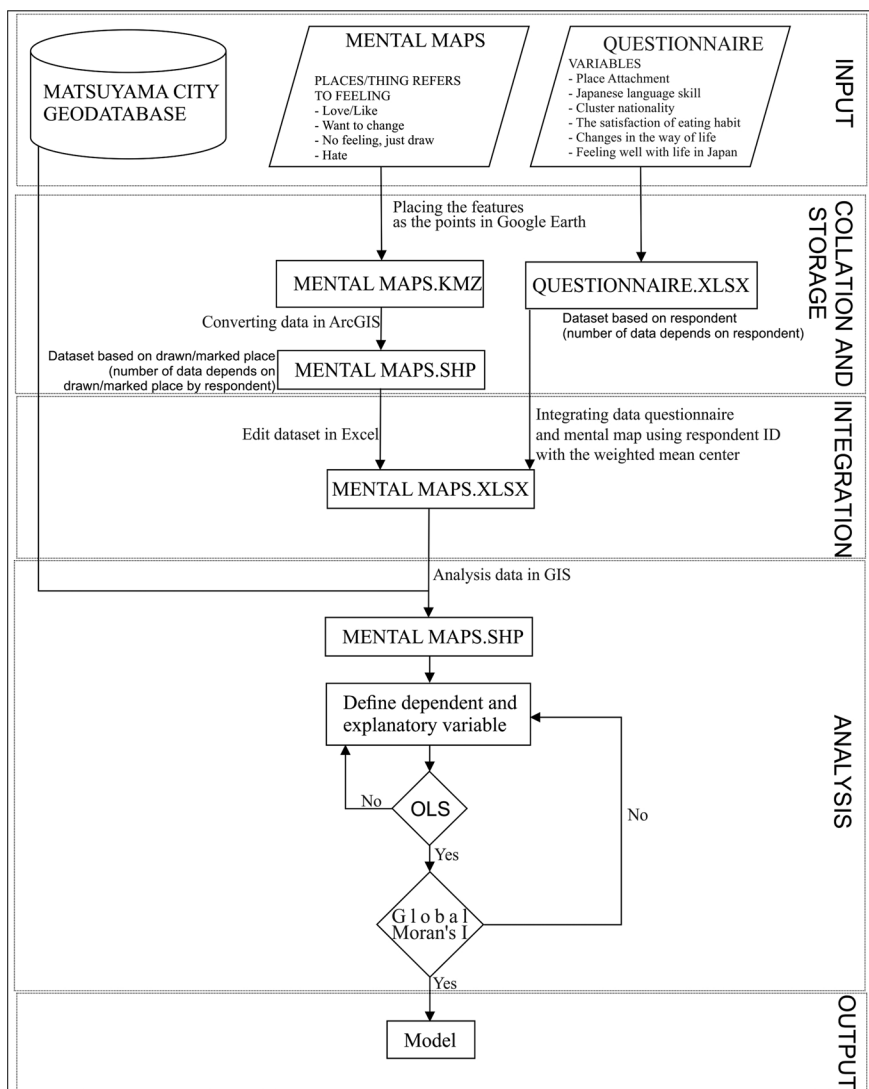

Figure 3: General data processing scheme

sented by point feature. In every feature, there was a description of the level category of that place (see Table 1).

Then, "mental map.kmz" was converted and recollected in ArcMap (ArcGIS) as "mental map.shp." This data is based on place. Next, this "mental map.shp" becomes the database in this process data handling and analysis. On Google Earth we added the features based on the respondents, consequently there were the same features between respondents. Furthermore, in ArcMap, these same features become repeated features in the dataset. Thus, we added new values (number, level 1, level 2, level 3, and level 4) in the dataset. The value is representative of variables in GIS. The number's value refers to the number of respondents who draw and mark that place. The value of level (level 1, level 2, level 3, and level 4) refers to the respondent ID who drew the places/things according to their feeling (see Table 1).

Figure 4 shows the sample of the dataset in "mental map. shp." In this sample, the place is Ishiteji (Ishite Temple) and the place ID is 65. In this feature, three respondents drew this place; consisting of one respondent who likes the place (respondent ID number 5); one respondent who wants this place to change (respondent ID number 13), and one respondent who draw without feeling this place (respondent ID number 44). While "0" in column "level 4" refers to no respondent who hate this place.

3.4.2 Integrated data

The dbf file from ArcGIS was processed in Excel to integrate data between the mental map and questionnaire and was saved as a new file in xlsx format (mental map.xlsx). In this file, we added several sheets that refer to the number of variables. In every sheet, we added the number of columns, refer to the number of respondents of every place, and distinguish the respondents' level with colors (see Table 1), and those columns were linked to data from the questionnaire (questionnaire.xlsx). Lastly, we added a column in every sheet. This column was the weight mean of every variable for every place. In this column, we used the equation of the weighted mean center (see Equation 1).

Table 4 shows the sample of the dataset for the sheet of place attachment from mental map data. This step was a con-

tinuation of the process in Figure 4. Table 4 shows Ishiteji (Ishite Temple) with place ID number 65. The column of "Respond of Place Attachment" refers to how respondent ID relate to Ishiteji's feature and was linked to the "questionnaire.xlsx" file. There are three subcolumns below the column of "Respond of Place Attachment" because it relates to the number of respondents for Ishiteji's feature (in this case, there are three respondents). In each subcolumn, there is 1 column for every level (1.1; 2.1; and 3.1), due to Ishiteji's feature, each level category except "level 4" consists of 1 respondent (see Figure 4).

In Table 4, score "4" in subcolumn "1.1" is the score of place attachment from respondents who like this place, in this case, respondent ID number 5; and score "4" in subcolumn "2.1" is the score of place attachment from a respondent who wants this place to change, in this case, respondent ID number 13, and so on.

In integrated data, we applied the equation based on the weighted mean center. This equation is used when we have more than one value of data; we consider some data values to be more important than others, and so we want to integrate some values to the average (see Equation 1). In the present study, there were two values of data: questionnaire and mental map. Following our goals in this study's new approach to put the mental map as the base data, in this calculation, data from mental map was the weight of data.

$$Yi = \frac{\sum_{i=1}^{n} MiVi)}{\sum_{i=1}^{n} Mi)} \qquad (1)$$

Where "Y" is the weighted mean variable used in regression analysis, "M" is mental map's score (which is, 4 for level 1; 3 for level 2; 2 for level 3; and 4 for level 1. See Table 1); "V" is data variable from the questionnaire; "i" is the place in the mental map; and "n" is the number of respondents who draw the place in the mental map.

In Table 4, the column of "place attachment" shows the application of this equation. In this process, we multiplied each weight (mental map scores in this case are 4, 3, and 2) by the questionnaire data (in this case 4, 4, and 3.25), added it all up, and divided by the sum of weights.

Next, data from columns consisting of every variable's

Figure 4: Example dataset of mental map file relating to level category of the respondent in ArcMap

Table 4: Example sheet for place attachment's variable in mental map.xlsx

Place ID	Name	Number	Respond of place attachment [1]				Place Attachment
			1.1 [2]	2.1 [2]	3.1 [2]	etc	
65	Ishiteji	3	4	4	3.25		$\frac{((4 \times 4) + (3 \times 4) + (2 \times 3.25))}{(4 + 3 + 2)} = 3.83$

Notes: [1] Linked to "questionnaire.xlsx" using the respondent ID. [2] A number depends on the number of respondents who mark the feature with the level feeling.

weight mean in every sheet was copied as a new value/variable in database ("mental map.shp") in ArcMap. Meaning, the mental map data was completely recollected and integrated. In the next step, mental map data was overlayed with Matsuyama City data in ArcMap

3.5 Analysis

The analysis used OLS in ArcGIS platform. In this analysis, we made place attachments as dependent variables and other variables as explanatory variables. We built several models to achieve a fit model. To do this, we investigated the model's fit measures of each model refering to Table 5 (VIF, AICc, Adjusted R-squared, Jarque-Bera Statistics), until finding a fit model. After that, we investigated the spatial autocorrelation model using Global Moran's I. Table 5 shows that all the measurements meet the requirements, meaning we achieved our proper model explaining international students' place attachment.

4. Result

In Table 6, the OLS analysis shows that all explanatory variables except cluster nationality were significant predictors of place attachment: the satisfaction of eating habits (β = .33, p < 0.001), changes in the way of life (β = .30, p < 0.001), feeling well with life in Japan (β = .20, p < 0.001), and to Japanese language skill (β = .15, p < 0.001). Then, in Figure 5 presents the histograms and the scatterplots of place attachment with explanatory variables (except cluster nationality). The histograms explore how each variable is distributed. The histograms show the variables not normally distributed. OLS does not require variables to be normally distributed (Currit, 2002). In these histograms and the scatterplots, all the relationships are positive linear.

5. Discussion and Conclusion

Generally, the present study confirms conceptual models of place attachment from the previous studies (e.g., Altman & Low, 1992; Manzo & Devine-Wright, 2013; Proshansky et al., 1983; Scannell & Gifford, 2010) using a new blend approach. The findings allow the following conclusions through an analysis of 65 data of questionnaire and 366 data of mental map instances.

Table 6. Result of OLS

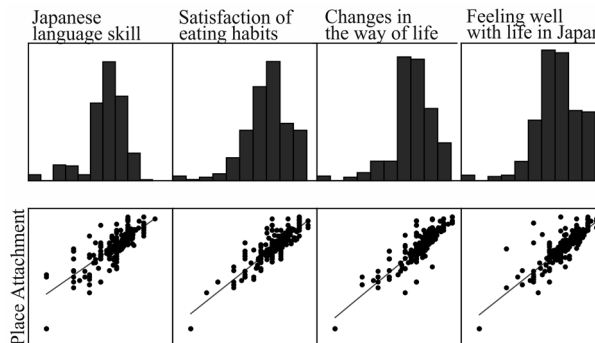| Variable	Coefficient
Japanase language skill	0.15592022797***
Cluster nationality	0.02567934848
The satisfaction of eating habits	0.33420222658***
Changes in the way of life	0.30473522773***
Feeling well with life in Japan	0.20671456143***

Note: *** p < 0.001.

Figure 5: Variable distribution and relationship

- To measure place attachment of international students with five aspects—Japanese language skill, cluster nationality, the satisfaction of eating habits, changes in the way of life, and feeling well with life in Japan—were found through spatial statistic analyses. Generally, the present study's results supported previous studies that the identity of the actor (Scannell & Gifford, 2010) processes the actor to attach to their environment (Altman & Low, 1992; Proshansky et al., 1983; Scannell & Gifford, 2010; Tuan, 1974), and the place has a role in building place attachment (Scannell & Gifford, 2010; Stokols, 1981).

- To become attached to a new place for international students in Japan, the satisfaction of eating habits has a more essential role than four other explanatory variables. This result is reasonable since eating habits are related to the primary human need. This finding also means that the different behavior and food cultures between the international student

Table 5: The model fit measures for OLS and spatial autocorrelation

Measure	Estimate	Threshold*
Ordinary Least Square (OLS)		
Variance Inflation Factor (VIF)	All of them < 7.5	< 7.5
Jarque-Bera diagnostic	0.965325	Not statistically significant
Adjusted R-squared	0.880053	Strong
Akaike's Information Criterion (AICc)	The lowest	The model with the lowest AIC
Spatial Autocorrelation		
Spatial autocorrelation (Global Moran's I)	Residuals in random and z-score is 1.574254	Residual should not be clustered in location and value

Note: * Source: https://desktop.arcgis.com.

and Japanese style are not cultural barriers and finally not place attachment barriers. This result is in line with previous findings that relate to place attachment and food emotions (Sthapit et al., 2017). Furthermore, this satisfaction also reflects the positive feelings of international students, and it supports previous theories about place attachment, which refer to positive feelings (Altman & Low, 1992; Proshansky et al., 1983; Tuan, 1974).

- "Changes in the way of life" represents international students' adaptation during life in Japan, while "feeling well with life in Japan" represents international students' acceptance to their new life. Both variables are the process that entangles the emotion, perception, knowledge, and value. The cultural barrier and the strength of Japanese identity are the reasons we wanted to explore both variables. Furthermore, those two variables were extracted from the concept post-move in place attachment and mobility (Inalhan & Finch, 2004), in the Japan context. The present study suggested that "changes in the way of life" has a moderate positive role in place attachment. Thus, it seems likely that place attachment of international students tends to increase as the feeling changes as the way of life in Japan increases.

- "Feeling well with life in Japan" has a role in effecting place attachment for an international student. This finding is also consistent with previous studies related to place attachment and positive feeling (e.g., Altman & Low, 1992; Proshansky et al., 1983; Tuan, 1974).

- The present study reported that Japanese language skill affects place attachment. This finding supports the study about language skills in relation to the way we connect to a place (Whorf, 1956), also the role of language to define the environment (Di Masso et al., 2014). Interestingly, in the present study, this variable has a weak positive effect to place attachment. This finding may have been due to the fact that the respondents are international students who mostly used English as a spoken language (63.1 %).

- Unfortunately, the present study found that cluster nationality was not a significant predictor of place attachment. This finding might have been due to the limited sample of our respondents.

- The present study demonstrated a new approach to model place attachment. Commonly, previous studies about place attachment used questionnaires (Choi, Park, & Lee, 2016; Kaida, 2015) with the concept of the database on the respondents. The questionnaire method mostly explores the socio-demographic and the physiological process of the respondent. Previous studies related to place attachment used a mental map with a sketch to gather data (Gillespie, 2010; Lynch, 1960; Matthews, 1984), but according to Matthews, this method is challenging to analyze (Matthews, 1984). Thus, some previous studies used a combined mental map with additional method to model place attachment (e.g., Boğaç, 2009; Larsen et al., 2016) such as an interview and

questionnaire (e.g., Boğaç, 2009; Larsen et al., 2016); however, the analysis used an analytic technique. Although some previous studies already used coding to define the place in place attachment, the focus of those studies is on the physical setting of the place, and cannot connect the respondent's perception and the place (e.g., Gillespie, 2010; Larsen et al., 2016). Accordingly, the present study attempted to make a dataset based on place wherein every place consists of the respondents' emotions, perceptions, and socio-demographics. To achieve this, we used a mixed-method questionnaire and a mental map. The questionnaire was the chosen method to explore the perception, and the mental map was the method to understand the place. In order to merge the data, the weighted mean center was applied in this process. Furthermore, spatial statistic was used to model the place attachment. Finally, the whole model's result reported that this model generally supported the previous studies, which means this approach could be an alternative method and analysis to model place attachment.

- In the mental map, international students' drawing type consisted of physical setting from built environment (home, street, etc.), natural environment (lake, forest, etc.), and living things (people, animals, etc). These types of drawing are similar with the previous studies (e.g., Boğaç, 2009; Lynch, 1960; Manzo, 2005). Interestingly, many respondents drew an object such as a traffic light, stone, street furniture, or a building in the block or street corner. According to the respondent, those objects do not consist of a feeling from them but they are important as a sign. This is similar to Tuan's suggestion about the mental map, that a mental map could be a direction and a help in geographical knowledge (1975).

The present study acknowledges a few notable limitations. First, the mental map was undertaken by freehand, resulting in a considerable spatial distortion level, bias for a particular place based on distortion, and bias for individual's orientation. Moreover, the respondents came from different cultures, sometimes using a different name for the same place. To deal with these issues, we have to confirm the mental map's data to respondents and native people, then manually transfer all mental map data using Google Earth. The whole process will need more time if the respondents are more than a hundred. Second, this study was based on international students' data, a somewhat restricted sample. Thus, more empirical studies should be conducted and expanded in different places, with different mixed methods (e.g., mental map with an interview or a mental map with FGD), different aspects and patterns from the actor (e.g., personal network, gender, or spoken language), and different aspects and patterns from psychological processes (e.g., related to spiritual aspect) or a more significant variety of respondents to ensure this concept model's universal validity. These attempts will allow variations in modeling place attachment of international

students. For instance, although the present study's analysis was supported by spatial statistic, the OLS did not assess the spatial aspect. Thus, further study should therefore include GWR (Geographical Weighted Regression) analysis in order to understand how place attachment and explanatory variables change over space. Furthermore, the present study would be beneficial to develop an understanding of the place attachment of the international student in Japan and how to model place attachment in different approaches.

Acknowledgment

References

Altman, I. & Low, S. M. (I. Altman & S. M. Low, eds.) (1992). *Place attachment*. New York: Plenum Press.

Boǧaç, C. (2009). Place attachment in a foreign settlement. *Journal of Environmental Psychology*, 29 (2), 267-278.

Brennan-horley, C. (2010). Mental mapping the "creative city." *Journal of Maps*, 6 (1), 250-259.

Brown, G., Raymond, C. M., & Corcoran, J. (2015). Mapping and measuring place attachment. *Applied Geography*, 57, 42-53.

Choi, B., Park, J. A., & Lee, H. J. (2016). The development of a measurement method for place attachment and its verification with a housing satisfaction measure: A survey of university students about their homes. *Journal of Asian Architecture and Building Engineering*, 15 (2), 193-200.

Currit, N. (2002). Inductive regression: Overcoming OLS limitations with the general regression neural network. *Computers, Environment and Urban Systems*, 26 (4), 335-353.

den Besten, O. (2010). Local belonging and "geographies of emotions": Immigrant children's experience of their neighbourhoods in Paris and Berlin. *Childhood*, 17 (2), 181-195.

Di Masso, A., Dixon, J., & Durrheim, K. (2014). Place attachment as discursive practice. *Place Attachment: Advances in Theory, Methods and Applications*, 75-86.

Gatrell, J. D., Bierly, G. D., & Jensen, R. R. (2011). *Research design and proposal writing in spatial science, 2nd edition*. Springer Science & Business Media.

Gillespie, C. A. (2010). How culture constructs our sense of neighborhood: Mentalmaps and children's perceptions of place. *Journal of Geography*, 109 (1), 18-29.

Giuliani, M. V. & Fieldman, R. (1993). Place attachment in a developmental and cultural context. *Journal of Environmental Psychology*, 13(1), 267.

Inalhan, G. & Finch, E. (2004). Place attachment and sense of belonging. *Facilities*.

Kaida, N. (2015). Explaining pro-environmental behavior by a relative sense of place attachment to neighborhood and city. *Journal of Human Environmental Studies*, 13 (1), 71-75.

Larsen, T., Larsen, T., & Harrington, J. (2016). *Mental maps and a community-based sense of place : A case study among Kansas third graders*. (August 2017).

Lynch, K. (1960). *The image of the city*. Cambridge, Massachusetts: The M.I.T. Press.

Manzo, L. C. (2005). For better or worse: Exploring multiple dimensions of place meaning. *Journal of Environmental Psychology*, 25 (1), 67-86.

Manzo, L. C. & Devine-Wright, P. (2013). *Place attachment: Advances in theory, methods and applications*. London: Routledge.

Matei, S., Ball-Rokeach, S., & Qiu, J. (2001). Fear and misperception of Los Angeles urban space: A spatial-statistical study of communication-shaped mental maps. *Communication Research*, 28 (4), 429-463.

Matthews, M. H. (1984). Environmental cognition of young children: Images of journey to school and home area. *Transactions of the Institute of British Geographers*, 9 (1), 89-105.

Ng, C. F. (1998). Canada as a new place: The immigrant`s experience. *Journal of Environmental Psychology*, 18 (1), 55-67.

Proshansky, H. M., Fabian, A. K., & Kaminoff, R. (1983). Place-identity: Physical world socialization of the self. *Journal of Environmental Psychology*, 3 (1), 57-83.

Scannell, L. & Gifford, R. (2010). Defining place attachment: A tripartite organizing framework. *Journal of Environmental Psychology*, 30 (1), 1-10.

Scott, L. & Getis, A. (2008). *Spatial statistics. Encyclopedia of Geographic Informations*. CA: Sage.

Scott, L. M. & Janikas, M. V. (2010). Spatial statistics in ArcGIS. In Manfred M. Fischer & Arthur Getis (Eds.), *Handbook of applied spatial analysis: Software tools, methods and applications* (pp. 27-41). Springer.

Sthapit, E., Björk, P., & Coudounaris, D. N. (2017). Emotions elicited by local food consumption, memories, place attachment and behavioural intentions. *Anatolia*, 28 (3), 363-380.

Stokols, D. (1981). People in places: A transactional view of settings. *Cognition, Social Behavior, and the Environment*, 441-488.

Takeda, H. (2008). Delicious food in a beautiful country: Nationhood and nationalism in discourses on food in contemporary Japan. *Studies in Ethnicity and Nationalism*, 8 (1), 5-30.

Terrazas-Carrillo, E. C., Hong, J. Y., & Pace, T. M. (2014). Adjusting to new places: International student adjustment and place attachment. *Journal of College Student Development*, 55 (7), 693-706.

Tuan, Y. (1974). *Topophilia: A study of environmental perception, attitudes, and values*. Englewood Cliffs and London: Prentice-Hall.

Tuan, Y. (1975). Images and mental maps. *Annals of the Association of American Geographers*, 65 (2), 205-212.

Whorf, B. L. (1956). *Language thought and reality*. The M.I.T. Press.