On Inference of Sense of Place from Geo-Social Networks

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Abstract

The aim of the study is to investigate whether individuals report the places they are attached to in location-based services, and whether there is a relationship between the attachment scores of these places and their corresponding check-in frequency information. A survey is conducted to measure the degree of place attachment of individuals based on self-reported locations. Then their Foursquare log data is collected which includes their check-in and venue information. Our results show that the majority of the participants check in to locations that they are attached to. Attachment score is shown to be related to the check-in frequency. The tips left for venues include terms and phrases, suggesting place attachment.

Introduction

People feel drawn to many types of locations ranging from their home, work-place, places they were always intimate, including outdoor recreation areas, restaurants, a certain region, or a city. Place Attachment is defined as the bonding between individuals and their meaningful environment (Scannell and Gifford 2010) which examines how people experience places and is a concept extensively used in Environmental Psychology (Lewicka 2011). It is argued to have relied on social features (Woldoff 2002) or physical features (Stokols and Shumaker 1981). Although it has been widely investigated in social studies, it has not received much attention in information systems domain. Shwartz (2014) linked place attachment concept with Location-Based Social Networks (LBSNs) to better understand the interaction between people and places.

Automatic identification of places people felt most attached to may provide important benefits. Place attachment can be used to support pro-environmental behavior, and to plan the use of public spaces, such as parks (Kyle, Graefe, and Manning 2005). It may also be used in recommendation systems. For example, some tourists may prefer to visit places where local people feel most attached to, such as a bar or a local restaurant instead of visiting a location which received high ratings from people, the majority of which are the tourists. The most common and agreed-upon concepts of sense of place are place identity, place dependence and place attachment. In our study, we use the two dimensional model of Williams and Vaske (2003). Place identity is the reflection of self that defines the relationship between person and place (Proshansky, Fabian, and Kaminoff 1983). Place dependence is defined as individuals' perceived strength of association between the specific places and themselves (Stokols and Shumaker 1981).

In this study, we aim to investigate whether people report the places they are attached to in LBSNs aka geo-social networks. We specifically used Foursquare as it is the widely used LBSN in Turkey. Check-in mechanism is the primary tool we used in this study. This paper aims to answer the following research questions:

a. Do people check in to places that they are attached to?
b. Is check-in frequency related to place attachment? More specifically, do people check in to places they are attached to more frequently than the other places that they are not attached to?
c. Do tips left for a venue in LBSN contain linguistic cues indicating place attachment?

Methodology

The method comprises three phases. The first phase includes a survey for eliciting information about respondents' choice of locations and the degree of their attachment to these places. The survey items are on a five-point strongly-disagree to strongly-agree Likert scale. The survey was based on the study of Williams and Vaske (2003). However, unlike creating scenarios as in Williams and Vaske (2003), we first asked participants to choose two venue categories based on Foursquare category types such as residence, outdoors, university or food according to *its importance* to the individual. The reason is that in the pretest of the survey, it was seen that users' interests vary significantly and by enforcing scenarios such as "a Saturday afternoon in June" to the users, users mostly reported places that they were not attached to. Therefore, users were asked to report at least two and at most four locations under the category each respondent reported as significant

(hereafter called Most Significant Places (MSP)). We used the same questions in the study of Williams and Vaske (2003) to measure place attachment. We also asked participants to report at least one and at most two places that they frequently visit but is not significant to them (hereafter called Not Significant Places (NSP)). In the second pre-test of the survey, we obtained satisfactory results and used these questions in the main study. In the second phase, a survey including questions about participants' use of check-in mechanism was provided by following the study of Lindqvist (2011). In the third phase, participants were asked to provide Keyhole Markup Language (KML) links of their Foursquare accounts which comprises user check-in history. In total, 98 people completely answered the survey and provided their KML. These participants have a total of 63436 check-ins and the check-ins contain 11288 Foursquare venues. All the venues reported by each respondent were matched manually with the check-in data. Many operations to handle erroneous data such as spelling mistakes were carried out. More details on how we filtered and utilized the data can be found in (Öz, 2014). The Cronbach alpha values were 0.947 for place identity, and 0.745 for place dependence constructs respectively.

T	Item	μ	Mo	Md	σ
Dependence	This place is the best place for what I like to do.	3.67	4.00	4.00	1.11
	No other place can compare to this place.	3.03	2.00	3.00	1.16
	I get more satisfaction out of visiting this place than any other.	3.72	4.00	4.00	1.05
	Doing what I do at this place is more important to me than doing it in any other place.	3.09	4.00	3.00	1.13
	I would not substitute any other area for doing the type of things I do at this place.	2.76	2.00	3.00	1.11
	The things I do at this place, I would enjoy doing just as much at a similar site. (reversed)	2.48	2.00	2.00	0.97
Identity	I feel this place is a part of me.	3.30	4.00	3.00	1.18
	This place is very special to me.	3.32	4.00	4.00	1.17
	I identify strongly with this place.	3.15	4.00	3.00	1.17
	I am very attached to this place.	3.14	4.00	3.00	1.12
	Visiting this place says a lot about who I am.	2.84	2.00	3.00	1.26
	This place means a lot to me.	3.28	4.00	3.00	1.18

Table 1: The descriptive statistics of the place attachment related constructs in the survey (N = 331, Min = 1.0, Max = 5.0). T is the type, μ is the mean, σ is the standard deviation, Mo is the mode and Md is the median.

Descriptive Data Analysis

As a result, 331 number of places were reported by the participants and their corresponding attachment scores were calculated. Out of 331, 223 locations were reported as significant to them and 108 of them not significant. 236 out of 331 places could be matched with Foursquare data. 62% of all the places the participants reported as feeling at-

tached to are the specific places (such as restaurants, night-clubs). Out of 98 participants, 43 were male and 55 were female. The majority of the participants were at their 20s (80%) and the majority of all were either university students or graduates as the survey was sent to the university e-mail lists. 83 of the participants were single and 15 were married. The attachment dimension items are given in Table 1. The type field indicates whether the questions aim to measure the place dependence or identity. Although the mean of the items are greater than the average, some of them are not very high. For example, "I am very attached to this place" has a mean of 3.08. Because the level of some individuals' attachment to places were low although they reported these places as significant to them. In addition, the table shows the cumulative statistics about all the venues that have been reported as MSP and NSP.

Data Analysis & Results

Do People Check in to Places That They Are Attached To?

For each participant, we identified two venues which received the highest and lowest attachment scores based on their reported MSP and NSP data respectively. For each participant, we identified two venues which received the highest and lowest attachment scores based on their reported MSP and NSP data respectively and then for each venue, its check-in order was calculated based on its check-in count divided by the total number of check-in counts of all the venues for that corresponding participant (normalized checkin value). Note that if the highest attachment score for a venue is less than 3, we do not calculate its check-in rank as it indicates that individuals are not strongly attached to their reported places. As a result, we analyzed data from 78 respondents. 63% of individuals check in to the places that they felt most attached to. Table 2 shows the number of respondents versus check-in orders. For example, 13 out of 98 individuals checked in to at least one location they felt attached to, more frequently than any other places (check-in order is 1). 169 out of the 223 places in MSP, making 76% of the significant places, were checked in at least once by the corresponding participant who declared that venue. These results may indicate that people tend to check in to places that are significant to them.

Check-in Order	Participant Count		Check-in Order	Participant Count	
	MSP	NSP		MSP	NSP
1	13	0	7	2	1
2	11	1	8	1	2
3	4	4	9	1	0
4	3	0	10	0	0
5	2	0	Not in top ten	22	13
6	3	0	No check-ins	16	22
			Total	78	43

Table 2: The number of participants vs. check-in ranks

The results of the survey regarding participants' use of check-in mechanism indicate that the majority of the par-

ticipants use the application for checking in to places that are important to them as can be seen from Table 3. This application is used mostly for recording new places and places that are important to them. However, it is not preferred for meeting with new people or gaming purposes.

Item	μ	σ	Md
I use more when I'm at a place that is special to me	4.10	1.18	4
I use more when in new places	3.89	1.28	4
I use more when I'm with family	2.69	1.18	3
I use more when I'm with friends	3.80	1.25	4
I use more on holidays	3.70	1.27	4
I use more on special days	3.66	1.20	4
To indicate places that have a special meaning for me	3.82	1.19	4
To discover new places	3.82	1.17	4
When I'm in crowded events	3.48	1.25	4
To mark places that I don't visit routinely	3.32	1.33	4
To see where my friends are	3.76	1.19	4
Games (Mayorship, badge, points)	2.58	1.34	2
To run into my friends	3.08	1.32	3
To meet with new people	1.84	1.03	2
To share with my far away connections	2.85	1.27	3
To keep my personal history	2.79	1.34	3

Table 3: The reasons about the participants use of Foursquare application (N=98)

Is Check-in Frequency Related to Place Attachment?

We investigated whether the check-in counts are related to the degree of place attachment. We first wanted to ensure that the data set will include all types of places: highly attached, neutral and low attached ones. Table 2 shows that in MSP category there are 62 places that have been reported as attached and were also checked in at least once by the participant. As for NSP, there are 21 places that were checked in at least once. We also included 9 places with neutral attachment scores, a score of exactly 3. If the venues declared by the respondents belong to a region (such as a district), or an area (such as campus or a mall), the check-in data in that region/area was merged which resulted in 3 additional places in the data analysis. In total, 95 places were obtained. The correlation between the normalized checkin value and the following three scores of each reported venue was investigated: (1) Place Attachment Score (PAS) which is the average score computed from all attachment measurement items. (2) Place Dependence Score (PDS) which is the average score calculated from the 6 place dependence items and (3) Place Identity Score (PIS) which is the average value calculated from the 6 place identity items in the survey. Spearman's rank-order correlation is used to investigate the relationship. The results in Table 4 show that there is a relationship between the check-in frequency and attachment scores.

	PAS	PDS	PIS
Correlation Coefficient	.381**	.365**	.372**
Sig. (2-tailed)	.000	.000	.000
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 4: Spearman's correlation results

We analyzed the results in detail. We looked at the proximity of the places with regards to the participant's home or workplace (asked in survey). The places that are not close to either home or work are 31% of MSP. 58% of these places are not in the top ten. This finding might indicate that there is a large physical distance between the declared place and individual's home town. For example, the place is visited at certain times of the year such as in holidays. People can still feel attached to such places but it will be hard to infer this from the check-in counts.

Do Tips Left for a Venue in LBSNs Contain Linguistic Cues Indicating Place Attachment?

A more appropriate indicator for attachment might be the tips left for the place. These tips are comments that express the feelings of the user towards that place. We embraced a qualitative approach and interpreted some of the tips by ourselves. We identified the places that received highest attachment scores from the respondents. These top scored places were indeed well-known and frequently visited places by the locals and young people in the region. The categories of these places were restaurants, bars and a famous outdoor region where young people meet. Note that as KML file does not include the comments of the individuals, we made use of all the tips left for each venue.

	Extracts from Reviews
Dependence	"The best Sangria I have had in this country" "It is the most decent place you can go in this region" "A classic in this region" "Vivien has an excellent taste which you must definitely try" "This city's one of the high-class restaurants. The food is nice, the employees are dutiful. I strongly recommend this place." "It is impossible to find a more decent place than here in this region" "I can live in this city forever just to visit this place every day and taste each dish." "The coziest place ever :)" "They say this place is the eighth wonder of the world…"
Identity	"My favorite restaurant" "To sum up fell in love" "Brother John Doe" "Our fellow venue. Our beloved John Doe :)" "I have grown up with this place. My whole school life and now business life" "It is our only place in this region." "XX is a family :))) we almost visit every day, food is excellent, it is cozy, and you should definitely go". "I say balcony and say nothing more! :)" "This is the place which I visit with my mates… beautiful place" "This is my second home…" "This is the only place where I have bitter sweet memories and this is the place where I come across with my ex-girlfriend…therefore I think we are still together :)" "This is the place where I have the best times of my whole university life"

Table 5: Some tips extracted from the reviews

Table 5 shows some of the excerpts taken from the reviews. Note that they were translated from Turkish to English. The name of the region and the venues were anonymized and we used "in this region" instead. When all the

texts were inspected manually, the following common linguistic cues were identified in the text: (1) The name mentions of the owner, chef etc. of the place; (2) The specific positive references to amenities, servings or objects of the location; (3) The use of "my/our <adjective> place/restaurant" ; (4) The use of smileys and exclamation marks; (5) The frequent use of positive sentiment words such as, excellent, awesome, incredible, superb; (6) The use of "strongly/definitely recommend" phrases; (7) The use of words for complimenting the chef, owner etc. (Many thanks to Mr. John Doe for ...); (8) The use of "The most <adjective> (typically representing a positive sentiment orientation) place in …" or the use of "The best … place in <region name>" phrases; (9) The mentions of family members, people who are important in individuals' lives (girlfriend, best friends, boyfriend etc.); (10) The mentions of "home" although the place is not the home of the reviewer; (11) The mentions of "life" such as "my whole life, in my life, lifesaving"; (12) The use of "my favorite"; (13) The mentions of "love/like/crazy for/mad about"; (14) The mentions of "The only place to <verb>" phrase. We also selected a pub venue with a place identity score of 5.00. The meaning of having such a high identity rating is that the person is intimately attached to the venue. The relationship is at a personal level such that the venue is a part of how the person defines himself/herself. Highest frequency word groups were observed to have a better understanding of the affection in question. Table 6 lists the words according to their usage frequency in the top thirty tips. The most frequent words are "balcony" and "go". The balcony of the venue is popular among the visitors and many reviewers recommend this place. Also the owner of the place's name and the keyword *brother* were mentioned by the reviewers. However, single words are not effective to reveal the sense of place alone. Note that stop words were discarded from the analysis.

Conclusion and Future Work

This paper has investigated whether individuals leave any digital footprints in the geo-social social networks. Although there are qualitative studies in the literature which show that people check in to places that are important to them (Ozkul & Humphreys 2015) and link LBSN usage with personal attachment (Shwartz, 2014), this study is the first study which has investigated this relationship based on check-in data of individuals. Our results also indicate that people check in to places that they are attached to. However, depending on the location of the venue, the check-in frequency may vary. The tips left for the venues contain important linguistic cues that can reveal place attachment levels. The importance of online reviews has been also discussed in the study of Afonso Dias et al. (2013). However, the scope of their study was different from ours where they have only investigated the phenomenon of online vacation rentals and the concept of sense of place appearing in tourists' reviews. Their study has adopted a qualitative approach where they solely relied on narrative analysis. Currently, we are in the process of creating our corpus and a local grammar approach is being developed which will be utilized to automatically extract important phrases that are highly likely to reveal place attachment.

The study is limited in number of participants so the results cannot be generalized. Although quantifying "sense of place" is challenging and there is no unified single theory, this study has attempted to shed light on this phenomenon in geo-social networks.

Table 6: Highest frequency words in the tips of the given venue

#	Word	Frequency
1	Balcony	10
2	Go	5
3	Wine	5
4	Place	4
5	Cool	4
6	John (Doe)	3
7	Brother	3

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