EXAMINING PLACE ATTACHMENT FROM A FOURSQUARE PERSPECTIVE

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ABSTRACT

EXAMINING PLACE ATTACHMENT FROM A FOURSQUARE PERSPECTIVE

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The aim of the study is to understand the relationship between self-reported place attachment and attachment measured by means of mobile applications that provide location-based services. To meet this end, a survey is conducted to measure place attachment and participants are asked about the places they prefer under certain categories, their attachments to these places, and properties of these places. In the second part of the study, participants' Foursquare log data is collected which includes their checkin and venue information. The venue information reported in the survey responses and Foursquare data is matched manually. Our results show that users usually check in to places where they have place attachment. Almost eighty percent of the places with high attachment rating are checked in by their corresponding participants and more than half of these places have ranked in the top ten of all the checkins of the participant. Attachment rating is shown to be related with the checkin frequency.

Keywords: Location-based service, place attachment, mobile, Foursquare, checkin

ÖZ

MEKAN BAĞLILIĞINI FOURSQUARE PERSPEKTİFİNDEN İNCELEME

Öz, Bilgehan Kürşad
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Bu çalışmanın amacı katılımcıların kendi bildirimleri kullanılarak bulunan mekan bağlılığı ile mekan-tabanlı hizmet sağlayan mobil uygulamalar aracılığıyla ölçülecek bağlılık arasındaki ilişkiyi anlamaktır. Bu amaç doğrultusunda mekan bağlılığını ölçmek için bir anket kullanılmakta ve katılımcılara çalışmada belirli kategorilerde gidilen mekanlar, bu mekanlara olan bağlılıklar ve mekanların özellikleri hakkında sorular sorulmaktadır. Çalışmanın ikinci kısmında, katılımcıların yer bildirimi ve mekan bilgilerini içeren Foursquare verileri toplanmaktadır. Anket yanıtlarında bildirilen mekan bilgileri ile Foursquare verileri elle eşleştirilmektedir. Elde ettiğimiz sonuçlara göre kullanıcılar genellikle bağlı oldukları mekanları bildirmektedirler. Yüksek mekan bağlılığı derecesi olan yerlerin yüzde sekseninde ilgili katılımcı yer bildirimi yapmış ve bu mekanların yarısından çoğu katılımcının bütün yer bildirimleri içerisinde ilk onda yer almıştır. Bağlılık derecesi ile yer bildirim sıklığının ilişkili olduğu gösterilmiştir.

Anahtar kelimeler: Mekan-tabanlı hizmet, mekan bağlılığı, mobil, Foursquare, yer bildirimi

I dedicate this thesis to my co-workers, who put up with me regardless and support me through all my struggles.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Personalized systems are getting widely used day by day. Systems that make use of human mobility data provide new ways in assisting users. Recommendation with context-awareness has been studied in many different ways, including collaborative filtering, matrix factorization and machine learning algorithms. But characterizing and classifying human activity is still a challenge.

Location-Based Social Networks (LBSNs) aka Geosocial Networks, are networks created by location-based services that enable users to publish their geolocation and share it with others. This activity is mostly named as "checking in." A checkin generally consists of the active user, place, time and accompanying people. In the top tech trends report, Garner Inc. mentions "Internet of Places" along with Internet of Things, Internet of People and Internet of Information as an emerging way of interconnection (Cearley, 2013). Foursquare is the leading location-based service of our time. It was reported that there were 3 billion Foursquare checkins by January 2013 (Cearley, 2013). A better and up to date number to show the latest situation as of August 2014 is given by the official Foursquare blog, stating that there are currently 6 billion checkins and 65 million venues (The Foursquare Blog, 2014). The application (and web-site) allows users to leave tips (suggestions) for venues. The current number of tips in Foursquare database is 55 million according to The Foursquare Blog (2014) post published in August 6th, 2014. Foursquare announced that they have 50 million users and also indicates that 1.9 million place owners claimed their venues (Foursquare About, 2014), meaning that they gave official status to the Foursquare venues, and use the application in their business model as a means of marketing.

A web site publishing interesting statistics about everyday use of Foursquare, puts Turkey in the second position by the percentage of users (Alexa, 2014). As expected, United States leads all countries with 21.9%, Turkey ranks second with 8.9% and Mexico comes in third place with 7.9%. Indeed, there is a growing interest for

Foursquare in Turkey. This is more supported by the claims made in (Bercovici, 2013). The site points out that even though new venue listings for United States are decreasing, it is increasing rapidly for Turkey. These analyses indicate that there is a growing base of Foursquare users and venues in Turkey.

The aim of this study is to understand the relationship between location-based services and the *Place Attachment* attained by the declarations of the participants. Scannell and Gifford (2010) define Place Attachment as the bonding between individuals and their meaningful environment. We will delve more into how and which places are deemed as meaningful, as in meaning something special to someone, in the next chapter.

Place Attachment examines how people experience places and is a concept extensively used in Environmental Psychology (Lewicka, 2011). Nearly forty years ago, in the field of human geography, studies aiming to identify meaningful places were carried out (Buttimer, 1980; Relph, 1976; Tuan, 1974). For the years to come, improving theoretical definitions and models brought about many different uses for Place Attachment in various and seemingly disparate fields. Sociology, community psychology, cultural anthropology, demography, urban studies, tourism, ecology, forestry, architecture and planning, and economics are all fields that have publications on Place Attachment (Lewicka, 2011). According to Lalli (1992), the phenomenological approach of researchers led to a decrease in positivist research involving quantitative studies and traditional hypothesis testing (Jorgensen and Stedman, 2001). Place Attachment has been worked in social sciences for many years, but its relationship with information systems is yet to be studied comprehensively. We consider the relationship between attachment and LBSNs as a novel topic deserving of attention.

1.2 Purpose of the Study and Research Questions

The main purpose of the study is to investigate whether a relationship exists between the Place Attachment concept and Foursquare use. Checkin mechanism is the primary tool we use in the study. Based on the purpose mentioned, the following research questions are guided throughout the study:

1. Can place attachment be inferred with the use of an LBSN?
2. What types and levels of attachment are suitable to use with LBSNs?
3. What types of users are suitable for place attachment evaluation?
4. Can checkin behavior be explained with place attachment?

Another aim is to present the significance of utilizing LBSN data to gain a better understanding of human mobility and provide a novel method for personalization in recommendation systems. We also aim to find the intentions of Foursquare users. Towards these aims, we asked participants about the places they have visited most and compared this information to their Foursquare checkins.

1.3 Significance of the Study

To the best of our knowledge, this is the first study to link Place Attachment and Foursquare data. Gathering and utilizing the participant data itself is a contribution as it helps to explore how to (1) interpret personal place attachments, (2) classify attachments and places, (3) categorize application user behavior, (4) use tips in order to form an attachment vocabulary for different levels of attachment, (5) use venue networks to investigate possible attachments, (6) use Foursquare to link between emotional and functional places.

This study will reveal the relationship between personal place attachments and user behaviors in mobile environments. There are no other studies with a measurement aspect in the Information Systems literature. Instead of self-report data, using implicit contextual data from mobile applications may provide input for many studies in the future. The studies on environmental planning, which are making use of place attachment measures, will be able to use the existing information in geosocial networks. With the data in geosocial networks, the focus can shift from people to places in the purpose of discovering the relationships among places. These relationships could then become objects of recommendation systems. Users can be recommended the highest attached places in a region. Thereby, the emphasis will be on the preferences of the local people instead of the more common touristic zones.

The results of this study may contribute to the existing literature in investigating personal place attachment under different conditions and understanding user behavior. We leave some aspects of our aims for further study.

CHAPTER 2

BACKGROUND INFORMATION

2.1 Geosocial Networks

Foursquare was not always the leader among location-based services. Before it was shut down in 2012, Gowalla was a major player and high profile studies such as Stanford Network Analysis Project used a Gowalla data set (Leskovec, 2011). Ousting of Gowalla has a lot to do with Foursquare's early support for API and connected apps. Third party apps expand the use of checkin services to whole new levels. There are now Foursquare apps used for orientation purposes, gaming, map visualization, budgeting, crowd sourcing, matchmaking, food recommendation and for many other purposes. In our study, the focus is more on the individual, and occasionally on the communal ties created by location-based services and the potential use of the ever growing spatiotemporal data in geosocial networks.

Cho, Myers and Leskovec (2011) use the Stanford Network Analysis Project data set that contains 6,442,890 checkins, 196,591 users and 950,327 ties. They argue that human movement is geographically limited and seemingly random but actually correlated with their social networks. The authors also state that short-range travel is periodic and that it is not affected by the social network structure whereas long-distance travel is more affected by social network ties. They claim that social relationships can explain about up to 30% of all human movement.

Cheng, Caverlee, Lee and Sui (2011) investigate how people use Location Sharing Services (LSS) and how LSS help in modeling patterns of human mobility. The authors study the geographical and temporal features of over 22 million checkins across the globe. Their aim is to explore the factors that influence human mobility; including social status, sentiment and geographic constraints. The authors claim that checkins have unique features such as being inherently social, meaning that the effects of social structure on mobility can be observed. They also suggest that since checkins point to venues, venue types can be analyzed. And also checkin messages can be used for understanding the moods and motivations of users. They mainly

investigate three properties which are distance-based displacement of consecutive checkins, standard deviation of distances between checked in venues and user home (i.e. gyration), and the periodic behaviors of users. Their results show that people in the densest areas travel much more than people in sparse areas, but people in sparsest areas travel farther than slightly denser area residents. They also indicate that people in wealthy cities travel more frequently to distant places than people in less rich cities. Frequent travelers talk a lot about airports and metropolitan areas. The specific words they use are sampled as "international airport", "flight" and "hotel". Users showing lower levels of mobility use words like "railway station", "bus", "home" and "church". The authors also study user sentiments on review texts. They find that most users have neutral sentiment, that is, they use words that do not convey much emotion. Their study shows that there are no location specific positive terms but there are many location specific negative terms, which indicates that users are more likely to express negative sentiments about certain locations. The article provides different approaches of using geographical and temporal data and extracting knowledge from them.

Zhuang, Mei, Hoi, Xu and Li (2011) propose a context-aware recommendation system that infers user intent and gives suggestions based on local, personal and temporal data. The authors argue that existing recommendation researches are mostly based on explicit input by a user and the recommendations are not personal or contextual as the rich context information that can be provided by mobile phones is not taken into consideration. The authors use an application they wrote to gather data but the lack of using readily available social network information is a limitation. Their proposed approach categorizes locations as entity types. Restaurant, bar or mall is defined as an entity type whereas a specific local business such as a fast-food restaurant is identified as an entity. The article takes into account the time interval that a certain user activity occurs (e.g. restaurant activity near 6 pm, lessened activity density during 2-3 am). The researchers also demonstrate possible connections between locations, for instance restaurant activity will probably be succeeded by a bar activity.

Staiano, Lepri, Aharony, Pianesi, Sebe and Pentland (2012) investigate the relationships between social network structures and personality. The authors focus on different types of social network analysis. They examine the relationship between individual personality traits and centrality measures and triadic structures. They also compare network and actor based data (communal activity vs. individual activity). They use a personality trait classification called Big Five which is named after five of the fundamental characteristics of a person: Agreeableness, Conscientiousness, Extraversion, Neuroticism and Openness. The researchers captured data from 53 users living in a student residency for couples in a university campus. They gave the users Android mobile phones and the user behaviors were captured for about three months, in a non-obtrusive way. They conclude that personality classification extracted from network structures is mostly superior to classification extracted from individual activity data. They also indicate that in personality classification, smart phone based behavioral data can be more useful than survey data and mobile phones appears to be the most suitable tool for persuasion because of the high pervasiveness. Despite their homogenous sample and small sample size, the article is valuable in that it investigates personality classification and relationships between social network structures.

In their article, Noulas, Scellato, Mascolo and Pontil (2011) explain their gathering and usage of LBSN data specifically Foursquare in detail. The authors claim to be the first on presenting a work of this scale on user behavior on Foursquare. They collected about 12 millions of user checkins over a period of 111 days spanning from May, 27th 2010 to September, 14th 2010. These checkins include information and patterns about more than 679000 users and 3 million geo-tagged and categorized venues. The authors present an analysis of the geo-temporal dynamics of collective user activity on Foursquare and show how checkins can help attaining human daily and weekly patterns and also urban neighborhood properties. They indicate that their analysis can be applied to user-specific location/activity recommendation and also to more community related fields such as urban planning. The authors acquire geographic coordinates, category, total number of checkins, unique number of visitors and address values for each venue from Foursquare. The authors compare the sample data to all Foursquare data. The two distributions show a similar trend. Few places have large number of checkins while many places have small amounts of checkins. User checkin behavior is also interpreted in the same way. Few users (around 10%) have more than 100 checkins. About 40% have more than 10 and 20% have a single checkin only. For this kind of user behavior, the authors identify reasons pertaining to cognitive factors, social factors, as well as privacy issues. The authors also contrast the user behaviors for weekday and weekend activities. At weekdays, the peak checkin counts can be assigned to: morning when people go to work, lunchtime, returning to home or going to malls and bars. Office category does not even exist among the weekend activities, whereas leisure activities such as Food and Hotel have strong presence. Home category shows similar behavior during the week where checkin counts constantly increase till night hours. Therefore, the authors conclude that these data can be instrumental in measuring how communities commit to different tasks over time, producing social applications as a result. The authors further investigate checkin distribution over time and space. They introduce the term inter-checkin times and define it as the time passed between two consecutive checkins. Two temporally close checkins belonging to the same user might mean that there is a correlation between these two locations. As the time difference increases the correlation weakens. As for inter-checkin distances, the authors support with their findings that longer inter-checkin distances have to do with the physical distance between locations. The authors also investigate the activity transitions. They question the succession between locations and whether this is consequential or not. They reach to the conclusion that LBSN user generated data provides valuable insights on how mobile user activities success each other. The last aspect the authors investigate is the place transitions. They use this study to show that location-based marketing can also benefit from these analyses. Transitions at smaller time intervals occur at locations that are physically close. Longer temporal intervals between checkins may indicate long distance travel. The transitions and the successor places may expose spatiotemporal connections that we are normally not aware of. The authors claim that the analyses for activity and place transitions initiate new researches in emerging fields such as global and regional transport networks, in addition to providing deeper understanding in widely studied subjects like human activity patterns. The authors also indicate some of the challenges. The fact that checkins being voluntary causes some problems in the interpretation of the data. Another challenge is handling the textual content of LBSNs, which was not a concern in the study. They suggest that valuable information from comments and tags can be extracted with the emerging topic modeling techniques. The article is

important in that it shows how to use LBSN data and also the authors are able to show the correlations between extracted behavior information and real life behavior.

Acquiring data is a major problem for researchers studying on social networks. Should they gather the data themselves, if so, is it better to form a study group or just monitor public accounts? Social network information can be obtained using smart phones. Smart phones are instrumental in that they provide cheap and invisible access to daily social behavioral patterns that were previously not available. Over the years, Bluetooth, call logs, and custom context-aware applications were the source of locational data. Currently, the pervasiveness of LBSN mobile apps guides researchers to GPS-powered apps. They provide implicit but dense data in high volumes. However Foursquare API has rules and constraints on how their data can be used and allows for limited access (Foursquare For Developers. 2014). For instance, an application can make at most 500 authenticated requests per hour for endpoints needing authentication. Actions like add, remove, like, approve, comment, follow, all need user authentication. Accessing user checkins, friends, lists, tips and photos also require authentication. Only the venue endpoint does not require an active user and that endpoint allows for 5000 requests per hour.

Many studies use Twitter as a workaround for Foursquare access limits. Many public tweets feature Foursquare checkins. Monitoring those checkins to acquire user and checkin data and then using the Foursquare API for venues, researchers are able to gather large collections of data through a public system. The problem with this approach is that Twitter is also applying rate limits. All endpoints require authentication, and use 15 minute windows, as of 2014 (Twitter Developers, 2014). According to the resource queried, either 15 calls or 180 calls are allowed within the window. These limitations might cause a shift back to Foursquare API.

2.2 Place Attachment

Place attachment is the connection between people and their meaningful place. It is a concept used in Environmental Psychology. Place attachment is inherently multi-dimensional, involving the meaning stemmed from the experience of people in a certain place, the effect of that meaning on the relationship, and the emotional, intellectual, temporal relationship itself. Manzo (2005) notes in her studies, that, places gain importance or meaning from experiences, such as realizations, milestones and experiences of personal growth.

People are drawn to many types of locations ranging from their home, their work-place, namely their most intimate places, to places like outdoor recreation areas, a certain region, or a city. We feel attached to holy sites, football stadiums, parks and cafés. The definition of a place can show diversity among studies and depend on the aims of the researchers. Kasarda and Janowitz (1974) study attachment on city, neighborhood and home levels (Scannell and Gifford, 2010). Woldoff (2002) argues place attachment relies on social features whereas Stokols and Shumaker (1981) claim that it relies on physical features. The apparent diversity in the definition surely comes from the richness of the studies but also presents problems in solidifying a theoretical structure. There is even a divergence in naming the concept. "Sense of Place" is generally used interchangeably with place attachment, but sometimes place attachment is seen as a sub-component of sense of place. Tuan

(1974) and Relph (1976) regard sense of place as a tie that fulfills fundamental human needs (Scannell and Gifford, 2010). This assessment puts the emphasis on functionality of the place, though human needs also embody cultural/religious needs and a sense of belonging. Examining the attachment as an emotional bond helps in understanding the feelings of people. The longing towards a place is also a type of attachment. This particular example shows that a person does not even have to be physically in that place to feel an attachment. The attachment might represent itself in fewer visits as the place might not be within easy reach of the individual.

In a study about displacement, Fried (1963) investigates the effects of a redevelopment project in Boston. The changes in the neighborhood caused the residents to lose connection to their surroundings and led to feelings of alienation. The redevelopment eventually paved the way for moving out. The study, thus, shows a potential use of place attachment information. 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). The symbolic tie between people and a locational resource can help assess the value of the place.

Table 1: Attachment types and regional levels (adapted from Hidalgo and Hernandez, 2001)

Attachment Type		**Question**
House	General attachment to house	I would be sorry to move out of my house, without the people I live with.
	Social attachment to house	I would be sorry if the people I lived with moved out without me.
	Physical attachment to house	I would be sorry if I and the people I lived with moved out.
Neighborhood	General attachment to neighborhood	I would be sorry to move out of my neighborhood, without the people who live there.
	Social attachment to neighborhood	I would be sorry to move out of my neighborhood, without the people who live there.
	Physical attachment to neighborhood	I would be sorry if I and the people who I appreciated in the neighborhood moved out.
City	General attachment to city	I would be sorry to move out of my city, without the people who live there.
	Social attachment to city	I would be sorry if the people who I appreciate in the city moved out.
	Physical attachment to city	I would be sorry if I and the people who I appreciate in the city moved out.

A study similar to Fried (1963)'s in subject but differing in result, was conducted by Francaviglia (1978). A town in Ohio was in need of rebuilding after a natural disaster. The reconstruction could have been an opportunity to improve upon the old design and solve former infrastructural deficiencies. However, residents and business owners pressed in favor of the old design and stood against the improvement proposals. The familiar look of their home was more important than solving the

recurring problems. The author, thus, underlines people's desire to keep the physical conditions of a connection intact.

We mentioned three different spatial levels in home, neighborhood and city. Hidalgo and Hernandez (2001) use a place attachment scale that consists of these spatial levels but the authors also investigate whether the attachment is physical, social or general. The questions they directed to the participants of their study are given in Table 1.

According to Hidalgo and Hernandez (2001), greater place attachment was observed for the home and city levels than for the neighborhood level and the social dimension of place attachment was found to be stronger than the physical dimension. When the attachment is directed towards other people who live there rather than the aspects of the place itself, it is considered to be a social bond instead of a physical one. Scannell and Gifford (2010) indicate that effects differ depending on the level and type of attachment, and use a study from Norway to illustrate this point. According to Vorkinn and Riese's (2001) study, Norwegian residents who were strongly attached to specific neighborhoods, opposed to a hydropower plant development whereas residents who were attached to the municipality as a whole, supported the development. The study presents a clear example of contrasting the levels of attachment.

Lewicka (2010) builds upon the levels and uses five type of places: apartment, house, neighborhood, city district and city, whereas Laczko (2005) adds province, country and continent levels. The survey questions in Lewicka (2010) are concerned with how much the person knows the place, how secure they feel, if they are proud of the place and if they feel the place is a part of them. In total 12 attachment questions are marked on a scale from 1 to 5. The questions may differ in some models, but the design of the survey is similar in many place attachment studies. Lewicka also measures place identity dimension by asking how people identify themselves, such as, as a resident of their district, as a European, or as a citizen of the world. We will explain more about different dimensions, models and measurement methods in this chapter.

2.2.1 Attachment Models

The most common and agreed-upon concepts of sense of place are place identity, place dependence and place attachment. Place identity is a substructure of a more global self-identification (Proshansky, Fabian, and Kaminoff, 1983) and is the reflection of self that defines the relationship between person and place. Place dependence is defined as "occupant's perceived strength of association between him or herself and specific places." in Stokols and Shumaker (1981). Place dependence is more goal-oriented and concerned with comparing to other places. Place attachment is mainly seen as a positive construct, that is, it defines positive emotional bonds. But place dependence can also be described negatively. Jorgensen and Stedman (2001) use these sub-concepts in their study. The authors compare different models. The first model is a tripartite model distinguishing the sub-concepts as different concepts although they correlate well. The second model is a single factor model that unifies all sub-concepts and treats them as the single dimension of sense of place. The other

models are of a higher level, and are effectively different combinations of the first two models. The authors find that sense of place is highly correlated with attachment.

A tripartite organizing model, suggested by Scannell and Gifford (2010) defines place attachment as a three dimensional model, consisting of Person, Process and Place. Person dimension deals with the question of how much the attachment is based on individually or collectively placed meanings. Pyschological process deals with how are affect, cognition, and behavior observed in the attachment. Place dimension deals with the object of the attachment and its nature. All dimensions have different aspects. Person dimension consists of cultural and individual levels. The three psychological process aspects are affect, cognition and behavior, as previously mentioned. And finally, social and physical aspects form the place dimension. The authors claim that the model organizes existing place attachment concepts and clarifies them.

In our study, we use the two dimensional model of Williams and Vaske (2003). Williams, Patterson, Roggenbuck and Watson (1992) note that the two concepts which dominate the literature in environmental psychology are place dependence and place identity. The model exhibits the multi-dimensional structure of place and makes it easy to lean towards quantitative measurements (Williams et al. 1992; Jorgensen and Stedman, 2001). In their study, Williams and Vaske mention two measurement phases. The first phase is the place elicitation survey. In the survey, the participants are asked to give their top three choices in certain scenarios. The scenarios include activities such as meeting with friends, showing people around and temporal constraints such as a Saturday afternoon in June or a weekend trip in the summer. In the second phase, the authors form a 12 question survey that measures the place attachment to the places acquired in the first phase. Six items for place identity and six items for place dependence are put in alternating order. The survey items are on a five-point strongly-disagree to strongly-agree Likert scale. Dimensions themselves are found to be measured with as few as four survey items. We choose this model as a basis for our study because the structured survey provides a verified quantitative study and the literature on the other models are not as improved as the two dimensional model. The tripartite model lays the theoretical foundation impressively but does not provide a verified testing mechanism as of yet.

a) Measurement of Place Identity

Williams and Vaske (2003) describe place identity as the emotional and symbolical meaning. It implies a psychological investment over time and a sense of belonging. Place identity is defined as a component of self-identity and is considered to be related to self esteem. The structured survey mentioned above contains six items for the place identity dimension. The survey items are listed below.

- I feel this place is a part of me.
- This place is very special to me.
- I identify strongly with this place.
- I am very attached to this place.
- Visiting this place says a lot about who I am.

- This place means a lot to me.

b) Measurement of Place Dependence

Williams and Vaske (2003) describe place dependence as the functional and physical meaning. Place dependence is goal-oriented and indicates an on-going relationship with an environment. The structured survey mentioned above contains six items for the place dependence dimension. The survey items are listed below.

- This place is the best place for what I like to do.
- No other place can compare to this place.
- I get more satisfaction out of visiting this place than any other.
- Doing what I do at this place is more important to than doing it in any other place.
- I wouldn't substitute any other area for doing the type of things I do at this place.
- The things I do at this place, I would enjoy doing just as much at a similar site.

2.2.3 Place Attachment with Information Systems

The literature on the interaction of place attachment and technology is limited. In his study in the field of human-technology interaction, Stals (2012) builds the theoretical background on place attachment concepts and studies on how technology affects city experience. The author mentions design fictions, i.e. fictional devices, that enhance and share user experience by the use of location and context aware devices and prospective new mobile apps. The research itself is a phenomenographic work that is based on interviews and map evaluations, making the research mostly qualitative and subject to interpretation. The studies of Farrelly (2013) and Ozkul (2013) were also carried out in a similar fashion and dealt with how technology can enhance place attachment. Farrelly (2013) investigates the nature of the relationship between people and places, how people use the place attachment information, the affects of mobile devices on place attachment and the potential of enhancing place attachment by making use of location-based services. Ozkul (2013) states that locational information such as checkins indicate social attachment to places and contains meaning about a place. The study considers checkins as a mean of communication between people and investigates how checkins contribute to the feeling of closeness and preservation of social connections.

As can be seen, studies that are based on place attachment and mobile applications are dated recently. These studies are mostly directed towards social science fields and do not use the contextual data provided by mobile applications to investigate the relationship between checkin behavior and place attachment. In our study, the main aim is to assess the possibility of using mobile applications that provide location-based services, in the purpose of finding an association with place attachment.

CHAPTER 3

RESEARCH METHODOLOGY

In this chapter, the research methodology adopted in the thesis is given. The design of the study is explained in detail in the subsections. An overview of the research steps is given in Figure 1. The methods for developing and conducting surveys, information about participants and the data models are presented.

The aim is to study the relationship between place attachment and Foursquare use. Therefore, Foursquare data of the participants are needed in order to use the data to analyze against place attachment ratings. Place attachment ratings are calculated on the reported survey responses. Participants first declare categories and places and then fill survey items about each place.

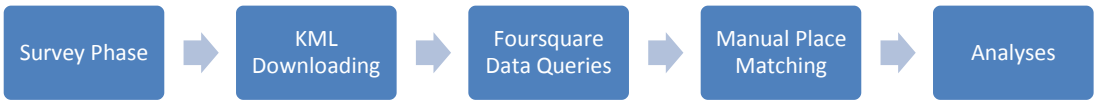

Figure 1: Flowchart of the research steps

Together with the survey, participants are expected to provide Keyhole Markup Language (KML) links of their Foursquare accounts. KML is a unique feed for every Foursquare user and it stores user checkin history in a geolocation-oriented way. KML links are only used for place identification. The links correspond to an XML file consisting of checkins. Thanks to KML, participants do not have to use a connected application and allow the application to access their data. Since detailed checkin information or other personal Foursquare information (photos, lists, user tips) are not used in the context of our study, KML feed is considered as a convenient way to gather place-specific data.

3.1 Survey

The design of the survey is critical as the quality of the data directly affects the results of the study. The survey was conducted in one phase. Despite the fact that a lot of information is needed about each participant, only one survey was created as we did not want to risk losing data because of non-returning participants. Also identifying the participant in order to establish a link between surveys is problematic and privacy preserving solutions are limited. The final version of the survey consists of the following steps, (1) venue category ordering by significance and visiting frequency, (2) stating two venues for every category specified, (3) filling out the structured place attachment survey for every venue specified, (4) validity questions checking (i) the familiarity for every venue specified (ii) whether the place is special, (5) checking if the venue is close to work or home, (6) Foursquare usage questions to profile the participant, (7) demographics, (8) providing Foursquare KML feed. The survey items are given in Appendix A.

The survey is designed and hosted on SurveyMonkey (2014). SurveyMonkey has a channel feature that channels a previous answer from the survey to a new question. This feature was important for us as we needed the participants to remain in touch with what they have answered or selected before. It may still be not as powerful as augmenting the memory visually (Paulos and Goodman, 2004) but it was necessary to trigger and keep the memory of a place stable throughout different steps and we did our best through verbal methods. The survey was accessed between 10th of April 2014 and 6th of June 2014.

The places provided by the participant are used to find their corresponding Foursquare venue from the KML file. This matching operation is essential because we need to be able to compare attachment ratings and Foursquare data. Venues are the connection points. Therefore, the selection of a venue should be such that it leads to a good fit with Foursquare checkins.

3.1.1 Place Elicitation

The design of the survey changed and evolved through different iterations. The place elicitation step, where participants are asked for venues, has gone through many changes after preliminary survey results did not satisfy our expectations. We base our place attachment research on Williams and Vaske (2003). In that study, place elicitation is done by asking what place the participant would go, given a certain scenario like "It is a beautiful Saturday afternoon in June, and you have a few hours before you have to go to work. You call a friend, and together, decide to spend some time outdoors." Then the question would proceed to ask the participants to list their top three choices. One of the reductions we needed to make was in the count of places. If we had three places and for instance six scenarios, that would give us 18 places that the participant should answer questions about. The step where place attachment is measured has 12 items for every place. That step alone would prove to be a tedious job for a participant. The huge amount of data to be processed would also render the survey unmanageable. Therefore, eventually it was cut down to two choices and one of them was made optional. Scenarios were also cut down as to both keep the survey size in check and make the scenarios as inclusive as possible. The scenarios needed to apply young or old, and to different walks of life. First refined

designs included similar but shorter elicitation scenarios: (1) Dinner on weekend, (2) To pass time after work or school, (3) To have fun at a Saturday evening, (4) To pass time at a weekend morning, (5) Other place you like to visit in Ankara. The questions were refined as to lead to certain categories. For instance the third item is intended for nightlife spots and fourth item is expected to be a park or a similar outdoor area. Initial test resulted in two observations. The first observation is that the specified places were not places that participants had checked in frequently. Therefore, we needed to better fit our items to Foursquare usage. The second observation is interesting but not that helpful at first glance. The second choices were checked in more frequently than the top choices for almost every scenario that has checkins.

The need to better fit with Foursquare steered us away from Williams and Vaske (2003) elicitation questions. Foursquare categories are used as a first phase and participants are asked to order them according to their significance but also according to the participant's Foursquare checkin frequency. This approach was immediately abandoned as the parts of place attachment and Foursquare checkins should be separate in order to have a healthy observation. Participants should not think about Foursquare and be biased when they are answering attachment questions. We aim to see if there is a natural connection between them. The data that is gathered, however, is fundamentally biased as it is bound to the survey participants. It is dependent upon the criterion of volunteering to take part in the survey. Therefore what is gathered is not a complete network and it does not represent all Foursquare data. Also it is limited to only users in Turkey mostly from city of Ankara.

Our last to final version asked the categories to be ordered by their significance and the frequency of being there. The final version also has this wording. The difference between the two versions is that the previous version asks three most significant categories and one least significant category whereas in the final version we cut the third most significant category in order to have fewer steps in the survey. In the second phase of elicitation participants are asked to specify their most preferred two places for that category. Entering the first choice and answering related place attachment items are mandatory.

Williams and Vaske (2003) includes validity and reliability check questions such as (1) Have you ever visited the area, (2) if yes, how many times in the past 12 months. In our initial versions we had these questions but they needed to be answered for every place and we had already put a guidance in the survey item by asking the specified place to be frequently visited. Therefore, we excluded them.

3.1.2 Structured Survey for Place Attachment

Items are as they are given in the second chapter. Our initial tests shows that place dependence ratings were consistently low. Place dependence is described to be a functional attachment. Yet, the items that are used have clear emotional wordings. For this reason, the dependence dimension may not be measuring functionality as well as it should. In order to measure a pragmatic functionality, we added three items to this step.

- I prefer this place as it meets my needs.
- This place makes my life easier.
- This place is convenient for what I do.

We call the average of these three items as functional dependence rating whereas we call the average of the six items of place dependence as emotional dependence. Note that, the last item of place dependence is negatively worded (The things I do at this place, I would enjoy doing just as much at a similar site), therefore is calculated inversely.

Table 2: Place attachment items from the survey with their construct names

#	Attachment Item	From Williams and Vaske (2003)	Construct Name
1	This place is the best place for what I like to do.	Yes	Dependence1
2	I feel this place is a part of me.	Yes	Identity1
3	No other place can compare to this place.	Yes	Dependence2
4	This place is very special to me.	Yes	Identity2
5	I get more satisfaction out of visiting this place than any other.	Yes	Dependence3
6	I identify strongly with this place.	Yes	Identity3
7	Doing what I do at this place is more important to than doing it in any other place.	Yes	Dependence4
8	I am very attached to this place.	Yes	Identity4
9	I wouldn't substitute any other area for doing the type of things I do at this place.	Yes	Dependence5
10	Visiting this place says a lot about who I am.	Yes	Identity5
11	The things I do at this place, I would enjoy doing just as much at a similar site.	Yes	Dependence6
12	This place means a lot to me.	Yes	Identity6
13	I prefer this place as it meets my needs.	No	FuncDependence1
14	This place makes my life easier.	No	FuncDependence2
15	This place is convenient for what I do.	No	FuncDependence3

The average of six place identity items gives the identity rating. The average of the 12 original items (place identity and emotional place dependence) gives the place attachment rating. The attachment items in the survey and their corresponding construct names that we used in the study are shown in Table 2.

3.1.3 Foursquare User Profile

The fact that there were participants in our initial tests that did not checkin to places they specified, urged us to extract profiles out of their Foursquare usage habits. Thus, we added a section where Foursquare use is investigated to see if there is a match of a certain profile to different types and levels of attachment. The items for the section

are based on "the reasons to use Foursquare" mentioned in Lindqvist (2011): (1) Personal history tracking, (2) Intimate sharing at a distance, (3) Discovery of new places, (4) Running into friends, (5) Gaming aspect, (6) Seeing where friends have been, (7) Routine vs. non-routine places, (8) At large events. The last item of "Special Places" was added to cross check with previous steps.

3.1.4 Downloading Foursquare KML File

The KML feed links to an XML file. The XML file consists of Placemark tags, which are equivalent to checkins. The structure of a placemark in a KML is as follows (Wikipedia, 2014):

```
<Placemark>
  <name>New York City</name>
  <description>New York City</description>
  <Point>
    <coordinates>-74.006393,40.714172,0</coordinates>
  </Point>
</Placemark>
```

Foursquare KML files have more attributes.

```
<Placemark>
   <name>Kentpark</name>
   <description>@
       <a
       href="https://foursquare.com/v/kentpark/4bd9a2a767b49c74d29
       52214">
           Kentpark
       </a>
   </description>
   <updated>Wed, 09 Apr 14 16:20:57 +0000</updated>
   <published>Wed, 09 Apr 14 16:20:57 +0000</published>
   <visibility>1</visibility>
   <Point>
       <extrude>1</extrude>
       <altitudeMode>relativeToGround</altitudeMode>
       <coordinates>
           32.775460012526366,
           39.913404252668954
       </coordinates>
   </Point>
</Placemark>
```

'href' attribute holds the Foursquare link of the venue. The last part in the URL is the venue's Foursquare id.

Downloading the XML file of KML is a manual operation. It is done as soon as someone completes the survey. Since the feed is a live link, if the user resets their feed, we would not be able to access to their checkins anymore. Therefore KML files were downloaded as fast as possible. This situation caused different processing times for participants. Last checkin dates differed according to the download date of the KML file (and according to their usage, of course). First KML download was on the 10th of April, 2014 and the last one was on the 6th of June, 2014.

KML files were processed in order to parse the XML tags and extract the checkin and venue data. These data were then put into the database for further analysis. The entity-relationship diagram of the database is given in Appendix B.

3.2 Foursquare Queries

Foursquare API provides userless access to their venue API which means that we do not need an authenticated user to work with venue API. This feature is also a reason why we were able to use KML for data gathering, we do not need active user sessions to access venue objects.

What we need is a connected application to use the API. Foursquare users can define an application with their user and a valid URL as identifier. Assigned tokens can be used to query Foursquare database.

As mentioned in the second chapter, API has rate limits. We were often blocked by the 5000 request limit per hour to venues endpoint. KML checkins resulted in more than ten thousand venues, so we needed at least three hours to query the API for all venues. In practice, we needed much more because of erroneous data or hanging calls.

3.2.1 Matching Participant's Places to Foursquare Venues

This operation is a manual process and is actually mostly done within our database. We have previously populated our database with venues connected to checkins. We try to match the places that participants specified (in the previous steps of the survey), to existing venues in their checkins. The steps in this process are given below.

- listing venues and corresponding total checkin counts for the given participant.
  - getting the participant for the given survey entry.
  - getting the KML for this participant.
  - getting the checkins for this KML.
  - getting the venues for these checkins.
- if the venue and its order among checkins are not clear, we query the checkins by the text of the specified place.
- if we find one corresponding venue, we put the checkin count and checkin order into database.
  - we also calculate the order when we exclude home and work checkins, and put the value into database.
- if we find more than one corresponding venue, we select the most checked in venue as the representing venue and put the checkin count and checkin order into database.
  - we also group all the corresponding venues and calculate their total checkin count and projected order among other checkins, and put the value into database.
  - we also calculate the projected order when we exclude home and work checkins, and put the value into database.

Many different cases needed to be handled in a structured way. The resulting database contains various checkin order values which are explained as follows.

- Actual order number when venue is in top ten.
- Checkin count order is not in top ten.
- Participant has checkins in KML but no checkins for this place.
- Participant has KML but no checkins.
- Place itself is a work or home venue, so "checkin order without work and home places" cannot be calculated.
- Checkin count cannot be calculated as the name of the place is vague or too broad.
- No place is specified or random characters are put.
- User has no KML.
- Null for grouped checkin order, when the venue is not grouped with other venues.

When deciding for the order value, "no place declaration" gets precedence over "no KML" and "no KML" gets precedence over "broad naming of the place."

As can be seen, the process needs to be handled manually because the self reported place of the participant is a text value and cannot be queried against formal venue names. There are a lot of misspelling (e.g. Eymir Lake vs. Eğmir Lake) and omitting Turkish characters (e.g. Ahlatlibel, Düveroglu), and cases of different naming for the same place (e.g. SUNSHINE vs. ODTU Sunshine, Bigos vs. The Bigos). Manual handling of venue names proved to be a daunting task as there are 548 participant places in the survey with an attachment rating and the same process needed to be done for each and every one of them. In total, 1255 places were declared in the survey but not all places have their corresponding attachment items filled.

3.2.2 Matching Categories and Subcategories

The survey asks for categories in the first phase of place elicitation, but the corresponding venue for the specified place also has subcategories and categories defined in Foursquare. Foursquare has a category hierarchy tree that is at most three levels deep. For instance, Borek Place is a Turkish Restaurant. Turkish Restaurant is a Restaurant, and Restaurant belongs to Food category.

To match the categories, we queried the API for every venue in our database. For every venue a list of direct subcategories was returned. We put this data in our database. Then we fetched the static list of category hierarchy to our local device. By parsing the tree, we found the supercategories and also put them into our database. In the final state, venues could be associated with more than one subcategory and more than one main category.

55 venues were not associated with any category. The reason is that the venue either got deleted or a category was not specified in the first place.

3.2.3 Fetching Venue Statistics

To fetch venue statistics, we queried the API for every venue in our database. The returning statistics for a venue include total global checkin count, distinct user count that checked in at the place, count of how many times the venue is used in a list, tip count, like count and the rating value. Note that, not all venues have rating values.

15 venues did not return any statistics. These venues were deleted from Foursquare.

3.2.4 Fetching Venue Tips

To fetch venue tips, we queried the API for every venue in our database. Tips are recommendations from users. They are simple, textual comments. Users can leave tips for every venue. Tips provide ample information regarding the affection for a place. The API returns the top 30 tips for each venue. The order is by how many likes the tip got. We ended up having more than 200K tips.

1344 venues did not return any tips. Related categories can be further investigated. There are a number of residence checkins and it makes sense not to have any tips attached. There is also the case of conflicting venues. When there are more than one Foursquare venue for the same physical place, tips might be in only one of the venues. These venues could have been merged, so only the more established one (the one that they are merged into) will return any tips. We can give Panora Mall as an example of merging.

- Panora Mall (Venue Id: 4bd1d293046076b0738d7271): https://foursquare.com/v/panora/4bd1d293046076b0738d7271
- Panora Mall (Venue Id: 4ff17d74e4b08abf25081a90): https://foursquare.com/v/panora/4ff17d74e4b08abf25081a90

The second link redirects to the first because the two venues are merged. Tips can be obtained only from the first venue. API also allows getting the users that saved the tip and the lists the tip were added, but we do not use those queries in our study.

CHAPTER 4

DATA ANALYSES

In this chapter, the data analyses of the study are described. First, the definitions and the initial descriptive results are given. Then, data analyses are conducted. Since we have many steps in the survey, not all participants actually participated in all of them. We explain in detail and give the numbers for each analysis inside the chapter.

Totally 345 people started the survey. 169 of them answered the mandatory place attachment items (first place for all three categories). 165 answered Foursquare user profile questions. 163 passed the demographics step and reached the final stage. 114 participants provided their KML on the last page and 98 of them were actually valid KML. Some provided unfinished, truncated URLs and some has made deformations on the URL or reset the link before we get the KML (which is unlikely as we downloaded the KMLs on the same day the surveys are completed.). Also some of the surveyees chose to enter meaningless characters to the URL field. They were able to complete the survey but Foursquare data is an integral part of the study. Therefore, in our Foursquare data analyses, we only use data from the 98 participants that provided their checkins.

4.1 Definitions

There are many variables and calculations in the study. The definitions below are used throughout the chapter.

Most Significant Category (MSC): Participants are asked to order place categories according to their significance and the frequency of visiting. The first two categories are participant's most significant categories. If the term is used in singular form, then it is either the first category in the survey or one place is filtered and selected from the categories. Also, mentioned as significant category.

Least Significant Category (LSC): Participants are asked to order place categories according to their significance and the frequency of visiting. The third category is participant's least significant category. Also, mentioned as insignificant category.

Most Significant Places (MSP): Places declared in most significant categories. It can be 2 to 4 places. Also, mentioned as significant places.

Least Significant Places (LSP): Places declared in least significant category. It can be 1 or 2 places. Also, mentioned as insignificant places.

Place Attachment Rating (PAR): The average value calculated from all 12 of the attachment measurement items. It is also plainly referred as Attachment Rating. Let *F* be the function calculating the rating, *x* is the Dependence and *y* is the Identity construct. The attachment ratings are calculated as:

$$F(x,y) = \frac{(\sum_{i=1}^{n=6} x + \sum_{i=1}^{n=6} y)}{12}$$

Place Dependence Rating (PDR): The average value calculated from the 6 dependence items. Also, mentioned as emotional dependence rating. Let *F* be the function calculating the rating, *x* is the Dependence construct. The attachment ratings are calculated as:

$$F(x) = \frac{(\sum_{i=1}^{n=6} x)}{6}$$

Place Identity Rating (PIR): The average value calculated from the 6 identity items. Let *F* be the function calculating the rating, *y* is the Identity construct. The attachment ratings are calculated as:

$$F(y) = \frac{(\sum_{i=1}^{n=6} y)}{6}$$

Functional Dependence Rating (FDR): The average value calculated from the 3 functional dependence items. Let *F* be the function calculating the rating, *x* is the FuncDependence construct. The attachment ratings are calculated as:

$$F(x) = \frac{(\sum_{i=1}^{n=3} x)}{3}$$

Functional Attachment Rating (FAR): The average value calculated from all items including the 3 functional dependence items along with the original 12 attachment measurement items. Let *F* be the function calculating the rating, *x* is the FuncDependence construct, *y* is the Dependence construct and *z* is the Identity construct. The attachment ratings are calculated as:

$$F(x,y,z) = \frac{(\sum_{i=1}^{n=3} x + \sum_{i=1}^{n=6} y + \sum_{i=1}^{n=6} z)}{15}$$

Attachment Ratings: This term is used when commonly referring to all attachment rating types.

Low Attachment Rating (LAR): Place Attachment Rating that is less than 3.0.

Neutral Attachment Rating (NAR): Place Attachment Rating that is exactly 3.0.

High Attachment Rating (HAR): Place Attachment Rating that is higher than 3.0.

Checkin Count (CC): How many times a participant checked in to a venue.

Checkin Order (CO): The ranking of the place among all venues the participant checked in to.

Order Without Work & Home (OWWH): The ranking of the place when home and office places are omitted.

Group Checkin Count (GCC): The total checkin count for the venue when more than one venue can be grouped under the same name.

Group Checkin Order (GCO): The ranking of the place among all venues that the participant checked in when Group Checkin Count is used.

Group Order Without Work & Home (GOWWH): The ranking of the place when home and office places are omitted and Group Checkin Count is used.

Merged Checkin Order (MCO): The term is used when considering a list of checkin order values. If a venue has a group checkin count, that value is higher than its checkin count and group checkin order can be used. If the venue does not have a group checkin count then its checkin count and checkin order value will be used. Merged Checkin Order value can be either Checkin Order or Group Checkin Order. This heterogenous list of participants' Merged Checkin Order can be used to compare to other variables for hypothesis testing. Also, mentioned as place ranking.

Categorized Checkin Order (CCO): The nominal value reached after categorizing checkin order of all participants. There are three categories consisting of (i) being in top ten, (ii) not being in top ten and (iii) not having any checkins.

Total Checkin Count (TCO): Count of all the checkins made by a participant.

Categorized Total Checkin Count (CTCC): The ordinal value reached after discretizing total checkin counts of all participants. Categories are created using equal frequency binning.

Representational Checkin Value (RCV): Proportion of the participant's checkin count for a specific venue to all of his/her checkins. Let F be the function calculating the value, x is Checkin Count and y is Total Checkin Count. The values are calculated as:

$$F(x, y) = \frac{x}{y}$$

Group Representational Checkin Value (GRCV): Proportion of the participant's group checkin count for a venue to all of his/her checkins.

Merged Representational Checkin Value (MRCV): The term is used when considering a list of representational checkin values. If a venue has a group checkin count, that value is higher than its checkin count and group representational checkin value can be used. If the venue does not have a group checkin count then its checkin

count and representational checkin value will be used. Merged Representational Checkin Value can be either Representational Checkin Value or Group Representational Checkin Value. This heterogenous list of participants' Merged Representational Checkin Values can be used to compare to other variables for hypothesis testing.

Distinct Venue Count (DVC): The count of the unique venues that the participant checked in to.

Average Checkin Count (ACC): The mean value of all the checkin counts for the participant.

Distinct Venue Per Checkin (DVPC): Proportion of the unique venue count to total checkin count for a participant. It is the inverse of Average Checkin Count and it is always less than 1. Let *F* be the function calculating the value, *x* is Distinct Venue Count and *y* is Total Checkin Count. The values are calculated as:

$$F(x, y) = \frac{x}{y}$$

Checkin Count Per Average Checkin Count (CCPACC): Proportion of the checkin count of a venue to average checkin count of a participant. Let *F* be the function calculating the value, *x* is Checkin Count and *y* is Average Checkin Count. The values are calculated as:

$$F(x, y) = \frac{x}{y}$$

Skewness: The skewness value of the distribution comprising all of the checkin count values for a participant.

4.2 Research Items

Based on our research questions from the first chapter, we can produce more detailed questions and give focus to the study.

1. What are the ranks of the attached places based on checkin count among other checked in places? Are they in top ten?
2. Are attached places close to home or office? Is there a relation?
3. For which Foursquare categories attachment is strongly observed?
4. How does classification of places (e.g. specific, brand, activity, region) affect attachment ratings?
5. Does the user profile affect place rankings (by checkin order) and attachment ratings?

4.3 Data Sets

The data sets that are used throughout the study are given in Table 3. Intermediate steps are shown in order to trace the flow in a better way. N_{place} does not denote the unique venue count. It is the corresponding place for the attachment relationship.

That means same venues are also included in the count. The main object in the data sets is the attachment itself, i.e. the participant and place pair.

Hypothesis testing was also applied on data sets that include averages of the attachment ratings but since the idea of using averages was abandoned, different data sets and filtering methods are used.

Table 3: Data sets

Data Set	$N_{participant}$	N_{place}	Based Data Set	Explanation	Tests
DS1	345	1255	-	Raw survey data.	
DS2	169	788	DS1	Participants that filled the mandatory place attachment items (first place for all three categories).	
DS3	163	788	DS2	Participants that filled the Foursquare profile and demographics items.	
DS4	163	548	DS3	Places that have their attachment items filled.	Cronbach's Alpha, Factor Analysis
DS5	98	331	DS4	Participants that provided their checkins. (MSP: 223; LSP: 108)	
DS6	98	229	DS5	Places that match with Foursquare venues and have checkins.	
DS7	7	7	DS5	Places that do not resolve to a single Foursquare venue (Not classified under SpecificPlace) but can be considered in a venue group.	
DS8	98	236	DS6, DS7 (Union)	Places with checkin counts (single or group).	Preliminary Testing
DS9	86	174	DS8	MSP with checkin counts.	Preliminary Testing
DS10	57	62	DS8	LSP with checkin counts.	Preliminary Testing
DS11	55	55	DS9, DS10 (Intersection, Average)	Participants that have both MSP and LSP. Average ratings of MSP in DS9 and average ratings of LSP in DS10 are used. (Average rating approach is then abandoned.)	Preliminary Testing
DS12	87	139	DS5	MSP that are marked as special.	
DS13	67	74	DS5	LSP that are marked as not-special.	
DS14	64	71	DS13	Not-special LSP that are declared correctly by the participant. (i.e. They have meaningful venue names.)	
DS15	78	78	DS12	Participants with High Attachment Rating. For each participant, the highest rated place is selected.	Preliminary Testing, Normality Tests
DS16	44	44	DS14	Participants with Low Attachment Rating. For each participant, the lowest rated place is selected.	Preliminary Testing, Normality Tests
DS17	43	121	DS15, DS16 (Union)	Combining the data is done in order to have a better distribution.	Normality Tests
DS18	13	15	DS5	Participants with Neutral Attachment Rating. Neutral-rated places from MSP and LSP are combined. They are not marked as either special or not-special.	Normality Tests
DS19	43	136	DS17, DS18 (Union)	Data set containing subjects with High, Neutral and Low Attachment Ratings.	Normality Tests, Spearman's Correlation, Multiple Regression

4.4 Descriptive Statistics

4.4.1 Demographics

The main population of the study is the Foursquare users that provided their checkins. Therefore, we filtered the total 345 participants to 98 participants. In the survey, KML URL is filled as a textual value. The field is recoded into numbers and missing cases are selected and omitted. Before this operation, we had already started establishing the database so we also knew about the two seemingly valid KML strings that do not resolve to an actual KML (either non-existent or deleted). Those two participants were also filtered, resulting in the 98 participant.

Table 4: Descriptive statistics for the population

Categorical Features	**Data Set**					
	Filtered			**All**		
Age	Values	Frequency	Percent	Values	Frequency	Percent
	15-19 (1)	3	3.1%	15-19 (1)	5	3.1%
	20-24 (2)	40	40.8%	20-24 (2)	65	39.9%
	25-29 (3)	38	38.8%	25-29 (3)	64	39.3%
	30-34 (4)	13	13.3%	30-34 (4)	19	11.7%
	35-39 (5)	3	3.1%	35-40 (5)	5	3.1%
	40-44 (6)	0	0%	40-44 (6)	3	1.8%
	45-49 (7)	0	0%	45-49 (7)	2	1.2%
	Missing	1	1%	Skipped	182	-
Gender	Values	Frequency	Percent	Values	Frequency	Percent
	Male (1)	43	43.9%	Male (1)	72	43.6%
	Female (2)	55	56.1%	Female (2)	93	56.4%
	Missing	0	0.0%	Skipped	180	-
Marital Status	Values	Frequency	Percent	Values	Frequency	Percent
	Single (1)	83	84.7%	Single (1)	135	81.8%
	Married (2)	15	15.3%	Married (2)	30	18.2%
	Missing	0	0.0%	Skipped	180	-
With Children	Values	Frequency	Percent	Values	Frequency	Percent
	Yes (1)	4	4.1%	Yes (1)	14	8.5%
	No (2)	94	95.9%	No (2)	151	91.5%
	Missing	0	0.0%	Skipped	180	-

The descriptive statistics for the population is given in Table 4. The study was targeted mostly for university students and active professionals. Most of the participants are at their 20s. This reflects on the majority of the surveyees being single. 96% of the filtered set does not have children and female participation is higher.

The participants are asked to declare two places for each category. For the places in the first ranks, filling the attachment measurement items is mandatory. The mandatory fields are used to calculate attachment ratings. The second places are optional to declare and even if it is declared, the attachment items can still be skipped. Thus, the reported places in the first ranks are our main objects of the study. The descriptive statistics for the first places are given in Appendix C.

4.4.2 Attachment Results

First, we investigate the attachment rating results. Totally, 1255 places were declared in the place elicitation phase. In order to calculate an attachment rating for a place, all the corresponding attachment items in the survey should be filled. Attachment ratings were calculated for 548 places. The attachment dimension items are given in the descriptive Table 5. The constructs were first explained in Table 2.

Table 5: Place attachment statistics (N = 548)

Construct	Min	Max	Mean	Mode	Median	SD
Dependence1	1.0	5.0	3.56	4.00	4.00	1.18
Identity1	1.0	5.0	3.28	4.00	3.00	1.21
Dependence2	1.0	5.0	3.03	2.00	3.00	1.20
Identity2	1.0	5.0	3.28	4.00	3.00	1.19
Dependence3	1.0	5.0	3.64	4.00	4.00	1.12
Identity3	1.0	5.0	3.14	4.00	3.00	1.19
Dependence4	1.0	5.0	3.01	4.00	3.00	1.18
Identity4	1.0	5.0	3.08	4.00	3.00	1.18
Dependence5	1.0	5.0	2.75	2.00	3.00	1.16
Identity5	1.0	5.0	2.84	2.00	3.00	1.26
Dependence6 (reversed)	1.0	5.0	2.50	2.00	2.00	1.05
Identity6	1.0	5.0	3.24	4.00	3.00	1.21

We labeled the place dependence dimension as emotional and wanted to measure a more functional dependence dimension. Corresponding attachment rating results are given in Table 6. The three added items are later investigated both separately from and together with the original attachment items.

Table 6: Functional place dependence statistics (N = 548)

	Min	Max	Mean	Mode	Median	SD
FuncDependence1	1.0	5.0	3.87	4.00	4.00	1.01
FuncDependence2	1.0	5.0	3.51	4.00	4.00	1.14
FuncDependence3	1.0	5.0	3.55	4.00	4.00	1.20

4.4.3 Survey and Query Results

The category names are not translated word by word from their Foursquare counterparts, but they fit completely excluding the Event category. Our study did not involve the Event category as we are more focused on physical locations and specific places. Category percentages for the most significant category (first item in the survey) are given in Figure 2. As can be seen, the top three categories are Food, University and Art & Entertainment. For the second most significant category, the top choice is also Food. Art & Entertainment and Outdoors follow.

The least important categories are selected as Nightlife, Shop & Service and Travel & Transport. Indeed when we think about it, malls or airports hardly evoke any attachment in people. Malls are even labeled as a non-place (Augé, 1995). It is because the malls are mostly visited for shopping purposes. In general users prefer to visit shopping malls that are near to their residence or workplace and recently opened. It is a question in the field of place attachment, that is, whether non-places are also able to trigger attachment.

As we understand Nightlife spots are seen as less important because either they are seen non-functional or are actually seen important but not visited as often. Note that, the question states participants should consider how frequent they visit a place in the category. After investigating the attachment ratings, we can see whether the attachment is really low. If the rating is high, but the checkin count is less than expected for high attachment ratings -but actually in line with the survey result since it is selected the least important category- we can investigate the Foursquare user profile questions we asked at the end of the survey to better understand the behavior of the participant. We leave that for further study. But the mentioned profile item results are given in Figure 8 and Figure 9.

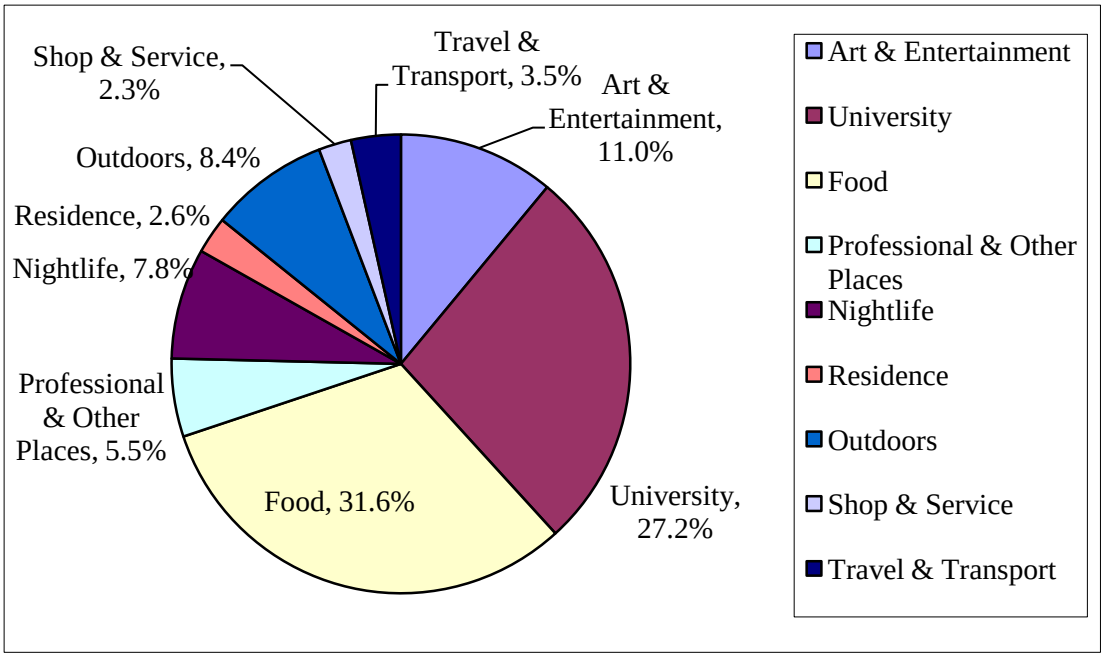

Figure 2: Most significant category's distribution

Our main aim is to compare survey and Foursquare data. Thus, we need participants with valid KML files that contain checkins. 98 participants meet this condition in the data set DS5. These participants have a total of 63436 checkins that span from 25th of June, 2010 to 7th of June, 2014, making the duration roughly 4 years.

The checkins contain 11288 Foursquare venues. Some of these venues can represent the same physical place as there is no limit for venue creation. Foursquare can join these venues if they know it is the same place. There is also the option for venue owners to validate the venue. These efforts help make the Foursquare venue unique and reduce the venue count for a physical place to one, but the category for the venue also plays a part in the success of this endeavor. While for the category 'Food', different venues for a restaurant can be merged quite easily, it may not be straightforward for the category 'Outdoors & Recreation.' A park, for instance, can cover a lot of physical ground, and a number of different Foursquare venues can be created to represent the park. The meaning of each venue should be investigated carefully to understand whether it represents the park as a whole or some specific part of it.

States & Municipalities, which is another subcategory for Outdoors & Recreation, can also cause a lot of vagueness as a venue. Our study contains checkins to venues such as Gölbaşı, Keçiören which are of County subcategory and checkins to Ankara, Istanbul, Barcelona, Paris and Munich which belong to City subcategory. In total, there are 614 venues that belong to States and Municipalities in our checkin database and the distribution of venue counts for the subcategories of States & Municipalities can be seen in Table 7.

Table 7: Venue counts for States and Municipalities category

Subcategory Name	Venue Count
City	141
Country	2
County	106
Neighborhood	350
Town	6
Village	9
Total	614

This observation leads us to investigate an attachment based on regions. Indeed, in the place attachment literature we see attachment levels that are categorized as regions, namely home, neighborhood and city. These levels were mentioned in Chapter 2.2.

When we investigate the checkin frequency per participant, the highest checkin count for a participant is 6973. The closest participant has 3607 checkins. There is one participant with a single checkin and two other participants with checkin counts less than 10. We grouped the checkin counts into 50 checkin bins. The frequency distribution is shown in Figure 3. The last segment is for the strongest users and for readability purposes, it spans more groups.

The highest frequency is observed for the bin including between 51 and 100 checkin counts. 15 participants fall into this segment. The distribution is not uniform, but we can clearly see that most of the participants have less than 250 checkins. The further details are given in Appendix C.

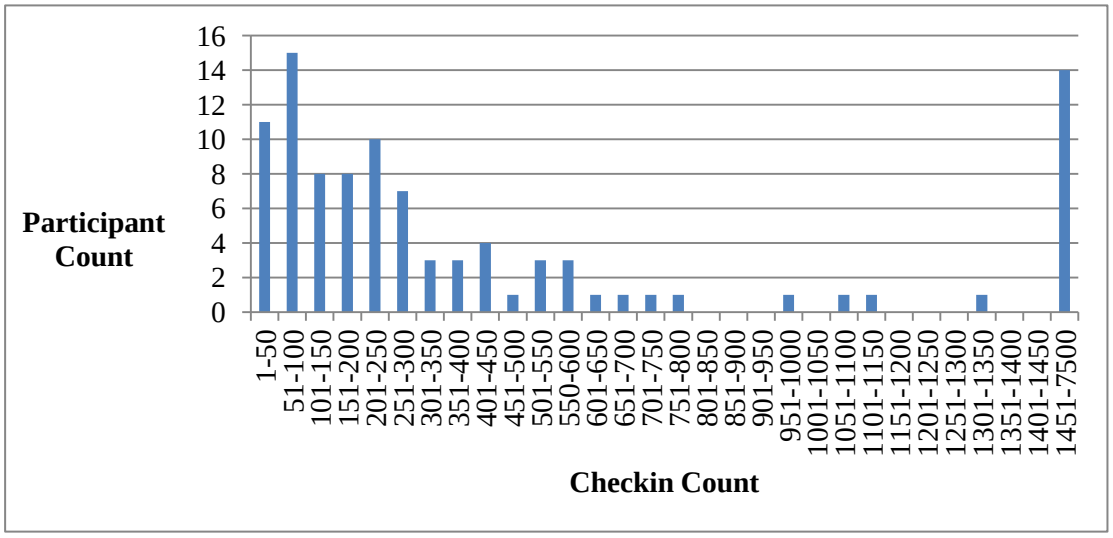

Figure 3: Participant frequency over varying checkin count bins ($N_{participant}$=98)

When we investigate venue checkins, out of the 11288 venues the most checked in one is 'ODTÜ Kortlar' (eng. METU Tennis Courts), with 748 checkins. Checkin counts are grouped into bins. Bins are created by equal width discretization where the width is set as 25. The distribution of venues over binned checkin counts is illustrated in Table 8.

Table 8: Distinct venue frequency over checkin count bins of 25 checkins

Checkin Range	Venue Frequency	Checkin Range (continued)	Venue Frequency (continued)
0-25	10942	401-425	0
26-50	179	426-450	3
51-75	60	451-475	3
76-100	20	476-500	1
101-125	14	501-525	2
126-150	14	526-550	3
151-175	10	551-575	0
176-200	7	576-600	1
201-225	5	601-625	1
226-250	5	626-650	0
251-275	1	651-675	2
276-300	5	676-700	1
301-325	1	701-725	0
326-350	4	726-750	1
351-375	0	751-775	0
376-400	3	776-800	0
		Total	11288

When the bin width is set as 25 checkins, an overwhelming amount of venues falls in the first segment. Therefore, a more sensitive scale is needed. When the bin width is set as 5 checkins until the first 100 checkins, the result is as in Table 9. Venues with one checkin are separated as to show its dominance.

The result in Table 9 is reached for distinct venues. When we group the venues by their names, the corresponding checkin counts differ. For instance, Starbucks becomes the most checked in place as it aggregates all of its venues. 10099 venues are obtained at the end, meaning that 1189 venues are merged with another. The further details are given in Appendix C.

Table 9: Distinct venue frequency over varying checkin count bins

Checkin Range	**Venue Frequency**	**Checkin Range (continued)**	**Venue Frequency (continued)**
0-1	6650	61-65	13
2-5	3123	66-70	5
6-10	661	71-75	8
11-15	249	76-80	7
16-20	164	81-85	1
21-25	95	86-90	3
26-30	53	91-95	5
31-35	42	96-100	4
36-40	33	101-800	87
41-45	26		
46-50	25		
51-55	23		
56-60	11		
		Total	11288

Dominantly, most of the venues are checked in only once. This phenomenon may have occurred due to many reasons. First thing we should consider is that the venue, actually non-existing or duplicate, is created by a user only to gain more points. Duplicate venues can be misleading for our research purposes. Foursquare makes it a constant effort to find and merge these venues. By looking at our own database we can see examples of venues belonging to the same physical place. For instance, "100.yil Parki" is a venue that was checked in only once. There is also a venue as "100. Yıl Birlik Parkı" that has 3 checkins. Indeed, the *real* venue is the latter one and when we use the Foursquare venue URL for the first venue, it now redirects to the second one. The existence of a venue is determined merely from a textual and statistical point. The second venue name is spelled better and worded in a better way. The more established venue is generally decided by the number of checkins and that venue will replace the duplicate venue ID. Requests to the API with the ID of the replaced venue will return the new venue object. Statistics like checkin numbers and category information are also merged.

We should also consider that the venue may not be a physical place. The main category for temporary gatherings is Event category. Table 10 shows the subcategories of Event and the respective venue counts in our data.

Table 10: Venue counts for Event category

Subcategory Name	Venue Count
Conference	6
Convention	2
Festival	5
Music Festival	2
Other Event	21
Parade	1
Street Fair	1
Total	38

An example for an event that has one checkin is "8. Ankara Kitap Fuarı ATO Congresium". The venue is about a book fair and is categorized as Other Event. It is a properly created venue for Foursquare and it happens to have only one checkin in our database. This is a valid checkin and cannot be classified as an erroneous use. One more thing to be considered when we are studying Event venues is that a venue can have more than one category. For instance, "The Soul Pub" is categorized as Other Event, but is also listed as two other categories in Bar and Pub (They have separate categories in Foursquare). This classification makes it harder to interpret the results of a checkin. Will you take the venue as a Nightlife Spot category, or an Event category? Our study did not list Event as an option in the survey phase as we are mostly interested in physical places.

Some other examples for event venues that have one checkin are "#duruyoruz" (eng. we are standing), "Malatya Gunleri Ataturk Kultur Merkezi" (eng. Culture Days for the City of Malatya) and "Kampüs Gelişim Günleri '14" (eng. Campus Development Days '14).

A venue can be both a physical place and an event. The venue named "19 MAYIS STADYUMU TURKEY - SWEDEN MAÇI" describes a friendly football game between Turkey and Sweden national teams. It is only checked in once. It is not categorized as an event, but rather as a Football Stadium under Arts & Entertainment main category. 19th May Stadium is the name of the physical place but the checkin is made for a venue that describes a temporary event. And the venue is only meaningful for the two hour span of the game, maybe a few more hours before while waiting for the game to start. The name of the venue is a mixture of Turkish and English, also indicating that it is not a proper venue. The venue's existence as a football stadium is questionable, it may have better served as an event. But here, it can be created as the way it is, as there are no constraints against it. This can be seen as a deficiency on Foursquare's part, but it is also one of its main strengths. The 15 billion Foursquare venues were created by the dedicated user base and they made it possible to establish a free venue database. The venue for the game is checked in only once in our database, but if we look at its statistics, we see that it was checked in at a total of 226 times, by 221 distinct users and even has 6 tips (as of August 24th of 2014). As we can see, however erroneous it might be, a venue can still become a place to gather. Even though venues like these might affect our studies, there are also counter measures. A Foursquare venue has a 'closed' attribute that shows whether or not a venue is available for checking in. As this game is long finished, Foursquare marked

the venue as closed. Our study is not using the closed attribute, but grouping venues and measuring frequencies according to it, can also provide more insight and more meaningful results. We leave this work as further study.

More than one checkin can be made to the same venue. When we look at the distinct venue count for every participant, we see that the highest number of venues a participant has been to is 1342. The lowest is 1. There are three more participants that checked in at less than 10 different venues. Overall when we group into 50 distinct venues, the results are as given in Figure 4.

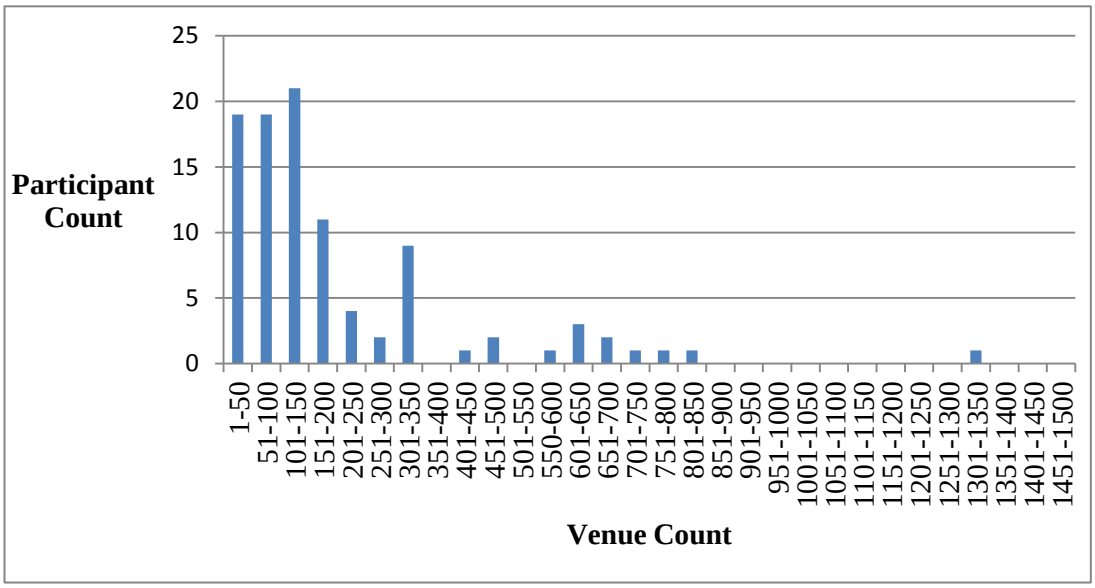

Figure 4: Participant frequency over distinct venue bins of 50 venues ($N_{participant}$=98)

Checkin ratio is calculated as the division of the checkin count of a participant to the number of distinct venues each participant checked in. Figure 5 shows the participant counts against checkin ratios.

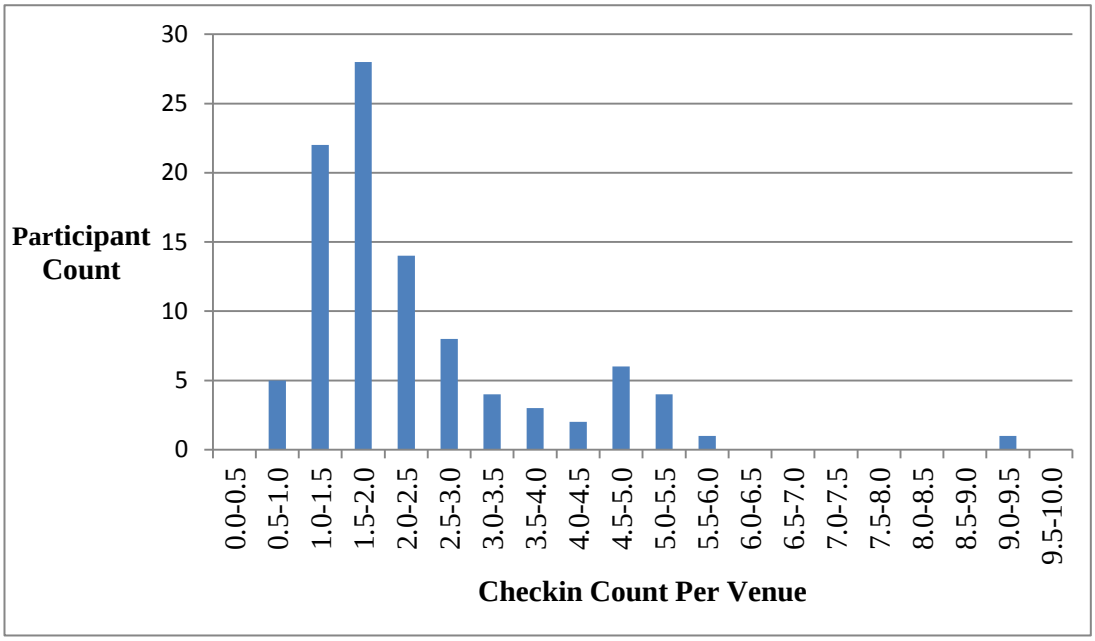

Figure 5: Participant frequency over checkin ratio bins ($N_{participant}$=98)

We can observe that the highest number of participants checkin averagely twice for a venue. Since a checkin is always associated with a venue, the ratio can never be less than 1. More checkins for a place will boost the ratio up.

Users tend to checkin to their homes and offices a lot more than other places. This behavior will be examined further when checkin orders for attached places are investigated. This tendency can cause to increase the checkin ratio for a participant.

We see the category distribution for checkins in Figure 6. The problem in investigating main categories is that a venue can fall under more than one category. We might select a single category for each venue and examine accordingly. But the basis for that selection is yet another problem. Here, we did not reduce the category count for a venue to one. Thereby the venue count is 12841 whereas the distinct venue count was 11288.

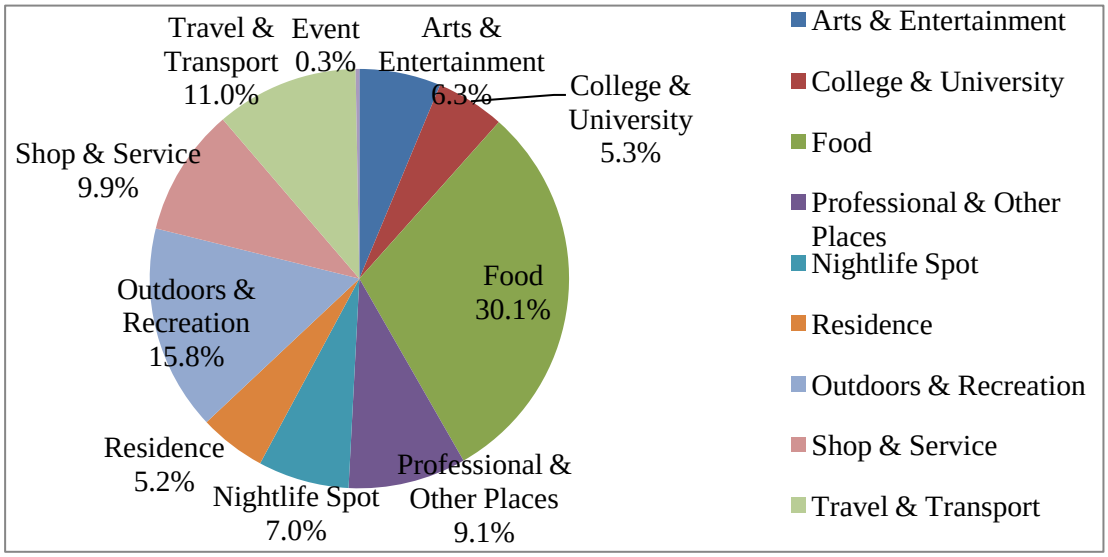

Figure 6: Category distribution for the checkins of participants

Examining the categories gives us an insight about our data. Food and Outdoors & Recreation venues are mostly physical places that are suitable to getting attached to. However, Shop & Service and Travel & Transport also show strong presence among checkins, so we cannot claim that only places suitable for emotional bonding are frequently checked in. But these two categories might show routine functional use of certain places and their place dependence rating might actually be high.

Another observation can be made for home and work places. Residence and Professional & Other Places categories together make up 14% of all the venues. If a participant does not have any qualms about checking in a residence, then these venues will be checked in frequently and will probably show high attachment for many participants. So we tried to mainly go for other categories and therefore, calculated a ranking excluding home and work places also.

When we look at the subcategory distribution for checkins, the top fifty subcategories can be seen in Figure 7. Cafe and Restaurant venues are the most checked in venues. Home (private) and Neighborhood categories also show strong presence.

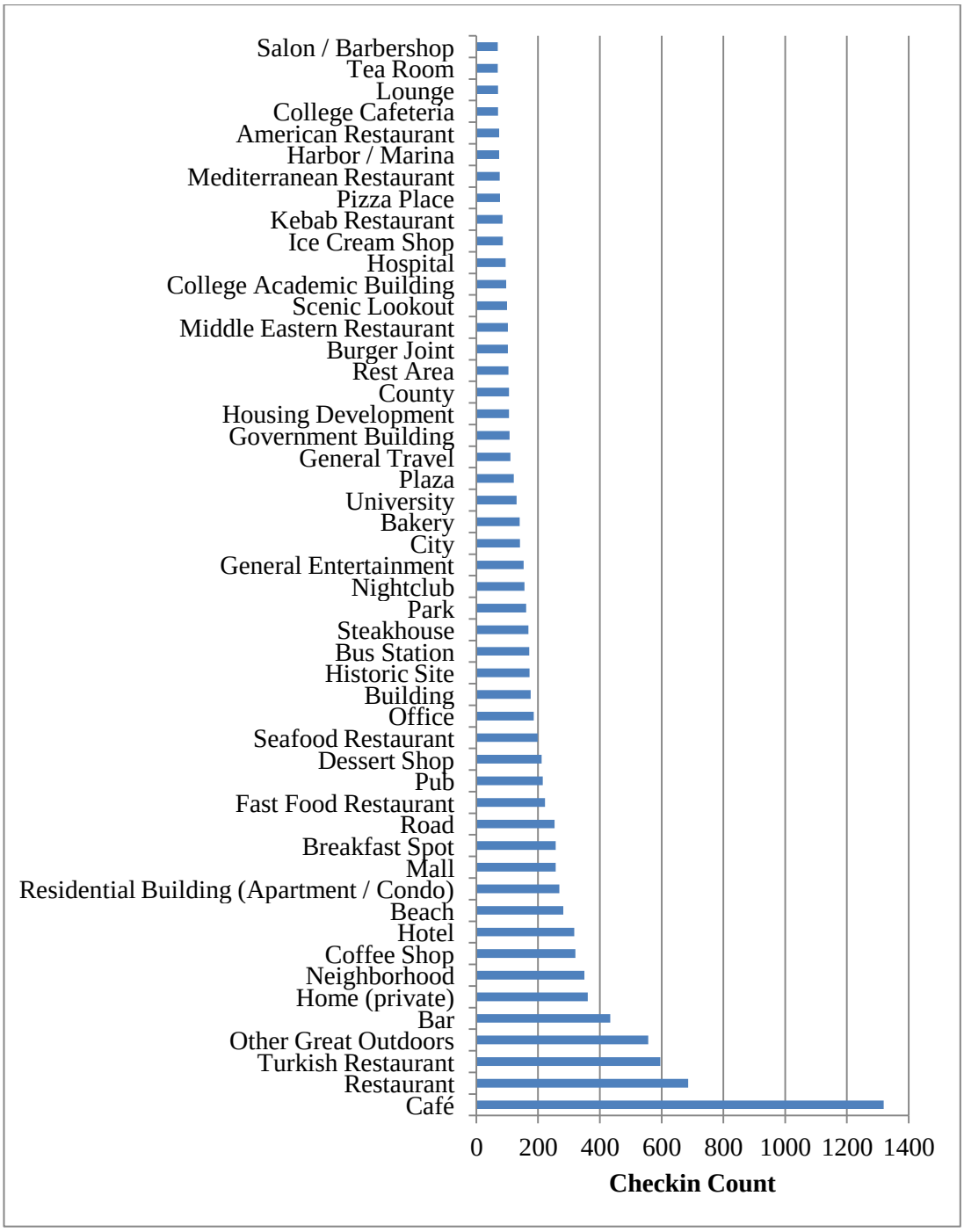

Figure 7: Top fifty subcategories ordered by checkin count

The main mechanism we use for our analyses is the checkin mechanism. Order values are specific to participant. Checkin Order is the order of the venue among other checked in venues. It gives the Place Ranking. Grouped Checkin Order is the order when we group the place with more than one venue (e.g. different Starbucks venues). Representational Checkin Value is the ratio of the venue's checkin count to total checkin count. It gives the percentage of the checkins belonging to the place and can provide more information than the raw count. Average Checkin Count is the ratio of participant's total checkin count to the count of distinct venues he/she checked in.

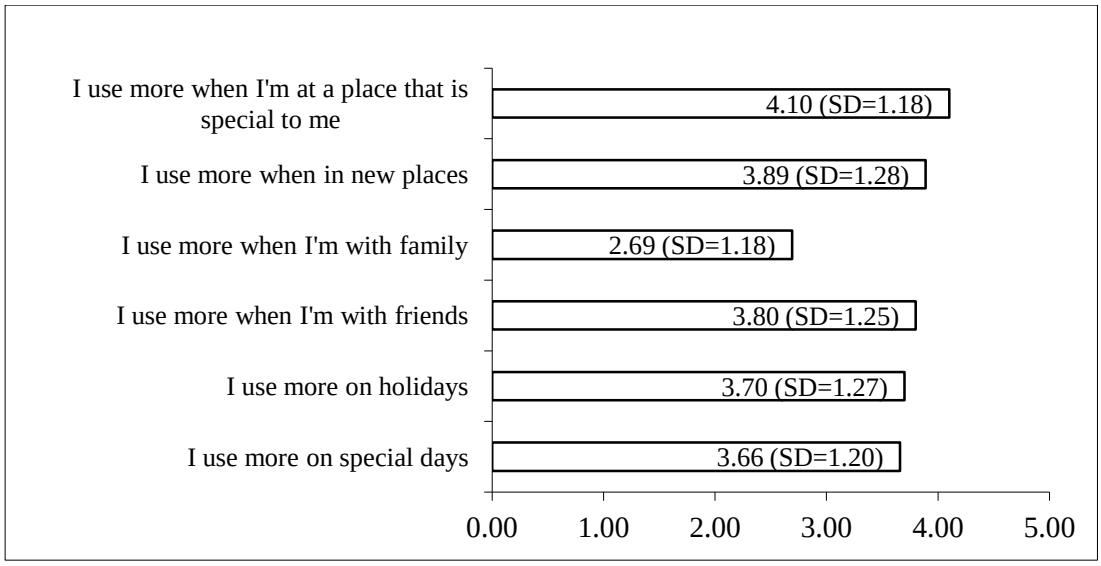

Figure 8: Foursquare usage frequency

Foursquare usage in Turkey is also investigated. The habits and usage frequencies are given in Figure 8. We see that Foursquare usage ratio is relatively low when the person is with family. The most defining habit is that people use Foursquare when they are at a place that is special to them and they have the need to share that moment. These results are gained from the 165 participant that answered these items in the survey.

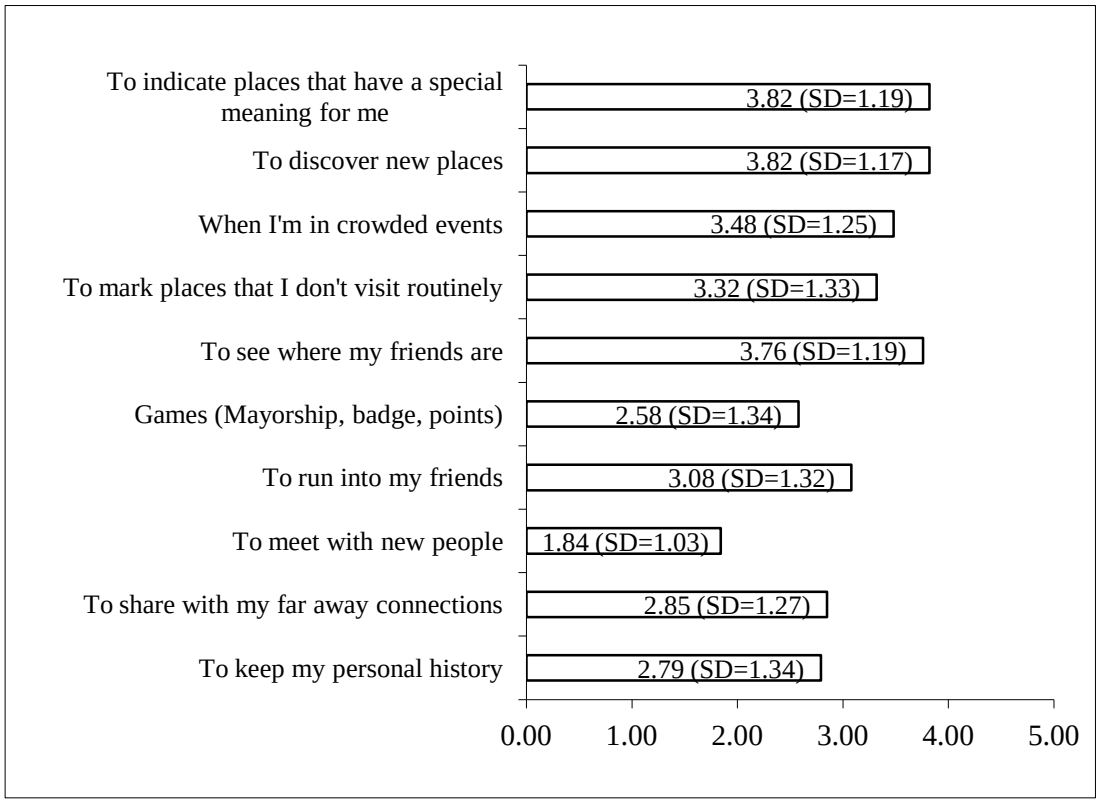

Figure 9: Purpose in using Foursquare

The purpose in using Foursquare is given in Figure 9. Similar to the habit and frequency aspect, people tend to use Foursquare to indicate a special place. These results confirm our basis in forming a study that links Foursquare and attached places. Discovering new places, looking at a friend's location and announcing participation in a crowded event are the top reasons why people are using Foursquare. Conversely, people do not seem to be using Foursquare actively for meeting with new people and gaming purposes.

Participants who provided their KML filled out 331 place attachment measurement sections in total (DS5). In 52 participant venues, the omission of home and office venues increased the order of the venue by chekin count. Out of the 230 venues, for which an order could have been calculated, 114 of them had a checkin order in the top ten including the home and work places. If the venue is out of top ten, then the effect of home and work omission was not studied. Therefore, we only look at the venues in top ten. It should also be noted that 10 venues out of 114, are home or office venues themselves. The ratio of 52 venues / 104 venues = .50 shows that with the omission of home and work places, half of the venues are affected positively regarding their checkin orders.

Out of 331 entries, in 57 venues, a group checkin count is calculated. Meaning that, the place is declared in a broad way, leading to multiple matches in the checked in venues. By definition, grouped checkin counts are higher than their single venue checkin count. So we can say that in 57 instances, by making grouping possible the checkin order of the venue increased. Out of these 57 venues, 4 of them are home or work places and 17 of them have their checkin order increased with the omission of home and work places.

As we pointed out earlier, there are different types and definitions of places, such as physical, regional or event-oriented places, and we felt the need to investigate them separately. We used the following place classification: (1) SpecificPlace, (2) SpecificArea, (3) Brand, (4) Activity, and (5) Region. SpecificPlace is a well-defined physical place that can be checked in as a venue. SpecificArea is also a physical place that can be checked in, but it also covers a lot of ground and may contain other venues in it. Main examples from our data are university campuses (e.g. METU, ITU) and shopping malls (e.g. AnkaMall). Multiple checkins for these venues are grouped, as explained in Chapter 3.2.1. Brands are the franchise names of some services that conduct their business in chain stores such as Starbucks, Timboo or Cinemaximum. If the participant mentioned a specific store/place (e.g. The Bigos Kızılay - Kızılay is the branch) or only checked in at one of them, then that venue is counted as SpecificPlace. However, if the participant declared the common brand name and checked in at different physical branches, then the classification is set as Brand and multiple checkins are added to the group checkin count. As we mentioned earlier, there are checkins for venues in States & Municipalities categories. We put those under Region class. Lastly, Activity class is formed by venue declarations that cannot be resolved to a single physical location as it is defined too broadly and mostly involves carrying out some type of activity. For instance: theater, bicycle lane, indoor pool and beach. The attachment is mostly pointed towards an action rather than a physical location. When we examined the checkins, if we found specific places (e.g. State Theater, METU Indoor Pool) we included them in checkin calculations but the class remains as Activity.

In our survey design, we used a validity question asking "Is this place special?" for every place specified. In the first two categories we asked about the most significant categories. If the participant evaluated the place as not-special, then their entry for that place is filtered out (DS12). It is is also valid for the third category. In the third category we asked for the least significant category. If the participant marked the place as special, then their entry for that place is filtered out. We also filtered three more places from the least significant places because they were not meaningful entries (e.g. "N/A") (DS14). The classification distribution for the filtered places is given in Table 11.

Table 11: Place classification frequencies

Classification	Significant & Special		Insignificant & Not Special	
	Frequency	Percent	Frequency	Percent
Activity	14	10.1	6	8.5
Brand	10	7.2	3	4.2
Region	5	3.6	5	7.0
SpecificArea	24	17.3	19	26.8
SpecificPlace	86	61.9	38	53.5
Total	139	100.0	71	100.0

36 of the 139 places in the filtered significant category have their group checkin counts calculated. As for the least significant category, in 71 places 8 of them have group checkin counts. 113 places in the significant categories (MSC) have checkins. That corresponds to 81% of the places. 40 places in the least significant category (LSC) have checkins. This means for insignificant places 44% do not have checkins.

Since we used a 5-point Likert scale, there are eight .5 measurement levels from 1 (Strongly Disagree) to 5 (Strongly Agree). We take the first four levels as low attachment and last four levels as high attachment.

Table 12: Attachment rating levels that are used for filtering

Attachment Rating Level	**Measurement Value**
Low Attachment Rating	[1.00, 3.00)
Neutral Attachment Rating	3.00
High Attachment Rating	(3.00, 5.00]

While the assignment of measurement levels might differ from study to study, we see similar wording for attachment measures as ratings in (Ryan, 2005).

When filtered for high attachment ratings, 24 of 113 significant places do not have any checkins (79% do have checkins). When filtered for low attachment ratings, out of 48 insignificant places 23 of them (48%) do not have any checkins.

As we have been explaining in our method of study, it can be seen that we applied many filters on the data to remove inappropriate or erroneous data. We selected 98 participants who provided their checkin values. There are different options on how to compare these checkin values to survey data. The validity question is used to

eliminate entries that might affect the study negatively. There are at least three and at most six places specified by the participants. We can calculate single attachment ratings for participants by taking averages of all measurements, or taking averages of significant/insignificant categories within themselves and comparing them. Essentially, place attachment is specific to the relationship between the person and the place. So it is best to select one representing attachment from significant categories and one representing attachment from insignificant category per participant. We selected these data by first applying the high and low attachment rating filters that are described in Table 12. Then, for significant categories (MSC) we simply selected the place with the highest rating. As for the insignificant category (LSC), we selected the place with the lowest rating. Thereby, we reached two attachment ratings for each participant. Selecting the places from the second choices can be justified considering the observation from the initial study in Chapter 3.1.1. The second choices were checked in more than the first ones. Here, attachment rating is used for selection instead of checkin count.

There are cases when the remaining place is actually checked in less than the filtered places, but we wanted to keep the processing of Foursquare and survey data separate, therefore a filtering on the survey data should be done within itself. We then compared these two data sets (Foursquare and survey) with each other. For further study, these processes can be applied separately for dependence and identity dimensions also.

The histograms in Figure 10 and Figure 11 use the data that is filtered by "Is this place special to you?" question and highest/lowest attachment rating per participant (DS15 and DS16). The corresponding places are investigated against positions in the top ten checkin order.

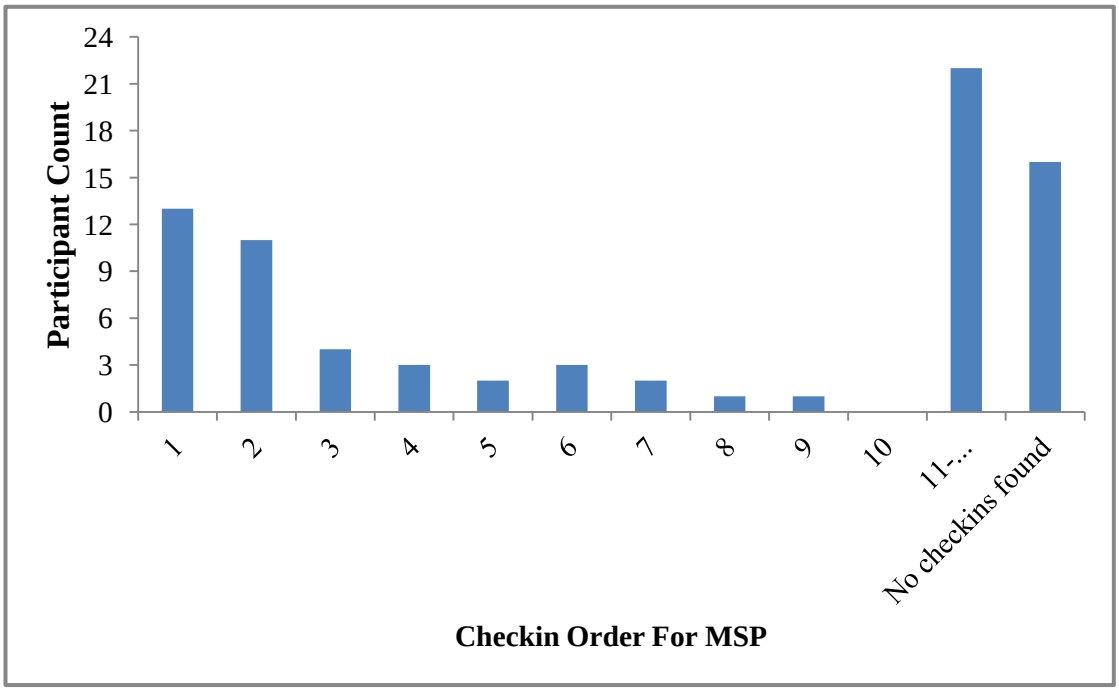

Figure 10: Participant frequency for checkin orders in MSP ($N_{participant}$=78)

51% of the entries in MSC have a checkin order in top ten whereas for LSC only 19% of the places are in top ten. This result fits with our expectation that places where people are emotionally attached are checked in more frequently than other places.

Low checkin counts can be investigated further. 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 the significant categories. 58% of these places are not in the top ten. For the unattached places in the insignificant category 56% of the places are not close to neither of them. Out of these places 57% are not in top ten. This finding might point to a long physical distance for the declared place. The reason that the place is not checked in frequently could be because of the fact that the place is far from the participant. The place could also be a type of place that is visited at certain times of the year. People can still feel attached to those types of places but it will be hard to infer this from the checkin counts.

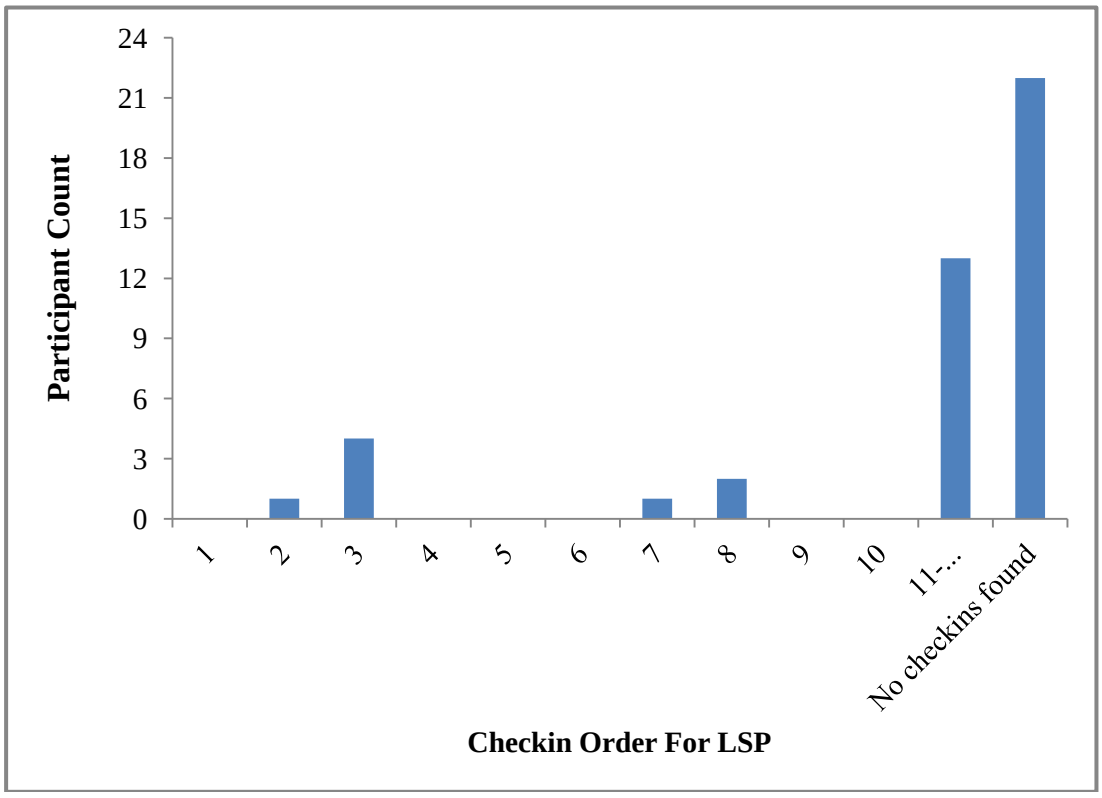

Figure 11: Participant frequency for checkin orders in LSP ($N_{participant}$=44)

A more appropriate indicator might be the tips left for the place. These tips are essentially comments that express the feelings of the user towards that place. Text analysis tools can be used to examine the textual content that exists in the tips. We embraced a more qualitative approach and interpreted some of the tips by ourselves. A place is selected according to its attachment ratings and category. The corresponding tips are examined.

One of the highest identity ratings is for Corvus Pub venue with a full rating of 5.00. The meaning of having 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. Foursquare gives the top thirty tips according to the number of likes the tips received. Table 13 lists top five sample tips for the venue.

Table 13: Top five tips for a given venue

#	Tip (in Turkish)	Number of Likes
1	balkon diyorum ba$ka bişey demiyorum! :)	33
2	Cumartesi geceleri balkonda oturabilmek için erkenden gidiniz.	12
3	Yavuz abi :) :)	11
4	Kardes mekanimizdir. Yavuz abimiz candir. Balkonu degerlidir.	5
5	Balkonunu sevdiğim:)	5

Identity dimension indicates a personal and familiar relationship. This aspect presents itself in the recurring "Yavuz abi" usage. It refers to a person whom the tip leaver is apparently close to. The tip leaver uses the person's name, along with calling him "brother". Another tip mentions the place as a sister venue. Four of the five tips refer to a seemingly popular "balcony"' in the place. It can easily be seen that the tips are positive as they contain the smiley characters ":)".

Highest frequency word groups were observed to have a better understanding of the affection in question. Table 14 lists the words according to their usage frequency in the top thirty tips.

Table 14: Highest frequency words in the tips of a given venue

#	Word	Frequency
1	Balcony	10
2	Brother Yavuz	3
3	Place	3
4	Ambiance	2
5	Brother (Separate from "Brother Yavuz")	2

The most frequent words are "balcony" and "brother/sister". There is also a tip as ":)) sıcacık mekan..", appreciating the coziness of the place. These examples show the type of wording to look for when analyzing the texts for a personal attachment.

4.5 Reliability Statistics

Reliability statistics in Table 15 shows us that all the Cronbach's Alpha values are quite high. Place identity value is higher than place dependence. This result supports our intuition, and findings from the initial tests, that dependence items are rated lower than identity items. The emotional wording of the items pulls down the goal aspect. When we add functional dependence items, Cronbach's Alpha for dependence gets higher. However, when we factor in identity items, alpha value (.922) becomes less than the original attachment value (.925). The negative wording of the sixth dependence item seems to present problems for the participants as it produces negative inter-item correlation for every item (it is reversed, as it should be). The highest alpha value (.952) was reached by omitting two dependence items, first and sixth. Original findings of Williams and Vaske (2003) state that a dimension can be

calculated with as few as four items, and here there are four items left for place dependence. But since the original items are quite established in the literature and the alpha values are high as it is, we decided not to change or include an item in other analyses.

Table 15: Reliability statistics

	Cronbach's Alpha	**N**
Place identity	.947	6
Place dependence (emotional)	.745	6
Place attachment (Place identity and dependence)	.925	12
Place dependence (functional)	.802	3
Place dependence (functional and emotional)	.812	9
Place attachment with functional dependence	.922	15
Place attachment with functional dependence minus Dependence6	.941	14
Place attachment minus Dependence1 and Dependence6	.952	10

Tabachnick and Fidell (2007) suggest that five cases for each item are adequate to do factor analysis. We applied principal component analysis on the 548 element data set and extracted two factors. Many coefficients in the correlation matrix were above .3. Kaiser-Meyer-Olkin Measure of Sampling Adequacy is .940; values above .6 are considered to be suitable to factor analysis (Kaiser, 1970). Bartlett's Test of Sphericity value is significant if it is less than .5 (Bartlett, 1954). It is measured as .000, therefore Bartlett's Test reached statistical significance and factor analysis is appropriate. The analysis revealed two components with eigenvalues over 1, explaining 61.660% and 9.344% of the variance respectively, 71.004% cumulatively. Oblimin rotation technique is used and the final structure matrix is given in Table 16.

Table 16: Factor analysis structure matrix

	Component	
	1	**2**
Identity3	.905	
Identity2	.896	
Identity1	.886	
Identity4	.884	
Identity6	.861	
Dependence2	.816	
Dependence4	.793	-.434
Identity5	.787	
Dependence5	.776	
Dependence3	.742	-.338
Dependence6		.902
Dependence1	.580	-.679

Out of six dependence items four of them loaded together. Correlation matrix value is -.298, which is considered low, so the strength of the relationship between components is weak. We can interpret this as, dependence and identity factors are separate dimensions.

4.6 Experiments and Results

The aim of the study is to investigate the association between place attachment and Foursquare. An important point to remember is that place attachment is the relationship between person and place. So the subject of many tests is not the participant but the attachment relationship itself. The attachment is unique to both participant and venue pairs. Testing based on the idea that the ratings can be averaged for a participant was pursued at first but abandoned soon after as the values do not represent the attachment ability, or the emotionally bonding ability of a participant. The ratings cannot be used without considering the corresponding place.

The place population counts in the data sets do not represent the unique venues, but rather, they correspond to the attachment relationship itself. So while participant population counts are also given, the place (attachment) population is more important.

Mainly Attachment Ratings and Place Ranking (Checkin Order, Group Checkin Order, Merged Checkin Order) are used to investigate whether checking in is related to feelings of attachment. Table 17 shows the hypotheses.

Table 17: List of experiments

Experiment Number	Hypothesis
1	**Hypothesis 1:** There is a relationship between Attachment Rating and Checkin Order.
2	**Hypothesis 2:** There is a relationship between Attachment Rating and Merged Checkin Order.
3	**Hypothesis 3:** There is a relationship between Attachment Rating and Merged Representational Checkin Value.
4	**Hypothesis 4:** Purpose of using Foursquare is associated with checking in to emotionally attached places.
5	**Hypothesis 5:** There is a relationship between Checkin Count Per Average Checkin Count and Attachment Rating.

4.6.1 Experiment 1

Hypothesis 1: There is a relationship between Attachment Rating and Checkin Order.

Data Set: In this experiment DS15, DS16, DS17, DS18 and DS19 are used. First four data sets are used for testing assumptions and to reach a better data set. Final hypothesis testing is done on DS19. DS19 is the data combining the High, Low and Neutral Attachment Ratings.

Methodology: In chapter 4.4.3, it was explained that 51% of the entries in MSC have a checkin order in top ten whereas for LSC only 19% of the places are in top ten. These findings are in line with the expectation that people check in to their emotionally attached places and there is a relationship between Attachment Rating and Checkin Order.

First, MSP (DS15) is investigated. In this study, Attachment Rating and Checkin Order are claimed to be negatively correlated because the smaller the order value means, the higher the rank is. A higher Attachment Rating for a venue indicates the place to be in a higher order among the checkins of the participant.

In order to say that the relationship is statistically important, the statistical tests should be performed. Either Pearson's product-moment correlation or Spearman's rank-order correlation will be used. In order to test for Pearson's correlation, the data need to pass some assumptions. First of all, the variables (i.e. Attachment Rating and Checkin Order) should be continuous variables. Attachment Rating is a continuous variable calculated from the survey. Checkin Order consists of the numerical order value so it could be considered as either ordinal or continuous. This study puts a special importance for being in top ten. Since top ten venues are focused on, for venues that are not in top ten, the actual order value is not calculated. It could be 11, or 50, or 1000. If there is a checkin for them, they are simply coded as "11". So the rational distance between 11 and 10 is different from 10 and 9. It should also be noted that the data sets DS15 and DS16 contain places that do not have any checkins. These examinations lead to a categorized approach for three separate groups: Top Ten, Not-In Top Ten, and No Checkin. The hypothesis is tested on both evaluations of the variable.

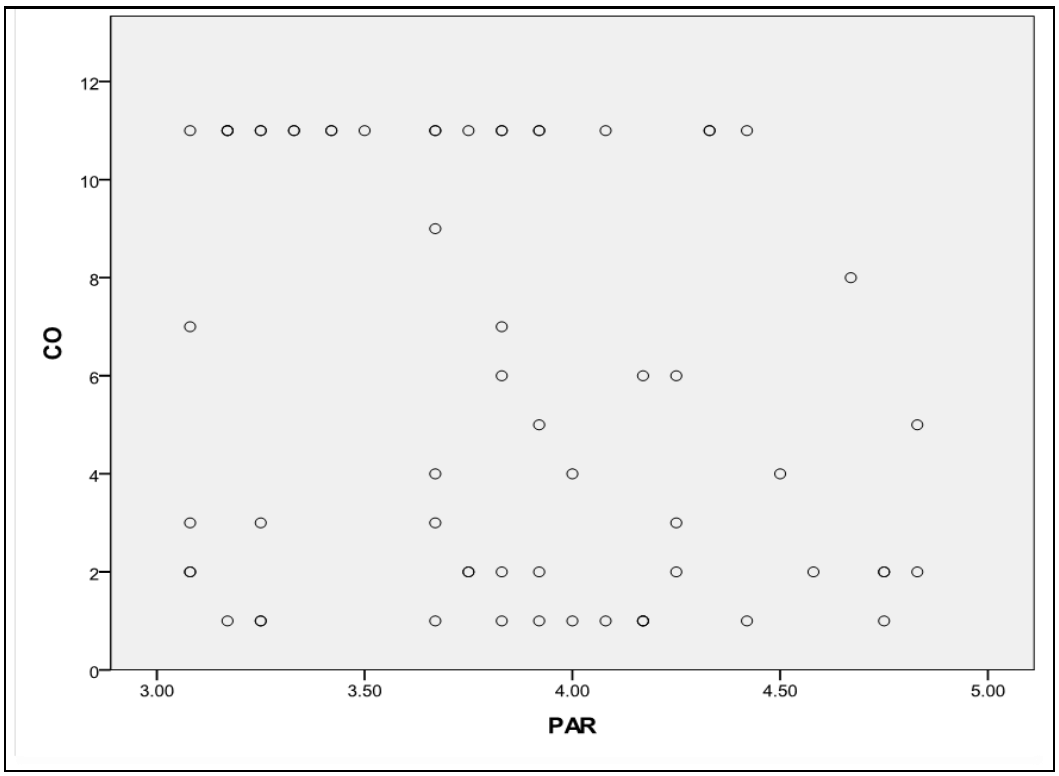

Figure 12: Scatter plot for Place Attachment Rating and Checkin Order in MSP

First, the order values were checked for the assumption to see whether there is a linear relationship with Attachment Rating. Places that did not have a checkin were filtered. 62 places remained. The scatter plot in Figure 12 is produced. Even if the venues that are not in top ten are filtered, the plot will not pass for linearity.

Spearman correlation can be used for testing but normality test was also carried out to see whether the variables are normally distributed or not. The results of the Kolmogorov-Smirnov Test and skewness-kurtosis values are shown in Table 18.

Table 18: The result of the Normality Tests for Attachment Rating and Checkin Order in MSP

	Kolmogorov-Smirnov				
	Statistic	df	Sig.	**Skewness**	**Kurtosis**
PAR	.100	62	.199	.212	-.862
CO	.243	62	.000	.211	1.761

According to the Kolmogorov-Smirnov test results, for Attachment Rating, the significance values are higher than .05, so it can be said that the data is normally distributed. The skewness and kurtosis values are close to zero which also shows the normality of the data. The histogram and Q-Q plot of the data set are drawn, and they can be seen in Appendix D and Appendix E. Not all variables were normally distributed, as assessed by Kolmogorov-Smirnov test ($p < .05$). The significance value for Checkin Order is lower than .05, so it can be said that the data is not normally distributed.

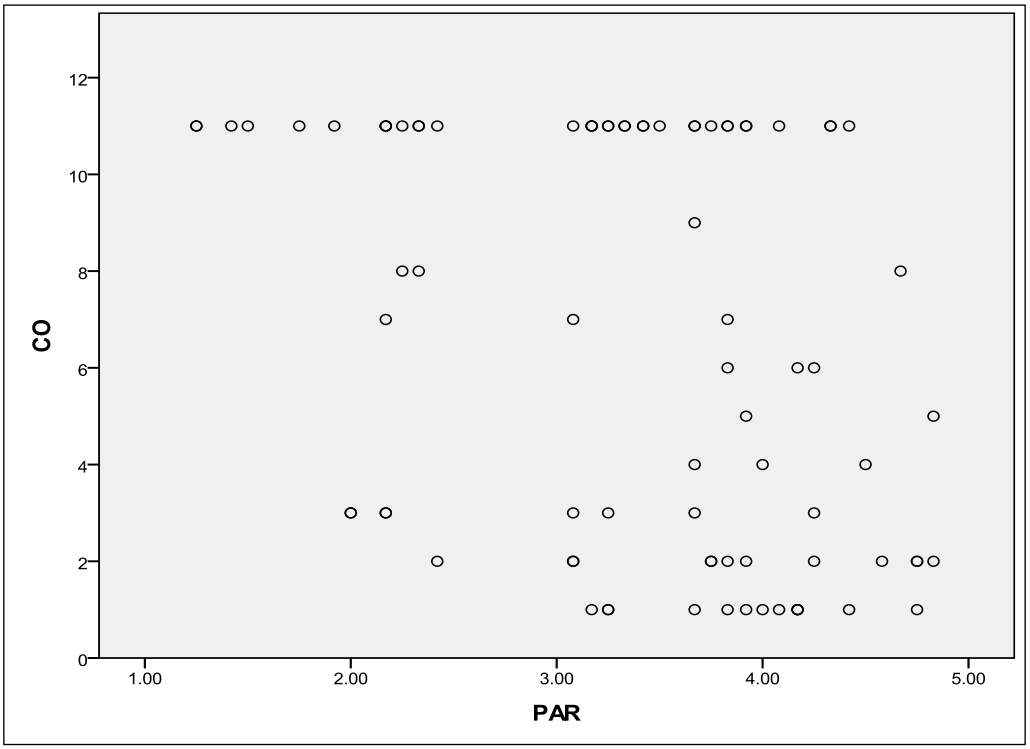

Figure 13: Scatter plot for Place Attachment Rating and Checkin Order in MSP and LSP combined

According to these findings, top ten checkin orders are not sensitive enough for MSP. There is not much difference between the rankings to form a linear relationship. It makes sense to include LSP to reach to a more normal distribution. Therefore, instead of testing Spearman's correlation separately for MSP and LSP, the places are combined to see whether the assumptions are met then.

Figure 13 gives the scatter plot for Checkin Order and Attachment Rating from the combined data set (DS17). Checkin Order and Attachment Rating are expected to be negatively correlated. Here the plot might be more linear but there are clear outliers. There are places that have low attachment ratings, and yet, they are in top ten. These places were investigated, but an apparent distinction was not observed.

Table 19: The result of the Normality Tests for Attachment Rating and Checkin Order in MSP and LSP combined

	Kolmogorov-Smirnov				
	Statistic	df	Sig.	**Skewness**	**Kurtosis**
PAR	.142	83	.000	-.547	-.575
CO	.277	83	.000	-.076	-1.803

Also, it should be noted that 22 places out of the 43 LSP were filtered because they did not have any checkins. This information is important for the analysis. It is another point for categorizing the order variable.

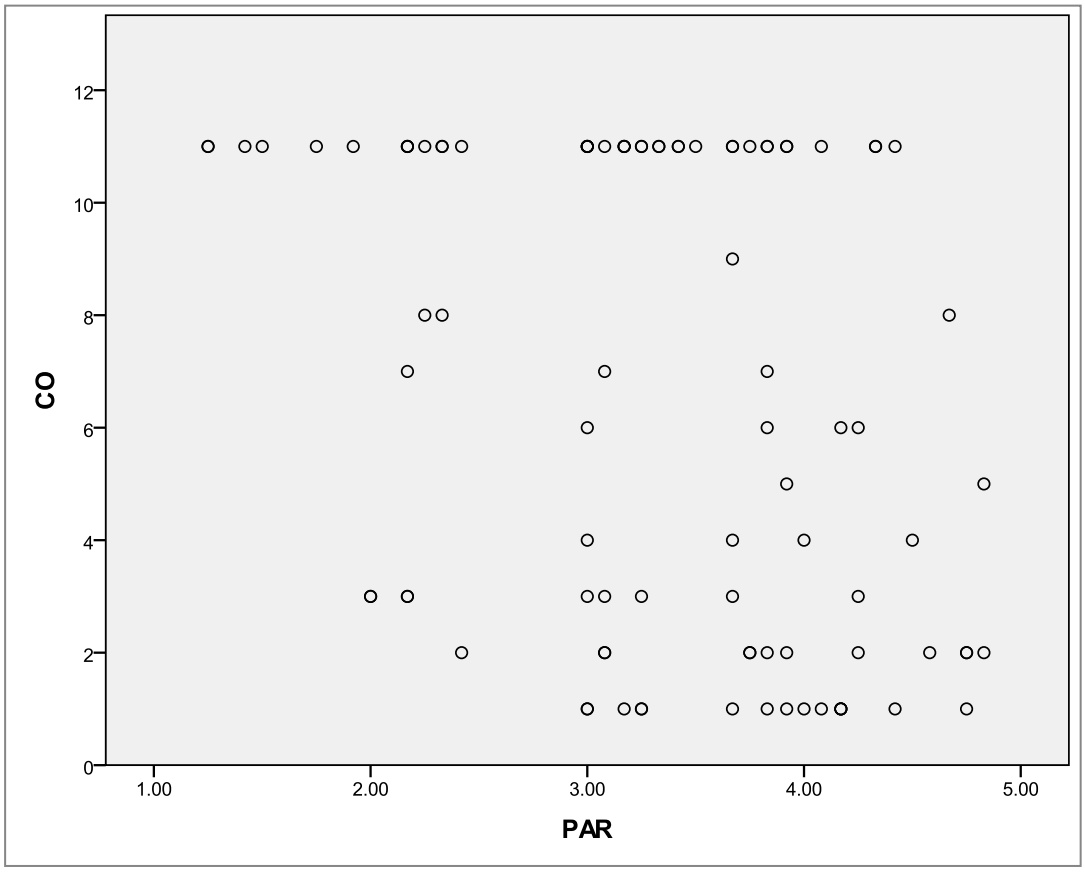

Figure 14: Scatter plot for Place Attachment Rating and Checkin Order in MSP and LSP combined with places that have Neutral Attachment Rating

The normality statistics are given in Table 19. The Sig. value for Attachment Rating is significant (.00 < .05), suggesting a violation of the assumption of normality. The histogram and Q-Q plot of Attachment Rating are given in Appendix F. When the histogram for Attachment Rating is investigated, it can be clearly seen that the distribution is missing the values at the middle. This is because of the High and Low Attachment Rating filters. Places with Neutral Attachment Rating should also be included. However, they will not be filtered for being marked as special or not. Note that, MSP in DS15 were marked as special and LSP in DS16 were marked as not-special. The item was filled by their corresponding participants in the survey. This filtering was done in order to select a better representative data.

Out of the included 15 neutral attachments, 6 of them did not have any checkins and were filtered from the initial linearity and normality analyses. Figure 14 gives the scatter plot for Checkin Order and Attachment Rating from the combined data set (DS18). Table 20 gives the normality statistics. The skewness and kurtosis values are close to zero which is an indicator for normality. The histogram and Q-Q plot of Attachment Rating are given in Appendix G. The normality improved at the Neutral Rating (3.00) point. But since the data between ratings 2.5 and 3.0 either does not exist or got filtered, the distribution is still not normal.

Table 20: The result of the Normality Tests for Attachment Rating and Checkin Order in MSP and LSP combined with places that have Neutral Attachment Rating

	Kolmogorov-Smirnov				
	Statistic	Df	Sig.	**Skewness**	**Kurtosis**
PAR	.122	92	.002	-.441	-.479
CO	.279	92	.000	-.076	-1.794

Spearman's correlation is used to test the association between Checkin Order and Attachment Ratings. Data set DS19 is used but the venues with no checkin are filtered, resulting in 92 places. Table 21 shows the correlation results. The main variable to test against is Attachment Rating (Place Attachment Rating, PAR), but the other attachment ratings are also tested. Correlation is significant at the .01 level for ratings including original Place Attachment dimensions (Dependence and Identity). Functional Dependency correlation is weaker than the other correlations and it is significant at the .05 level. All correlations are negative correlations. This result can be interpreted as, the higher the attachment rating the lower the checkin order (the higher the actual rank). Therefore, there is a relationship between Attachment Rating and Checkin Order.

Table 21: Spearman's correlation results for Checkin Order and Attachment Ratings

Spearman's correlation		PAR	PDR	PIR	FDR	FAT
CO (N=92)	Correlation Coefficient	-.349**	-.356**	-.334**	-.230*	-.372**
	Sig. (2-tailed)	.001	.001	.001	.027	.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 22 shows the correlation results when testing with a Categorized Checkin Order. The categories are as (1) No Checkin, (2) Not-In Top Ten, and (3) Top Ten. This way, the previously filtered venues that do not have any checkin are added back to the test.

Even though the Spearman's rho values are lower, the results are quite similar to Checkin Order (without categorization). There is a positive correlation with Place Attachment Rating. Spearman's correlation is .313 and the correlation is significant at the .01 level.

Table 22: Spearman's correlation results for Categorized Checkin Order and Attachment Ratings

Spearman's correlation		PAR	PDR	PIR	FDR	FAT
CO (Categorized) (N=136)	Correlation Coefficient	.313**	.326**	.283**	.199*	.338**
	Sig. (2-tailed)	.000	.000	.001	.020	.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Results and Discussion: We investigate whether people's attachment to a place that they frequently visit, is associated with its ranking among their Foursquare checkins.

Note that, the evaluated value for place attachment is first and foremost, the relationship itself. So the tests can include the same participant for more than one instance. The subject is the participant-place pair.

There is not much difference for a venue to be in the fourth place and fifth place. The same can be claimed for different points in top ten. Out of hundreds of venues, being in top ten is considered enough of an achievement in the study. However, for a more sensitive approach it might be better to pick, for instance top 10% of venues specific to the participant. Different thresholds can be selected and tested. This approach would reduce the effects of different checkin patterns. A user checking in high volumes for many venues might have a significant place left out of his/her top ten whereas a user only checking in to 10 venues in total, will have all his/her venues considered important.

Checkin Order is positively skewed within the top ten data. There are more first places compared to places ranked tenth. There is an asymmetrical distribution with a long tail to the right and attachments falling into top ten decreases mostly uniformly within themselves. Even if the venues that do not have a checkin is coded as a negative number and venues that are not in top ten are coded as eleven, the distribution is not normal. This is because of the nature of the top ten feature. Note that, determination of the order value is part of the manual matching process between survey and Foursquare data. The process is described in detail in Chapter 3.2.1. Since the venue name is a text specified by the participant, it is error prone and it may not resolve to an actual venue. Therefore, the venue's order cannot be easily found by database queries, it has to be searched for within the sorted venues. Calculating the exact order position for all venues (i.e. also calculating outside of top ten) would entail having to examine all venues for each participant. This is the sum of the distinct venue counts for participants, 19519 places in total.

A percentage approach as suggested previously, or calculating all order values might give better distributions but checkin distributions are already highly skewed distributions. Appendix H gives the skewness values for all checkin counts per venue for each participant.

A Spearman's rank-order correlation was run to assess the relationship between Attachment Rating and Checkin Order in venues representing all attachment rating filters. Preliminary analysis showed the relationship to be non-linear, as assessed by visual examination of a scatter plot. Transformations on data can be used to coax the non-linear relationship to a linear one but the data is more suitable for non-parametric tests. There was a negative correlation between Attachment Rating and Checkin Order, $r_s(90) = -.349$, $p < .01$. There was a positive correlation between Attachment Rating and Categorized Checkin Order, $r_s(134) = .313$, $p < .01$.

Attachment Rating and Checkin Order are claimed to be negatively correlated because the smaller the order value means the higher the rank is. A higher Attachment Rating for a venue indicates the place to be in a higher order among the checkins of the participant. The hypothesis is supported and there is a relationship between Attachment Rating and Checkin Order. People are frequently checking in to the places where they have place attachment.

4.6.2 Experiment 2

Hypothesis 2: There is a relationship between Attachment Rating and Merged Checkin Order.

Data Set: In this experiment DS19 is used. This is the data combining the High, Low and Neutral Attachment Ratings.

Methodology: The same methodology discussion in Hypothesis 1 applies for Hypothesis 2. This hypothesis will be tested on Merged Checkin Order. It is the merged values of Checkin Order and Group Checkin Order. The type and nature of the Group Checkin Order variable can be considered similar as Checkin Order. If a Group Checkin Count is calculated, Merged Checkin Order value is Group Checkin Order. Otherwise, it is the same as Checkin Order. Spearman's correlation is used for testing the hypothesis. The results are given in Table 23.

Table 23: Spearman's correlation results for Merged Checkin Order and Attachment Ratings

Spearman's correlation		PAR	PDR	PIR	FDR	FAT
MCO (N=95)	Correlation Coefficient	-.363**	-.369**	-.343**	-.261*	-.394**
	Sig. (2-tailed)	.000	.000	.001	.011	.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Correlation is significant at the .01 level for ratings including original Place Attachment dimensions (Dependence and Identity). Functional Dependency correlation is weaker than the other correlations and it is significant at the .05 level.

Results and Discussion: A Spearman's rank-order correlation was run to assess the relationship between Attachment Rating and Merged Checkin Order in venues representing all attachment rating filters. There was a negative correlation between Attachment Rating and Merged Checkin Order, $r_s(93) = -.363$, $p < .01$. The hypothesis is supported, there is a relationship between Attachment Rating and Merged Checkin Order.

A point to build on Hypotheses 1 is that Merged Checkin Order correlation with Attachment Rating is stronger than Checkin Order correlation with Attachment Rating. This was expected as more venues, checkins and higher Place Rankings were included in the data (i.e. they were not filtered).

4.6.3 Experiment 3

Hypothesis 3: There is a relationship between Attachment Rating and Merged Representational Checkin Value.

Data Set: In this experiment DS19 is used. This is the data combining the High, Low and Neutral Attachment Ratings.

Methodology: Spearman's correlation is used for testing the hypothesis. The results are given in Table 24.

Table 24: Spearman's correlation results for Merged Representational Checkin Value and Attachment Ratings

Spearman's correlation		PAR	PDR	PIR	FDR	FAT
MRCV (N=95)	Correlation Coefficient	.381**	.365**	.372**	.353**	.421**
	Sig. (2-tailed)	.000	.000	.000	.000	.000

**. Correlation is significant at the 0.01 level (2-tailed).

As can be seen from Table 24, all the attachment ratings are significant at the .01 level. The correlation strengths are moderate.

Results and Discussion: Representational Checkin Value gives the percentage of the related checkin count to the total checkin count of the participant. It is a value that is always between 0 and 1 for the corresponding attachment. Thus, it is easier to compare between attachments.

A Spearman's rank-order correlation was run to assess the relationship between Attachment Rating and Merged Checkin Order in venues representing all attachment rating filters. There was a positive correlation between Attachment Rating and Merged Representational Checkin Value, $r_s(93) = .381$, $p < .01$. The hypothesis is supported, there is a relationship between Attachment Rating and Merged Representational Checkin Value.

A point to build on Hypotheses 1 and 2 is that if it applies Group Checkin Count is higher than Checkin Count, so Merged values result in stronger correlation in the tests (Spearman's correlation between PAR and RCV is, $r_s(90) = .324$, $p < .01$). For further study, different threshold values for MRCV can be tested to examine the correlation with Attachment Ratings.

4.6.4 Experiment 4

Hypothesis 4: Purpose of using Foursquare is associated with checking in to attached places.

Data Set: In this experiment DS19 is used. This is the data combining the High, Low and Neutral Attachment Ratings.

Methodology: In this hypothesis, a multiple regression model is used where the ten purpose items from the survey form the independent variables and the merged checkin order is the dependant variable. The experiment is testing the relationship between the purposes of using Foursquare with Merged Checkin Order.

The model passes the independence of residuals assumption. There was independence of residuals, as assessed by a Durbin-Watson statistic of 1.696. A value of approximately 2 indicates that there is no correlation between residuals.

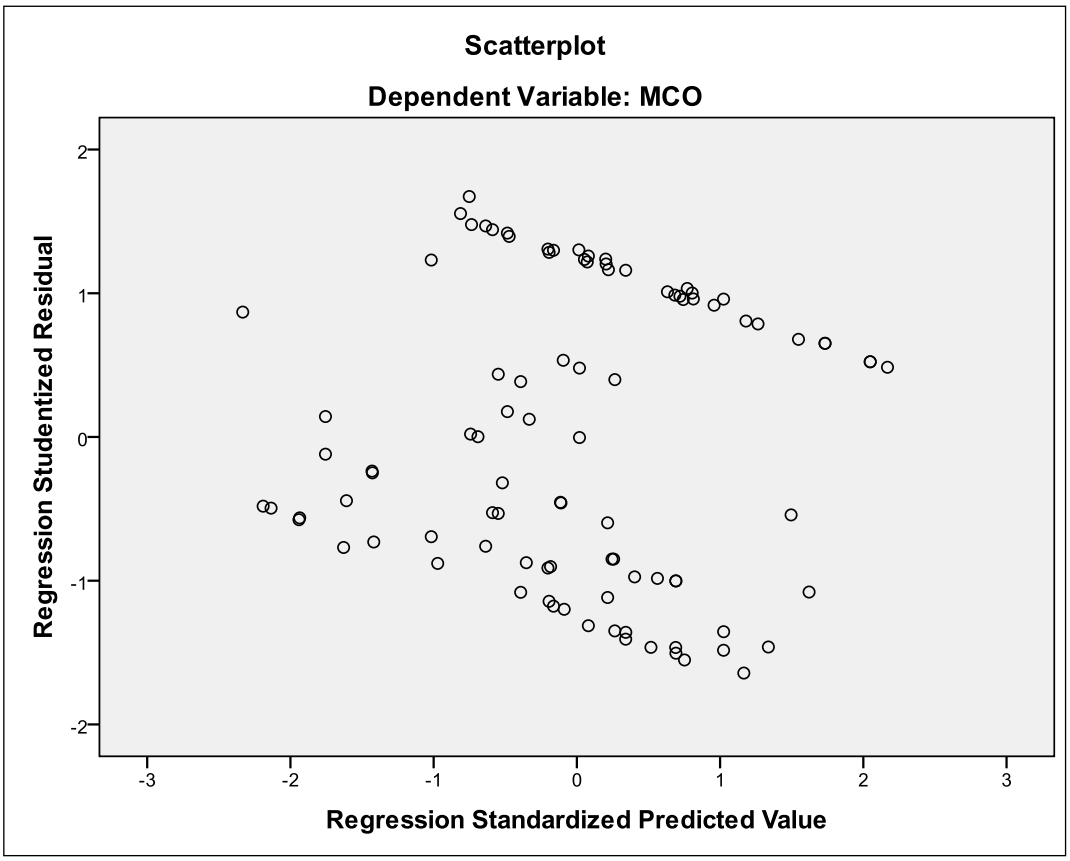

Figure 15: Scatter plot for studentized residuals against the predicted values

As a second assumption, a linear relationship is needed between the predictor variables and the dependent variable. This is checked by plotting the studentized residuals against the predicted values. If the residuals form a horizontal band, the relationship between the dependent and independent variables is considered as likely to be linear. The scatter plot is given in Figure 15. As can be seen, a slightly slanted band is formed. Partial regression plots are also examined to see whether they show a linear relationship between dependent variables. These plots are given in Appendix I. The points in the plots are too scattered to be considered in a linear form. Therefore,

it is assumed that at least some of the relationships are not linear and multiple regression is not a suitable method for testing.

Results and Discussion: The contribution was only found significant for the purpose of "Checking in when I'm in crowded events." and the correlation values were weak. The population in the test consisted of 95 subjects and 10 predictor purpose variables. When 15 subjects per predictor are aimed for, this sample size can allow up to only six or four seven variables. Different data sets and decreasing the number of variables may improve the results but overall, there is a problem with linearity and data transformation is needed.

4.6.5 Experiment 5

Hypothesis 5: There is a relationship between Checkin Count Per Average Checkin Count and Attachment Rating.

Data Set: In this experiment DS19 is used. This is the data combining the High, Low and Neutral Attachment Ratings.

Methodology: Subjects that have Average Checkin Counts equal to 1 are filtered. Spearman's correlation is used for testing the hypothesis.

Table 25: Spearman's correlation results for Checkin Count Per Average Checkin Count and Attachment Ratings

Spearman's correlation		PAR	PDR	PIR	FDR	FAT
CCPACC (N=131)	Correlation Coefficient	.313**	.325**	.285**	.265**	.356**
	Sig.(2-tailed)	.000	.000	.001	.002	.000

**. Correlation is significant at the 0.01 level (2-tailed).

The results are given in Table 25. All the attachment ratings are significant at the .01 level.

Results and Discussion: The variable Checkin Count Per Average Checkin Count compares the checkins made to the venue to the overall checkin behavior of the participant.

A Spearman's rank-order correlation was run to assess the relationship between Checkin Count Per Average Checkin Count and Attachment Rating in venues representing all attachment rating filters. There was a positive correlation between Checkin Count Per Average Checkin Count and Attachment Rating, $r_s(129) = .313$, $p < .01$. The hypothesis is supported, there is a relationship between Checkin Count Per Average Checkin Count and Attachment Rating.

CHAPTER 5

CONCLUSION AND FURTHER STUDY

In this study we showed that people are checking in to places where they have place attachment. Attachment ratings are found to be associated with the place rankings. Attached places are observed to be checked in frequently as they are represented in the top ten venues of many participants. Nearly 80% of the places with high attachment have checkins. In accordance, nearly 50% of the places with low attachment do not have any checkins. Checkin behaviors overlap with reports of attachment. For the most significant places declared, more than half of them have a checkin order in the top ten. As expectedly, for the places in the least significant category the ratio drops around to 20%. In addition to these observations, it is also statistically verified that there is a relationship between checkin orders (or percentages) with attachment measurements.

An interesting observation from the classification of places is that normally it is expected that physical specific places would be the type to fit thoroughly with the relationship with attachment, but it is not. At least for some of the highest attachment relationships, corresponding specific places are not among the top ten checked in venues. An inference could be made as that for the most special places, people may choose to announce the moment in specific times (i.e. checkin less). For instance, they might checkin when they are with certain friends. Our data contains the description text of the checkins, therefore we may extract the checkins mentioning accompanying friends, as a prospective further study. But it should also be obvious that checkin mechanism cannot be considered as the only variable in assessing the attachment or the user behavior. The psychological features of feeling attachment and announcing it in a public environment should be studied by the domain professionals.

More statistical tests can be carried out to build on the research. It can be investigated whether there is a significant difference between attachment ratings of places that are close to work/home or not. The result may be used to estimate attached places from checkins. Checkins contain coordinate values. Venues also have categories as Residence and Professional & Other Places. Places falling under these categories might be investigated and close venues could be estimated for attachment.

The difference between attachment ratings can also be tested for comparing the purpose in using Foursquare and checkin frequency of the participant. Foursquare usage questions were asked in order to profile the user behavior. Every user's motivation can be different. It can be investigated whether these attributes statistically significantly help predict the participant's checkin patterns. They can also be used as filters to refine the data in other tests.

The same statistical tests in the study can also be applied for the data set filtered by venues classified as specific place. The sample size gets smaller, but the data become more accurate to what the study first aimed. The other types also attract attachment but their respective venues are broadly defined. Checking in to such a place might mean very different things. One can check in to a city to show their attachment to the place they live, or they can simply check in to a city that they just arrived at. This observation leads to more investigation as the home and neighborhood information might be useful to understand some of the behaviors. That information could be inferred from checkin coordinates and frequencies, but it is left for further study. All types in the classification may lead to further research but specific physical places are still the most suitable to study with checkins.

There are some limitations in the study. Since all data gathering steps are handled in a single survey, the design of the study directs the participants and makes them aware of the use of Foursquare in the study. Ideally, the phases are best handled separately. Organizing two phases has its own complications as not all participants from the first phase return to the second and linking the participants between phases cannot be easily done while preserving privacy. Thus, the study uses a single phase that combines place attachment survey and Foursquare data gathering.

The evolution of the elicitation questions in the survey may have eventually steered us away from specific places. The declared places are a mixture of activities, regions, brands and physical specific places. This heterogeneity makes it difficult to interpret the venues and attachments as a whole. We had to use many filters and the population size got small for some of the tests.

The survey was voluntarily filled by participants from varying universities and workplaces. The participants were not in a position to affect each other as the survey was filled online, and not from a certain physical place. Rather than the survey, Foursquare data might be more vulnerable because checkins are voluntary and they present problems in interpreting the data.

KML contains checkin time information. It can be investigated whether the attachment to a place is developed by an investment over time. The place could also be a type of place that is visited at certain times of the year. People can still feel attached to those places but it will not show in checkin counts. The time aspect can be extracted from the checkin data. It can be investigated whether the places are suitable for classification by their checkin times. KML also contains geographical coordinates. The neighborhood of the user can be inferred from the frequent checkins and the attached places falling outside of the neighborhood zone might need to be handled differently in the studies. For instance they should not be expected to have high checkin counts.

There may be many reasons for checking in a place. Other than the study's main assumption of "people checkin to places where they feel attachment", there can be

many more different conditions for a checkin. Simple promotions such as free WiFi or free drinks might encourage people to use Foursquare. Irregular or once-in-a lifetime activities such as visiting a certain famous place can also lead to checkins but not to the form of attachment examined in the study. Some of these motivations are handled in the user profiling section of the survey. Checking in places that are not routinely visited, for instance, can be investigated separately.

There are many more possible opportunities for further study. Foursquare categories can be further investigated to see whether they can be used to determine venues that have dependence features. Places showing high place identity features might be found near to places showing high place dependence features. We can extract the definition "dependence venue" from Foursquare categories. Categories such as Mall, Gym, Airport Terminal and Office contain functional, goal-oriented places. We can get the places with high identity ratings, look for the checkins made in the same day and look for the checkins geographically close. Among the gathered checkins, we can investigate the ratio of dependence venues. We might look for participants who declared attachment to similar places or places in close proximity. We can get all the checkins and venues for all participants and use the venues as connection points to create a venue network. Investigating the venues with strong ties, might lead us to places that potentially show high attachment for other participants.

Location dimension enables the virtual social networking environment to have a real connection to the world. The venue aspect of Geosocial Networks provides a connection point for users and allows us to tap into both user networks and venue networks. The fact that locations have an existence by themselves lets us work on them as a connection point for people, and form social networks. Social network analysis methods can be applied to study on the networks. Checkins are the ties between users and venues, so essentially the whole checkin network is a two-mode network where the actor set is formed by participants (users) and the event set is formed by venues. The one-mode network of participants can be used to group participants and find user similarity. The one-mode venue network, on the other hand, can be used to find ties between venues and used for recommendation purposes. Foursquare API already has a similar feature in suggesting "next five venues" that are popular after visiting the current place. As a distinction, the network of attached places could be investigated. Inferred network of attached places finds potential attachments for a participant that are not reported or realized yet. Different attachment dimensions may lead to different findings. Dependence venue networks and identity venue networks can be studied separately.

Foursquare venue categories, user profiling, place classifications, regional attachment levels are all fields that can be studied separately. The resulting social networks from the checkins can be analyzed further to find implicit connections between nodes. As a contextual entity, place information is suitable for personalization efforts. Handling the textual content of LBSNs was not a major concern in our study, but comments and tips can be extracted to reach valuable information. Tf-idf statistic can be investigated to understand the importance of a word. The emotional category and the positivity/negativity of the word may also be investigated. The information can be used to better understand affection words for different types of attachment and provide input to recommendation systems. In order to reach general inferences about places, Foursquare's own venue statistics and tip information would be better suited instead of using personal survey data.

Place attachment is a rooted concept in social sciences. However, its relationship with information systems and technology in general, has been revealing only recently. We consider using mobile applications and LBSNs in particular to find out implicit information, a novel approach that can also have benefits in the field of place attachment. Instead of relying on direct inputs from people, scientists, city planners, public authorities, researchers, all alike can turn to utilize the readily available networks of information. Therefore, we find value in using Foursquare and similar mediums to possibly measure or estimate personal attachments in the future. This study, however, mostly investigated checkin behaviors through the concept of place attachment. Judgment report of emotional attachment in public places is the main subject of measurement. Self-report attachment declaration is used to investigate the activity of voluntarily checking in and publishing the whereabouts of oneself. Attachment rating is shown to be related with the checkin frequency. This study has been a research towards a better understanding of checkin mechanisms and the potential integration of place attachment concepts in the domain of geosocial networks.

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APPENDICES

Appendix A: Survey Questions (in Turkish)

Gönüllü Katılım Formu

Merhaba,

Bu çalışma ODTÜ Enformatik Enstitüsü Bilişim Sistemleri bölümünde yürütülmekte olan bir yüksek lisans tezi kapsamında hazırlanmıştır. Çalışmanın amacı katılımcıların bağlılık hissettikleri mekanların, coğrafi konum tabanlı hizmet sağlayan mobil uygulamalar aracılığıyla bulunabilirliğinin araştırılmasıdır. Bu amaç doğrultusunda, çalışmanın ilk bölümünde katılımcıların bağlılık hissettikleri mekanları anket aracılığıyla ortaya çıkarmak için sorular sorulacaktır. Çalışmanın anket ayağı tek seferde tamamlanacak olup; ilk olarak katılımcıların mekan kategorilerini kendileri için önem sırasına göre önceliklendirmeleri istenecektir. Sonraki adımda, katılımcılardan belirttikleri kategoriler için en çok tercih ettikleri mekanlar alınacaktır. Mekanlar belirlendikten sonra kullanıcının belirtmiş olduğu mekanlarla ile ilgili olarak mekan bağlılığını ve orada bulunma sıklıklarını ölçen sorular sorulacaktır. Sonraki adımda Foursquare uygulaması kullanıcı profillerini araştıran sorular ile demografik bilgiler sorulacaktır. Anketin sonunda kullanıcılardan kendi Foursquare yer bildirimlerini içeren bir bağlantıyı paylaşmaları istenecektir. Çalışmanın ikinci bölümünde katılımcılardan elde edilen Foursquare uygulaması geçmiş yer bildirim verileri incelenerek verilerin anket sonuçlarıyla ilişkisi incelenecektir.

Anketteki soruların doğru ya da yanlış cevabı yoktur, sizin için geçerli cevabı işaretlemeniz yeterlidir. Bilgilerinizin gizliliğini korumak adına anketin herhangi bir aşamasında adınız ve soyadınız sorulmamıştır. Bütün kişisel bilgiler anonimize edilip bu bilgiler ve edinilen dosyalar çalışma sonrası silinecektir. Çalışmada vereceğiniz yanıtlar tamamen gizli tutulacak olup, sadece araştırmacılar tarafından değerlendirilecek ve bilimsel amaçlarla kullanılacaktır. Ankete katılım gönüllü olup; katılmamaktan ötürü ya da katılımdan vazgeçme sonunda olumsuz hiçbir sonuç olmayacaktır.

Toplamda yalnızca 15 dakikanızı alacak anketi doldurursanız araştırmamıza büyük katkıda bulunmuş olacaksınız.

Çalışmaya yapacağınız değerli katkılar için şimdiden teşekkür ederiz.

Yrd. Doç. Dr. Tuğba Taşkaya Temizel (ttemizel@metu.edu.tr)
Bilgehan Kürşad Öz (b.kursad.oz@gmail.com)

Dear All,
This is a call for participation in an online survey (in Turkish only)
Kind regards

Gönüllü Katılım Formu'nu okudum ve kabul ediyorum.

A) Mekan Kategorisi Sıralama

Aşağıdaki kategorileri sizin için önemine ve bulunma sıklığınıza göre sıralayarak seçiniz.

1. Birinci öncelikli kategoriyi seçiniz.

- (•) Sanat & Eğlence
- ( ) Üniversite
- ( ) Yemek
- ( ) Mesleki & Diğer Yerler
- ( ) Gece Hayatı
- ( ) Mesken
- ( ) Açık Hava
- ( ) Mağaza & Hizmet
- ( ) Seyahat & Ulaşım

2. İkinci öncelikli kategoriyi seçiniz.

- ( ) Sanat & Eğlence
- ( ) Üniversite
- ( ) Yemek
- ( ) Mesleki & Diğer Yerler
- ( ) Gece Hayatı
- ( ) Mesken
- ( ) Açık Hava
- ( ) Mağaza & Hizmet
- ( ) Seyahat & Ulaşım

3. Sizin için en önemsiz kategoriyi seçiniz.

- ( ) Sanat & Eğlence
- (•) Üniversite
- ( ) Yemek

- Mesleki & Diğer Yerler
- Gece Hayatı
- Açık Hava
- Mağaza & Hizmet
- Seyahat & Ulaşım

B) Mekan Belirtme

Aşağıda verilen kategorilerde EN ÇOK tercih ettiğiniz mekanların adlarını belirtiniz.

4. [Q1] için tercih ettiğiniz en iyi mekanı belirtiniz.
5. (Varsa) [Q1] için tercih ettiğiniz en iyi ikinci mekanı belirtiniz.
6. [Q2] için tercih ettiğiniz en iyi mekanı belirtiniz.
7. (Varsa) [Q2] için tercih ettiğiniz en iyi ikinci mekanı belirtiniz.
8. [Q3] için tercih ettiğiniz en iyi mekanı belirtiniz.
9. (Varsa) [Q3] için tercih ettiğiniz en iyi ikinci mekanı belirtiniz.

C) Mekan Hakkında Duygu ve Düşünceler

Belirttiğiniz mekanlar için aşağıda verilen ifadelerle ilgili size en uygun seçeneği işaretleyiniz.

	Hiç Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Tamamen Katılıyorum
Bu mekan yapmak istediğim iş için en iyi yerdir.					
Bu mekanın benim bir parçam olduğunu hissediyorum.					
Başka hiçbir mekan burası ile karşılaştırılamaz.					
Bu mekan benim için çok özel.					
Diğer yerlere kıyasla en çok buraya gelmekten tatmin oluyorum.					
Bu mekanla kendimi çok kuvvetli bir şekilde özdeşleştiriyorum.					
Yaptığım işi burada yapmak, başka bir yerde yapmaktan daha önemli geliyor.					
Bu mekana çok bağlıyım.					
Bu mekanda yaptığım işler için başka hiçbir alanı buranın yerine kullanmam.					
Bu mekana gelmek, kim olduğumun önemli bir göstergesi.					
Bu mekanda yaptığım işleri, benzer bir yerde yapmaktan da hoşlanırım.					
Bu mekanın benim için anlamı büyük.					

10. [Q4] için size en uygun seçeneği işaretleyiniz.

Bu mekanı ihtiyaçlarımı karşıladığından dolayı tercih ediyorum.	○	○	○	○	○
Bu mekan hayatımı kolaylaştırmaktadır.	○	○	○	○	○
Yaptığım iş için bu mekan elverişlidir.	○	○	○	○	○

11. [Q6] için size en uygun seçeneği işaretleyiniz.

12. [Q8] için size en uygun seçeneği işaretleyiniz.

13. Kategoriler için birden fazla mekan belirtmişseniz bu mekanlar için de "Mekan Hakkında Duygu ve Düşünceler" aşamasına ait sorulara cevap verebilirsiniz.

Bu bölüme devam ederek sorulara cevap vermek istiyorsanız "Evet" seçeneğini, soruları atlamak istiyorsanız "Hayır" seçeneğini işaretleyiniz.

○ Evet ○ Hayır

14. (İsteğe Bağlı) Belirttiyseniz [q1] için en çok tercih ettiğiniz ikinci mekan için size en uygun seçeneği işaretleyiniz. Mekan belirtmediyseniz lütfen 'İleri'yi seçerek bir sonraki soruya geçiniz.

[Q5]

15. (İsteğe Bağlı) Belirttiyseniz [q2] için en çok tercih ettiğiniz ikinci mekan için size en uygun seçeneği işaretleyiniz. Mekan belirtmediyseniz lütfen 'İleri'yi seçerek bir sonraki soruya geçiniz.

[Q7]

16. (İsteğe Bağlı) Belirttiyseniz [q3] için en çok tercih ettiğiniz ikinci mekan için size en uygun seçeneği işaretleyiniz. Mekan belirtmediyseniz lütfen 'İleri'yi seçerek bir sonraki soruya geçiniz.

[Q9]

D) Mekan Bilgileri

Mekan belirtme aşamasındaki kategoriler için tercih ettiğiniz mekanı düşünerek aşağıda verilen ifadelerle ilgili size en uygun seçeneği işaretleyiniz ya da ilgili kutuları doldurunuz.

17. [Q4] mekanına olan aşinalığınızı değerlendiriniz.

Hiç Aşina Değilim	Biraz Aşinayım	Aşina Sayılırım	Oldukça Aşinayım	Tamamen Aşinayım
○	○	○	○	○

18. [Q4] sizin için özel bir yer mi?

○ Evet ○ Hayır

19. Evinize yakın mı?

○ Evet ○ Hayır

20. İş yerinize yakın mı?

Evet Hayır

21. [Q6] mekanına olan aşinalığınızı değerlendiriniz.

Hiç Aşina Değilim	Biraz Aşinayım	Aşina Sayılırım	Oldukça Aşinayım	Tamamen Aşinayım

22. [Q6] sizin için özel bir yer mi?

Evet Hayır

23. Evinize yakın mı?

Evet Hayır

24. İş yerinize yakın mı?

Evet Hayır

25. [Q8] mekanına olan aşinalığınızı değerlendiriniz.

Hiç Aşina Değilim	Biraz Aşinayım	Aşina Sayılırım	Oldukça Aşinayım	Tamamen Aşinayım

26. [Q8] sizin için özel bir yer mi?

Evet Hayır

27. Evinize yakın mı?

Evet Hayır

28. İş yerinize yakın mı?

Evet Hayır

E) Foursquare Kullanımı

Bu bölümde Foursquare uygulaması kullanımınıza yönelik genel sorular yer almaktadır. Size en uygun seçeneği işaretleyiniz.

29. Foursquare uygulamasına ne sıklıkla giriyorsunuz?

Hiç	Yılda birkaç kez	Ayda birkaç kez	Haftada birkaç kez	Haftada birçok kez	Her gün

30. Foursquare uygulamasında ne sıklıkla yer bildirimi yapıyorsunuz?

Hiç	Yılda birkaç kez	Ayda birkaç kez	Haftada birkaç kez	Haftada birçok kez	Her gün

31. Foursquare kullanım sıklığınızla ilgili size en uygun olan seçeneği işaretleyiniz.

	Hiç Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Tamamen Katılıyorum
Özel günlerde kullanma sıklığım artar.					
Tatillerde kullanma sıklığım artar.					
Arkadaşlarımla beraberken kullanma sıklığım artar.					

	Hiç Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Tamamen Katılıyorum
Ailemle beraberken kullanma sıklığım artar.					
Yeni mekanlarda kullanma sıklığım artar.					
Benim için özel anlam ifade eden mekanlarda kullanma sıklığım artar.					

32. Foursquare kullanma amacınız için size en uygun olan seçeneği işaretleyiniz.

	Hiç Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Tamamen Katılıyorum
Kişisel geçmişimi muhafaza etmek için kullanırım.					
Uzakta bulunan tanıdıklarım için paylaşım amacıyla kullanırım.					
Yeni insanlarla tanışmak için kullanırım.					
Arkadaşlarımla karşılaşabilmek için kullanırım.					
Oyun amacıyla kullanırım. (Mayorluk, rozet, puan kazanma)					
Arkadaşlarımın nerede olduğunu görmek amacıyla kullanırım.					
Rutin olarak gitmediğim yerleri bildirmede kullanırım.					
Kalabalık organizasyonlara katıldığımda kullanırım.					
Yeni yerler keşfetmek için kullanırım.					
Benim için özel anlam ifade eden mekanları bildirmede kullanırım.					

F) Kişisel Bilgiler

Bu bölümde sizden bazı kişisel bilgiler istenmektir. Sizin için uygun olan seçeneği işaretleyiniz veya ilgili kutuyu doldurunuz.

33. Cinsiyetiniz nedir?

Erkek Kadın

34. Mesleğiniz nedir?
35. Yaşınız nedir?
36. Medeni durumunuz nedir?
37. Çocuğunuz var mı?

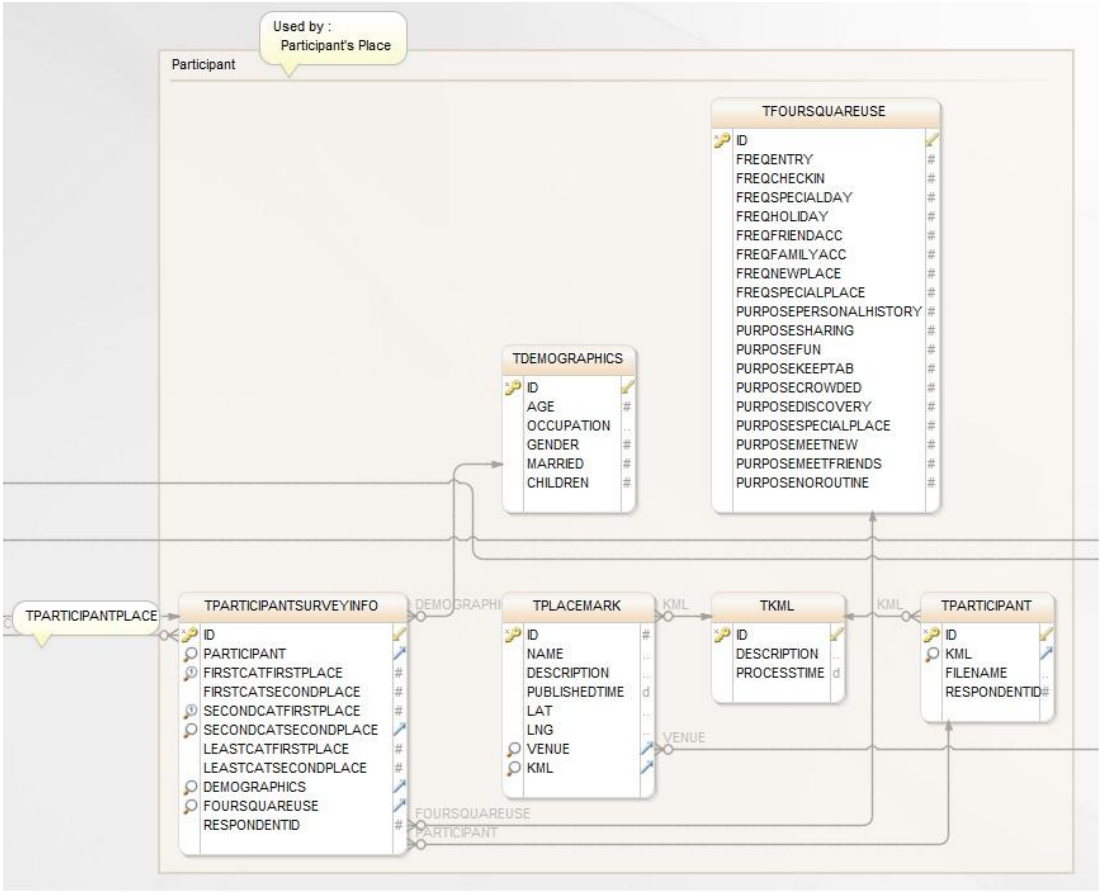
G) Foursquare Yer Bildirimleri

38. KML bağlantı adresinizi giriniz.

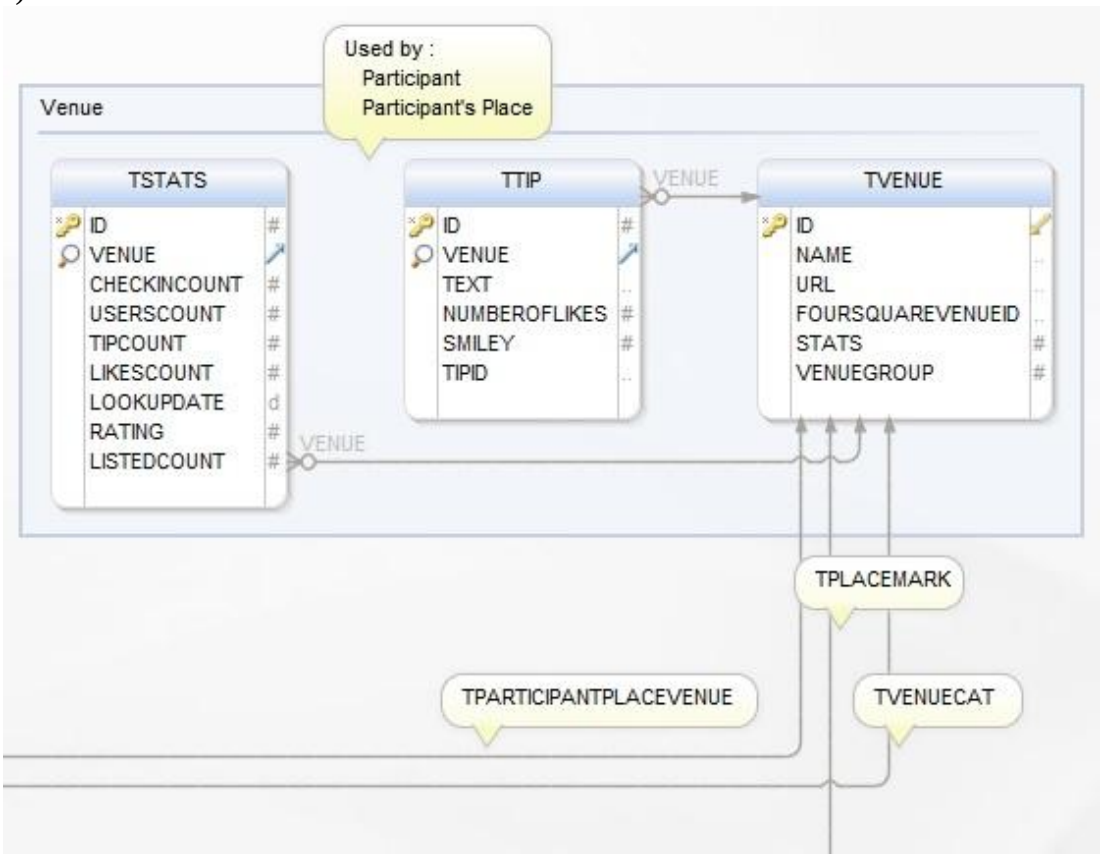
39. Anket ile ilgili belirtmek istediğiniz düşüncelerinizi buraya yazabilirsiniz.
40. İndirim kuponu çekilişine katılmak istiyorsanız sizinle iletişim kurabilmemiz için bir e-posta adresi veya telefon numarası belirtiniz.

Appendix B: Database Entity Relationship Diagram

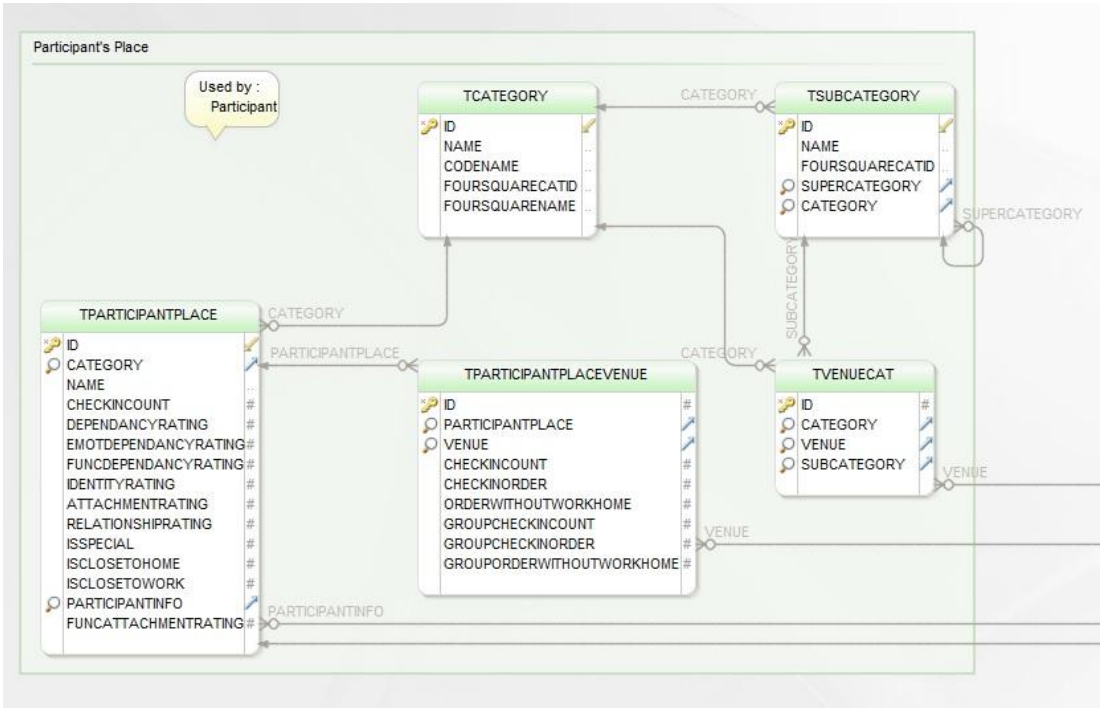
a) Participant related tables



b) Venue related tables



c) Tables related to places specified by participant



Appendix C: Descriptive Statistics

a) Descriptive Statistics for First Category First Place (N=98)

	Min	Max	Mean	SD
Dependence1	1.00	5.00	3.6837	1.21500
Identity1	1.00	5.00	3.6633	1.11174
Dependence2	1.00	5.00	3.1531	1.16080
Identity2	1.00	5.00	3.6837	.94811
Dependence3	1.00	5.00	4.0510	.92360
Identity3	1.00	5.00	3.4490	1.01659
Dependence4	1.00	5.00	3.1633	1.08118
Identity4	1.00	5.00	3.3571	.98703
Dependence5	1.00	5.00	2.9082	1.18484
Identity5	1.00	5.00	3.0000	1.25180
Dependence6	1.00	5.00	3.5510	.95380
Identity6	1.00	5.00	3.6122	1.08059

b) Descriptive Statistics for Second Category First Place (N=98)

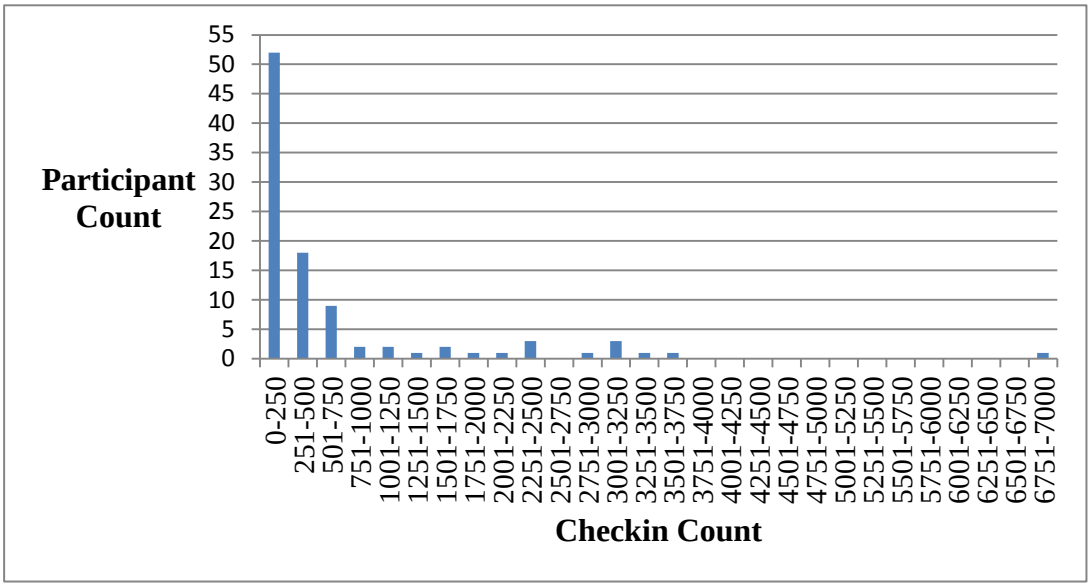
	Min	Max	Mean	SD
Dependence1	1.00	5.00	3.6939	1.04938
Identity1	1.00	5.00	3.3163	1.16298
Dependence2	1.00	5.00	3.0408	1.17463
Identity2	1.00	5.00	3.4286	1.18409
Dependence3	1.00	5.00	3.7755	.97949
Identity3	1.00	5.00	3.1939	1.16352
Dependence4	1.00	5.00	3.2041	1.16618
Identity4	1.00	5.00	3.2653	1.14470
Dependence5	1.00	5.00	2.7143	1.07454
Identity5	1.00	5.00	3.0612	1.29882
Dependence6	1.00	5.00	3.6020	.97113
Identity6	1.00	5.00	3.3980	1.18182

c) Descriptive Statistics for Third Category First Place (N=98)

	Min	**Max**	**Mean**	**SD**
Dependence1	1.00	5.00	3.6020	1.17306
Identity1	1.00	5.00	2.9490	1.22997
Dependence2	1.00	5.00	2.8571	1.17535
Identity2	1.00	5.00	2.9184	1.21565
Dependence3	1.00	5.00	3.3571	1.15990
Identity3	1.00	5.00	2.8469	1.23816
Dependence4	1.00	5.00	2.9082	1.14951
Identity4	1.00	5.00	2.7959	1.16618
Dependence5	1.00	5.00	2.6633	1.08356
Identity5	1.00	5.00	2.5408	1.21984
Dependence6	1.00	5.00	3.3878	1.00137
Identity6	1.00	5.00	2.8367	1.19874

d) Checkin frequency

When we group into 250 checkin segments, the distribution is as follows.

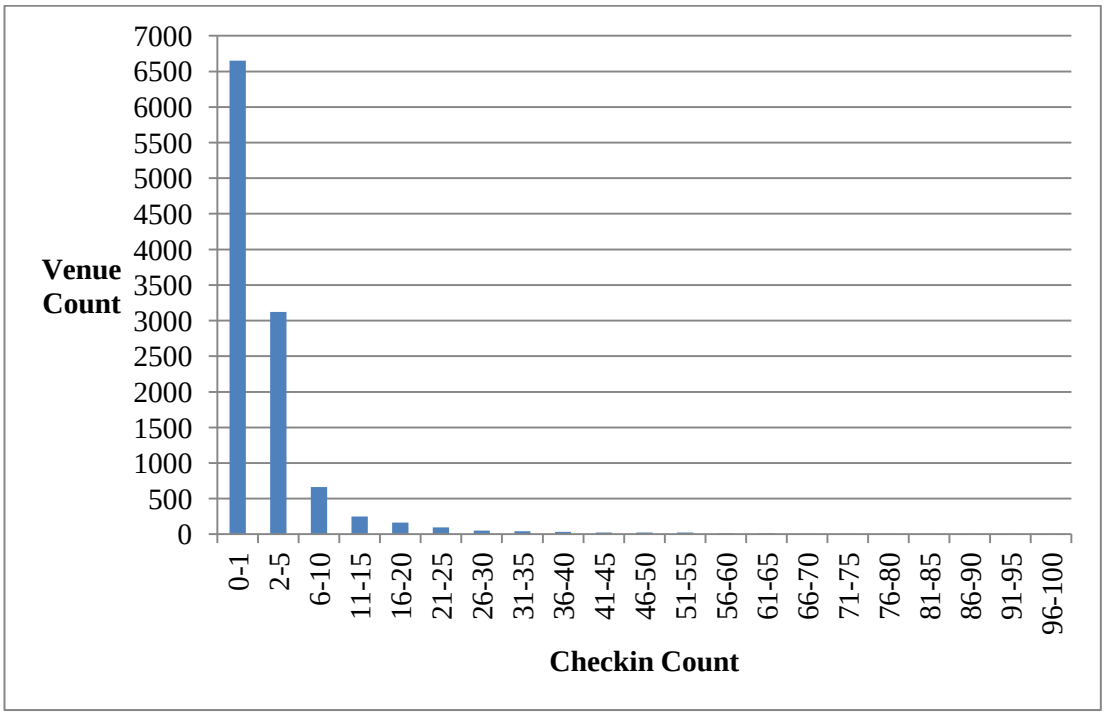


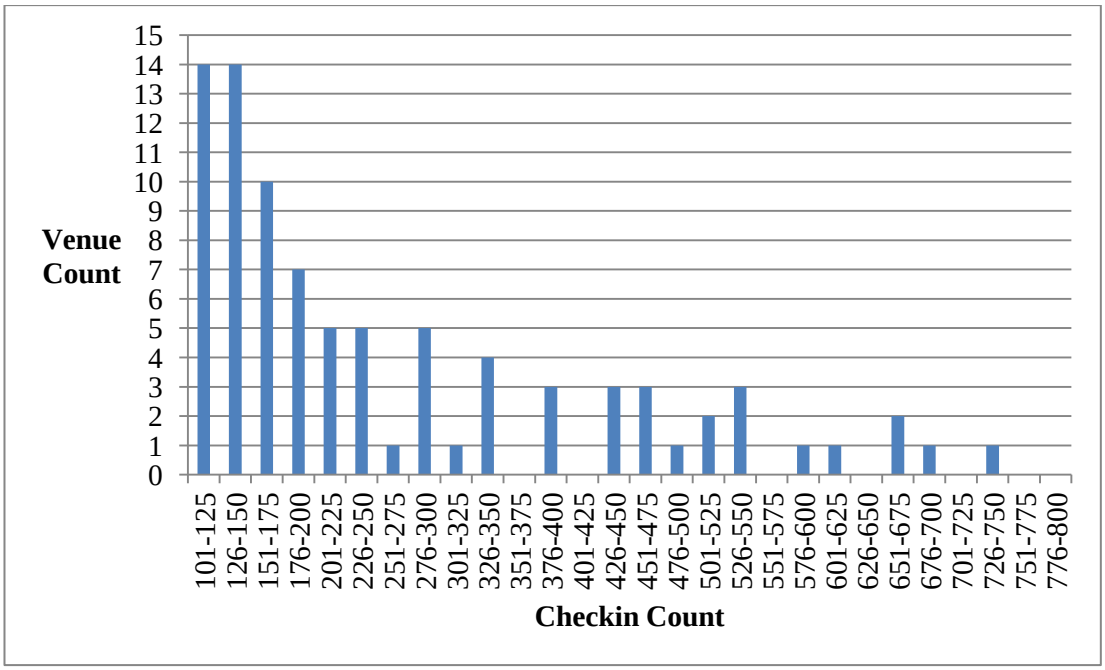
Checkin Range	Frequency	Checkin Range (continued)	Frequency (continued)
0-250	52	3501-3750	1
251-500	18	3751-4000	0
501-750	9	4001-4250	0
751-1000	2	4251-4500	0
1001-1250	2	4501-4750	0
1251-1500	1	4751-5000	0
1501-1750	2	5001-5250	0
1751-2000	1	5251-5500	0
2001-2250	1	5501-5750	0
2251-2500	3	5751-6000	0
2501-2750	0	6001-6250	0
2751-3000	1	6251-6500	0
3001-3250	3	6501-6750	0
3251-3500	1	6751-7000	1
3501-3750	1		
		Total	98

The frequency shows a decreasing pattern until the 1500 checkin mark. From there on, we can say that the participants for each segment is low in numbers and do not show any kind of pattern.

e) Venue count per checkin

Following figures show venue count distribution until 100 checkins with groups of 5 checkins and venue count distribution between 100 checkins and 800 checkins with groups of 25 checkins.



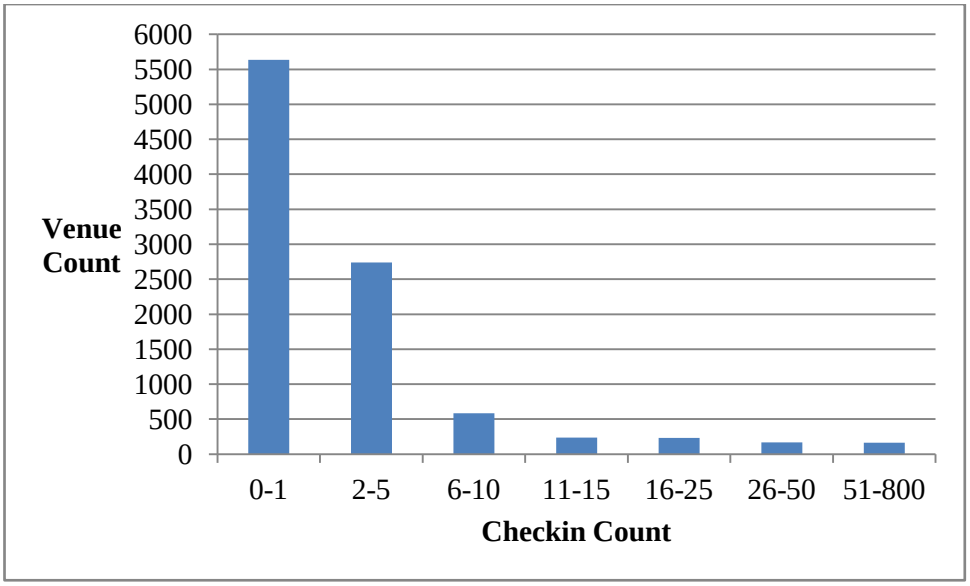


The venue count distribution tables after grouping with venue names are as follows.

Checkin Range	Frequency	Checkin Range (continued)	Frequency (continued)
0-1	5805	51-55	20
2-5	2841	56-60	11
6-10	604	61-65	14
11-15	244	66-70	5
16-20	156	71-75	9
21-25	89	76-80	8
26-30	59	81-85	4
31-35	40	86-90	4
36-40	32	91-95	4
41-45	26	96-100	7
46-50	25	101-850	92
		Total	10099

Checkin Range	Frequency	Checkin Range (continued)	Frequency (continued)
0-25	9739	426-450	3
26-50	182	451-475	3
51-75	59	476-500	1
76-100	27	501-525	1
101-125	15	526-550	2
126-150	16	551-575	1
151-175	10	576-600	1
176-200	6	601-625	1
201-225	7	626-650	0
226-250	5	651-675	2
251-275	1	676-700	1
276-300	5	701-725	1
301-325	1	726-750	1
326-350	3	751-775	0
351-375	1	776-800	0
376-400	3	800-850	1
401-425	0		
		Total	10099

The figure below shows the distinct venue counts against checkin count groups.



f) Distinct venue count per participant

Venue Range	Participant Frequency	Venue Range (continued)	Participant Frequency (continued)
1-50	19	751-800	1
51-100	19	801-850	1
101-150	21	851-900	0
151-200	11	901-950	0
201-250	4	951-1000	0
251-300	2	1001-1050	0
301-350	9	1051-1100	0
351-400	0	1101-1150	0
401-450	1	1151-1200	0
451-500	2	1201-1250	0
501-550	0	1251-1300	0
550-600	1	1301-1350	1
601-650	3	1351-1400	0
651-700	2	1401-1450	0
701-750	1	1451-1500	0
		Total	98

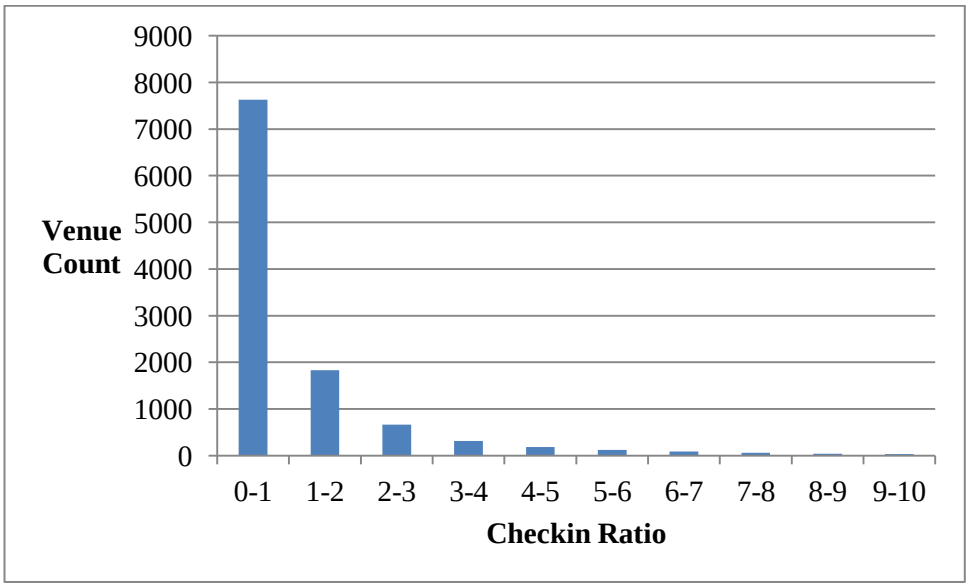
g) Participant checkin ratio per venue

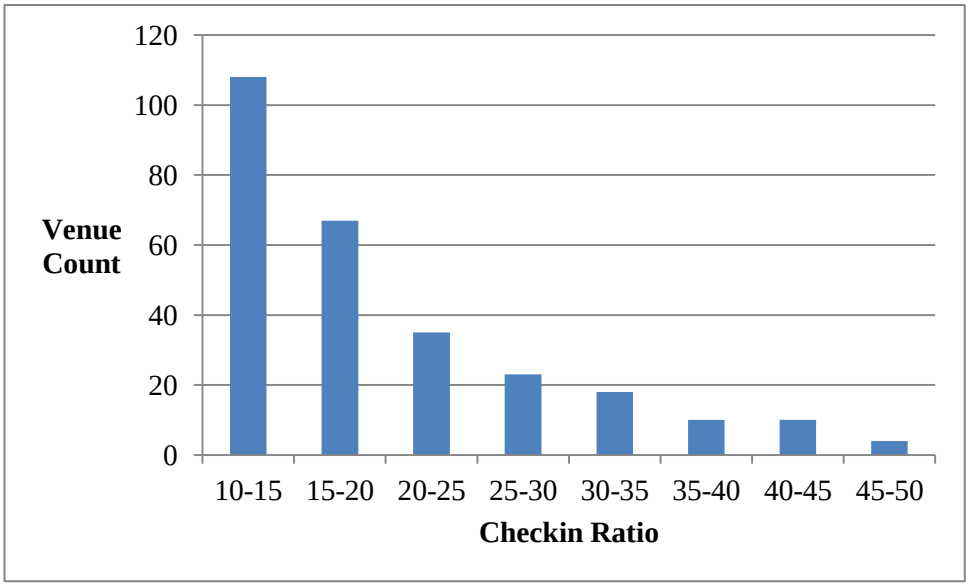
To calculate the participants' checkin ratio for their distinct venues, we divide the checkin count of a participant to the number of distinct venues the participant checked in. The figure is as follows.

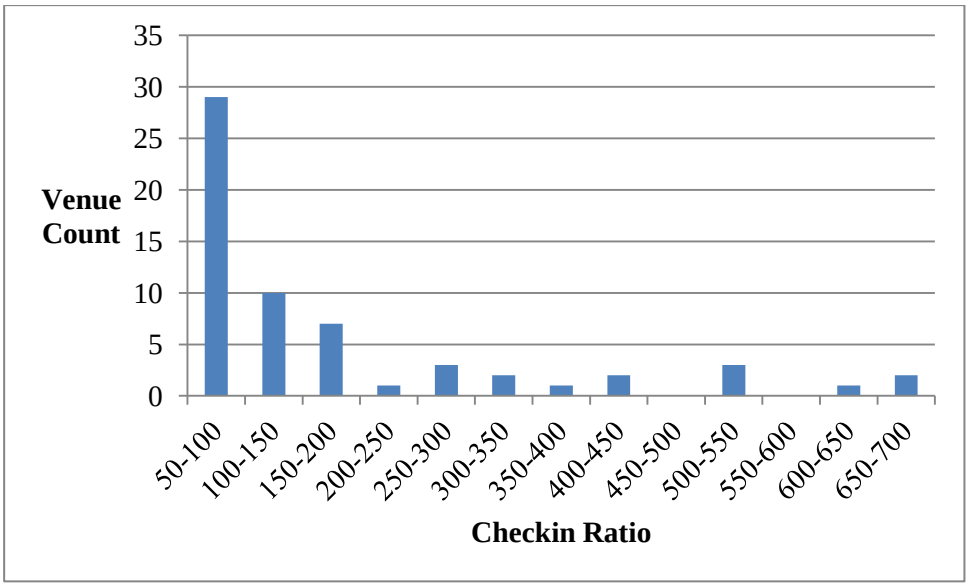
Ratio Range	Frequency
0.0-0.5	0
0.5-1.0	5
1.0-1.5	22
1.5-2.0	28
2.0-2.5	14
2.5-3.0	8
3.0-3.5	4
3.5-4.0	3
4.0-4.5	2
4.5-5.0	6
5.0-5.5	4
5.5-6.0	1
6.0-6.5	0
6.5-7.0	0
7.0-7.5	0
7.5-8.0	0
8.0-8.5	0
8.5-9.0	0
9.0-9.5	1
9.5-10.0	0
Total	98

h) Venue checkin ratio from KML checkins

Checkin ratio of a venue is calculated as the proportion of checkin counts to distinct user counts. The figures below show that higher checkin ratio is seen at fewer venues.

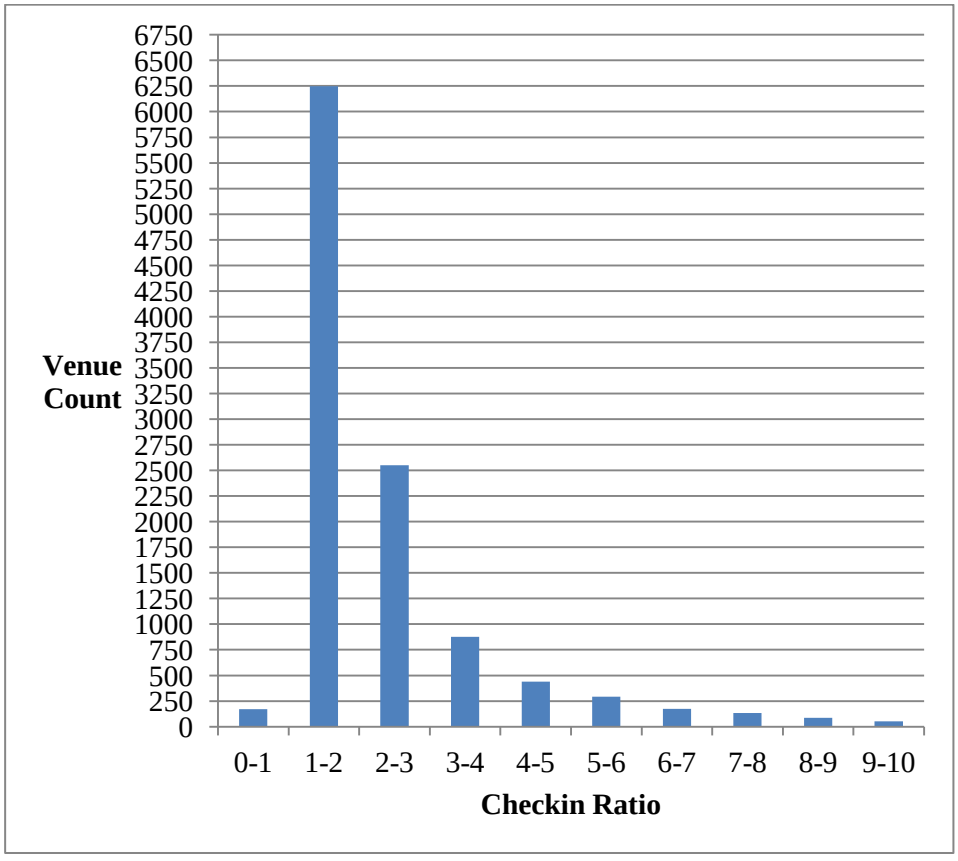


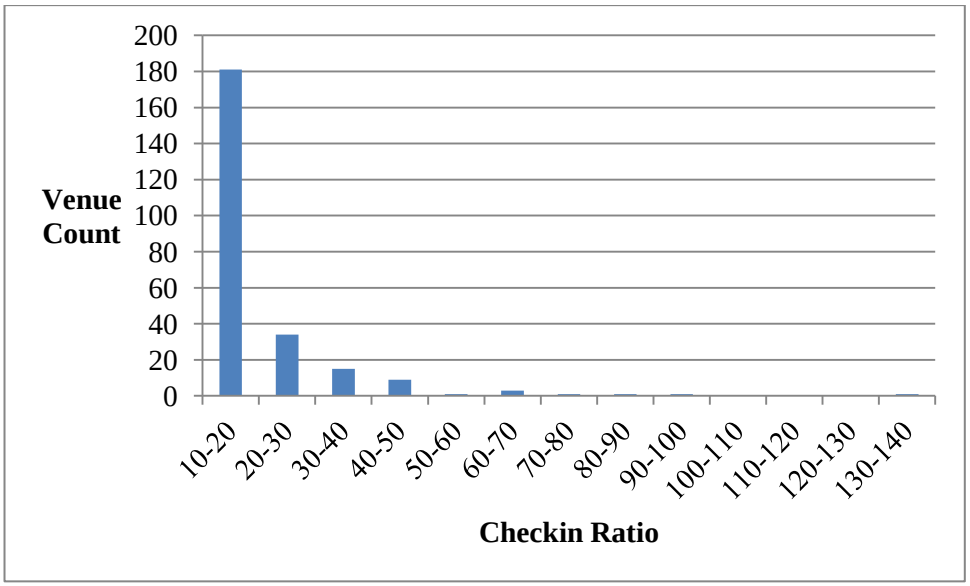




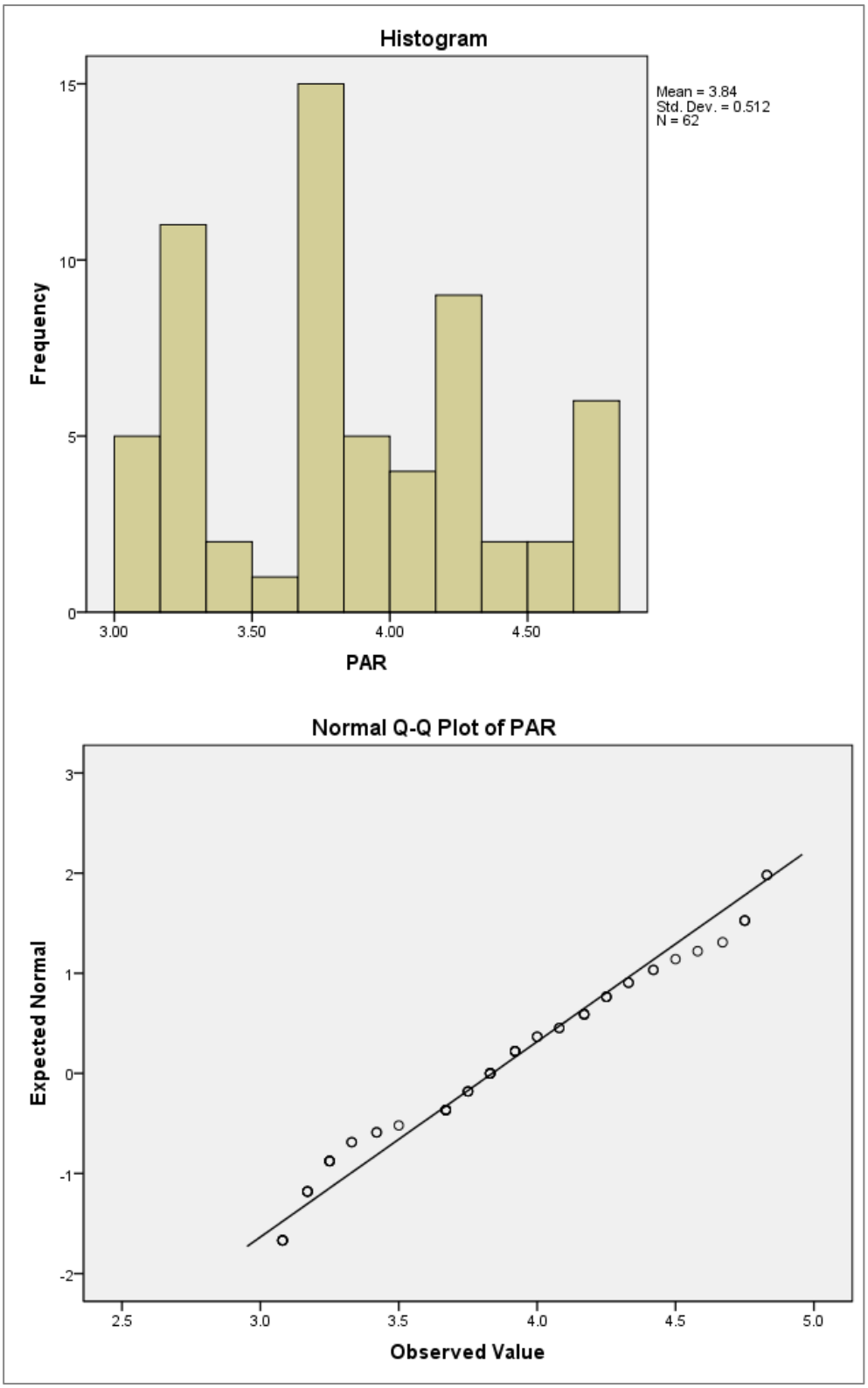
i) Venue checkin ratio from Foursquare statistics (Venue statistics from the API)

We had fetched Foursquare venue statistics from the API to our database. These statistics include checkin count and distinct user count. Their proportion gives us the checkin ratio for Foursquare statistics. We calculate this value as to contrast with our data. As can be seen the two ratios show similar decreasing trend. Fewer venues have more distinct visitors.

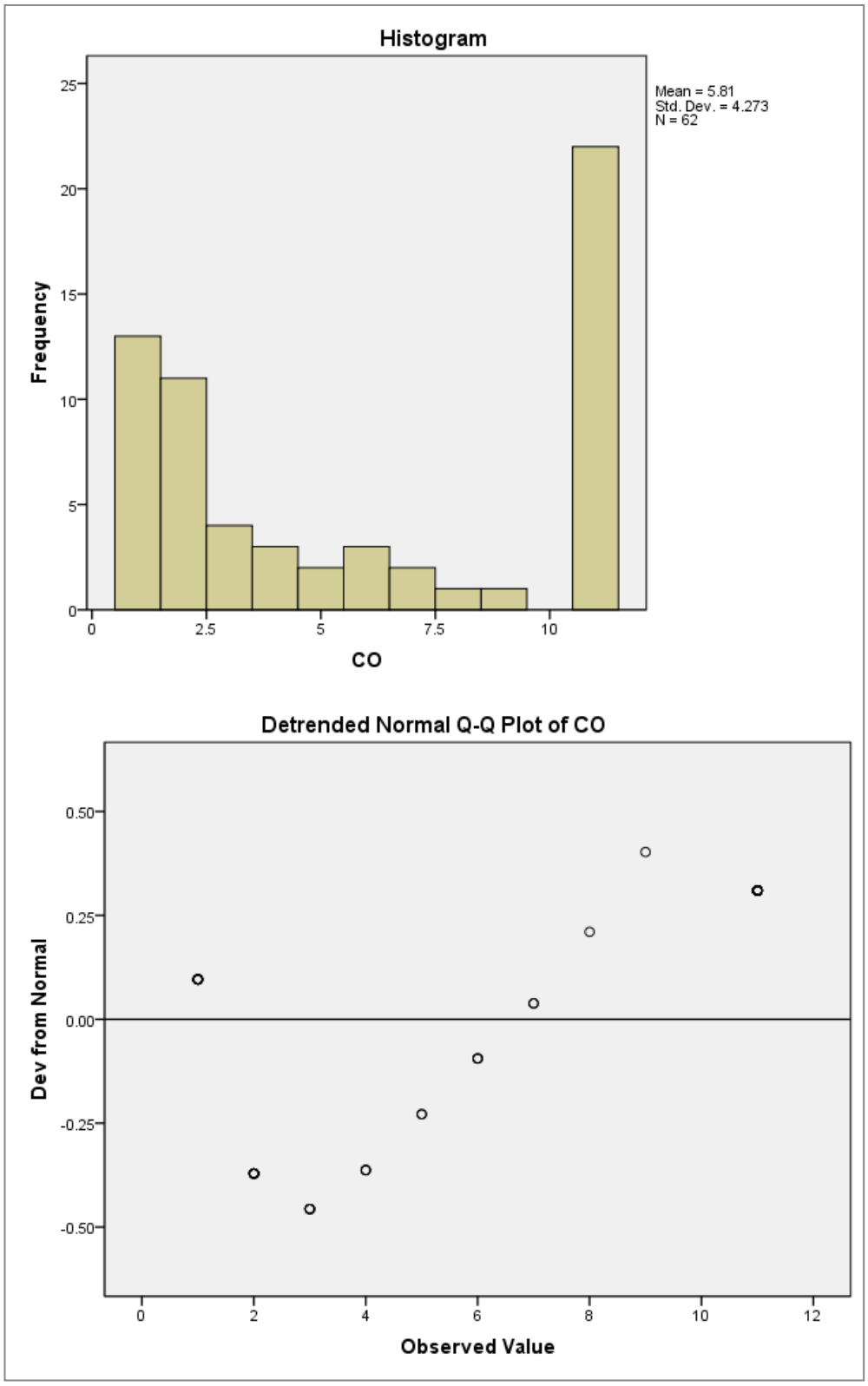



Venue Count
200
180
160
140
120
100
80
60
40
20
0
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-100
100-110
110-120
120-130
130-140
Checkin Ratio

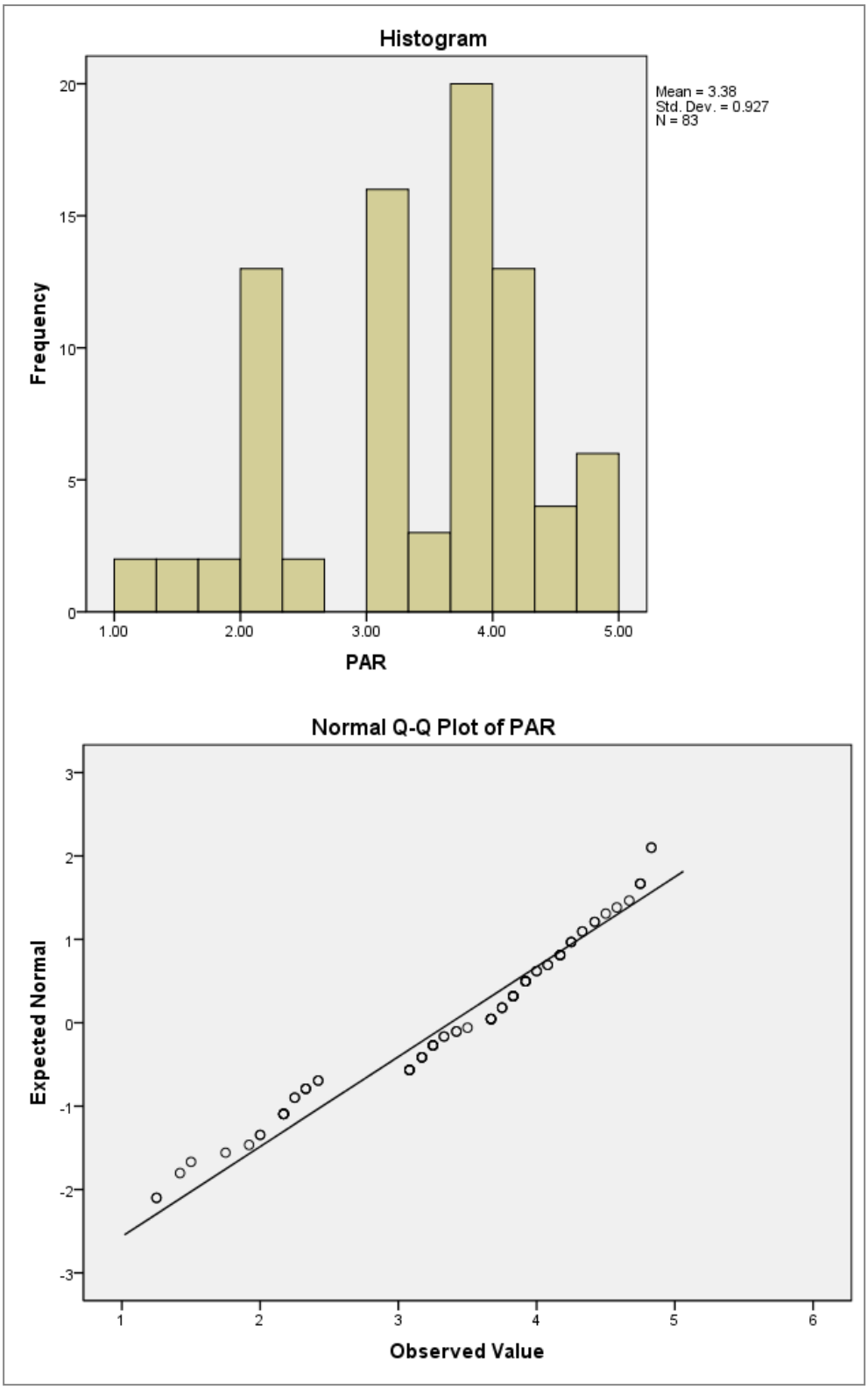
Appendix D: Histogram and Q-Q Plot for Attachment Rating in MSP



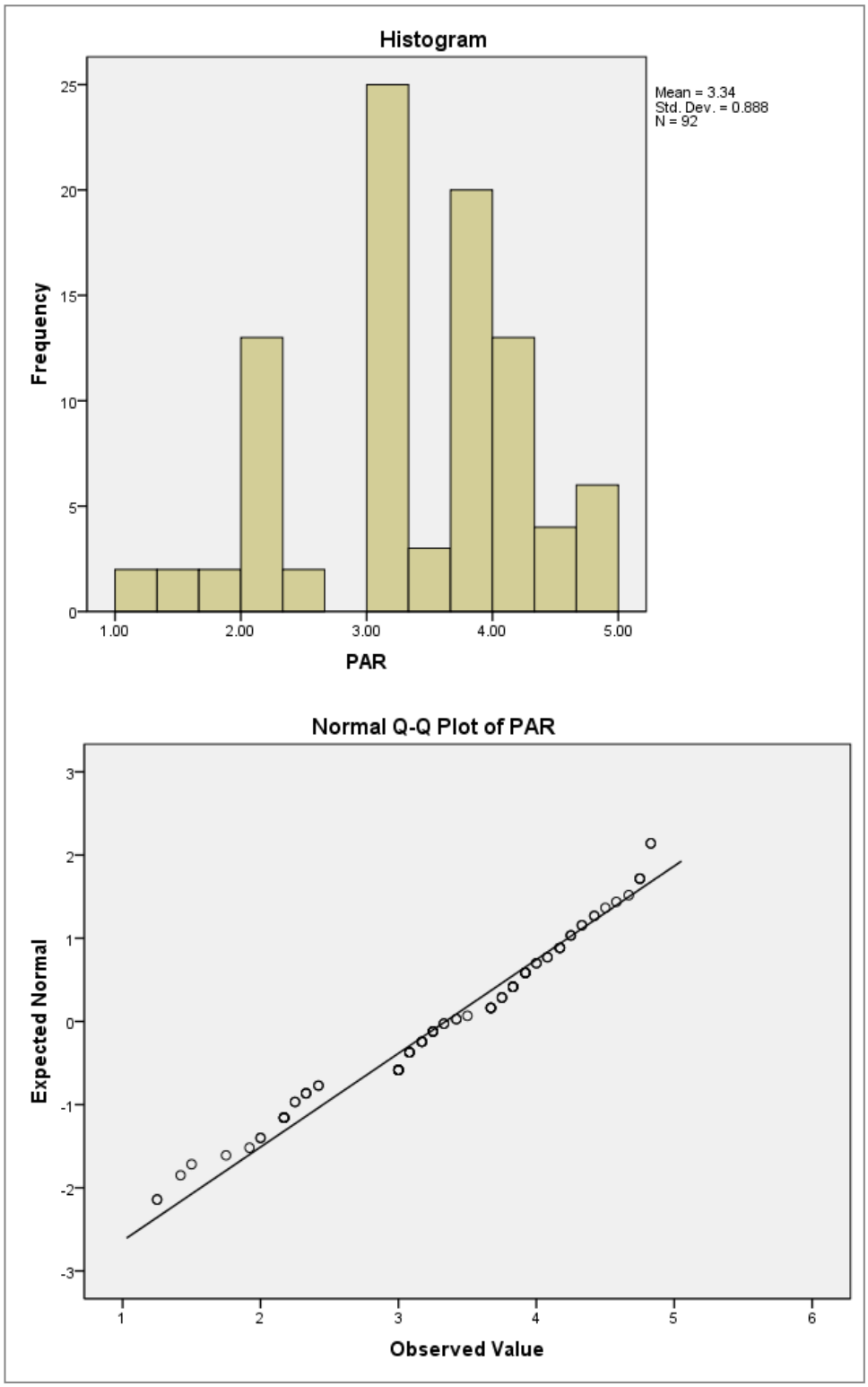
Appendix E: Histogram and Q-Q Plot for Checkin Order in MSP



Appendix F: Histogram and Q-Q Plot for Attachment Rating in MSP and LSP Combined



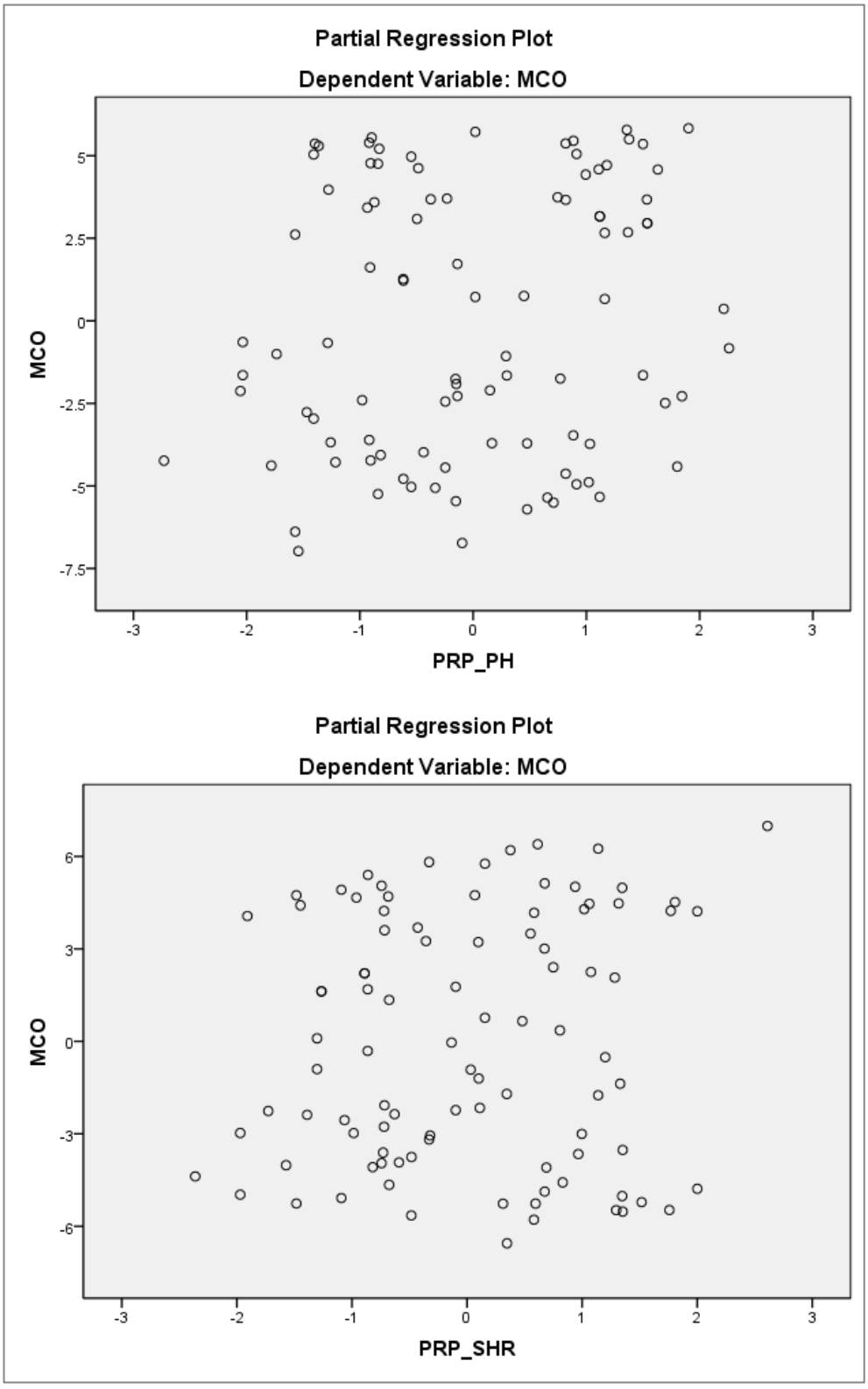
Appendix G: Histogram and Q-Q Plot for Attachment Rating in MSP and LSP Combined with Places with Neutral Attachment Rating

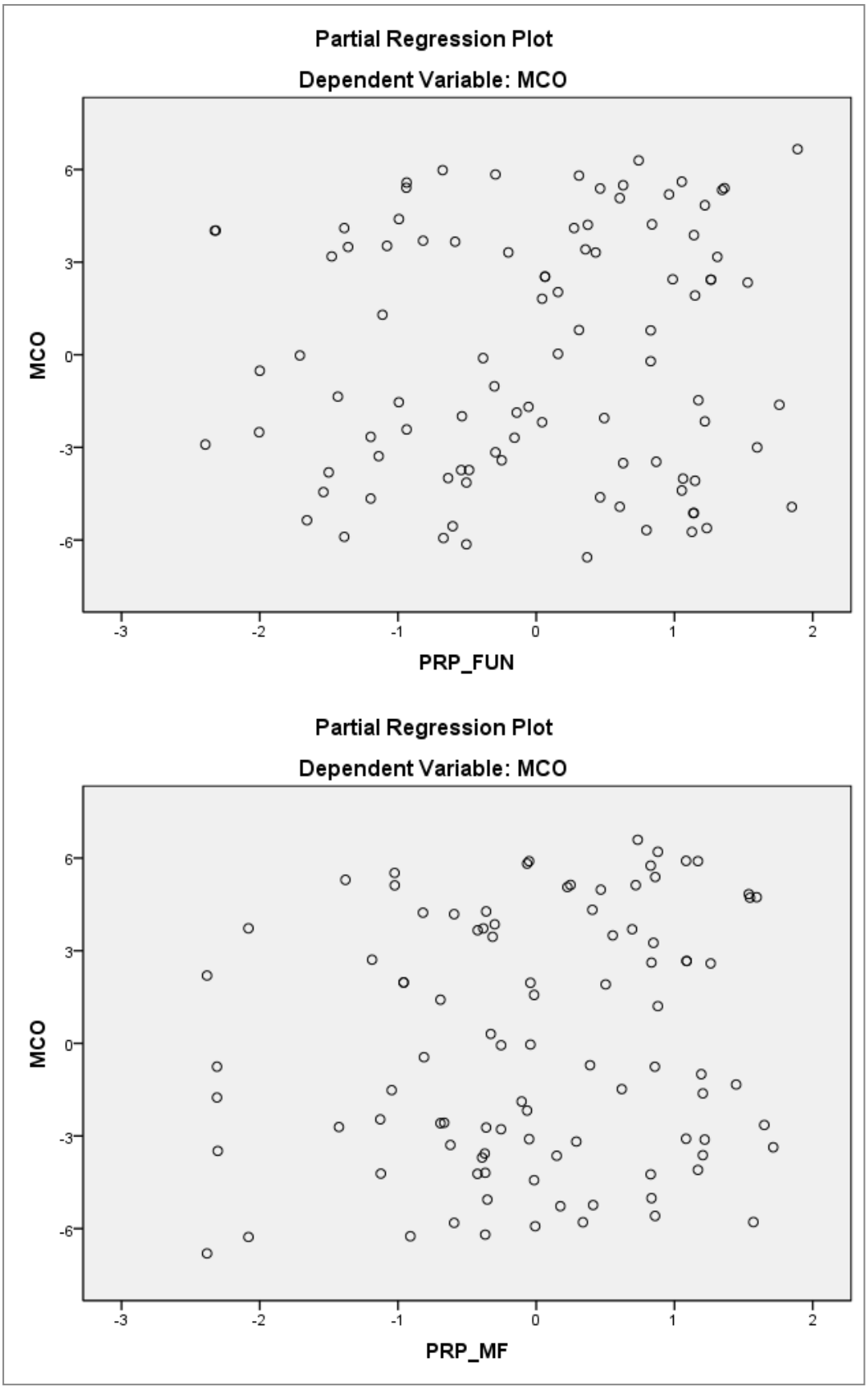


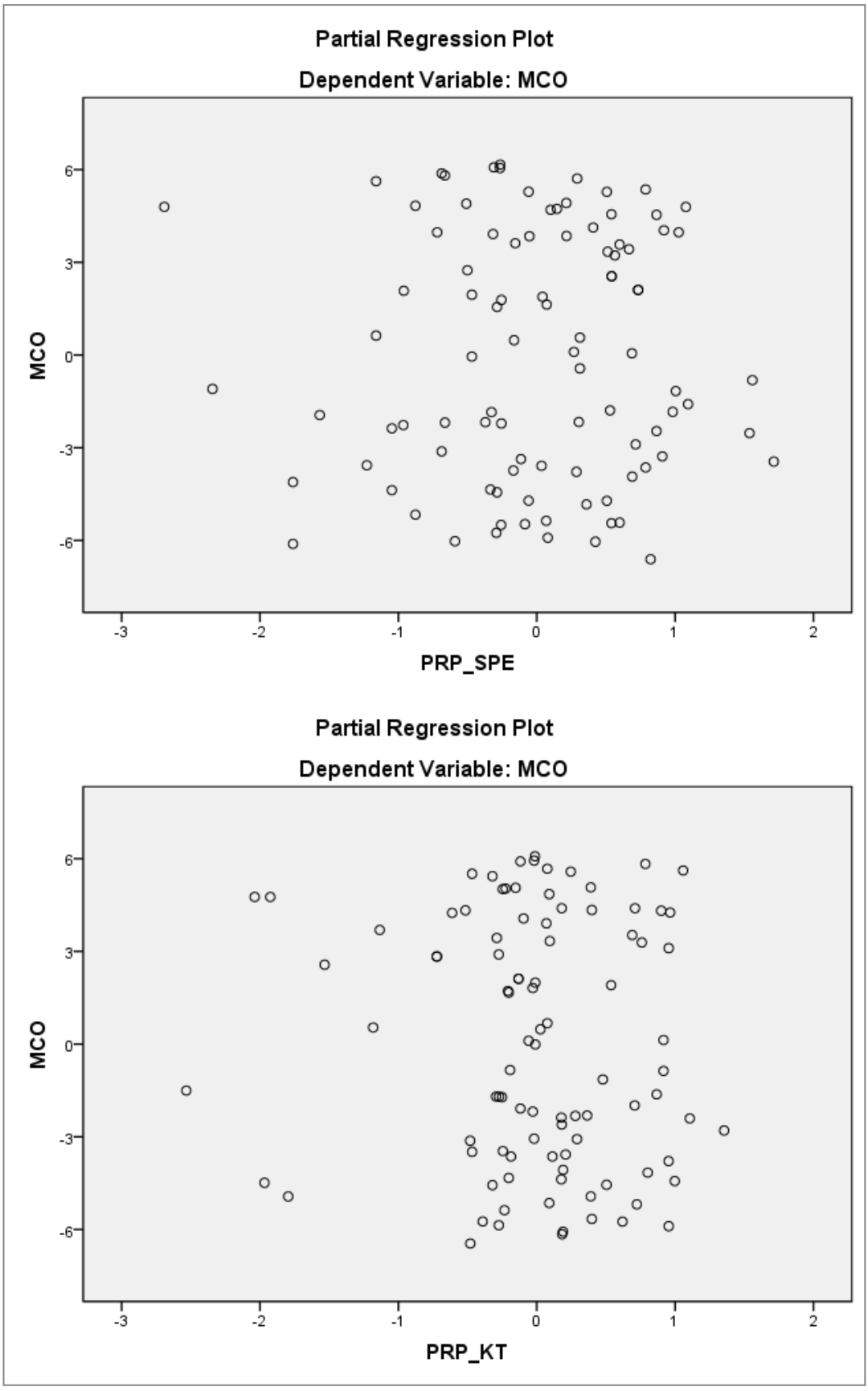
Appendix H: Skewness of Checkins for All Participants

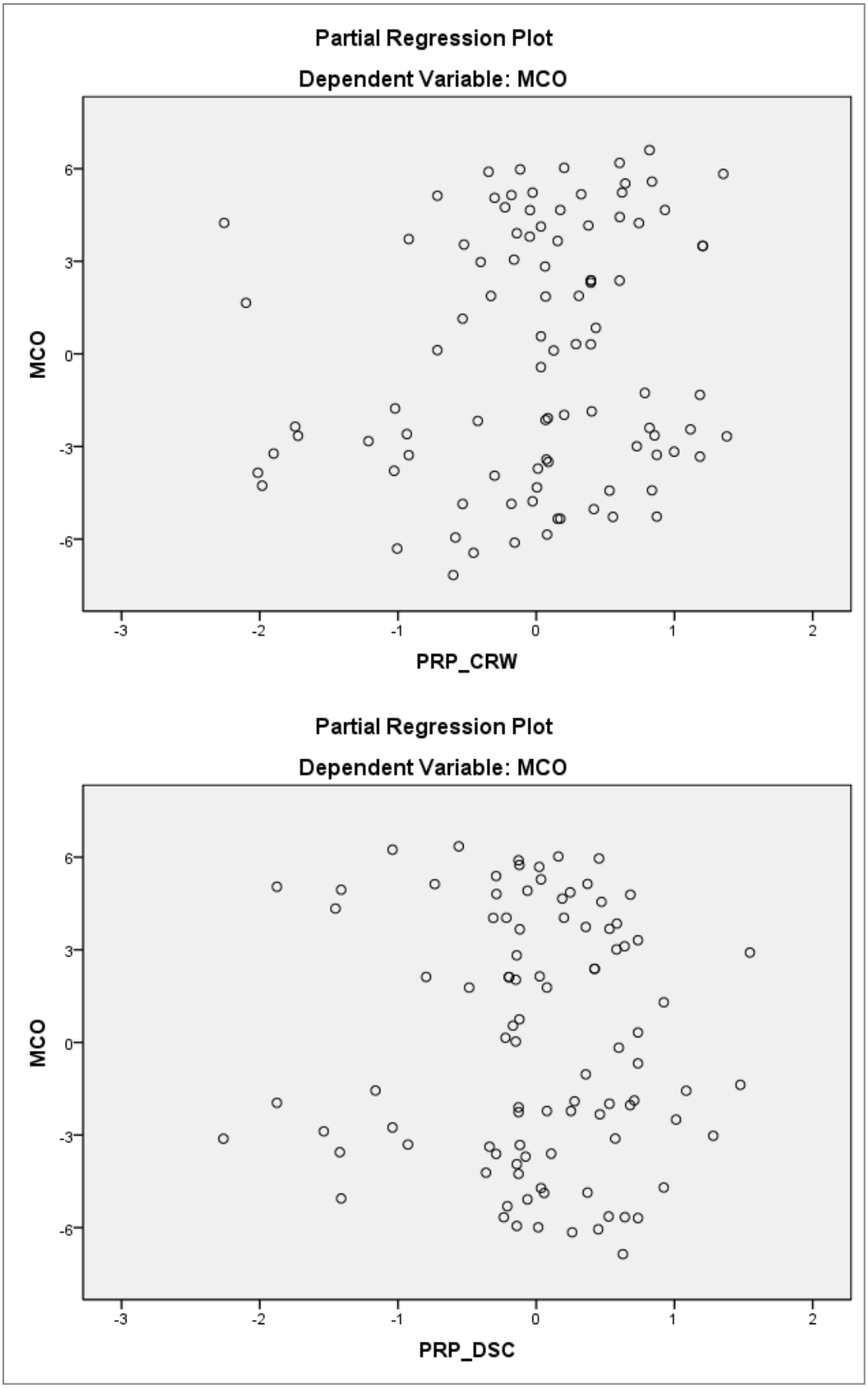
	Skewness	Std Error		Skewness	Std Error		Skewness	Std Error		Skewness	Std Error		Skewness	Std Error
1	2.784	.214	**21**	3.484	.293	**41**	4.591	.195	**61**	9.259	.143	**81**	2.560	.456
2	3.817	.225	**22**	5.929	.182	**42**	4.878	.186	**62**	8.852	.109	**82**	8.651	.188
3	1.176	.580	**23**	6.119	.204	**43**	6.553	.181	**63**	9.383	.136	**83**	5.923	.226
4	3.196	.266	**24**	3.373	.456	**44**	.	.	**64**	6.195	.212	**84**	4.727	.237
5	7.446	.093	**25**	6.501	.225	**45**	3.792	.340	**65**	1.474	.456	**85**	9.524	.236
6	3.018	.249	**26**	4.672	.201	**46**	9.238	.135	**66**	2.305	.254	**86**	7.312	.230
7	.	.	**27**	7.018	.211	**47**	3.483	.330	**67**	19.356	.089	**87**	5.789	.306
8	3.494	.374	**28**	2.208	.403	**48**	.	.	**68**	2.266	.441	**88**	4.851	.194
9	4.917	.195	**29**	12.672	.162	**49**	3.319	.192	**69**	8.917	.101	**89**	3.585	.354
10	14.716	.115	**30**	5.609	.215	**50**	13.456	.166	**70**	.999	.752	**90**	9.445	.230
11	2.827	.327	**31**	8.355	.140	**51**	3.438	.306	**71**	9.657	.136	**91**	5.251	.253
12	5.797	.179	**32**	3.595	.281	**52**	7.244	.311	**72**	4.613	.281	**92**	5.679	.154
13	3.015	.201	**33**	3.295	.202	**53**	5.022	.217	**73**	4.377	.333	**93**	.	.
14	12.169	.067	**34**	3.000	.293	**54**	7.040	.136	**74**	17.491	.134	**94**	3.376	.316
15	5.958	.276	**35**	3.979	.227	**55**	10.335	.135	**75**	1.897	.327	**95**	3.729	.383
16	5.444	.236	**36**	3.825	.229	**56**	12.469	.157	**76**	11.161	.096	**96**	6.029	.203
17	3.163	.200	**37**	1.148	.637	**57**	14.872	.120	**77**	5.832	.293	**97**	9.326	.131
18	4.409	.134	**38**	6.470	.190	**58**	8.635	.150	**78**	16.134	.098	**98**	14.862	.096
19	.	.	**39**	17.370	.094	**59**	4.844	.266	**79**	12.203	.091			
20	5.703	.369	**40**	7.559	.179	**60**	9.630	.084	**80**	2.486	.378			

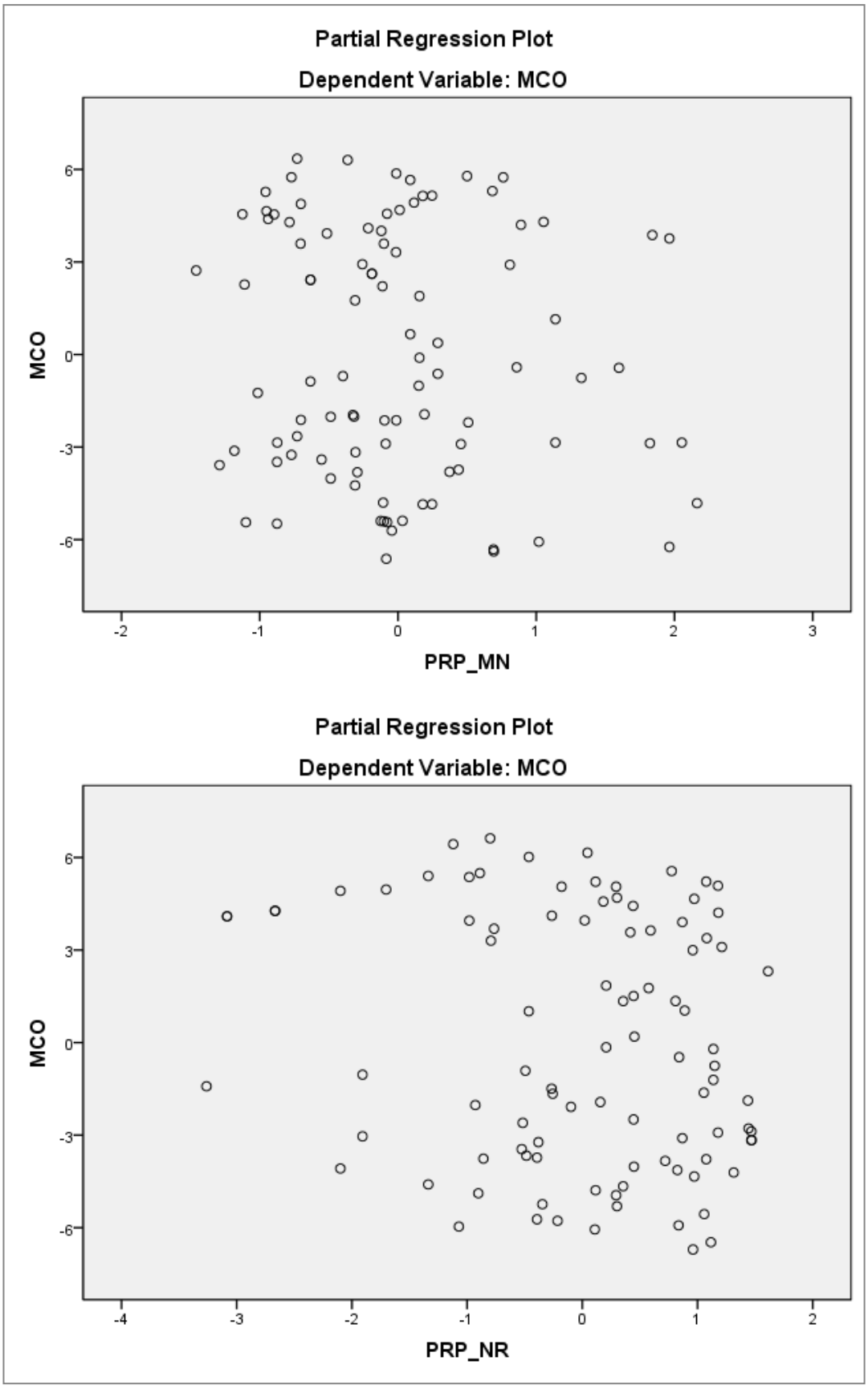
Appendix I: Partial Regression Plots for the Dependent Variables in Hypothesis 4




Partial Regression Plot
Dependent Variable: MCO
MCO
PRP_FUN
Partial Regression Plot
Dependent Variable: MCO
MCO
PRP_MF


Partial Regression Plot
Dependent Variable: MCO
MCO
PRP_SPE
Partial Regression Plot
Dependent Variable: MCO
MCO
PRP_KT


Partial Regression Plot
Dependent Variable: MCO
MCO
PRP_CRW
Partial Regression Plot
Dependent Variable: MCO
MCO
PRP_DSC


Partial Regression Plot
Dependent Variable: MCO
MCO
PRP_MN
Partial Regression Plot
Dependent Variable: MCO
MCO
PRP_NR