

Interpreting Food-Venue Visits: Spatial and Social Contexts of Mobile Consumption in Urban Spaces

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Abstract. The increasing amount of mobility data introduces an opportunity to develop novel urban applications that are integrated with everyday practices. Although simple events (e.g., visits to places) can be inferred from mobility traces, events have very different meanings in different contexts. To contribute to the body of work that aims to uncover effective methods to integrate ubiquitous computing technologies in urban spaces and context, we discuss interpretation of ubiquitous events in urban computing: food-venue visits. Based on a survey and a small supplemental study, we identify the spatial and social contexts that influence the meanings of food-venue visits. We also suggest a possibility of novel technological support for eating out.

Keywords: Eating out · Food · Consumption · Urban context

1 Introduction

There is an increasing amount of mobility data captured and accumulated by using GPS, WiFi access points, cell-towers, video cameras, laser range scanners, embedded sensors, foursquare check-ins, etc. It is of interest to many people to identify visits to places based on mobility data because a visit to a venue can signify some meaning, and be useful for providing context-aware services. Also, collective patterns of visits can be visualized to interpret the state of the city. However, it is not always easy to interpret venue-visit data as their meaning depends on contexts. This makes it difficult to fully exploit the data in urban applications.

Food consumption is a pervasive activity in urban spaces, and it would be extremely useful for service providers and consumers to understand (or automatically infer) its patterns, meanings and contexts. For example, such understanding can be used to build effective recommender systems for food venues. Therefore, we have studied the spatial and social contexts that influence the meanings of food-venue visits in Japan.

Japan, as a site for investigating food-venue visits, can be characterized by many different types of food venues clustered in urban spaces, as well as the large amount of information about food venues available in print, broadcast, outdoor and digital media. Urban sociology researchers selected the country as a non-Western context for comparative studies of consumption, with Western countries (e.g., [4]). More than 66% of the country's population live in cities, and Tokyo, in particular, has a very large number of food venues as shown in Fig. 1 [22].

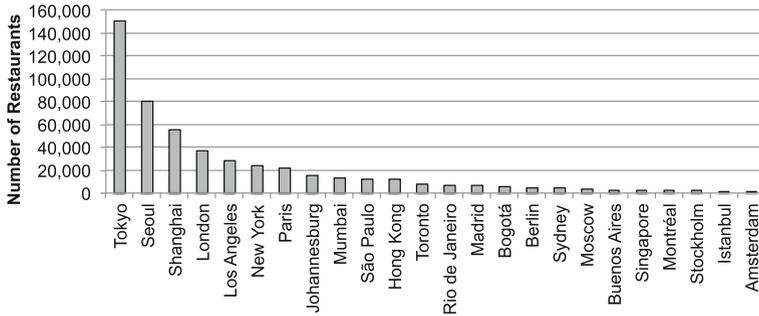


Fig. 1. Number of restaurants in cities

Based on a survey and a small supplemental study, we identify and discuss spatial and social contexts of food venue visits. The discussions also suggest a possibility of some technological support for eating out.

2 Related Works

2.1 Mobile Tourist Guides and Recommenders

Many mobile applications have been developed to support consumption-centric activities such as tours [8]. The earliest examples include Cyberguide [1], and GUIDE [3] for city visitors. More recently, a mobile recommender system has been proposed to infer user preferences to recommend nearby points of interest (POIs) [2]. Paay et al. discuss a design approach for context-aware urban guides by combining rapid ethnography, architectural analysis, design sketching, and paper prototyping, without a particular focus on urban consumption or eating out [13].

Although there are many commercial applications that suggest food venues to mobile users [6, 7, 14, 18, 23, 24], there is relative scarcity of research systems that focus on food venues. An interesting example is the experimental system by Lee et al., which recommends restaurants based on users' location, demographic data and environmental information such as weather and temperature [12]. However, this system does not consider social contexts.

2.2 Mobility and Context

Context awareness is a popular feature of many mobile applications. To support urban activities effectively, we need to rethink mobility and context, going beyond a clean model of geometric spaces. In contrast to common approaches to context-aware urban applications that focus on cities as generic settings for “mobile users,” Williams and Dourish discuss an approach that views cities as products of social practices [21].

Interpreting urban mobility data, including food venue visits, is closely related to an alternative view of context that consider dynamic and interactional aspects [5]. This notion of context could be applied to food venue visits to examine their contexts in depth.

Ethnographic participant observation has been carried out to analyze microscopic aspects of mobile contexts based on an ethnomethodological approach [17]. We focus on a more macroscopic aspects related to food venues in particular.

3 Food Consumption in Urban Spaces

Consumption plays an important role in everyday lives of urbanites [4]. One of the pervasive consumption activities in urban spaces is eating out.

The practice of eating out has been studied in depth by sociologists [20]. Some of their findings can be useful for interpreting food venue visits. First, different food venues attract different types of people. For example, social class and gender as well as life styles can influence the choice of food venues. Second, people have different attitudes towards eating out. For example, some people are interested in learning and enjoy trying out new food. Other people like to stick to the food that they know they like. Third, there are different reasons to eat out, besides the necessity to fill one’s stomach. People may do it to socialize, celebrate, relax, or trying out something new; or because of social obligation.

Moreover, the act of eating out can be understood in terms of its symbolic significance, or *sign value*, as well. Having a cup of coffee at a trendy cafe could be a form of expression through food consumption, and the coffee may not necessarily taste good.

4 Venue Visits in Context: A Survey

We have conducted a survey to understand patterns and contexts of food-venue visits in Japan using a crowdsourcing service called Lancers [10].

4.1 Method

Crowdsourcing such as Mechanical Turnk [9] has been used for running user studies. Lancers [10] is the largest crowdsourcing service in Japan (and in Japanese), which has 279 thousand registered users as of March 2014. Unlike Mechanical

Turk, almost all (>99%) workers on Lancers live in Japan [11]. It supports microtasking as well as other forms of crowdsourcing, and more than 70% of the workers live outside Tokyo [11].

We developed survey questions that asked about food-venue visits. After testing and revising survey questions, we obtained a permission from our institutional review board. A microtask request was then posted on Lancers, which is linked to a corresponding online survey form on SurveyMonkey [16]. Filling out the survey form takes approximately 5 min with the payment of 50 Japanese Yen (i.e., about 50 US Cents). Workers had to be adults (≥ 20 years old) and answer the survey no more than once.

Figure 2 shows the overview of the survey questions¹.

1. Age, gender, and occupation.
2. How many times a week do you eat out on average?
3. When you eat out with other people, do you think you have discretion over the choice of the venue? Provide answers for different group sizes: 2, 3-4, 5-10, and more than 10.
4. During the last 7 days, did you compromise when eating out? (e.g., went to an undesirable venue just to be sociable; went to a nearby venue because the lunch break was short; went to a different venue because the preferred venue was crowded.) If your answer is yes, how many times did you compromise and what are the reasons for compromising.
5. Do you have a favorite venue? How many times do you use the favorite venue? Do you want to tell your acquaintances and friends having a similar taste as you about the favorite venue? Do you want to know about venues whose food taste and ambience are similar to the favorite venue?
6. Do you want to use a service or a system that automatically recommends venues based on the records of usage and activity?
7. Do you use information from words-of-mouth communication websites when using a venue that you have never used before? If your answer is yes, how much do you use words-of-mouth communication websites? If your answer is no, provide the reason for not using.

Fig. 2. Overview of survey questions

4.2 Findings

After filtering out invalid responses, we analyzed responses from 193 people, 130 (67%) of which are female and 63 (33%) male. Figure 3 shows distributions of respondents by age groups, occupations and the numbers of times to eat out in a week. Similarly to what has been reported about the demographics of Mechanical Turk [15], there are more female respondents than male respondents, and the largest age group is 30-39 years old.

¹ The original survey questions are in Japanese, and they were translated into English by the authors.

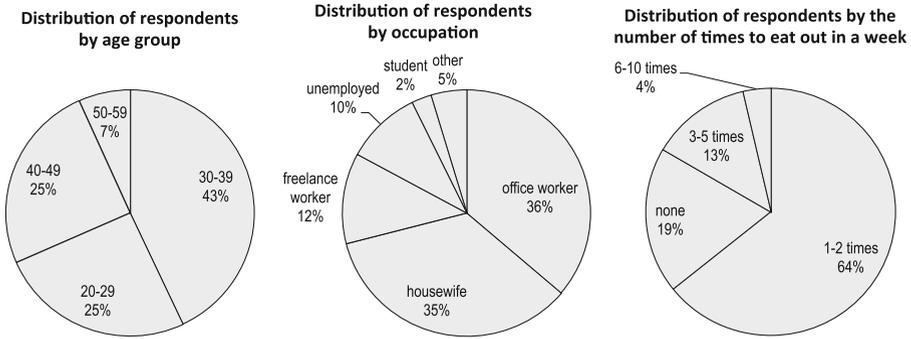


Fig. 3. Distributions of respondents by age group, occupation and eat-out frequency

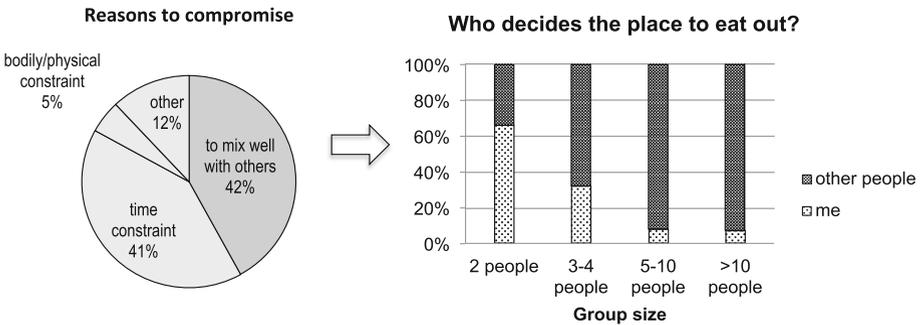


Fig. 4. Patterns of compromise in selecting place to eat out

32% of the respondents compromised in the last 7 days, by going to food venues that they did not think were the best. Visiting a food venue many times does not necessarily mean that one likes the venue.

We asked the people who compromised why they did so. Figure 4 shows the summary of the responses. Apparently, time constraints are a major reason for compromising. What seems interesting is that as many people said that the reason was to *mix well with others*². Respondents' comments point to concrete situations in which they selected suboptimal food venues, as they said "That was the only food venue nearby," "The venue was busy, so I dropped in a vacant venue," and "I made myself agreeable to my peer in terms of taste."

As this suggests the importance of social contexts in eating out, we examine the impact of group size on discretion. Among the people who said that they compromise to mix well with others, 66% said that they decide the venue by themselves when eating out in a group of two people, but only 7% when eating out in a group of more than 10 people.

² The responses are originally in Japanese as well. They were translated into English by the authors.

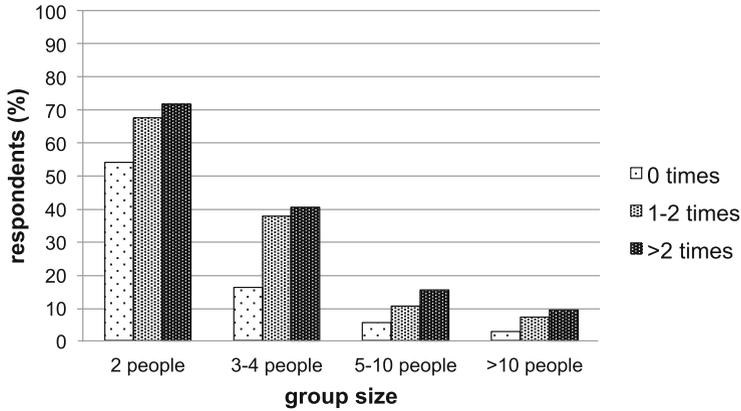


Fig. 5. Ratio of people who decide the place to eat by themselves, by group size and weekly eat-out frequency

As this seems to simply reinforce a common sense understanding that the more people one eat out with, the more likely to compromise, there is a less trivial pattern related to the frequency of eating out. As shown in Fig. 5, respondents who eat-out frequently are more likely to decide the place to eat by themselves. Moreover, this impact of eat-out frequency on discretion is statistically significant for a certain group size only.

There is a statistically significant association between eat-out frequency and discretion for the group size of 3–4 people ($\chi(2) = 6.661, p = 0.036$). However, when the group size is 2 ($\chi(2) = 3.001, p = 0.223$), 5–10 ($\chi(2) = 1.935, p = 0.380$), or more than 10 ($\chi(2) = 1.367, p = 0.505$), the association is weak and *not* statistically significant. The impact of eat-out frequency is the strongest.

5 Chain Restaurants and Time of Day

In a preliminary study that supplements the survey, we looked into the impact of two additional contexts: time of day and chain restaurants in different food categories.

5.1 Method

We examine it by creating recommendation lists of food venues based on time of day and food chains, and collecting feedback about the lists from a small number of citizens in person.

We crowdsourced the data collection to build a database from which recommendation lists are derived by using user-based collaborative filtering. The microtask request we posted on Lancers asked people to provide the names of at most seven favorite food venues in Shibuya along with the frequency to visit

them, followed by the questions that asked the frequency of eating out in different time of day (i.e., early morning, morning, around noon, evening, night, and midnight) and the frequency of using 9 chains of family restaurants, 7 chains of hamburger restaurants, and 4 chains of beef bowl restaurants. They serve similar food with comparable prices, yet, interestingly, people prefer a certain chain over other chains. Carrying out this microtask takes approximately 5–10 min with the payment of 80 Japanese Yen (i.e., about 80 US Cents). Again, workers had to be adults (≥ 20 years old) and perform the task no more than once.

We collected responses from 36 people on Lancers, and 3 people in person, and built two databases, one of which represents the relationship between the people and the time of day to eat out most frequently (DB_{tod}), and the other represents the relationship between the people and the chains they visit most frequently (DB_{chain}). We used the data to compute nine recommendation lists for the 3 people, p_1 , p_2 and p_3 . Of the three recommendation lists for each person, one is based on DB_{tod} , another based on DB_{chain} , and another based on an equally weighted sum of the interpersonal similarities (i.e., Pearson correlation coefficients) based on DB_{tod} and DB_{chain} .

5.2 Preliminary Results

p_1 liked the recommendation list based on DB_{chain} the best because it prioritizes venues that are not chain restaurants. In contrast, p_2 liked the recommendation list based on DB_{tod} the best because it recommends a venue in a shopping mall that p_2 frequently visits.

This anecdotal finding complements the survey in that it suggests (1) time of day is a relevant context for interpreting and using venue-visit logs, (2) chain restaurants are also a relevant context and they can connect people in different areas or cities, which could be potentially useful for recommending venues in unfamiliar environments, and (3) these two contexts need to be interpreted and prioritized in different ways for different people and/or contexts. These three points are more relevant for venue visits in urban spaces than page visits on the web or an e-commerce site.

6 Discussion

Our findings suggest the importance of group size, visit frequency, distance, crowding, time of day, and other contextual factors in understanding food venue visits. We now discuss them in more depth based on relevant conceptual frameworks, and suggests some technological interventions for eating out, which is a pervasive consumption activity in urban spaces.

The sheer amount of food venues in cities facilitate people to eat out without the physical and social constraints of traditional “eating home with family members.” Although people often associate eating out with reduced spatial and social constraints, people’s decision making about food venues is under constant

tension and *satisficing* solutions need to be sought by considering social, temporal, and spatial constraints. One often has to conform to peer-group norms in groups of different sizes and social distances. Indeed, “*there are many graduations of experience between freely willing and feeling inescapably obliged to participate in any given social practice*” [20, p. 66]. Moreover, not only physical distances, accessibility, travel costs, available alternatives and financial circumstances but also life styles and symbolic aspects of food venues make the decision making process a dynamic and multi-faceted one in the context of everyday practices.

It can be useful to make a distinction between consumption for necessity and luxury. When eating out of necessity, it is often under many circumstantial pressures such as the available time and money, nutritional requirements, and proximity to daily or planned trajectories through time and space. This distinction seems to be reflected in the design of physical food venues such as eat-in convenience stores, food court in shopping malls, and “*Eki Naka*” (in-station) fast-food restaurants although such distinction is not as apparent in the design of conventional urban applications such as location-based services.

When purchasing a book on an e-commerce site, it does not matter very much whether one buys it in the morning or in the evening. However, meanings of a visit to a restaurant in the morning and in the evening can be very different because people who eat out in the morning can have different daily life patterns than the ones who eat out in the evening, and the restaurant may provide different food and services for breakfast, lunch, and dinner. Time of day is a context which is particularly relevant to mobile, ubiquitous consumption, and it could have some impact on the quality of recommendation lists.

Another factor that differentiates eating out from online consumption is that eating out is an embodied, situated activity in which different kinds of consumption are combined as people consume visual, auditory, olfactory and gustatory information as well as physical food. This suggests potential use of various sensors and locative media for the support of food venue visits.

In many cases, food venue visits cannot be simply defined as the conduct of market exchange. For example, the association between eat-out frequency and discretionary venue choices can be analyzed based on a more holistic view that consumption is embedded in practices. What the discussion on consumption and theory of practice suggests is the importance of participation and learning to be competent in consuming food and services appropriately [19]. In some cases, the level of participation and competence could be reflected in the frequency of eating out as well as the influence on decision making in a social eat-out setting. More generally, different degrees of involvement in practices can generate behavioral variation, and patterns of food venue visits can be interpreted and used based on relevant practices.

Based on a traditional view on consumption, food venue visits can be interpreted as the act of satisfying hunger, or expressing personal tastes in relation to their *sign values*. However, a view based on practices interprets food venue visits in terms of competence, participation, and cultural conventions. We believe that

the latter view is also important in ubicomp applications for food consumption as much as in physical environments for eating out.

Finally, information about preferred chain restaurants could have some impact on the quality of recommendation lists as well. Chain restaurants are an interesting class of food venues because many of them are distributed across the nation at somewhat regular intervals, thereby enabling association of food venue visits in different areas. This suggests that other types of *spatially connective structures*, besides the spreading patterns of networked chain stores, could potentially be relevant as well.

7 Conclusion

In this paper, we discussed spatial and social contexts of food venue visits in urban spaces based on a survey and a supplemental study. We identified several important contexts and discussed how they might come into play in different settings based on an existing conceptual framework about consumption and practices.

The discussions related to chain restaurants and time of day are based on preliminary results and rather speculative. Therefore, we avoided making strong conclusions on these issues. That said, our findings from the survey and overall discussions suggest directions towards novel design strategies for urban applications, and open up opportunities for further research in ubiquitous computing for urban consumption.

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