

# Experiences of Event Visitors in Time and Space: GPS Tracking at Dutch Design Week

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## Abstract

Visitor experiences are crucial for the success and sustainability of an event. It is necessary to understand spatial processes during events in order to have more insights on their developments and potentials. The visitors' perceived event experiences depend not only on visitors' personal background but also on temporal and locational aspects of the visit. This paper aims to add to the understanding of event experiences in time and space by using GPS data with additional surveys collected at Dutch Design Week in October, 2017. This study estimates the influence of personal, temporal and locational aspects on the type of experiences by conducting a binary logit model. It is found that in general visitors tend to have more positive feelings than negative during their visits. This is expected because people go to events in order to have different and worthy experiences. The duration of the visit, familiarity with the event and the event location is found to be influential on the visitors' feelings. In addition, if people visit the attractive places, they tend to have more positive feelings. These results can be useful for event organizers and local governments. The paper concludes with reflections on the results and future research.  
*Keywords:* GPS tracking; geo-semantic; feelings; visitor experiences; survey

## 1 Introduction

Visiting planned events is a type of out-of-home leisure activity for which the visitors expect to experience something different and worthwhile. Therefore, visitor experiences are crucial for the success and sustainability of an event. Visitor experiences do not only include the event program but also the event location and environment. Learning about visitor experiences and where they occur can give valuable insights to managers and designers to improve the quality of the event.

Planned events can occur at venues, large public spaces or whole community/city (Petersson and Getz, 2009). This paper focuses on a large-scale planned event that is distributed in different large areas of a city. At such large scale events, visitors move to different areas to see the fixed attractions during their visits. While the event itself is the main attraction, its setting, accessibility and environment shapes the visitors' experiences.

Event experiences consists of movement patterns and perceptions of visitors and they occur at a given time and space (Getz, 2007). Every experience evokes emotions at given time and location. These emotions are dependent on the atmosphere, time of the day, the people in the area and the physical attributes of an area (Huang et al., 2014). So that people generally associate places with feelings such as being comfortable, boring, dangerous or enjoyable (Mody et al, 2009; Korpela, 2002). These emotions have important role in determining how people perceive their environment, its structure and layout.

Due to the development of new technologies such as mobile data networks, in and outdoor positioning technologies, it is possible to observe people's behaviour including movement patterns (Doherty et al., 2014). These technologies also allow the experiences to be geo-tagged and recorded with their time and location. Geo-tagging data provides the information for a spot that belongs to a particular interest to the user. However,

location data derived from such techniques lack of semantics such as user profile and user emotions at the location. Therefore researchers should use additional methods to collect experience or emotional data associated with location-based data. In the existing studies such as Pánek & Benediktsson (2017), Resch et al. (2015), Roberts et al. (2012), Bergner et al. (2011), Nold (2009) additional methods of wearable sensors, extracting data from location-based social networks such as Twitter, Flickr and Facebook, and surveys are used. Studies mentioned above generally focus either on improvement of the data collection methods or on technical aspects of mapping and visualization of the collected data. They do not try to understand in particular how positive and negative experiences are influenced and distributed in the city during events.

In tourism and leisure activity field, using GNNs for tracking and geotagging event experiences/emotions has been studied by Shoval et al. (2018), Birenboim (2016), Birenboim et al. (2015), Zakrisson & Zillinger (2012). These studies use Global Positioning System (GPS) devices and surveying methods for understanding event experiences in terms of movements and feelings during events. Nevertheless, they focus on analysing the experience data at an aggregated level.

It is necessary to understand spatial processes during events in order to have more insights on their developments and potentials. Understanding the factors that influence the way visitors perceive their environment as well as mapping and analysing these perceptions could be the key to designing a rewarding event experience. Therefore, this paper aims to add to the understanding of event experiences in time and space by using GPS device data with additional surveys collected at Dutch Design Week in October, 2017. This study estimates the influence of personal, temporal and locational aspects on the type of experiences by conducting a binary logit model.

The remainder of the paper is organized as follows. Section 2 represents methodology including the data collection,

descriptive of the sample and analysis methods. Section 3 represents the results of the analysis. Finally, section 4 represents the conclusions of the paper and future directions for this study.

## 2 Data and Methodology

### 2.1 Data Collection

The data is collected during Dutch Design Week (DDW) event. DDW is an annual event about Dutch design and always hosted in Eindhoven, The Netherlands. The event takes place every year at the end of October and it lasts for 9 days with exhibitions, workshops, seminars and parties at approximately 80 different venues in the city. Those 80 venues can be indoor or outdoor.

The data is collected at 4 different days of the event in October, 2017. The respondents are approached near the ticket office which was just out of the central train station. In order to collect data on event visitors' mobility and experiences a mix approach of tracking with GPS devices and questionnaires has been applied.

For collecting the GPS track data, a commercial device called 747Pro GPS trip recorder is used which allows users to log their routes. Points of interest can also be recorded by a push button. With built-in buzzer alarm and light, the device lets the user know whether the GPS location is fixed or a POI is recorded successfully.

During data collection, the participants were asked to fill in a questionnaire about their socio-demographic background and also their familiarity with the event and its area. Then they were asked to carry a GPS device and fill another questionnaire during their visits at the event. The respondents were explained how the GPS device works and that if the light on the device is constant, it means that GPS has no signal and they have to wait till it is flickering light again.

The second questionnaire was about their experiences during the visit. They were explained that if they experience a feeling about the exhibitions, event and its area, they should push the point of interest (POI) button of the GPS device and fill in the questionnaire about their experience. POI button registers the location and time of the experienced feeling. They are also explained if they have experienced a feeling in a building, they should click the POI button after they are outside the building and when the light of the GPS logger is flickering again. Then respondents were asked to indicate the location of the experience (indoor/outdoor), type of experience (choosing from variety of positive/negative feelings) and the strength of the experience on a 5 point scale. Additionally, respondents are explained to indicate the location of the feelings using optionally on a given paper map or by writing the exhibition number for the corresponding feeling. Finally, they were asked to bring the GPS tracker devices back to the researchers and if it is not possible, then to send it back by post. The GPS devices register a coordinate every 3 seconds. They record latitude, longitude, date, time, altitude and POI register.

In total 281 respondents returned GPS tracker devices with experience questionnaires. Some of the questionnaire for feelings were not correctly filled or some of the GPS data didn't have POI data. Therefore, 47 respondents were

removed from the sample. After cleaning the data, questionnaires from 234 respondents were useful. 63 of respondents are from 21/10/2017, the first day of the event, 48 of respondents are from 24/10/2017, 50 of respondents are from 26/10/2017 and 73 of respondents are from 28/10/2017.

Apart from the data generated from the survey questions, some extra variables were added to the data by using the data collected with GPS devices. These variables are the time of the day for feeling registered, duration until the feeling registered, day of the week for the visit and feelings that fall within the most-time spent areas. The latter variable is derived by using geographical information systems (GIS). The most time-spent area can be an indication of locations that people find more attractive as they spend more time at these locations compared to other areas. These areas are found by using density maps in GIS environment for each event day. Then these density maps are converted to raster format and multiplied by using raster calculator. After that, the most time-spent areas are converted to vector format and the registered feelings that fall within these areas are identified. Addition to all these data, weather data is gathered from Royal Netherlands Meteorological Institute which is available at hourly ranges. The occurrence of rain is matched with the time of the registered feeling and added to the dataset. Because the weather conditions can influence the emotions of people directly (i.e. mood changes) or indirectly (i.e. alteration of activities). Finally, all the data are gathered and converted in a table format for estimation.

### 2.2 Sample Characteristics

Table 1 represents the sample characteristics for respondents. Number of visitors in the sample are higher in the weekends. The female respondents are highly represented in the sample. Majority of the sample are 30 years old or lower. 35% of visitors in the sample are not familiar with Eindhoven while 12% is extremely familiar. In addition, 54% of the visitors in the sample have never visited DDW before while 46% have visited one or more times. 55% of respondents indicated that they will combine the visit with other activities such as shopping, visiting bar/café/restaurant, work. 41% of the respondents indicated that they will spend less than 5 hours at the event, 59% of the respondents indicated that they will spend more than 5 hours for the visit. Majority of the respondents are visiting the event with a company that might include family members, friends or colleagues.

Table 2 and 3 show feeling specific characteristics in the data. In total 1017 feelings are registered from 234 respondents. This means that each respondent had one or more feelings with average of 6 feelings. 73% of registered feelings are positive while 27% are negative. Majority of the feelings are registered at indoors, during weekdays, after 12:00 and the most time-spent areas. Table 4 shows the distribution of the positive and negative feelings according to location and weather. This distribution is in-line with the overall distribution of feelings. Both positive and negative feelings are registered mostly indoors.

The distribution of positive and negative feelings in space can be seen in Figure 1 and 2. Most of the feelings are registered in Central and Strijp-S areas. According to figure 1 and 2, it can be said that one location can trigger different types of feelings for different people. Moreover, feelings are

not only registered at exhibition locations but other places such as public space, shops and cafes.

Table 1. Sample Characteristics (N= 234)

| Variable                    | Levels            | Frequency | Percentage |
|-----------------------------|-------------------|-----------|------------|
| Gender                      | Female            | 148       | 63%        |
|                             | Male              | 86        | 37%        |
| Age                         | <30               | 167       | 71%        |
|                             | > 30              | 67        | 29%        |
| Travel Company              | Alone             | 97        | 41%        |
|                             | With others       | 137       | 59%        |
| Combining Other Activities  | Yes               | 129       | 55%        |
|                             | No                | 105       | 45%        |
| Familiarity with Eindhoven  | Not at all        | 83        | 35%        |
|                             | Slightly          | 51        | 22%        |
|                             | Somewhat          | 32        | 14%        |
|                             | Moderately        | 40        | 17%        |
|                             | Extremely         | 28        | 12%        |
| Previous Visits to DDW      | Never             | 127       | 54%        |
|                             | One or more times | 107       | 46%        |
| Indicated Duration of Visit | < 5 hours         | 95        | 41%        |
|                             | > 5 hours         | 139       | 59%        |
| Day of the Week             | Weekday           | 98        | 42%        |
|                             | Weekend           | 136       | 58%        |

Table 2. Feeling Specific Characteristics for Continuous Variables (N of feelings= 1017)

| Variable                                       | Mean  | St. Deviation |
|--|-------|---------------|
| Duration until Feeling registered (in minutes) | 175.3 | 118.1         |
| Total number of feelings per respondent        | 6.4   | 4.1           |

Table 3. Feeling Specific Characteristics for Discrete Variables (N of feelings= 1017)

| Variable            | Level        | All Feelings (#) | All Feelings (%) |
|---------------------|--------------|------------------|------------------|
| Time of Experience  | Before 12:00 | 164              | 16%              |
|                     | After 12:00  | 853              | 84%              |
| Day of the Week     | Weekday      | 628              | 62%              |
|                     | Weekend      | 389              | 38%              |
| Area of Feeling     | Attractive   | 681              | 67%              |
|                     | Other        | 336              | 33%              |
| Location of Feeling | Indoor       | 865              | 85%              |
|                     | Outdoor      | 152              | 15%              |
| Weather             | Rain         | 194              | 19%              |
|                     | Dry          | 823              | 81%              |

Table 4. Feeling type according to Location and Weather

| Variable            | Level   | Positive Feelings (N=745) | Negative Feelings (N=272) |
|---------------------|---------|---------------------------|---------------------------|
| Location of Feeling | Indoor  | 87%                       | 81%                       |
|                     | Outdoor | 13%                       | 19%                       |
| Weather             | Rain    | 20%                       | 17%                       |
|                     | Dry     | 80%                       | 83%                       |

Figure 1. Distribution of positive feelings in space (red: positive feelings; green: exhibition locations)

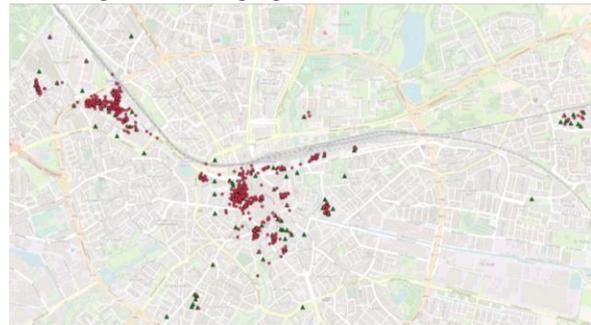


Figure 2. Distribution of negative feelings in space (blue: negative feelings; green: exhibition locations)



### 2.3 Method

In this study, the aim is to understand the influence of personal, temporal and locational aspects on positive feelings compared to negative feelings. For that purpose, binary logistic regression is used.

The dependent variable is the type of feeling (positive/negative). The independent variables are gender, age, whether respondent has travel company, whether people combine the event visit with other activities, respondents' familiarity with Eindhoven, whether respondent visited DDW before, indicated duration of visit, day of the week, duration until the feeling is registered, time of feeling, day of the week, whether the feeling is registered in attractive locations, whether the feeling is registered indoor or outdoor and whether it was raining at the time of feeling registered. The categorical variables are dummy coded in the data file. The estimation is done by using NLogit software (Greene, 2009). As each respondent can have different number of feelings registered at different time and locations, panel data structure is used in the estimation.

### 3 Results

According to the estimation,  $R^2$  is found to be 0.17 which shows a decent model fit for behavioural studies (Hensher et al., 2005). The results of this estimation can be seen in Table 5. The coefficients indicate the probability of positive feelings are registered. Therefore, positive coefficients indicate that more likely a positive feeling is registered for given variable while the negative coefficients indicate the opposite.

Looking at the personal characteristics, the increasing familiarity with Eindhoven influences the probability for having positive feelings. Although this influence is at 10% significance, this result may indicate that when people know the area, they know where to visit and how to reach the areas that they intend to visit. Respondents who have never visited DDW event tend to have more positive feelings. This is expected as an event might offer more different and worthy experience when it is visited the first time. After the first time visit, visitors will know what to expect from the event. Respondents who indicated to spend less than 5 hours at the event are less likely to have positive feelings. Moreover, respondents who indicated to combine the event visit with other activities are more likely to have positive feelings. Although this effect is significant at 10% level, this result is plausible. Because doing leisure activities in general increases the utility that people obtain (Dane et al., 2015).

Increasing duration (time-spent at the event) until each feeling is registered, has a positive influence on the type of the feeling. Conducting the event visit in the weekend has a positive influence on having positive feelings. Moreover, indoor locations are more likely to evoke positive feelings. This might be because most event locations were indoors but might also be due to weather or atmosphere of indoors. Moreover, feelings registered at attractive locations (most-time spent areas) are more likely to be positive, as expected. Finally, it is found that when it rained within the hour of registered feeling, it is more likely that visitors have positive feelings. This influence is significant at 10% level. A possible explanation can be that most of the feelings are registered indoors and people felt more positive being indoors during rain.

Overall, the results show that temporal and location aspects of the event visit activity have role on visitors' feelings. Moreover, familiarity of visitors with the event and the event area also influences visitors' experiences.

Table 5. Binary Logit Estimation on Feeling Type

| Variables                         | Coefficient | t-value |
|-----------------------------------|-------------|---------|
| Constant                          | -0.980***   | -14.12  |
| Female                            | 0.071       | 0.48    |
| Age < 30 years                    | -0.217      | -1.39   |
| Familiarity with Eindhoven        | 0.093*      | 1.70    |
| Never visited DDW                 | 0.328**     | 2.14    |
| Visiting < 5 hours                | -0.324**    | -2.10   |
| Solo visitor                      | 0.188       | 1.25    |
| Combining with other Activities   | 0.250*      | 1.70    |
| Afternoon                         | 0.107       | 0.49    |
| Weekend                           | 0.384**     | 2.17    |
| Duration until feeling registered | 0.002**     | 2.23    |
| Indoor Location                   | 0.699***    | 4.11    |
| Attractive Location               | 0.465***    | 3.02    |
| Rain                              | 0.437*      | 1.80    |

Note: \*\*\*, \*\*, \* ==> Significance at 1%, 5%, 10% level.

## 4 Conclusion

The overall aim of this study is to add to the understanding of event experiences in time and space by using GPS device data with additional surveys collected at Dutch Design Week in October, 2017. So that more insights on the developments and potentials of the event can be obtained. The visitors' perceived event experiences depend not only on visitors' personal background but also on temporal and locational aspects of the visit.

It can be said that the sample of the study is not representative of the Dutch population but it might be representative of the design event visitors. The registered feelings tend to be more positive than negative. This is expected because people go to events in order to have different and worthy experiences.

In order to increase the positive feelings during large-scale event visits, more explanations on exhibitions and other leisure activity locations such as cafes/restaurants can be given to the visitors who are not familiar with Eindhoven and/or DDW and to the visitors who have limited time to visit the event. These explanations can be on the specifications of the exhibitions, their locations and accessibility options. Moreover, different tour options can be created for different types of visitors such as visitors who are first time visitors and have less than 5 hours for their visit. Choosing relevant visitor groups can be done by applying latent class analysis to define sub-groups of visitors.

To have more insights, the environmental characteristics of the attractive locations and the locations of registered feelings can be investigated. So to say, the closeness of these locations to event locations, transport facilities, other leisure activity spots such as cafes, restaurants, green areas can be gathered and analyzed. In addition, GPS data of visitors can be further investigated to see the routing options and transport modes that are used by visitors.

Overall, mixed approach using GPS data and surveys are useful for the purpose of this study and it offers more possibilities for future research.

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