Towards Understanding Information Needs and User Acceptance of Mobile Technologies to Improve Passenger Experience in Airports

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ABSTRACT
User uptake and acceptance of new technologies or innovations is driven by the attitudes and psychology of the users as much as it is driven by the technological capabilities. Perceived utility, perceived ease of use, and trust in the system all play major roles in uptake and acceptance. In order to facilitate user uptake of a smartphone application designed to improve traveler experience in airports, we must first assess baseline attitudes and information needs of potential users. This paper outlines the distribution of an online survey which explored this. Key findings were that people are more trusting of information from “official” sources, or sources in which they did not need to rely on their own interpretation of information. It was also found that the use of navigation aids may need to be supplemented with additional information. The paper provides an example of how identifying key need areas at early stages of development may help with uptake at later stages.

Author Keywords
Smartphone application; user uptake; user acceptance; passenger attitudes; application requirements.

ACM Classification Keywords
H.5.m

INTRODUCTION
PASSME is an EU-funded Horizon 2020 project which aims to reduce the overall journey time for each passenger in European airports by 60 minutes. This is achieved through a number of avenues, including the redesigning of airport interiors, restructuring luggage journeys, and real-time modelling of passenger flows. The project also aims to enhance passenger experience and reduce passenger stress during their journey. This is achieved through a technological mediation framework, specifically centered on a smartphone application which will track passenger movements and physiological responses, as well as provide them with timely information throughout their journey. The goal of this is to keep passengers up-to-date with their journey, enhance wayfinding, and allow passengers to more effectively and efficiently organize their journey from the terminal entrance through to leaving their destination terminal. The end goal is that this application will remove uncertainties around airport navigation and travel, which will allow for a more enjoyable travel experience. Before this application is developed, however, it is important to engage users at early stages of the development process. This will allow the developers to determine current passenger attitudes and trends, as well as determine the most appropriate information that users believe should be included in the application. Adopting a user-centric approach at all stages of development (although especially in the initial stages) should help to increase user acceptance and uptake of the system once the technological innovations have been implemented.

User-uptake and acceptance
User-uptake and acceptance refers to the willingness and/or likelihood of users adopting a new technology or system once it has been implemented [1]. This obviously has large implications for developers, given the time and high costs associated with the development of applications for a large population. A number of frameworks exist which attempt to explain or predict user-uptake and acceptance of technological innovations. These frameworks tend to focus on a few core themes; perceived utility/value, perceived ease of use/practicality, and system trust [2] [3] [4]. There are also a number of other themes which, it could be argued, fit in between these core themes, however are often cited as their own distinct categories. For example, perceived risk [5] [6], perceived monetary value [7] and social image [8].

It is argued that user-acceptance of new technologies relies as much on the psychology and existing attitudes of the user, as it does on the actual technological capabilities of the device [9] [4]. In other words, having the most innovative or technologically advanced application is not necessarily the key predictor of that devices success. If an emerging technology is to succeed after implementation
then understanding the existing attitudes of users, as well as the perceived utility of that technology or device, at an early stage of development is a key factor.

**Existing Passenger Attitudes**

In regards to the PASSME project, there is relatively little literature on existing airport passenger attitudes, both towards general travel as well as towards technological innovations designed to assist with passengers’ journeys. This is despite the large and ever increasing volume of passengers moving through airport terminals each year. One possible reason for this is due to existing applications being put forward by independent companies; perhaps by single airlines to only provide information and deals on their flights, or by individual airports themselves. This creates isolated and competing applications with little information shared between them. For the technological innovations of PASSME to succeed, we must first examine existing user attitudes and passenger behavior at airports.

Some of this research has already been undertaken as part of the PASSME project [10]. This research employed mobile diaries which passengers completed during their travels, followed by semi-structured interviews in which their travel journeys were unpacked. The key findings of this study were that while passengers’ may present with a specific set of needs at certain points during their travel (i.e. direction to certain facilities within the airport), the emotional experience and responses of passengers fluctuated over the entire course of the journey as reported within the mobile diaries. Traveler personas (which would determine different travel paths) were also able to be developed as part of these investigations, stressing the need for personalized information at certain points during travel.

The current investigation looks to extend this research, and further examines current passenger attitudes during travel. In particular, the research described here focusses on attitudes regarding what users would find most beneficial as part of the PASSME technological innovation. It also focusses on current trends regarding passengers’ information search during travel, and what information would help to reduce passenger stress. This is performed in order to explore the perceived utility of technological innovations, and it is hoped that by outlining this information during the development stage, it will improve user-uptake and acceptance after implementation.

**METHOD**

**Participants**

77 participants completed the survey. 50.6% were between the ages of 16 and 25, 16.9% between the ages of 26 and 35, 20.8% between the ages of 36-45, 9.1% between the ages of 46 and 55, and 2.6% between the ages of 56 and 65. 59% respondents were female, and 40.3% were male. 64.9% of respondents were from non-EU countries, and 35.1% were from EU countries.

All participants had travelled internationally at least once in their lifetime. Individual travel information was not gathered as part of this study.

**Materials and Procedure**

The “Understanding Passenger Attitudes at Airports” survey is a 30-item questionnaire designed to explore passenger attitudes towards air travel, specifically travel through the airport terminal itself. The questionnaire is divided into three separate 10-item subscales, which have the themes of “attitudes towards air travel”, “attitudes towards luggage”, and “attitudes towards airport terminals”. The 30-item questionnaire used in this study will eventually be reduced to a shortened survey to be used later in the project lifecycle. Each item in the scale was rated on a 7-point Likert scale. There were also two items which were open-text questions. These items asked participants how they thought airport terminals could best be improved, and what information they felt would be best to include in a smartphone application.

Participants were also asked to provide basic demographic information, as well as information regarding their travel to and from the airport terminal.

Participants were recruited through both social media and flyers posted around the University of Nottingham. The surveys were taken online, with a link being provided to each participant through either a hyperlink or QR code.

**RESULTS**

An exploratory factor analysis (principal axis factoring with direct oblimin rotation) was performed on each of the individual 10-item scales used in the survey. This was performed in order to determine which items would be retained for further analysis. This resulted in a five factor solution, with the factors of “negative flight experiences”, “handling of luggage by staff”, “luggage logistics”, “navigation through terminal” and “information search”. The items loading on these factors will be those which are examined in more depth. In order to maintain a clear focus for this paper, only the items that related directly to the themes of user acceptance and user information requirements will be reported here.

Additionally, participants were provided with an opportunity to suggest where they might best improve airport terminals and facilities, and what information they feel would be best included in a smartphone application that could improve navigation throughout the airport. Text entries were analyzed with a thematic analysis approach [11].

Respondents were asked to rate four items related to where they would search for information if they were unsure of where their gate was. Those items were “… I will ask for help from airline/airport staff”, “… I will look for wall signs to direct me”, “… I will look at a map to direct me”,

...
and “... I will walk around until I find the information I need”. Respondents rated highly on asking staff (M = 5.57, SD = 1.68) and looking for wall signs (M = 6.03, SD = 1.24). There were lower mean responses and high rating spreads for looking at a map (M = 4.17, SD = 2.02) and walking around to find the information (M = 4.88, SD = 1.72). Asking staff and looking at wall signs were considered to be forms of ‘official’ information, due to being provided directly to the respondents from an official source. Map reading and walking around to find information were considered to be forms of ‘unofficial’ information, due to their reliance on respondents’ interpretation and input. Therefore, a paired comparison t-test was performed comparing the combined ‘official’ information scores versus the combined ‘unofficial’ information scores. This yielded a significant result, t(76) = 6.33, p = .000, with official information rating higher (M = 5.80) than unofficial information (M = 4.53).

Respondents were asked two questions relating to facilities available in the airport; “I would have a much more pleasant journey if the airport provides various services (wifi etc)”; and “I enjoy the time in the departure lounge waiting for my flight”. Respondents rated highly on having a more pleasant journey if the airport provided various services (M = 6.13, SD = 1.22), and low on enjoying their time in the departure lounge (M = 3.27, SD = 1.79).

In order to assess user needs, participants were asked what would be the most important information for them in a smartphone application. A thematic analysis approach [11] was adopted for the qualitative data. Unfortunately, the only respondents to this set of questions were from the EU, and not the non-EU countries. Four key themes of information were identified, which are shown in Table 1. Themes are ordered by the frequency in which they were mentioned.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Example</th>
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<tbody>
<tr>
<td>Navigation to gate/gate information</td>
<td>“Show where I am, where my gate is”; “the exact direction I need to go”; “...floorplan, direction to walk towards”; “which gate my flight is likely to be, so I can at least be in the right part of the airport”</td>
</tr>
<tr>
<td>Available facilities</td>
<td>“What is available at the airport to kill time”; “show places to charge electronics”</td>
</tr>
<tr>
<td>Up-to-date information</td>
<td>“if the airport is doing repairs/remodelling, it would be nice to know”</td>
</tr>
<tr>
<td>Timely reminders</td>
<td>“Notify me when boarding starts”</td>
</tr>
</tbody>
</table>

Table 1. Themes identified from text-entry data.

**DISCUSSION**

**Trust in Information Search, Acquisition and Interpretation**

Two key interpretations have been made from responses relating to information search when trying to find gates. First, respondents trust information from an official source (wall signs and airport staff) rather than information that requires their own input or interpretation of information given to them (map reading and personal information search). Map reading and personally searching for the information requires people to rely on their own interpretation of information found, which they may see as unreliable due to their unfamiliarity with the airport. Additionally, these could be seen to be more cognitively demanding tasks due to the increased requirement for information processing, interpretation, and decision-making. Seeking information from staff or signage on the other hand may be seen as more “official” or trustworthy, meaning that people are less likely to second guess the information that they receive. Importantly, these types of information may require less cognitive demand, as it is likely there would be less information processing and decision-making requirements when this information is provided directly to the individual. This is further illustrated by the significant difference found between the combined official information scores and the combined unofficial information scores. If the application developed as part of PASSME can consistently provide correct and “official” information to the user it will be seen as a trustworthy source to the user, which will spur system trust, improve perceived utility due to the usefulness of the information, and increase user-acceptance.

A second key point found in these responses is that using a map to find the information needed had the lowest mean score and the highest spread of scores. This poses an interesting issue for the technological interventions of the PASSME, given that real-time map information and internal GPS is intended to be a feature of the application developed. Perceived utility is a key facet of user uptake and acceptance, and redundancy of information can be seen as an inhibiting factor to uptake and use [4]. While some users may find a map useful for navigation, it may represent a “last resort” feature to others. This complements the previously made point that people may be untrusting of information that is not from an official source. This does not necessarily mean that such a feature should be abandoned. Rather, it would indicate that a map navigation feature would need to be supplemented with official information or cues that align with the information provided on the map. This would improve overall system trust, which would in turn assist with user acceptance. The spread of responses also highlights the need to provide for different user types. Previous research [10] identified as-is personas for passengers during travel. The spread of responses in regards to the use of navigation aids during travel may represent these different user types. Further investigations may be needed in order to match these personas to
navigation aid attitudes, and to explore whether differences in information may be needed for these types.

In addition to the survey responses, the most frequently cited theme for important information to be provided in the smartphone application was in relation to navigation to the appropriate gate and gate information. This may be due to the higher importance of finding the appropriate gate during travel. Again, this suggests that including important navigation information to the user may increase perceived utility, and in turn, user acceptance and uptake.

**Awareness of technology-supported Airport Facilities**

Respondents were asked two questions relating to facilities available in the airport. The findings show that passengers would have a more enjoyable journey if the airport provided services such as wifi and charging ports, and that they currently did not seem to enjoy waiting in terminals. This, combined with the qualitative data which suggests that participants would find terminal information helpful, suggests that travelers are currently uncertain about what facilities are available within the terminal. Many airports do provide these services to passengers, however it is unclear whether the lack of knowledge of facilities is the cause of lack of enjoyment, or whether the lack of enjoyment is caused by other factors. A point for further studies in the PASSME program is to determine whether providing this information in the form of the smartphone application will increase enjoyment within the terminal. If the source of passengers not finding the terminals enjoyable is due to the lack of knowledge about available facilities, then providing official and trustworthy information (as mentioned above) may improve this. Additionally, this could further feed into perceived utility of the application, leading to increased user uptake.

**CONCLUSION**

This paper represents work performed to gather baseline data from passengers regarding current attitudes towards travel through airports. It also examines current needs for technological innovations planned as part of the PASSME project, which aims to reduce travel time in European airports. The work provides an example of how user uptake and acceptance may be influenced at early stages of development (i.e., before prototypes have been developed) by engaging users at all relevant stages. It is intended that the work-in-progress presented here will be approached again at a later stage in the development of the technological interventions, and will show the impact of gathering baseline attitudes on user uptake and acceptance. The work also provides some insight into attitudes of airport passengers, which is an area which has not received a large amount of focus in scientific literature. As such it provides a basis to guide further investigations in the area.

**REFERENCES**


