The requirements for location based services: differences between target user groups

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The Requirements for location-based services: differences between target user groups

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Abstract

This paper reports on original work that will determine opportunities for the development of mobile location-based services for different user groups.

Location-based services (LBS) employ knowledge of the user's location to enable the provision of new or enhanced services to a user via a wireless device (e.g. mobile phones, PDAs).

The Valued LBS research project focuses on what users are trying to do, what information they need, and how you add value by providing them with information that is location or time relevant - the right information at the right time and in the right way.

In the reported study, a user-centred approach was developed to identify particular contexts in which location-relevant information would be perceived as ‘valued’ by users. Value, in this case, is assigned to new information which is useful and relevant enough to justify the resources needed to access it and its benefit over other existing sources.

A series of interviews (semi-structured and structured) were conducted using a scenario-based technique. The participants were required to describe their ‘location’ map (where they go, modes of travel) and then to detail the different types of day they have (with respect to the travelling that takes place). The two busiest types of day were then investigated in detail. Participants described the day along a timeline e.g. 6am – 6am which was broken down into hour segments. They identified the times when they travel or change location. In the semi-structured interviews they were asked to rank the importance of these journeys and in the structured interviews they were asked to rate each of these journeys, in terms of the likelihood of something going wrong and the consequence if it were to go wrong for them.

The data formed a chronological structure that the interviewer then worked from for the final stage of questioning which involved interviewees explaining the cognitive processes involved in the planning and execution of each journey. This enabled an understanding of how their information needs vary throughout the day. As a result, the study was able to ascertain where there are high and low requirements for information for that individual and hence estimate the potential to provide value.
A range of user groups is of interest to the LBS industry: both current mobile users and potential future users (if the device can offer valued LBS). This paper will concentrate on the findings from interviews with two or more of the following user groups (the groups are also described according to their working arrangements, commuting and travel behaviour):

- Teenager
- University student
- Young professional
- Parent (dependent children)
- Retired person

In summary the exploratory interviews enabled testing of the location mapping technique and this proved valuable in creating a visual picture of the travel ‘worlds’ of a range of people. The questionnaire enabled a snap-shot of current student awareness of, and attitudes to, location-based services. Approximately half of students were aware of services such as find my nearest, pedestrian direction, driving directions and friend finder. Finally the in-depth interviews showed that the lives of the students investigated in the study was defined by a relatively small world of movement with lots of routine which serves to ensure they meet up with friends regularly throughout the day.

The work will conclude with the development and test of new concepts for location-based services for a range of user groups and contexts.
1. Introduction

1.2 Project Background

The work discussed within this paper is part of the Valued LBS project. This is a joint academic/commercial research venture, running from June 2003 to December 2005. The project is supported by EPSRC through the Loughborough University Innovative Manufacturing and Construction Research Centre (IMCRC). The commercial partners are Ordnance Survey, Yeoman and VTT industrial Systems. The resulting project team has expertise in the human factors of mobile telephony and the adoption of new technology, geographical information systems, the design of travel and traffic services and the design of mobile devices.

This is an applied research project where the main focus is on providing answers to research questions that are relevant within a commercial market. The specific aims of the project are to conduct original work to:

1. Identify the customer requirements for a set of target LBS, users and scenarios.
2. Assess the gap between the needs of consumers and current ways of satisfying those needs.
3. Develop and test new concepts/prototypes for services and interaction methods that will support enhanced LBS.
4. Develop new, multidisciplinary approaches to using concepts of ‘value’ to inform the design of new or enhanced services.

1.2 Theoretical Background

A key opportunity for mobile services is the delivery of information to support users within a dynamic and location-varying information environment such as travelling. However, as noted by Lindgren [1], ‘the mobile marketplace has to offer value if people are going to start using it’. This is also the view of Ahmed [2] who states that ‘customers will only use the wireless devices and services that quickly and easily add some value to the customers’ lives’.

Various theoretical perspectives explicitly address the need to provide benefit to the user of new technology, e.g. the ‘effectiveness’ and ‘efficiency’ of usability [3], the ‘perceived usefulness’ of technology acceptance [4], and the ‘relative advantage’ of innovation diffusion [5]. Although the importance of ‘context’ has come to the front within the remit of ubiquitous computing (e.g. [6]), relatively little research has attempted to understand what generates ‘value’ for an end user – in effect what would make an individual take a mobile device out of their pocket in the real world, and the contextual influences that would motivate a user to ‘press the button’ that may result in payment for information.

It is particularly important to be able to identify ‘moments of value’ i.e. a specific circumstance where the need for information, and hence the willingness to pay, is high.
Incorporating location awareness with services enables context-relevant services to be developed which support a task impacting on a location. A task that requires knowledge of the location of people, places and objects, or a task where the information is relevant is highly context dependent.

1.3 Aims

The three main aims of the study reported here were:

1. To map and log everyday activities and consider the similarities and differences between user groups
2. To identify opportunities for location-based services within the above context for a specific user group
3. To develop and test a method to achieve 1 and 2
2. Approach

This paper describes a task- and user-centred (technology independent) approach to identifying opportunities for mobile location-based services to support/enhance users during their everyday lives.

The focus was intentionally to concentrate on the everyday rather than the one-off situations, i.e. where things typically go wrong and LBS could offer solutions. Both situations offer opportunities for LBS but the revenue implications differ for each situation. Potentially, for the ‘one-offs’ the willingness to pay could be higher (more likely to be emergency situations). For the ‘everyday’, the cost people are prepared to pay would be much less but the potential revenue opportunities are greater due to the increased frequency of use.

A three-stage approach was used with the first two stages contributing to the third, main data collection stage. Each stage is discussed, in turn, in this paper, including the main results from each stage. Discussion and conclusion of the main findings of each stage are brought together at the end of the paper.

The brief outline of each stage, its purpose and the link between the three stages is provided below with an overview diagram at the end of this section:

2.1 Exploratory Interviews

Interviews were conducted with a diverse range of potential users with the purpose of: (i) developing methods appropriate to all groups, (ii) confirming that the method was appropriate for identifying LBS opportunities and (iii) identifying the range of issues that affect the perception of the opportunities for LBS (e.g. income, mode of transport.)

The output was intended to contribute to the methods used in the in-depth interviews (third stage).

2.2 Questionnaires

This 2nd stage focused on one group of users and used a questionnaire to develop a profile of that group with regard to mobile phone usage and awareness of/attitudes to current location-based services. The selected group were students, chosen as potential early adopters of current/near future LBS and an immediately accessible group for the research.

The results were intended to provide a description of the population to enable selection of a representative sample of ‘typical’ students for the third stage (in-depth interviews). The results would also identify the current level of awareness of LBS and enable the opportunities identified in the in-depth interviews to be discussed in this context.
2.3 In-depth Interviews

A representative sample of students (from the population who participated in the questionnaires) was interviewed in-depth about their everyday activities and travelling. This was to enable a description of student lifestyles, activities, travelling habits and modes and the identification of ‘moments of value’ in their everyday lives where LBS could enable or enhance current or new activities.

This stage also aimed to further test and develop the methods used in the exploratory interviews and identify their appropriateness for demonstrating similarities/differences between user group and identifying opportunities for LBS.

The model below demonstrates the approach that has been adopted and gives an up-to-date view of completed research (darker boxes) and future research (lighter boxes).
3. Exploratory Interviews

3.1 Aims

The main aims of the exploratory interviews were:

1. Test the methodology for identifying user profiles
2. To generate a visual indication of differences between groups
3. Identify issues important for location-based information

3.2 Method

The interviews were broken down into two sections. The first section investigated the places that the participants had visited and the amount of times they had been to them over a period of the last six months. This was achieved through the process of location mapping. The second section investigated in detail the places they visited and the activities they undertook in an everyday week. This was achieved through a semi-structured interview technique.

3.2.1 Location Mapping

The exploratory interviews consist of two main components: the location mapping procedure and the semi-structured interview.

Location mapping is based on a previous technique called ‘mobility mapping’ (see definition below). It is low cost, paper based and is quick and easy to use requiring very little advanced preparation. It has been stated that:

‘mobility mapping seeks to provide a framework for indirectly exploring the participants current and potential future use of mobile products in relation to their mobility, their social communication needs and their current use of other non-mobile communication and information technologies’ [7].

Mobility Mapping evolved and was influenced by the approach to concept product design adopted within Maypole and related projects [8], the use of graphical representations of work context within systems design [9] and Mobile Informatics research [10].

The actual process of developing location maps enables the researcher to aid the participant to recollect the places they have visited and the journeys they have made to provide the researcher with a range of contexts of use for current and future mobile services. It also helps the researcher to understand the location patterns and movements of the participant which in turn starts the development of a profile for that person and eventually the user group. This process acts as an introduction to encouraging the rapport between the researcher and the participant and it creates a user-centred context for thinking about current and future mobile services.

An example schematic was shown to the participant to help explain what they were about to undertake and how it would work. The map is developed on an A3 piece of
paper with a series of five concentric rings on it. These rings are representative of the participants home town / city (inner ring), other towns / cities in their county (2\textsuperscript{nd} & 3\textsuperscript{rd} ring), other counties across the UK (4\textsuperscript{th} ring) and finally places abroad (outer ring).

Information is collected and put onto the location map through prompting the participant to recall places they have visited over the last seven days. Once they have completed going through the last seven days participants were asked to recollect places they have visited over the last month, then six months and then finally over the last year.

The data recorded needed to be managed so information relating to the form of travel used and the time taken to reach a destination was recorded; along with what they did there. The form of transport used was recorded via journey lines and these always originated from the centre circle or from other places on the map (e.g. train station) where appropriate.

Opportunities to do something different were also recorded along with the reasons why they chose not to. For example, why they go to a certain cinema rather than use another one might be because of quality or comfort or cost.

In reality the journeys made by the participants are far more complicated than are depicted within the location map. Also the location map does not give a complete picture of all the places the participants may have visited, however it is sufficient to enable the participant to recollect the important places they may have visited or travelled to within the last twelve months.

3.2.2. Structured Interview

The semi-structured interview flows on from the location mapping as it requires the participant to recollect a typical week. As they have been thinking about previous places and journeys they have been on this section asks the participants to take it a step further in detail. This section of the interview was broken down into four different steps.

The 1\textsuperscript{st} step involved getting the interviewee to think about a typical week that they currently undergo. Then once they have a typical week in mind they were asked how many different types of day they have, for example a week day & quiet night, a week day & training at night, a day at the weekend etc. This would count as three different types of day. By getting the interviewee to carry out the aforementioned process it enables us to aid them focus on a typical week.

The 2\textsuperscript{nd} step involved asking the interviewee to explain to what extent these days involve travelling, or being in different locations. A list is then created and the days which have the most and least changes of location are selected for further discussion. This now focuses the interviewee on typical days within the week and they are now in a position to explain each of these days in detail.

The 3\textsuperscript{rd} step involved getting the interviewee to start with their busiest day and describe this day along a timeline e.g. 6am – 6am which is broken down into hour
segments. This is a brief process as the details are collected at a later stage. They identify the times when they travel or change location. When this is completed they were asked to rank these journeys in terms of importance. Now a chronological structure is achieved that the interviewer can work from for the final step of the interview.

The 4th step is reached, now that a typical day has been outlined. The interviewee is then asked a series of questions regarding each change of location, or period of travel. It was a semi-structured process because there was already an outline of a day that the interviewee had explained in step three. Along with this outline there was also a list of services that the interviewer could use to prompt the participant whenever appropriate. This proved quite effective and some useful insights were recorded and are presented in the results below. However this semi-structured approach proved inefficient to analyse for within groups and across groups. Consequently a structure was developed for the in-depth interviews which were held a later date. The interviews were recorded and then transcribed in full.
3.3 Results

The results of the exploratory interviews are divided into sections. The first section represents the location mapping procedure carried out across the user groups. The second section shows a range of insights that have been selected to give an overview of the type of information that has been gathered.

3.3.1 Location mapping across groups

Within each interview a location map is produced. The following four maps show the differences that can occur between different user groups.

**Young professional**

![Location Map](image)

Figure 1.1

The following factors are represented within this location map.
- This person is located in Loughborough
- This person predominantly travels by car even in their hometown
- This person has travelled to numerous locations which are a long distance from where they live
- These places are mainly for leisure purposes e.g. visiting friends and family
- This person works within the local area
- This person has travelled to Europe three times in the last year

Each of these factors helps build a profile for this individual but this also contributes to the overall user group of young professionals.
The following factors are represented within this location map:

- This person is located in Somerset
- This person predominantly travels by car
- This person has an even spread across the location map. They visit as many places far away as they do to locations nearby.
- The places visited which are further afield are mainly for leisure purposes e.g. visiting friends and family
- This person has travelled to Europe twice in the last year
The following factors are represented within this location map:

- This person is located within Somerset
- This person predominantly travels by car
- This person travels to locations far away but mainly for business as opposed to leisure
- This person also uses a variety of modes of transport to travel to their business locations
- This person has visited the United States of America and Europe within the last year
Student

Figure 1.4

The following factors are represented within this location map:

- This person is located within Loughborough
- This person predominantly travels by foot or by bus
- A large proportion of the locations visited are within the local as opposed to the business user
- This person has been to Europe once in the last year

3.3.2 Summary of insights across user groups

The following page presents a summary of points arising from the interviews across all the user groups. There are points from:

Students
Young professionals
Young professional / Parents
Parents
Business users
Business / Parents
4. Questionnaires

4.1 Aims

The main aims of the questionnaires were:

1. To determine people’s attitudes to and experiences with Location-Based Services.
2. To achieve this it is necessary to understand people’s lifestyles.
3. To enable selection of representative interviewees
4. To understand their use of mobile phones

4.2 Method

The questionnaire was designed based on earlier work carried out in the exploratory interviews. The questionnaire was divided into sections. The first section dealt with participant demographics, e.g. age and gender. The second section investigated their use of mobile phones. This section included questions relating to the make and model of phone, the type of contract, and the network. When obtaining feedback from the partners this information was deemed helpful to them because they could then see if this user group (students) predominantly adopts high end technologically advanced mobile phones with long-term contracts or whether they prefer a less advanced phone on a pay as you go contract. These factors make a difference to services they may provide. Refer to Section 4.3.1 – Student Questionnaire Results – Demographics.

The third section of the questionnaire investigated the students’ attitudes/opinions on potential mobile services. Participants were asked to tick one box for each type of service, to indicate their level of awareness, use, opinion etc. A comprehensive list of services was placed within a table and participants were asked to rate on a scale from ‘never heard of it’ to ‘use it now’. The services were individually identified, but to help participants they were also grouped under the following headings:

- Proximity & information services
- Navigation & travel services
- Mobile communities
- Gaming
- Commerce
- Security

The attitudes section was incorporated because the output from it would demonstrate the current attitudes/opinions on services from this user group. Refer to Section 4.3.2 - Student Questionnaire Results – Attitudes. Following on from the table was a question on ‘Points of interest’ (POI’s). The students were asked to state five POI’s that were of interest or relevant to them. They were also asked if they would like a generic description (telling you what it was) or a specific brand/chain description for that object (Supermarket, Sainsbury). This gave a quick snapshot of what places and events were important to each of them and in turn gave a simple representation of the type of things they liked doing.
The final section investigated the students’ attitudes, likes and dislikes. The students were asked to answer a series of questions about factors they liked and disliked about their mobiles. They were asked about the functions they wished it could do and whether they had any issues surrounding some of the new services, for example if they would have privacy concerns with services like find a friend. Again this gave a snapshot of the attitudes students have towards mobile phones and helped build the profile of the student user group. The results of this are not presented in this paper but are available on request.

4.3 Results

4.3.1 Student Questionnaire Results - Demographics

The following set of graph results are from a paper-based survey of 122 students at Loughborough University. The survey was carried out and completed in February 2004. This was a snapshot of a student population. Graphs 1.1 – 1.4 describe the selected population in terms of gender, age, make of mobile phone and the mobile network. This information aided the selection of typical students for the in-depth interviews.

Graph 1.1 Percentage gender mix of student respondents (n=122)
Graph 1.2 Age distribution of student respondents (n=122)

Graph 1.3 Student ownership of different makes of mobile phone
Graph 1.4 Student usage of different mobile networks

Graph 1.4
4.3.2 Student Questionnaire Results - Attitudes

The following section of graphs refers to student’s attitudes towards different mobile services. Graph 1.5 represents an overview across a number of services. Graphs 1.6 – 1.12 present a more detailed view of an individual service. The scale with which the students rated on was a six point scale and began with ‘never heard of it’ and ended with ‘use it now’.

Graph 1.5 Student attitudes to different mobile services - attitudes across all services

Graph 1.5 is best viewed laterally and longitudinally to understand how attitudes towards services differ. For example a large number of the bigger bars are found near the back, therefore the students have not heard a lot about these particular services.
Graph 1.6 Student attitudes to Proximity & Information Services: nearest services e.g. bank

Graph 1.6 shows that 36% of the student population asked had not heard of the service ‘where’s my nearest’. This service will find what you need when you need it most, whether it's a cash machine, pub or restaurant. It will give you the address and telephone number and an easy to read map.
Graph 1.7 Student attitudes to Navigation & Travel Services: walking directions

Graph 1.7 shows that 45% of the student population asked had not heard of walking directions. This is a very large percentage considering the student population surveyed generally walk from location to location. This is also a result of Loughborough being a market town with most amenities being easily accessible.

Graph 1.8 Student attitudes to Navigation & Travel Services: driving direction
Graph 1.8 presents a slightly different picture. Even though there are a large percentage of students who have not heard of driving directions it has to be taken into account that many of the students surveyed may not own cars.

**Graph 1.9 Student attitudes to Navigation & Travel Services: public transport information**

Graph 1.9 is a good comparison with graph 1.8. This is because students use the public transport services the most out of all of the services (13%). It also has the highest percentage of people who are aware of the service and want to use it. Finally only 18% of students have not heard of the service. This is because they have a much higher need for this type of information.
Graph 1.10 Student attitudes to Mobile Community Services: friend finder

Graph 1.10 demonstrates the lack of awareness of mobile services in the student community. This is because 50% of the students asked had never heard of the service ‘find a friend’. This service allows you to find out the location of family, friends or colleagues so that you can arrange to meet up with them (they would have given you permission to do this). When questioning about what the service did, a large amount of students were interested in trying this service out as they again saw a purpose and need for it.

Graph 1.11 Student attitudes to Gaming Services: mobile games

Graph 1.11
Graph 1.12 Student attitudes to Gaming Services: location-based games

In comparison graph 1.12 shows the potential of location-based gaming. This is a game on a mobile phone that involves the environment you are in. A considerable 72% have not heard of it and only 2% are aware of its existence and currently use it. Based on the uptake of normal gaming; location-based gaming has huge potential but is currently not being marketed correctly and is not widely available as yet.
5. In-depth Interview

5.1 Aims

1: To understand the scope of activities that different user groups (in these cases students) currently undertake everyday.
2: To understand what activities are important to these people.
3: To investigate where the opportunities are for providing location-relevant information.
4: To investigate what services would make a difference to them and why.
5: To further understand people’s opinions on services delivered to mobile devices.

5.2 Method

The interviews were broken down into two sections as before. The first section involved the location mapping procedure. For details on this procedure please refer back to the ‘Exploratory Interviews’ Section 3. The second section incorporated a structured interview. The differences in procedure are shown below.

5.2.1 Location Mapping

The procedure was very similar; however some developments were made as a result of feedback from the project team and from the findings of the exploratory interviews. Developments were made with what data was recorded, this time the frequency with which they visited a place was taken, but the time it took to reach a place was not. In addition certain places were expanded further. The criterion for expansion was as follows:

- They had to stay overnight
- For the two inner circles this rule applied for over the last month
- For the two outer circles this rule applied for over the last six months

For each of the places visited that met the above criteria a record was made of the form of transport used, the frequency they visited a place and what they did there

5.2.2 Structured Interview

The structured interview flowed on from the location mapping as it requires the participant to recollect a typical week they currently undergo. As before the interview technique was adopted but this time structured interviews were used. This was due to their facility to enable us to understand in detail the cognitive processes and opinions of the interviewee and to allow comparison of information across different user groups. The procedure was identical as in the exploratory interviews for the first 2 steps. However, the 3rd and 4th steps were changed.
Once the interviewee had given details of their two busiest days they were asked to rate each of these journeys in terms of the likelihood of something going wrong and the consequence if it were to go wrong for them. This was achieved using two, four point scales. The fact that the likelihood and consequence have been identified will later aid in deciphering how information needs change with importance of journey. Now a chronological structure is achieved that the interviewer can work from for the final step of the interview.

The 4\textsuperscript{th} step is reached, now that a typical day has been outlined. The interviewee is then asked a series of questions regarding each change of location, or period of travel using the following structured prompts:

<table>
<thead>
<tr>
<th>Prompts adopted for interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is this important to you?</td>
</tr>
<tr>
<td>2. Why?</td>
</tr>
<tr>
<td>3. Would knowing something more help you?</td>
</tr>
<tr>
<td>4. What?</td>
</tr>
<tr>
<td>5. What would it help you to do?</td>
</tr>
<tr>
<td>6. When would you want this information?</td>
</tr>
<tr>
<td>7. Would you make any effort to get this?</td>
</tr>
</tbody>
</table>

The worked examples shown below demonstrate how the prompts actually worked in practice and how they would compare across the different user groups.

**Example 1** demonstrates how a specific scenario/event may be described by a student

**Example 2** demonstrates how a specific scenario/event may be described by a businessman

**Example 3** demonstrates how a specific scenario/event may be described by a parent

**Prompt 1: Is this important to you?**
This will be used as the first prompt when an event/scenario is stated. It will be followed by the second prompt ‘why’ regardless if it is important to them or not. If it is not then it won’t make a difference if a service is available to them.

*Example 1*  
**Getting to lectures in the morning**

- **Prompt:** Is this important to you?
- **Response:** Yes very because it is my final year and I need to make my lectures to get the information  
  
  *Ok go to Prompt 2*

*Example 2*  
**Getting to a meeting at a new venue in London**

- **Prompt:** Is this important to you?
- **Response:** Yes it is important to get there but it does not matter if I am a bit late as there is a meet and greet time to allow for people who get lost.  
  
  *Ok go to Prompt 2*

*Example 3*  
**Going shopping**

- **Prompt:** Is this important to you?
- **Response:** Yes as it is the one time I get to relax away from the children  
  
  *Ok go to Prompt 2*

Obviously if any of the responses had said no then the interviewer would know not to continue in questioning about that scenario/event but would have a reason why the service was not important to them.

**Prompt 3: Would knowing something more help you?**

This will act as the third prompt. Again if the participant responds with a positive answer then the interviewer will know to continue to the fourth prompt ‘what’. It might be that the participant undertakes this scenario/event everyday so the opportunity to gain further information may be minimal in this particular instance.

*Example 1*  
**Getting to lectures in the morning**

- **Prompt:** Would information from a service help you?
- **Response:** Yes a variety of information would be helpful for instance knowing when the bus is going to arrive so that I don’t have to wait in the rain, also finding out which of my friends are going to the lecture, also whether the lecture has been cancelled  
  
  *Ok go to Prompt 3*

*Example 2*  
**Getting to a meeting at a new venue in London**

- **Prompt:** Would information from a service help you?
- **Response:** Yes it would because London is very busy in the morning so I would like some navigation information and traffic information to try and get there on time.  
  
  *Ok go to prompt 3*

*Example 3*  
**Going shopping**

- **Prompt:** Would information from a service help you?
- **Response:** Yes it would because I do not have very much time and I want to get a present for my friend but am not sure what to buy her.  
  
  *Ok go to prompt 3*
Again if you think of negative statements to the above responses the line of questioning into that scenario/event would stop.

Prompt 5: What would it help you to do?

This prompt will provoke the participants to take a step back and actually think about how they make their daily decisions, and if they can be aided in making these decisions by being provided with more information from a relevant service. If not then the questioning into the scenario/event will stop.

Example 1  Getting to lectures in the morning
Prompt: Would information from a service help you make a decision?
Response: yes definitely if it was information that I would not be able to access i.e. going to get the bus...being informed about an accurate arrival time rather than phoning a friend to see if the lecture was on – a service would not be necessary for this

Ok go to Prompt 4

Example 2  Getting to a meeting at a new venue in London
Prompt: Would information from a service help you make a decision?
Response: It would definitely help me make a decision because it would be a new area of London to me so I would find it a lot more difficult without the information

Ok go to prompt 4

Example 3  Going shopping
Prompt: Would information from a service help you make a decision?
Response: Yes because it could give me a variety of options for presents and also let me know what shops have them

Ok go to prompt 4

Again if a negative response was given to the prompt then the interviewer would not pursue the line of questioning relating to the scenario/event.

Prompt 6: When would you want this information?

This is the penultimate structured prompt that will be used. However if the interviewer feels there is an opportunity to ask some more detailed questions then they should continue.

Example 1  Getting to lectures in the morning
Prompt: When would you want this information?
Response: In relation to the bus information it would be time critical as I cannot miss the bus, so it would be good to receive constant updates.

Start the prompts again at the next scenario/event

Example 2  Getting to a meeting at a new venue in London
Prompt: When would you want this information?
Response: I would need this information in real-time what with London
being so busy. Also some more general information prior to
leaving on the journey would be good so that I would have a
rough idea of where to go

**Start the prompts again at the next scenario/event**

**Example 3**

**Going shopping**

Prompt: When would you want this information?
Response: I’m not sure really I suppose the day before or a few hours
before I go shopping because I would need time to think about
what the best suggestion from the service was. If I had it in
real-time then I would not have time to think about it and make
a decision.

**Start the prompts again at the next scenario/event**

**Prompt 7: Would you make any effort to get this?**

This is the final prompt used in the interview. Once a response is given then the
interview will carry on as normal and the prompts will be used from the beginning of
the next scenario/event

**Example 1**

**Getting to lectures in the morning**

Prompt: Would you make any effort to get this?
Response: I would if I could receive the information through my mobile.

**Start the prompts again at the next scenario/event**

**Example 2**

**Getting to a meeting at a new venue in London**

Prompt: Would you make any effort to get this?
Response: it would depend on the importance of the meeting. If it was
critical then I would make a lot of effort and would pay for it.

**Start the prompts again at the next scenario/event**

**Example 3**

**Going shopping**

Prompt: Would you make any effort to get this?
Response: I would make a fair amount of effort especially if I was in a
rush.
5.3 Results

This section of results is divided into two parts. Firstly there is the location mapping schematics. Each schematic has a list of characteristics that relates to that participant. Secondly there are some examples of the insightful comments that were collected from the recorded section of the interview.

5.3.1 Location mapping within students

Participant 1
- Male
- 1st year student
- Lives in halls on campus
- Has no car whilst at University
- Is based at Loughborough

Figure 1.5

The following factors are represented within this location map.
- This person is located in Loughborough
- This person predominantly walks everywhere
- This person has travelled to numerous locations where they have stayed overnight, hence the expanded areas
- These places are mainly for leisure purposes e.g. visiting friends and family
- This person works within the local area
- This person has travelled to Europe once in the last year
Participant 2
- Male
- 1st year student
- Lives in rented accommodation off of campus
- Has a car whilst at University
- Is based at Loughborough

Figure 1.6

The following factors are represented within this location map.
- This person is located in Loughborough
- This person predominantly travels by car even in their hometown
- This person has travelled to numerous locations which are a long distance from where they live but have not stayed overnight very often
- These places are mainly for leisure purposes e.g. visiting friends and family
- This person has travelled to Cuba once in the last year
Participant 3
- Female
- 1st year student
- Lives in halls on campus
- Has no car whilst at University
- Is based at Loughborough

The following factors are represented within this location map.
- This person is located in Loughborough
- This person predominantly walks everywhere
- This person has travelled to numerous locations which are a long distance from where they live and sometimes stayed overnight
- These places are mainly for leisure purposes e.g. visiting friends and family
- This person has not travelled abroad in the last year
Participant 4
- Female
- 1st year student
- Lives in halls on campus
- Has no car whilst at University
- Is based at Loughborough

The following factors are represented within this location map.
- This person is located in Loughborough
- This person predominantly walks everywhere
- This person has travelled to numerous locations which are near to Loughborough
- These places are mainly for leisure purposes e.g. visiting friends and family
- This person has travelled to Europe once in the last year
Participant 5
- Male
- 1st year student
- Lives in halls on campus
- Has no car whilst at University
- Is based at Loughborough

The following factors are represented within this location map.
- This person is located in Loughborough
- This person predominantly walks everywhere
- This person has not travelled very far out of Loughborough other than home in the last year
- These places are mainly for leisure purposes e.g. visiting friends and family
- This person has not been abroad in the last year
Participant 6
- Female
- 1st year student
- Lives in halls on campus
- Has no car whilst at University
- Is based at Loughborough

Figure 1.10

The following factors are represented within this location map.

- This person is located in Loughborough
- This person predominantly walks everywhere
- This person has travelled to numerous locations which are a long distance from where they live and stayed overnight, hence the expanded areas
- These places are mainly for leisure purposes e.g. visiting friends and family
- This person has travelled to Europe once in the last year
### 5.3.2 Summary of insights within the student user group

The following comments are made from the same six students who helped develop the location maps above. The comments were given during the recorded section of the structured interview. These are a few examples of the attitudes and opinions that the students interviewed hold.

<table>
<thead>
<tr>
<th>Activities</th>
<th>Services</th>
<th>Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>Cancellation notification</td>
<td>‘knowing not to go’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>‘suppose it would be nice to know if it is on or not, but we always get an email if it is not on’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>‘Sometimes it gets cancelled so knowing that would save me a journey’</td>
</tr>
<tr>
<td>Room Change</td>
<td>Module content</td>
<td>‘Look it up in a textbook or just read over a few notes just so I know I won’t be starting from scratch’</td>
</tr>
<tr>
<td>Change notification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting with friends</td>
<td>Friend finder</td>
<td>‘yeh I actually ring my friends to make sure they are still at the canteen, so maybe knowing they are there beforehand instead of ringing them up that would be handy’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>‘I suppose so but only if they do not answer their phone’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>‘it’s a safety thing, if someone had just left we could catch up with them’</td>
</tr>
<tr>
<td>Leisure activities</td>
<td>Booking facilities</td>
<td>‘sometimes people have booked all of the courts due to 1st team training’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>‘how many courts are free’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>‘sometimes end up going back home, it would be nice to have a phone number, so we can check availability’</td>
</tr>
</tbody>
</table>
6. Discussion

6.1 Exploratory Interviews

The location mapping technique was deemed to be sound. It is a flexible technique which enabled us to extract the sought after information. It can be extended in any direction - in this case the frequency that you visit places was added. They worked well as an introductory tool to help the participants feel at ease before a quite personal conversation about what they do and when, and the maps visually identified the differences that occur across the groups and will be used in further studies to do that.

The interviews served as a good technique for extrapolating important information needs and system design requirements. A combination of the location maps and the interviews identified the factors that impact on the different user profiles e.g. income, social circle, travel habits etc. The location maps are affected by the size of the world the individual habits in. This implies the differences that are shown between living in a small village compared to living in a large city. Below are some examples of the various types of location maps that are envisaged to be received. They are defined by the small circles.

Figure 11 demonstrates that the individual lives within a small world, so does not have the need to travel or visit places further a field (small circles close to the centre). However in Figure 12 the opposite holds true. Their ‘world’ is larger and they travel and visit many places that are quite a distance away (small circles are spread out and far away). Figure 13 shows that they live in a large world but only travel and visit a small number of places but they do a lot of activities when at these places (small circles close together and far away).

Figure 11 demonstrates that the individual lives within a small world, so does not have the need to travel or visit places further a field (small circles close to the centre). However in Figure 12 the opposite holds true. Their ‘world’ is larger and they travel and visit many places that are quite a distance away (small circles are spread out and far away). Figure 13 shows that they live in a large world but only travel and visit a small number of places but they do a lot of activities when at these places (small circles close together and far away).

The outputs of these interviews were twofold. There are method and system implications. The method factors that were identified affect the profile of an individuals location map. These factors are:

- Dispensable income
- Variety of social / business trips
- Knowledge of the area
- Location of their social circle

These factors were investigated further within the questionnaire and the in-depth interviews.
The system implications need to take into account different profiles. These profiles impact on individuals’ cognitive perception of space, for example what is near and far. The systems need to take this information into account.

6.2 Questionnaires

The questionnaires enabled the selection of a representative population for the in-depth interviews and they will be used for this in the future research. In relation to awareness, of the services that were identified 50% of the student population were aware of them. They are more aware of mobile games, but this is because games now come as standard on a mobile phone. The main reason for showing this result (Graph 1.11) is the relationship to the location-based gaming service (Graph 1.12). Some 72% of the population have never heard of this service, but its potential is very good as is shown by the awareness of the less developed mobile games service. With the diffusion of technology this is likely to change over time. Our results are independent of technology.

6.3 In-depth Interviews

6.3.1 The Student Lifestyle

There was a group of lifestyle factors that came out of the student questionnaires and in-depth interviews. The population investigated had a lot of routine involved in their days and generally the physical world that they interacted with was a small one, as they are based within a small market town (Loughborough). It is very self-contained and everything you need is nearby. As a result there is not much need for transport or public transport. However taxis are used a lot. This user group is very sociable and because they have a set routine it means that they meet up regularly with their friends. There is a lot of information passed when face-to-face and generally they all live very close together, usually in the same hall and often on the same floor so there tends to be a lot of texting and less phone calls. The main information they need is when arrangements have changed.

6.3.2 The Activities

The activities that are important to the students are that they get to their lectures, they meet with their friends, they arrange evenings out and organise leisure activities. With lectures it was important they find out if it had been cancelled, with meeting friends it was more related to where and when, and for leisure activities it was all about successfully booking facilities. The interesting point here is that although lectures are important, the students are more motivated to spend more effort on making sure things work out ok like meeting their friends and booking squash courts, but they are not willing to pay much. They want it to be quick and easy and cheap. They refer a lot in the interviews to ‘just popping out’ and ‘grabbing something to eat’, both of which imply immediacy and convenience.
6.3.3 The Services

Currently services are competing with Texting, the World Wide Web, E-mail and instant messaging. They can simply download information from sources like the internet when they miss a lecture. They also receive emails if a lecture is cancelled. Services need to have an added value. They need to be at the right time and location. They need to be easy to use and they need to be cheap or even free! The more people that are involved the more in advance the information needs to be. For example out on a Friday night, the information is required on Thursday. There are trade-offs being made everyday. For example people stating that ‘it’s not worth it’, or ‘if it was cheap enough I might use it.’ Lots of activities are low-value activities for students like food shopping and booking squash courts so in comparison it is unlikely that they are going to pay for services especially when a lot of the problems they currently have can be sorted out by text or phone. There would have to be a lot of added value for anything more expensive. All information is available at the moment but from different sources. Services currently fail to bring it together in an easy and immediately accessible way.

6.3.4 The Potential for Services

The output from the questionnaires and in-depth interviews was identification of potential value-adding new services and location-based services. Some of these services have a location element like going out and some relate to mobile services more generally. These are discussed below:

1. Going out
   - Co-ordinating a large group
   - Knowing what is going on in town
   - Arranging taxis – how long until it arrives
   - What places have special offers and discussing where to choose with friends – this information would be required during the week before
   - Who is going out - this information would be required on the day
   - What time people are meeting - this information would be required a few hours before
   - How busy the places, queues are - this information would be required in real-time

   There are numerous sources for obtaining information at the moment, but it is how all of these sources are integrated into a mobile device that is the issue. When people meet up with others in town and they are trying to find out where they are or if they are in a queue or in the club. These tasks are currently being solved via text. It is a flexible arrangement and it does change each time. Other activities are quite routine and similar each day.

2. Lecture cancellation
   Currently if a lecture is cancelled students are notified by email when at home. If it is a morning lecture they require the cancellation information the night before so they do not have to get up early. If however, they have already left the house there is no way of getting
that information other than from friends and they really need it as soon as possible.

3. Ballooning
   - Need to know which fields have crops in before they get to low.
   - This cannot be done through a visual searching process.
   - For the ground crew, they need to know the best route to the balloon.
   - They have a trailer which is restricting.
   - They cannot always find the best route for approach

This service would involve combining location and mapping

The other services that were mentioned were for booking leisure activities like squash. Currently they have to walk to the courts only to find out that they are all fully booked. Making a decision whether to eat in halls at lunch or dinner, so information about the menus would be required.
7. Conclusions

The approach succeeded in its three main objectives, i.e. to map, log and compare the everyday activities of different user groups, to identify opportunities for LBS for one group and to develop a method to support this.

The exploratory interviews enabled testing of the location mapping technique and this proved valuable in creating a visual picture of the travel ‘worlds’ of a range of people. Particularly, it enabled comparisons between different users ‘worlds’ which could then be explored further in the interviews. Understanding people’s perceptions of these worlds further (in follow-on research) may provide an insight to how future systems and services should convey ideas of space and movement to the user.

Together with the subsequent interviews, the location maps also supported users in identifying the issues that influence daily activities and hence will be important to take account of in future location-based services. Examples of such issues are the location of their social circle, the variety of social/business trips, knowledge of the area and disposable income.

The questionnaire enabled a snap-shot of current student awareness of, and attitudes to, location-based services. Approximately half of students were aware of services such as find my nearest, pedestrian direction, driving directions and friend finder. They were more aware of public transport information services and very few had heard of location-based games (compared with high awareness of mobile games per se). Only a few had actually used the services in question.

The questionnaire also allowed the selection of a representative sample of the student population to be selected for the in-depth interviews.

The in-depth interviews showed that the lives of the students investigated in the study was defined by a relatively small world of movement with lots of routine which serves to ensure they meet up with friends regularly throughout the day. Communication and information needs mostly occur when there is some change to routine (e.g. a lecture is cancelled) or the arrangement of flexible social events (e.g. a weekend night out that is dependent on events going on, people available etc.). Future LBS would have to compete with, and provide value over and above, current information sources which are text, the Internet, email and instant messaging. Students are constantly making trade-offs between the effort involved to get the information, the benefits it would give them and how much it would cost (e.g. “it’s not worth it”, “I might use it if it was cheap”)

One of the main opportunities for LBS for students would be the provision of integrated information. Currently lots of different information sources and communication methods are used to arrange a night out (e.g. flyers/posters for events, texting around friends to check availability and arrange times, phone calls for taxis). Further research could identify the exact nature of this information and the potential to provide a ‘one-stop-shop’ with all the information and communication brought together. Still, cost would remain an issue for this group.
The methods developed within the research have proved valuable in enabling the identification of all these issues. The next stages of the research will follow two main directions: (i) the questionnaires and in-depth interviews will be conducted for the other user groups, i.e. young professionals, teenagers, parents and retired people, to enable a comparison of the location maps and opportunities for LBS; (ii) the opportunities for services for each group will be studied in greater detail using scenario-based focus groups to determine the exact nature of the information required and the importance of location in these contexts.

The work will conclude with the development and test of new concepts for location-based services for a range of user groups and contexts.
References


