# QUESTIONS AND ANSWERS: EXPLORING MOBILE USER NEEDS

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# Abstract

The users of mobile devices increasingly use networked services to address their information needs. Questions asked by mobile users are strongly influenced by context factors, such as location and user activity. However in research which has empirically documented the link between mobile information needs and context factors, information about expected answers is scant. Therefore, the goal of this study is to explore the context factors which influence the mobile information needs and the answers expected by mobile users. The results, are obtained by analysing information from paper diaries and digital diaries. This project involved a user study, comprising two different types of studies concerning a paper diary and a digital diary. The analysis of both the paper diary and the digital diary was conducted through grounded theory and taxonomy of information needs. our results indicate a relationship between mobile information needs and context factors and expected answers. Our study explored this relationship between mobile information needs and context factors, and provides a better understanding of the expected answers related to mobile information needs.

# Acknowledgements

It would not have been possible to complete this thesis in a relatively short period of time without the great support and help of a number of people whom I would like to recognize and thank.

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Finally, I wish to express my heartfelt gratitude to my family. To my adorable parents; Amy and Ben who have the overwhelming love and support. To my siblings; Cindy, Coco and Benson who help and encourage me. To my lovely dog; Maggie which walks with me every morning to clear my mind. I could not have done this without you all.

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# Glossary

**Context Factor**

Environmental factors which cause people perform a mobile search.

***Clickers***

People who click the search term for search; defined in the paper 'Questions not Answers' by Jones et al.

**Digital Diary**

A user study in which participants use electronic products, such as the mobile phone to record information.

**Digital Record**

It is part of a photo or video recorded in a digital diary.

**Geographical-question**

Questions that relate to the location or place.

**Geographical Needs**

Category of mobile information needs related to the geographical information, such as navigation when driving a car.

**GPS**

Global Positioning System provides reliable location and time information in all weather and at all times and all places via satellites.

**Grounded Theory**

It is a systematic methodology in social science and is mainly used for qualitative research. It analyses the collected data by grouping the data

into similar concepts or categories and using these results to create the theoretical framework.

**Information Needs**

It is a requirement for an individual or group to locate and obtain information to satisfy a conscious or unconscious need.

**Informational Needs**

Category of mobile information needs related to everything except geographical information.

**Mobile Search**

Internet search using a search engine on a mobile phone.

**Mobile Information Needs**

It is a requirement for the mobile search to find information to only satisfy a mobile user's information need.

**Paper Diary**

A related user study in which participants use paper and pen to record relevant information.

**PDA**

Personal Digital Assistant is a palmtop computer which has the function of notebook, calendar and databases.

**Problem-question**

Questions that relate to anything except location or place.

***Searchers***

People who type a search term for search; defined in the paper 'Questions not Answers' by Jones et al.

**Search Term**

Specific word or phrase used for Internet search in the search engine.

**Tag Cloud**

It is a visual depiction for the population of each word. Tags are usually

single words and using color or font size indicate the importance of the tag in the group.

**Text Record**

It is text in a digital diary (as distinction from photos or videos).

**User Study**

It is a method used mainly to study the user's behaviour and it is usually used in information science research.

# Chapter 1

# Introduction

The first mobile phone was created in 1973 and provided only a functionality for people making calls. With the evolution of digital wireless communication, the mobile phone greatly improved in offered functionalities. Digital wireless communication evolution is a key factor which advanced the mobile phone and enabled other functions to be developed. The basic functions of todays mobile phone are a camera, Personal Digital Assistant (PDA) and Global Positioning System (GPS). The next requirement of mobile device is the technique is not the function and it is the effectively search in the mobile device. Even though the search engine develops complete in the computer but it can not transfer to the mobile device. By reason of mobile device is restricted by the size of screen to display search results.

The last decades have seen growing importance placed on research in mobile device development. As technology capacities increase, so does the demand for more effective search methods and precise information presented to mobile users. The paper by Jones et al. [1] provides excellent discussions of the applications of mobile search techniques. Growing numbers of researchers have considered the context information to help mobile search engines retrieve relevant information.

This chapter first introduces the general idea of the history of mobile phone and the mobile search technique. Then we introduce the results which are found in

our previous studies on mobile information needs. We use these concepts as a starting point for this project and to explain our scenarios for more advanced mobile users information needs issues. Subsequently, the objective of this study is described.

## 1.1 Background

Jones et al. [1] determined that a mobile search is influenced by the location context. Their study further confirms that previous questions offer some useful information when people search the location information in mobile search. They also point out the mobile user behaviour in the interface of mobile search. Mobile users prefer using clicking-through for mobile search therefore Jones et al. brings these concepts and develops the novel mobile search technique.

In our previous studies [2, 3], we found that related work on mobile information needs can be classified into two major categories. The first category considers query terms entered into mobile devices; these terms are found to have large overlaps between different users and also a strong relationship with the user location. Work in the second category studies users needs expressed as sentences, typically in paper diaries; they observe that user questions vary greatly and only a few overlaps can be found.

So far there is no substantial research exploring the influence of the mobile user's activity on their information needs, nor on the questions of what types of answers mobile users expect in different situations. This project will explore three aspects of mobile information needs:

1. Mobile information needs will be influenced by *context factors*.

2. Maps are important in any *geographical* mobile information need.

3. *Physical situations* will cause mobile information needs to arise.

## 1.2 Scenarios

In the Section 1.1, we described that features relating to mobile search technique and context factors are influenced by the mobile search. We also introduce the three aspects of this project (context factors, geographical information needs with maps and physical situation). This section uses the scenario to illustrate the situation of mobile search.

### 1.2.1 Scenario for Context Factor

Mary and David are walking in Victoria Street in Hamilton. This is first time they have travelled around New Zealand. They just were finished visiting Hamilton Garden and have returned to Victoria Street. Mary says "It is time to eat and I want to eat a good meal in Hamilton." David just takes his smart phone to make search. He already stores his travelling routines and preferences in the phone so his phone will suggest restaurants he will like.

David clicks on 'restaurant' then the results display the information for 3 different types of restaurant. They have a wonderful lunch in the restaurant of their choice and continue their travelling.

Figure 1.1: Mary and David travel to Hamilton and want to find a good restaurant for their lunch.

This scenario illustrates that context factor play a key role in mobile information needs, especially when a user is in a new environment and makes enquires in this environment.

### 1.2.2 Scenario for Map of Mobile Information Needs

Andy is on the way to visit his aunt. He has been there once before when he was a little boy. He can not find the direction to his aunt's home so he needs map to help him. He uses his new mobile phone which can accesses the Google map. On the way, he suddenly remembers cheesecake is his aunt's favourite food and he should bring one with him.

Hence, he types 'cheese cake' on his mobile device and tries to find a shop which sells great cheesecake. He finds the information of 'Yummy Cake House (YCH) on the search result of the third page. When he clicks the YCH; it also provides the location in the Google map. In the end, Andy shares the delicious cheesecake with his aunt at her house.

Figure 1.2: Andy wants to buy cheesecake on the way when he goes to visit his aunt.

This scenario illustrates that a map is an important part of geographical information needs. It also indicates the relationship between the map and the expected answer of the mobile information needs.

### 1.2.3 Scenario for Physical Situation

Jane walks her dog in the park. She meets her neighbour; Mrs. Key who has bought groceries from the supermarket. Suddenly Jane thinks she also needs to buy groceries for this week. She knows one supermarket is having specials this week but she can not remember which supermarket it is.

She uses GPS function in her mobile phone to locate the 'nearby' supermarket firstly and then looking for the specials in these supermarkets. After 3 minutes, she finds a supermarket Good Buy which is two blocks away from her house, so she goes to Good Buy and buy groceries straightaway.

Figure 1.3: Jane knows that one nearby supermarket has specials this week but can not remember which supermarket it is.

This scenario illustrates have mobile information needs an met by the conversation with people. the other point of this scenario shows that 'nearby' is one feature of geographical information needs.

## 1.3 Goal of this Study

This study gives the idea of mobile information needs is focused on improving the mobile search work be more efficiently for mobile users. We have found in the previous project [2] location and activity both are the context factors to influence the mobile search. As a result, there are two approaches to understanding mobile information needs. They are exploring mobile user's behaviour and analysing mobile search intent. For exploring mobile user's behaviour, we have confirmed that the location has a significant impact on the mobile information needs and the mobile search is also influenced by the previous queries [1]. For analysing mobile search intent, we found that knowledge-based needs are more popular than geographical-based needs in the mobile search [2]. It should be noted, however, that there have been few attempts to establish a direct relationship between physical situations and the mobile information needs. We

also believe there are the relationship between the expected answer and the mobile information needs. We agree that the paper diary can not capture these latent factors. Consequently, this project extends our previous project in order to confirm the category of location and activity in the mobile search as well as to address the details of expected answers for mobile users. Here, we focus on the following issues:

1. Extend the existing results from the previous project and relate the paper diary study to the results of further context factors and expected answers.
2. Use the digital diary study to explore the latent factors of a mobile search and compare the results with the paper diary study to find the differences.

The goal of this study is to extend and analyze results we have collected in the paper diary study and the digital diary study. We intend to find the context factor which influences the mobile information needs and the expected answers required by mobile users. We believe that the results of this study will build the pattern of the mobile users intent as well as provide the concept of the mobile users behaviour.

## 1.4 Structure of this Thesis

In Chapter 2, the related work of the study is described. We start by papers of mobile search behaviour and one of them is the background of this study, Questions not Answers [1]. Then related work regarding the mobile search intent i.e., why users want to search for information.

In Chapter 3, we examine the paper diary study and following-up interview to investigate three issues of mobile information needs. Then we explain each issue in more detail.

In Chapter 4 , we first give details of the design of the pilot user study for the digital diary. Then we used the results in the digital diary study which we focus on Chapter 4. We then analyze the results and compare with the paper diary study.

Finally, the conclusion summarizes this thesis and gives an outline for future work in Chapter 5.

# Chapter 2

# Related Work

There are two approaches to understanding mobile information needs. The first explores the mobile user's behaviour of *what users search for* and *how users search for information* on the mobile device. The second approach focuses on *why users want to search for information*.

## 2.1 Analysing Mobile Search Behaviour

The analysis of the mobile search queries has provided significant insights into the types of information of the mobile users search for, i.e., what they search for and how they search for information.

### 2.1.1 Questions Not Answers

Researchers specialising in mobile technology have suggested that the location would most likely affect the search behaviour on mobile devices especially in the area of mobile search function. For example, Jones et al. [1] conducted a two-phase field study. Phase one elicits queries regarding to a user location, and phase two examines the reaction of user behaviour to a new interface. The new interface focuses on previous queries related to a user location in order to investigate the most useful search results.

The authors identified two contextual influences that play a key role and change the mobile user behaviour. Firstly, there is the user who looks for something


(a) Phase I interface preforms "local" search at the campus.

(b) Phase II interface with previous queries for clicking "local" option.

Figure 2.1: Probe interfaces, Reprinted from "Questions Not Answers: A Novel Mobile Search Technique", by M. Jones, G. Buchanan, R. Harper and P.-L. Xech, 2007, *Proceedings of the SIGCHI conference on Human factors in computing systems*, p.155–158. Copyright 2007 by ACM. Reprinted with permission.

accidentally. This happens when a user is in a new environment and makes ventures in this environment as a tourist. Secondly, it is the user that uses the "purposeful information-seeking" as if they know the environment well and search the information to assist their activity. These findings address the mobile user behaviours are changed by contexts such as location. More recent works by Chang [2]and Hinze et al. [3] focused on the contexts of mobile user information needs.

Jones et al. generated a new interface by extending the MSN searching engine with the traditional searching box on the top of the interface. Two modes are provided on the interface: "location" and "web" search. The "location" search is designed to present results related to the local area such as a campus or a shopping mall(see Figure 2.1a). Additionally, the "web" search is designed to show all the results related to the query participants typed on the web (see Figure 2.1b). The button of Figure 2.1b presents other clicking options for a same local search as they are the top ten common tags from the tag cloud used (see Figure 2.2). These tags came from the phase one where participants entered the search terms regarding to their location (i.e. these tags are strongly location sensitive).

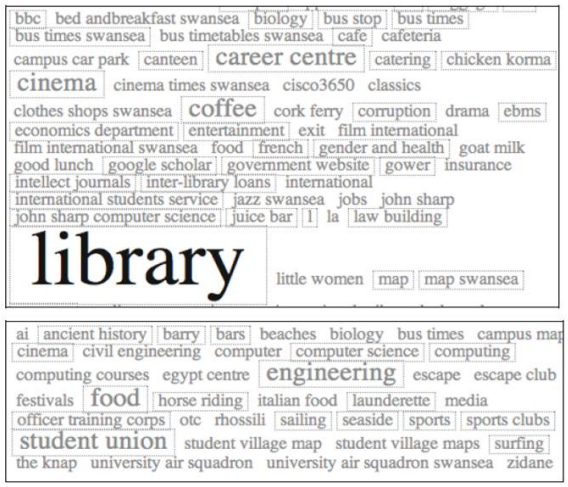



Figure 2.2: Probe interfaces, Reprinted form "Questions Not Answers: A Novel Mobile Search Technique", by M. Jones, G. Buchanan, R. Harper and P.-L. Xech, 2007, *Proceedings of the SIGCHI conference on Human factors in computing systems*, p.155–158. Copyright 2007 by ACM. Reprinted with permission.

The authors found that the location has a significant impact on the mobile information needs in phase one. The findings of 89% of questions examined in this study were asked about location by users suggesting that the mobile search is context sensitive. They also analyzed the query terms and found the query certainly related to the location and the overlap of queries captured in the same location. That is, these queries are generated by the location and they have the meaning for the location.

Jones et al. further highlighted that the mobile user behaviours are different responses to different type interactions. The study examines two interactions: the traditional search interaction (the *Searchers*) and the click-through interaction (the *Clickers*). 41% of users used the *Searchers*, and the result of 15% of queries copied the literal of click-through titles. It therefore deduced that the mobile search is influenced by previous queries, in particular, while users are engaging in a local search. One of their findings related to the traditional search interaction of mobile search terms tends to be short (1.7 words on average). 36% of users through the *Clickers* do mobile search and they are able to find the counterpart of the query term in the previous queries. The study goes on highlight the mobile search which is engaged by the previous queries.

Jones et al. found the location context is forceful factor for the context-sensitive mobile search and previous questions could offer some useful information for users engaging in location search.

### 2.1.2 Mobile Search Result Display

Han [4] explored whether the users' mobile information needs change depending on the result visualization on the map. This study examined the way in which differences of geographical context factor are overcome.

The author focused on the aspect of a user obtaining a quick idea about the surroundings through implementing iPhone and Google map API. Throughout the first phase collecting the information has been certain searched by all 40 participants with the query term. The result highlighted the majority of mobile search are geographical search (94%), while the context is one of the control variables.


(a) M1: local question.


(b) M2: knowledge based question.

Figure 2.3: Data visualization. Reprinted from *Questions not Answers* (p.23–24), by Z. Han, 2010, New Zealand, NZ: The University of Waikato. Copyright 2010 by Zhang Han. Reprinted with permission.

Subsequently, all the information about the query term and the answer was collected and connected to a map for data visualization as in Figures 2.3a and 2.3b. The author also found that users understand the map concept based on answers more than that with questions. The study highlighted that the location question with the map is more useful than the knowledge based question with the map. It suggests that results of the knowledge-based questions do not make sense to participants by simply displaying them on maps. The author further emphasized that separating types of these two question, the geographical-based type and the knowledge-based type, makes the users do more intuitive and useful mobile search by using the maps.

One finding of Han's study looked at the data visualization. Han explained that the study of the mobile user behaviour are influenced by the tag density. The author transformed query terms into tag clouds and associated them with maps in the local search. The map shows high levels of the tag densities, and that most of the overlapping queries are on the same coordinate (see Figure 2.4). This study was the first one to address that users simply ignored those with overly high tags densities and did not value those with tiny tag densities either. Thus, mobile users consider the quality more heavily than the quantity on the mobile search field.

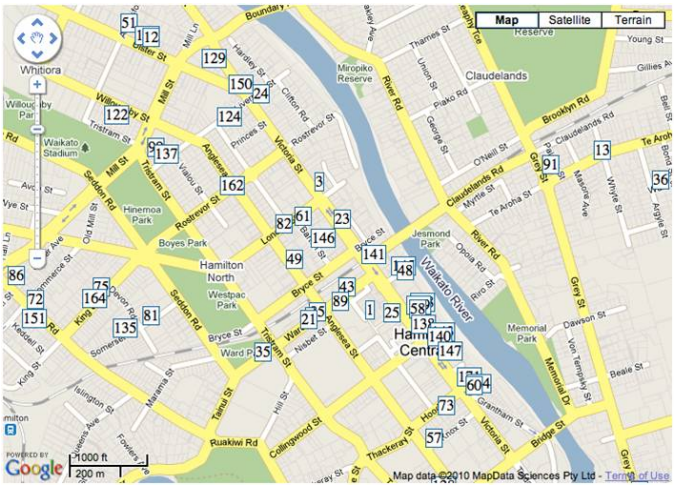



Figure 2.4: Example of a map with density of tags. Reprinted from *Questions not Answers* (p.22), by Z. Han, 2010, New Zealand, NZ: The University of Waikato. Copyright 2010 by Zhang Han. Reprinted with permission.

## 2.2 Analysing Mobile Search Intent

The analysis of the mobile search is for understanding the goal/intent behind the question, i.e. why they search.

### 2.2.1 Questions Not Answers: Information Needs for Mobile Users

Chang [2] and Hinze et al. [3] focused on finding the types of questions that interested mobile users. Compared to the Jones et al. [1], the major difference is that different methodologies had been used. Chang and Hinze et al. carried out a paper diary study to capture information needs, while the Jones et al. study captured query terms through those who had actually been asked on a mobile device. Contextual factors will influence the questions that are asked by the mobile users as observed by Chang and Hinze et al. These studies were the first to use a score an a scale which expresses how much the questions relate to the place and activity or to the place alone or to the activity alone. A significant portion of independent questions (without reference to location or activity)was found.

Chang analyzed the category of question, place, and the relationship of question in the study. In this work, Chang categorised questions into two classes according to the question type: Geographical (25%) and Problem (75%). The author also found that 30% of the user questions are related to problem-question, in fact, asking for advice. Most of these are questions of problem-questions related to personal data so that the answers can hardly be found on the internet or in the books. The result shows that personal questions of problem-question are a major type in the study. The finding then is focused on context factors. The result highlights that questions of mobile users are strongly influenced by their current place and activity through the evaluation of quantitative questions and scoring for relationships. Jones et al. study [1] had been done completely on location context which is the forceful factor in mobile search, and Chang [2] study results also support this claim even with

the paper diary. Besides, this study highlights the following activity of mobile search is a context factor and the empirical evidences support its strongly influential effect to a question and an answer.

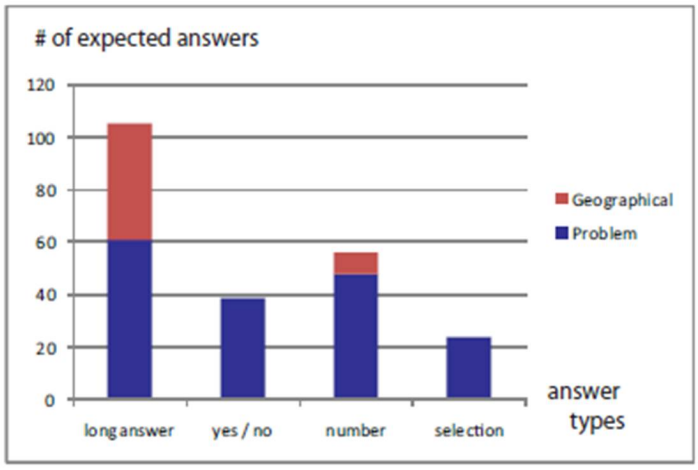



Figure 2.5: Distribution of answer type. Reprinted from "Contextual queries express mobile information needs," by A.M. Hinze, C. Chang, and D. M. Nichols, 2009, *Proceedings of the 12th international conference on Human computer interaction with mobile devices and services*, p.327–336. Copyright 2010 by ACM. Reprinted with permission.

Chang [2] and Hinze et al. [3] examined the expected answers on the mobile search. The authors categorised expected answers into four classes according to the word length: long answer, yes/no, number and selection. No matter what the question type was, long answer was the most expected answer for the mobile search (see Figure 2.5). The food may be asked for recipe for problem-question type while the driving direction would be more likely to be asked for geographical-question type. The results show that yes/no is the second expected answer for problem-question types in our study. Yes/no, the closed question is totally different from long answers of the open question but both of them are the most expected answers in problem-question type.

Chang and Hinze et al. focused on the type of questions recorded by participants which vary across their locations (home, work, at friends homes, out in

the city and while driving). These variations occur both in the query terms and in the desired answers. The observed results detected that context (e.g., to identify location related questions) and analysis of query keywords alone is not enough. This is also the reason for using paper diary studies to capture a complete question sentence rather than using the query term alone on mobile devices such as done in [2, 3]. More information was collected from the question sentence by analysing the query words (e.g., when, how, what) that are fairly consistent across the question category.

The studies from both Chang and Hinze et al. reinforce the roles of contextual factors, such as location and activities in order to understand and emphasis users' mobile information needs. They also reported an unusual number of highly personal, affective and subjective queries in the participants' diary entries. These queries seem to be less organized than those found in earlier similar studies. In contrast, only a few independent questions are reported, which are those which are affected by neither location nor activity in the diary entries.

### 2.2.2 Diary Study of Mobile Information Needs

In a recent analysis Sohn et al. [5] carried out a diary study of mobile information needs, focusing on what mobile users search for and also to explore these needs. Their study included 20 participants and carried out a 2-week study. The authors found the top three categories of information needs related to that is trivial (18.5%), directions (13.3%) and point of interest (12.4%). They also found 55% of entries the information needs were either later or not at all (see Figure 2.6). Sohn et al. analyzed how information needs were addressed at the time when they arose; the Internet based mechanisms (web access 30%) were the most popular (see Figure 2.7). They also highlighted the contextual factors: time, location, activity and conversation that prompted mobile information needs (see Figure 2.8).

Church et al. [6] is similar in nature to the Sohn et al. study. However in

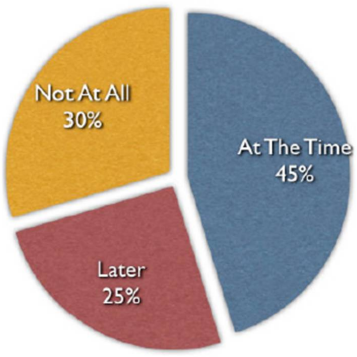



Figure 2.6: Pie chart of diary entry percentages when participants addressed their information need. Reprinted form "A Diary Study of Mobile Information Needs," by T. Sohn, K. A. Li, W. G. Griswold, and J. D. Hollan, 2008, *Proceedings of the twenty-sixth annual SIGCHI conference on Human factors in computing systems*, p.433–442. Copyright 2008 by ACM. Reprinted with permission.

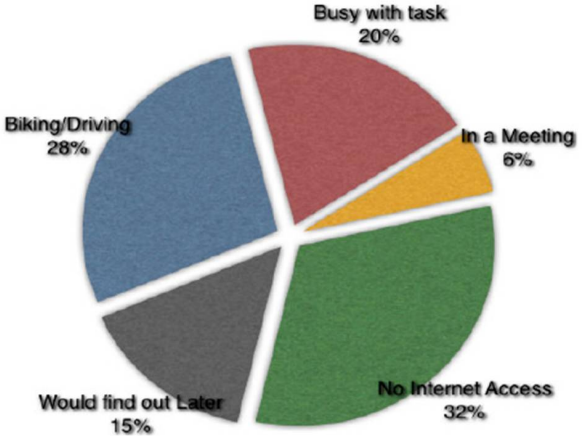



Figure 2.7: Breakdown of how need were addressed at the time they arose across all diary entries. Reprinted from "A Diary Study of Mobile Information Needs," by T. Sohn, K. A. Li, W. G. Griswold, and J. D. Hollan, 2008, *Proceedings of the twenty-sixth annual SIGCHI conference on Human factors in computing systems*, p.433–442. Copyright 2008 by ACM. Reprinted with permission.

Church et al. 's study, they look at the mobile information needs at length and exploring the goal/intent behind information needs. Church et al. carried out 4-week study and participants were asked to log information needs on a blank notebook (see Figure 2.9). Their study involved 20 participants (13 males and 7 females) and participants comprised a diverse mix are university students, the people working on IT and business people. All participants owned a mobile phone and have experience with making phone calls and text messaging but only 50% of participants have used their mobile to access the Internet. Most participants reported the main reasons they did not use the mobile to access the Internet was that the cost of the Internet, the speed of the Internet and the input/interaction of the mobile.

Church et al. concluded the three results: location context, user goals and topics in the study. They examined the diary entries to finding the majority of entries (>67%) generated when the participant was commuting, travelling abroad or on-the-go (see Figure 2.10). That is, this result also claims that the location is the context factor for the mobile search. Church et al. extended the concept of Broder classified Web queries [1]to this study and examined the three class of the goal/intent: informational, geographical and personal information management (PIM). The results show the most entries (58.3%) refer to informational needs. That is, the informational needs are those which most frequently arose in the mobile search. The topic analysis shows the mobile needs for the informational needs only. They found further that the most popular mobile topics are local services (24.2%) and travel & commuting (20.2%).

They also analysed all diary entries with each user goal (i.e. informational, geographical and PIM) by the location context. The results show that 75% of geographical entries are generated when the user is 'mobile'[2], compared to 25% while the user is in a 'non-mobile'[3]. That is, the geographical needs increase

[1]Broder categorised Web queries of the intent into three classes: Navigational, Informational and Transactional.

[2]mobile: users are away from their home or away their desks at work.

[3]non-mobile: users are at home or at work.

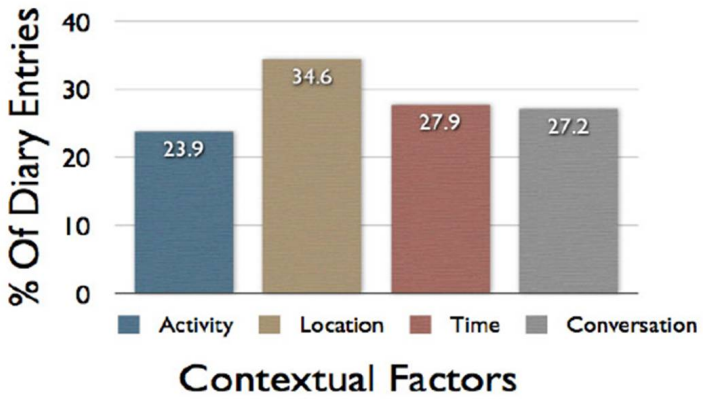



Figure 2.8: Percentage of different contextual factors that prompted information needs. Reprinted from "A Diary Study of Mobile Information Needs," by T. Sohn, K. A. Li, W. G. Griswold, and J. D. Hollan, 2008, *Proceedings of the SIGCHI conference on Human factors in computing systems*, p.433–442. Copyright 2008 by ACM. Reprinted with permission.

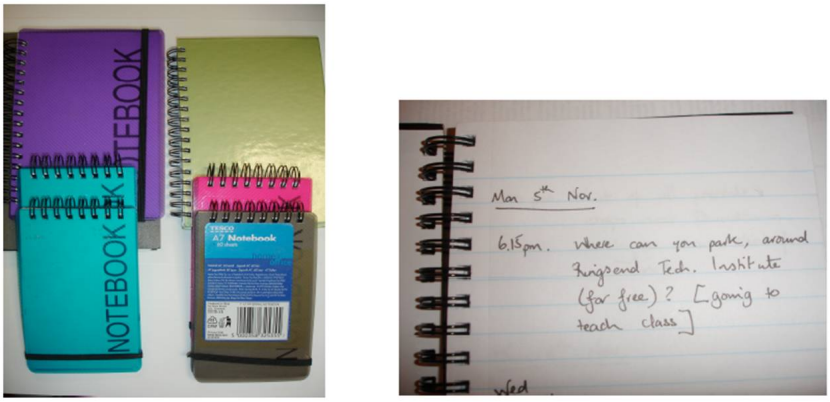



Figure 2.9: Sample diaries from participants illustrating the range of notebooks (right) used by participants as well as snippets of the actual entries (left) generated by participants. Reprinted from "Understanding the intent behind mobile information needs," by K. Church, and B. Smyth, 2009, *Proceedings of the 14th international conference on Intelligent user interfaces*, p.247–256. Copyright 2009 by ACM. Reprinted with permission.

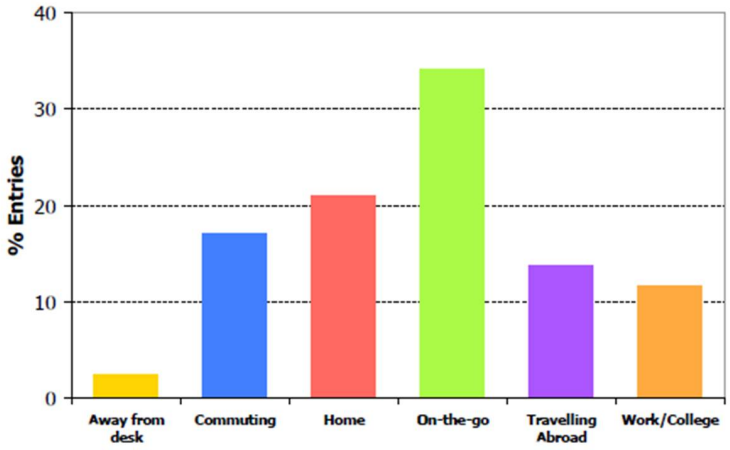



Figure 2.10: Distribution of location context highlighting under what conditions information needs arise. Reprinted form "Understanding the intent behind mobile information needs," by K. Church, and B. Smyth, 2009, *Proceedings of the 14th international conference on Intelligent user interfaces*, p.247–256. Copyright 2009 by ACM. Reprinted with permission.

significantly when participants are 'mobile'.

Temporal dependency is one of the mobile contexts in their study. Some participants reported their entries with the explicit temporal cues like tonight, tomorrow, next week etc. That is, the users required to know the answer having temporal dependency. The results highlighted over 30% of entries were geographical needs and require having a temporal dependency.

## 2.3 Summary

In this chapter, we first introduced two general approaches to understanding mobile user information needs: analysing mobile user behaviour and analysing mobile search intent. We discovered that the location has a significant impact on the mobile information needs, and the mobile search is also influenced by the previous queries especially regarding the local search. We believe we need to examine the valid previous queries for concerning recommender systems in the mobile search filed. From the recent work (described Section 2.1.2), we draw the important conclusion for the geographical needs that the results

display of the geographical-based needs associating with a map are the most efficient way for the mobile search. It is likely that the map will have a significant impact geographical-based needs.

We also observed that when the information needs were affected by both location and activity, they tended to be strongly affected by both factors. In regard with the category of location with questions, the results showed that home is the most common location asked in problem-question type while for geographical-question type, it is the public place. However it is worth noting some studies examined the outcome of the place category of move has the most question numbers of geographical-question than that of public place. We found the scoring concept that is the efficient approach to describe the relationship between the mobile contexts and mobile search.

Recent works all indicated that the location is an important context in mobile information needs. The related work of the diary study pointed out that the time and the types of expected answers depend on context as well as location in mobile information needs. We also found that diary studies are useful for capturing data in the environment in the most natural way possible.

# Chapter 3

# Paper Diary Study

In this chapter, we reported about our paper diary study that investigates what mobile users search for and also to explore these needs. Our focus is on the performance of results using the paper diary. We begin this chapter with the design of paper diary and the procedure. Then we illustrate the analysis of the results for three issues, *question*, *answer* and *activity*.

## 3.1 Goal for Paper Diary

This study aims to find out what kind of questions users like to ask in the mobile search. In particular, the paper diary is designed to focus on the possible relationship between the question to the user's location and the user's activity.

## 3.2 Method

Two methods have been used to collect the data for this study: paper dairies and interviews. Participants kept a diary for one week to record questions and were further interviewed about their general searching experience on mobile devices and about the questions recorded in their diaries (see Ethics Consent Approval in Appendix A). Moreover, in order to explore more deeply the relationship among questions, details of all questions for user action, expected answers, similar question checking and interviews were also conducted with

participants as well.

The diary method is a relatively unintrusive method to capture the information of mobile usage and it has been used frequently in previous studies [2, 5, 7]. An advantage of this is that diary logs can present narratives about the question motivation and the context of the user grounded in real life with the follow-up interview discovering the missing piece in the log. However, the drawback of this method is that the data is not accurate and comprehensive, participants could have forgot to record entries or are selective in recording for some personal reasons [5] and this may lead to biased results.

The follow-up interview was semi-structured and performed shortly after the week of data collection. Questions were asked about the question users had provided in the diaries, together with general information about their searching experience and habits (see the interview from in Appendix1 C).

The analysis of both the diary and the interview material was followed by two studies. Cunningham et al.'s study [8] showed, using the grounded theory to analysing the collected data and grouping the data into the similar concepts/categories, that the results are the theoretical framework. Heimonen's study [9] presented the concepts of the taxonomy of the mobile information needs which consisted of categorising the data accordingly.

### 3.2.1 Participants

A total of 12 participants (4 females, 8 males) were recruited from the COMP539 - Usability Engineering course. It is a third-level course of computer science in Waikato University focusing on the design and evaluation of human-computer interaction with user studies. The students of COMP539 learn to design and organise user studies [1]. They therefore have the experience of being a participant and most of them are studying for their Honour's degree or are in the

[1]The course information comes from the Computer Science school of The University of Waikato. http://www.cs.waikato.ac.nz

first year of their Master's study. Based on these participants education background, all of them have enough computer competence to access this study. Of the seven participants which had mobile search experience before, five had done the geographical-based search and two had done the knowledge-based search (see Table 3.1). See Table 3.2 for general data about the participants.

Table 3.1: Results of classifying participants mobile search behaviour.

| **Mobile Search Experience** | **# of participants** |
|---|---|
| Yes | 7 |
| - Geographical-based: | 5 |
| - Knowledge-based: | 2 |
| No | 5 |

All of the 12 participants reported that the most common search method was search through the Internet; while two participants reported asking people as their second searching method. The most common service referred to was Google, a search engine that also provides other services such as email, maps, instant messaging and so on. One of the participants reported using the university web page for assignment information; one reported used a different website for a specific purpose, like YouTube for video searching or Facebook for connecting with people.

### 3.2.2 Paper Diary

The diary study was designed as a 20cm × 10cm booklet whose size is similar to the size of a mobile device (see Figure 4.1a). The booklet consisted of a 1 page introduction which describes the process about the user study and 3 examples with a scenario which explains how to use the booklet to record the questions (see Figure 4.1b). Data was collected primarily by paper diary as a record of questions that the participants produced. Each entry consists of eight questions as shown in Table 3.3 (see the photograph in Figure 3.3):

Table 3.2: General data about study participants.

| **ID** | **Gender** | **Mobile Search Experience** | **Mobile Search Type** | **Methods Used** | **Search Website** |
|---|---|---|---|---|---|
| P1 | F | Yes | Geographical-based | Internet searching | Google |
| P2 | M | Yes | Geographical-based | Internet searching | Google |
| P3 | M | No | | Internet searching | Google |
| P4 | M | No | | Internet searching | Google |
| P5 | F | No | | Internet searching Asking people | Google |
| P6 | M | Yes | Knowledge-based | Internet searching | Google |
| P7 | F | Yes | Knowledge-based | Internet searching | Google Waikato website |
| P8 | F | Yes | Geographical-based | Internet searching | Google |
| P9 | M | No | | Internet searching Asking people | Google |
| P10 | M | Yes | Geographical-based | Internet searching | Google |
| P11 | M | No | | Internet searching | Google YouTube Facebook |
| P12 | M | Yes | Geographical-based | Internet searching | Google |

Table 3.3: Questions for Paper Diary.

| Q# | Question |
|---|---|
| Q1 | What is your question? |
| Q2 | Where are you? |
| Q3 | How strongly is the question related to the **current place**? |
| Q4 | What are you doing **now**? |
| Q5 | How strongly is the question related your **current activity**? |
| Q6 | What activity you will do **next**? |
| Q7 | How much does the answer influence your **next activity**? |
| Q8 | What kind of answers would you like? |

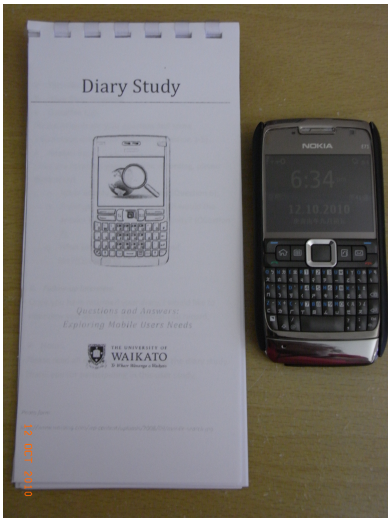



Figure 3.1: Actual diary study booklet and mobile phone for comparison.

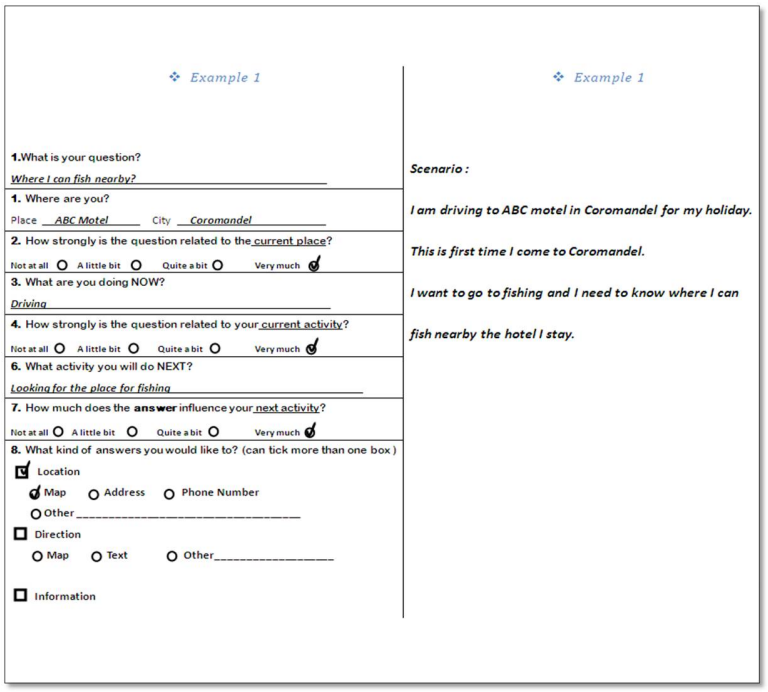



Figure 3.2: Example diary page - scenario and completed form.

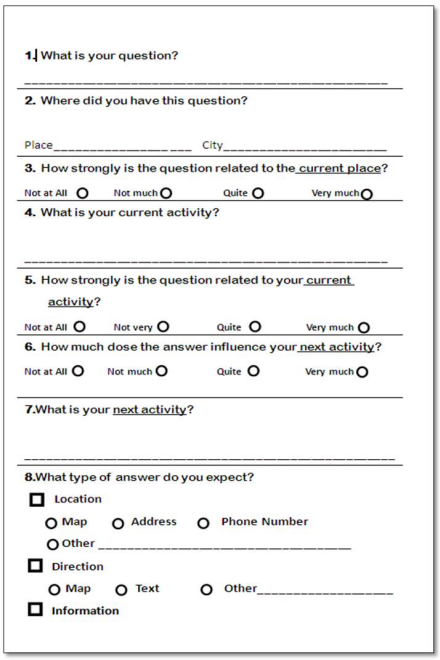



Figure 3.3: Example diary page - blank.

Table 3.4: Options for Next Activity.

| Option# | Question |
|---|---|
| OP1 | Anticipatory Action: participant does the activity without the question no matter whether the answer arises or not. |
| OP2 | Decision-making Action: participant does the activity depending on the question the answer is needed. |
| OP3 | Keeping Current Action: participant could do nothing or keep their current activity. |

The first two questions were included to describe the information needs where they encountered the question. While on the other hand, Q3, Q5 and Q7 were designed to ask how strong the relationship is between the question and place of the current activity, and how they degree of relativity of the answer influenced the next activity. There were three contextual factors to explore in this study: place, current activity and next activity; from a scale of 0 to 3 (Not at all=0, A little bit=1, Quite a bit=2, Very much=3). Q4 and Q7 were designed to know about their current activity and also their next activity. Q8 was formulated on what kind of answers participants wanted for this entry. There were 3 options they could expect: *location* (the information about the location), *direction* (the driving-guide or walking-guide) and *information* (for the most knowledge-based search).

### 3.2.3 Follow-up Interview

Participants were interviewed for approximately half an hour about their diary logs. The follow-up interview included general information requirements and a post study semi-structured interview was for each entry. The general information check has 4 questions and it was designed to understand participants' search experiences on different platforms (see in Table 3.6). G2 and G3 were focused on the search experience with the mobile device. G4 was for the search experience with the computer.

Table 3.5: Types for Expected Answer.

| Option# | Question |
|---|---|
| ANS1 | Yes/No: the closed question can be answered with either yes or no - e.g., Is diet coke on special at New World? -P4. |
| ANS2 | Choice: the question can be answered with some options - e.g., Do we go to city centre/Chartwell Shopping Mall for watching movies? -P6. |
| ANS3 | Numerical: the question can be answered with plain numbers - e.g., How much ferritin do I have in my blood? -P1. |
| ANS4 | Other: all other answer types outside what we listed above - e.g., Where can I find a chocolate cake recipe? -P12. |

The interview was carried out to discover additional information and clarify vague records in diary logs. I1 and I2 confirmed the participant's record through the interview. I3 had three options for categorizing the next action (see Table 3.4). I4 was the same question as Q8 in the paper diary (check Table 3.3) but we asked for more details in the interview. Hinze et al. classified the information according to the word length such as *long text* and *short text* [2, 3]. Further we grouped the short text into the four types (see Table 3.5). I5 to I7 were designed to test the importance of the *recommended information* on various locations; if participants were willing to check these 'similar questions' and offered at least one example.

## 3.3 Results And Discussion

12 people participated in the diary study which needed to be continuous recorded for over one week. Our study generated 174 questions (see Diary Records in Appendix D), with an average of 15 questions per person (min:4, max:30, stand deviation: 9.9). During interviews we asked participants for clarification of unclear records. All data was analyzed qualitatively using open coding of the grounded theory. These codes grouped all the data into classes

Table 3.6: Questions for Follow-up Interview.

| Id# | Question |
|---|---|
| | **General Information Question** |
| G1 | Gender? |
| G2 | Have you used your mobile doing any information searching? (If **No**, go to **G4**.) |
| G3 | What kind of information do you usually search for? |
| G4 | Where do you usually get the answer? |
| | **Post Study Semi-structured Interview Question** |
| I1 | Where is the location of the answer? |
| I2 | What is the current activity for this question? |
| I3 | The type of **Next Activity**? |
| I4 | What is the answer you expect for? |
| I5 | Would you like to know where else people have a question like yours? |
| I6 | Would you like to know what other questions have been pointing to your current location? |
| I7 | Would you like to know which questions people have asked in your answer's location? |

based on similar concepts in order to make data more workable. We analyzed a number of different aspects of the dairy records, which are discussed in the following sections. Each Section identifies one issue from *question*, *answer* and *activity*.

### 3.3.1 Question Issue

In this section, we focused on the mobile information needs related to the question alone. It includes the subsection of *user goal*, *score type*, *context factor* and *location context*.

#### 3.3.1.1 User Goal

Table 3.7 shows that the distribution of goal categories in this diary study from all the question users want to ask. There were three main categories of intent: *geographical* (geographical references), *informational* (problem solving) and *geographical information needs with advice (GA)*; we had also classified each of them into a number of topics. Our categories are related to those used in other studies, but is largely influenced by the availability of mobile information needs [2, 3].

Table 3.7: Results of information needs by user goal.

| **Goal** | **% of questions** |
|---|---|
| Geographical | 20% |
| Informational | 71% |
| Geographical information needs with Advice (GA) | 9% |

Table 3.7 shows almost 30% of questions are *geographical* needs, suggesting a location has a certain dependency in mobile information needs. Looking closer at these questions we found that 9% out of these questions asked the duplex types of needs as *geographical information needs with advice (GA)* people asking about *GA* want to know not only the geographical information, but also recommendations about the place. Clearly, the results revealed that the *informational* needs is the main goal in the mobile search. It further indicated that people referred to *geographical* needs needed more information. The most common combination would be integrating with the used experiences (*GA*).

Our topic analysis shows that mobile information needs seek to be general for the topic of geographical needs on Table 3.8. Intuitively, we find the most popular topic of the geographical-based is *location*. *Location* accounts for 44% of questions that users required the physical address of the place. Examples of information needs in this topic category are

Table 3.8: Results of *geographical* information needs by topic.

| **Topic** | **Description** | **%of questions** |
|---|---|---|
| Location | asking the physical address for the location. | 44% |
| Nearby | asking the specific place surrounding the participant's current location. | 28% |
| Direction | asking the route form place A to Place B. | 11% |
| Time | asking the driving-time or walking-time to their destination. | 8% |
| Short-cut | asking the fastest route to their destination. | 6% |
| Distance | asking the driving-distance to their destination. | 3% |

*"Where is the motor lodge inn?"* (P2, Q17)[2] and
*"Where can I play soccer?"* (P10, Q120).

The second most popular topic category was *nearby* with 28% of users' questions requiring some specific place around their current location. Examples are

*"Where is the closest supermarket?"* (P5, Q41) and
*"Where is a good sushi bar (nearby)?"* (P11, Q153).

We find that the category topic of *direction* (11%), *time* (8%), *short-cut* (6%) and *distance* (3%) all identified the need for moving from one place to one other. 28% of questions account for these topics in total. We understand that the location search is the main requirement of geographical needs and it also supports that the location is the main context factor on the mobile search.

[2](Participant# , Question#)

Table 3.9: Results of *informational* needs by topic.

| **Topic** | **Description** | **%of questions** |
|---|---|---|
| Information | the answer is published by an authority or organization. | 21% |
| Personal Information | of or relation to a particular persons information. | 20% |
| Real-time Information | concerning whether forecast or traffic news. | 10% |
| Food | concerning food or cooking. | 10% |
| Entertainment | concerning movies or books. | 7% |
| Study | concerning school work. | 7% |
| Schedule | concerning TV or sports games schedule. | 6% |
| Trivia | unimportant, trifling things or details. | 6% |
| Shopping | concerning buying goods or services. | 3% |
| Public Transport | concerning public transport information. | 3% |
| Contact Information | concerning phone number, website or email address. | 2% |
| Travel | concerning flights or holidays. | 2% |
| Gift | concerning gift suggestion. | 2% |
| Health | concerning health. | 0.8% |

On the informational needs, our topic analysis shows that the informational needs had varying topics which were more complex than the topic of the geographical needs. The details are given in Table 3.9. We found that the most popular topics for the informational needs are *information* and *personal information*. *Information* accounts for 21% of questions that required the answer published by authorities or organizations. Examples are

*"How much is a motorbike licence?"* (P3,Q25) and
*"What time is the computer labs shut?"* (P6, Q65).

However, *personal information* required a particular persons information and accounted for 20% of questions. Examples include

*"What time is my meeting with supervisor this week?"* (P6, Q71) and
*"Is my baby hungry at home?"* (P7, Q81)

The answers to these questions cannot found on the Internet or in books; asking a person is only way to find the answer. The *real-time information* topic category encompasses the slight geographical needs involved, they change along with time and local. It has 10% of questions, and examples are

*"Is it going to be cold raring late?"* (P5, Q40) or
*"Is there traffic on Hillcrest street busy?"* (P11, Q151).

The topic of *food* (10%), *trivia*(6%) and *shopping* (3%) all related to people daily life and examples are

*"How do you cook the roast chicken?"* (P5, Q50),
*"Does anyone want to go to the city centre?"* (P1, Q2) and
*"Does my chosen second had shop has what I want?"* (P10, Q140).

The topic of *schedule*(6%) and *public transport* (3%) both refer to the type of the schedule, the main focus is on TV or sports games and then later is about the bus timetable. Examples include

*"Is the 'A Team' movie playing yet?"* (P4, Q24) and
*"What time does bus no.13 arrive at the transport centre?"* (P8, Q112).

The study was carried out during the World Cup games thus most questions relating to schedule are asked by some participants who are sport fans. The topic of *entertainment* and *study* both have 7% of questions but their characters are opposite. The first is looking for fun and the latter is asking about

school things. *Contact information* has 2% of questions to look for information to contact a store or a person. The topic of *travel* and *gifts* also account for 2% of questions and these questions require advice. The topic of health has one question only, which is

> *"How much ferritin do I have in my blood?"* (P1, Q8).

Table 3.10: Results of *geographical information needs with advice (GA)* needs by topic.

| **Topic** | **Example** | **%of questions** |
|---|---|---|
| Food | Where can we eat at 9pm? (P12, Q163) | 63% |
| Shopping | Where can I find the second hand goods? (P10, Q138) | 19% |
| Gift | Where should I buy a thank-you gift for Lyn & Phil? (P5, Q53) | 6% |
| Travel | Where I can go for taking a short trip? (P1, Q5) | 6% |
| Health | Where can I do X-ray for immigration purpose? (P10, Q148) | 6% |

The *geographical information needs with advice (GA)* shows independent needs of user's goals but all topics encompassed request for geographical-based information with people's advice. We found the most popular topic is *food* that it account for over 60% of questions. The pattern for GA needs related to food is

> **Where is the *best/good* [food name] store?**

Examples are

> *"Where is a good place to get coffee?"* (P5, Q38) or
> *"Where is the best fish and chips?"* (P2, Q15).

*Shopping* is the second more popular topic (19%) and users usually are looking for the particular thing e.g.,

> *"Where can I get that bicycle?"* (P7, Q104) or
> *"Where is the best shop to buy shoes?"* (P10, Q123).

The topic of *gift*, *travel* and *health* account for 6% of questions each. We also concluded the pattern for these topics that is

> **Where can I buy/do *useful/have suitable* things (related to *gift/travel/health*)?**

#### 3.3.1.2 Score Type

A scale of 0 to 3 was used to measure how strongly the question related to the *place* and *current activity*; how much the answer influenced the *next activity*. We described the result by using T3 to T0. Table 3.11 offers a taxonomy that was used for classifying the data in this study grouping into four types.

Table 3.11 shows place, current activity and next activity as context factors in our study and analysing the scores they gained setting into the four types.

Table 3.11: Breakdown of category for score.

| **Type Name** | **Place Score** | **Current Activity Score** | **Next Activity Score** | **Total Score** |
|---|---|---|---|---|
| T3 | Min:1<br>Max:3 | Min:1<br>Max:3 | Min:1<br>Max:3 | Min:3<br>Max:9 |
| T2 | **Two** of them gained Min:1 Max:3 | | | Min:2<br>Max:6 |
| T1 | **One** of them gained Min:1 Max:3 | | | Min:1<br>Max:3 |
| T0 | 0 | 0 | 0 | 0 |

**T3** participant is question was a member of T3, if Q3, Q5 and Q6 received a score greater than zero. T3 thus expressed that the participant's question had a relationship to location, current activity and next activity.

**T2** participant's question was in T2 if it received exactly one zero from either Q3, Q5 or Q6. That is, this question in T2 related to two factors.

**T1** participant's question was in T1 if it scored two zeros from Q3, Q5 or Q6. That is, this question in T1 only related to one of the factors.

**T0** This indicates the type that none of the three questions, Q3, Q5 and Q6 received scores greater than zero. The participant's question had no relationship to location, current activity or next activity.

87 entries were sorted to *T3* which also the largest category (50%) resulting in an average of seven entries per participant. *T2* and *T1* groups both have 38 entries with an average of three entries per participant. Each participant had one entry of *T0* on average. They all are shown in Table 3.12.

It is found that generally, almost half of the questions had a relationship with the place, current activity and next activity together *(T3)*. Only a few of questions were the independent type *(T0)* without any relationship involved. T2 and T1 related to one or two factors and they both had 22% of questions. That is, most of questions are affected by at least one factor on the mobile search. The remarkable relationship of the diary questions with the context factor was a significant finding on Chang's study [2]. In this study, we investigated activity more by dividing them into *current activity* and *next activity*. The results of our study is similar to the finding of Chang's study. Analyses of quantity of questions were used to detect significant difference among factors which were *T2* and *T1*.

Figure 3.4 shows the average score and its standard deviation (STDEV) for each context factor by the score type. STDEV means the deviation of the average score of one score type to its real value in one context factor. That means when the STDEV is big, the difference between the context factors for

Table 3.12: Results of # questions by score types for each participant. (T3 = related to the place, the current activity and the next activity, T2 = related to two context factors, T1 = related to one context factor only, T0 = no relation with the place, the current activity and the next activity.)

| **ID** | **#questions of T3** | **#questions of T2** | **#questions of T1** | **#questions of T0** | **Total** |
|---|---|---|---|---|---|
| P1 | 4 | 4 | 3 | 0 | 11 |
| P2 | 4 | 1 | 1 | 0 | 6 |
| P3 | 2 | 4 | 2 | 0 | 8 |
| P4 | 0 | 2 | 4 | 0 | 6 |
| P5 | 16 | 2 | 6 | 6 | 30 |
| P6 | 7 | 7 | 4 | 0 | 18 |
| P7 | 22 | 3 | 3 | 1 | 29 |
| P8 | 3 | 1 | 1 | 1 | 6 |
| P9 | 1 | 1 | 2 | 0 | 4 |
| P10 | 18 | 6 | 6 | 0 | 30 |
| P11 | 2 | 5 | 3 | 2 | 12 |
| P12 | 8 | 2 | 3 | 1 | 14 |
| Total | 87 | 38 | 38 | 11 | 174 |
| Average | 7 | 3 | 3 | 1 | 15 |
| Number% | 50% | 22% | 22% | 6% | |

the same score type is large too. The highest score of T3 was placed on the next activity (2.6), the place had the last score at 2.2 and its STDEV is 0.21. The next activity had the largest average score of T2, 1.9. Current activity and place obtained the same score for T2 at 1.2 and their STDEV is 0.40. As for T1, its highest score 2.3 could be found on the current activity which is followed by next activity at 2.2 and its STDEV is 0.15.

The results in Figure 3.4 describes that the context factor had closer score results on *T3* and *T1*. This means that the context factor is equally effective

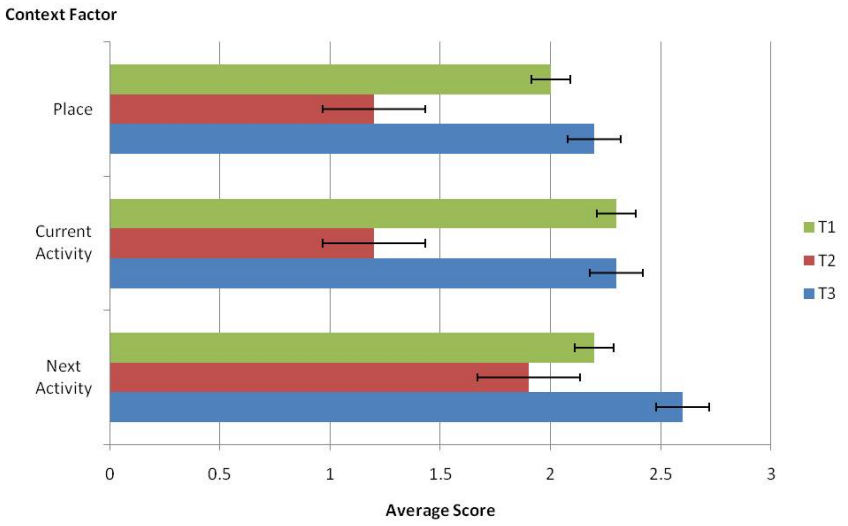



Figure 3.4: Results of the average score with standard deviation for context factor by score type.

in the mobile information needs in the condition of *T3* and *T1*. However the context factor accounts for the difference between each in the T2's condition and it means that the context factor affects the mobile information needs differently. The results further show the next activity is the main source of influence in the mobile information needs by two context factors alone *(T2)*.

#### 3.3.1.3 Context Factor

In this section, we analysed the contextual factor. *Place*, *current activity* and *next activity* are context factors in our study. Using the scores of the context factor gained in this study we examined T1 and T2. Figure 3.5 and Figure 3.6 show separately each contextual factor under the condition of T1 and T2. It was a contrast between one factor involved (T1) and one factor not involved (T2).

Figure 3.5 represents the context factor with the number of questions (T1). On T1's condition, it showed that *next activity* had the most the questions, at 25; *place* had 9 and *current activity* had 4. In other words, *next activity* was the key contextual factor to influence the mobile information needs.

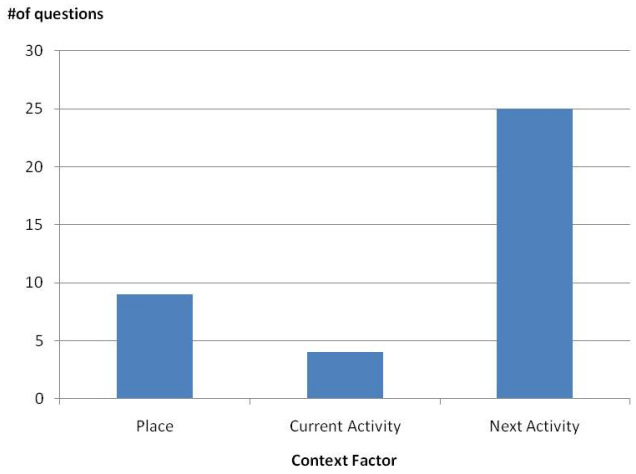



Figure 3.5: Distribution of questions with one context factor only (T1 = related to one of context factors.), i.e., the dependent context factor.

Figure 3.6 represents the context factor with question numbers on the condition of two factors affected (T2). Overall, each cluster had a similar number of questions under the condition of T2. Moreover by checking the cluster respectively, 'place & next activity' was the most common set on T2, accounting for 14 questions, followed by 'current activity & next activity' (13) and 'place & current activity' was the last (11). Therefore, we assumed that there was a restriction between factors that caused the narrowly close results in Figure 3.6. Also, it explained that the *next activity* had a particular influence for information needs as we can see that the group without next activity involvement had the least number of questions in Figure 3.6 (one factor not related to).

Figure 3.7 shows the average score for the context factor. Next activity had the highest average score (2 out of 3) in Figure 3.7. Furthermore, the slight difference in average score between place (1.4) and current activity (1.5) was 0.1 only. It also matched the results from deciding the context factor (see in Figure 3.5) and the independent contextual factor (see in Figure 3.6): next activity was the key factor and had a certain influence for the mobile information needs.

We conclude that the main context factor is *next activity* through the quality

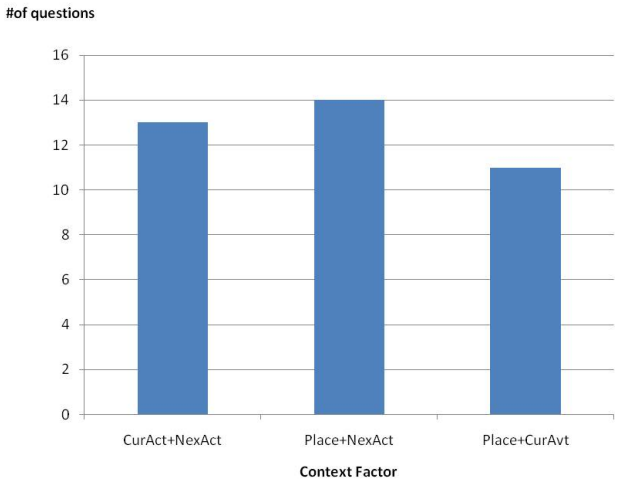



Figure 3.6: Distribution of questions with two context factors (T2 = related to two context factors.), i.e., the independent context factor.

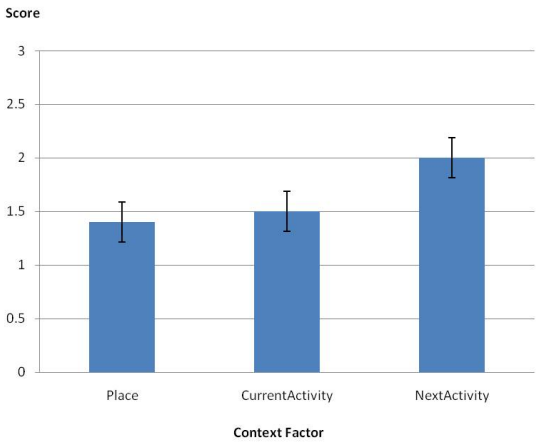
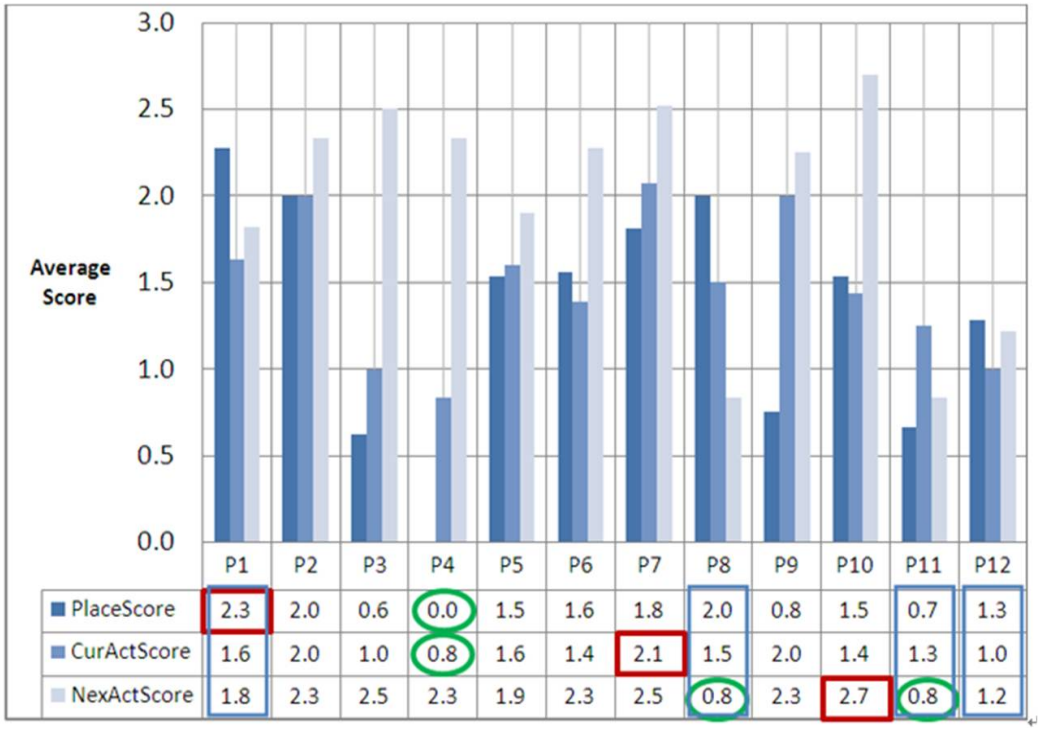



Figure 3.7: Results of average score by context factor.

and quantity analyses. On the quality analysis, the results of the dependent context factor (Figure 3.5) corresponds to the independent context factor (Figure 3.6) and they both determine that *next activity* is the key factor by the question numbers. On the quantity analysis, the next activity also produced the highest average score in this study.

Figure 4.4 shows each participant with an average score of the context factor, the highest score marked with a red square, the lowest score marked with a green circle and the discordant results marked with a blue square.




| | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PlaceScore | 2.3 | 2.0 | 0.6 | 0.0 | 1.5 | 1.6 | 1.8 | 2.0 | 0.8 | 1.5 | 0.7 | 1.3 |
| CurActScore | 1.6 | 2.0 | 1.0 | 0.8 | 1.6 | 1.4 | 2.1 | 1.5 | 2.0 | 1.4 | 1.3 | 1.0 |
| NexActScore | 1.8 | 2.3 | 2.5 | 2.3 | 1.9 | 2.3 | 2.5 | 0.8 | 2.3 | 2.7 | 0.8 | 1.2 |

Figure 3.8: Context factor score distribution for participant (*Red square: highest score, Green circle: lowest score, Blue square: discordant score*).

In general, the results show the next activity is the main influence in the mobile information needs. However, there were only 4 out of 12 participants having different results: P1, P8 and P12, the highest score placing on place; P11 had the highest score on current activity. The score details for each context factor are the place that had 2.3 (out of 3) as the highest score and 0 was the lowest; current activity had 2.1 as the highest score and 0.8 was the lowest, and next activity had 2.7 the highest score (also the highest score for the entire score) and 0.8 was the lowest, and next activity had 2.7 as the highest score which is also the highest score for the entire score and 0.8 was the lowest at P8 and P11 for both.

#### 3.3.1.4 Location Context

Table 3.13 describes the place category for the location in which a participant encountered a question. It was grouped further into four more precise categories in Table 3.13 as public place (34%), private place (44%), moving (19%) and others (3%). For others, it is Fieldays, the largest agribusiness exhibition

Table 3.13: Results of place by categories.

| **Category** | **Description** | **%of questions** |
|---|---|---|
| Public Place | A place is open and accessible to all people. | 34% |
| Private Place | A place belongs to one particular person only. | 44% |
| Moving | People shift themselves from one place to another. | 19% |
| Others | Fieldays | 3% |

in New Zealand. The results explain that the place caused the mobile information needs to arise. Figure 3.9 shows the four broad categories of place (see Table 3.13) with the question numbers for each sub-category. In a total of 174 questions, private place had 76 questions, public place had 59 questions, moving had 33 questions and others had 6 questions.

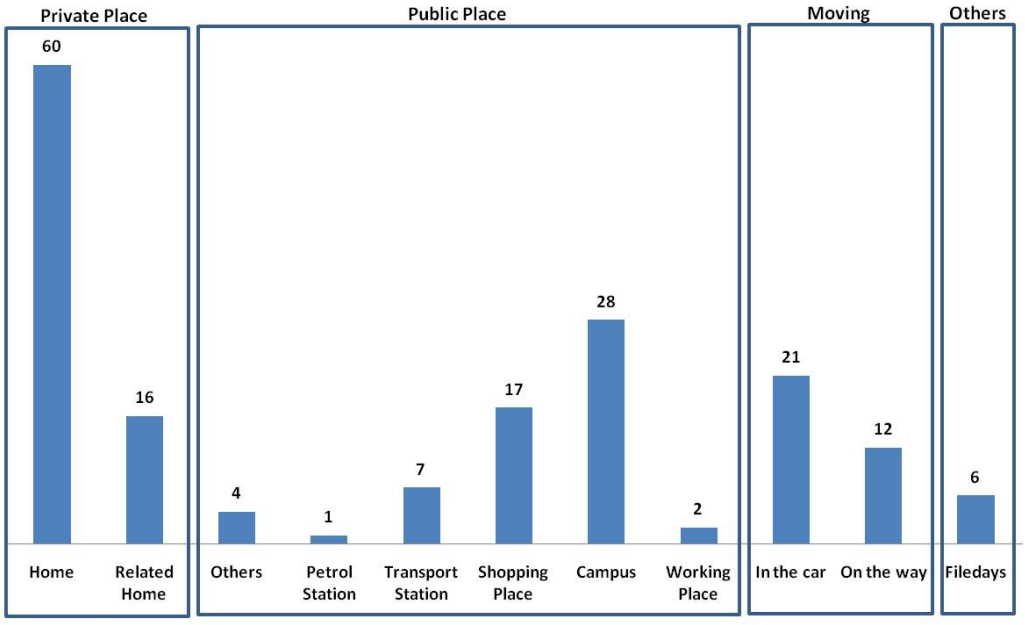



Figure 3.9: Results of # questions by place category.

The results of Figure 3.9 shows that home and campus are the most frequently location for the private place and public place. When analysing those questions

we found a number of interpretations for these results. The first interpretation is that home and campus are places for participants to spend most of their time daily. That is, the question numbers increase in proportion to the location at which users stay. Additionally, one interpretation is that the mobile device has become powerful and useful enough to replace the computer in some situations and as well as its proximity and convenience for users. Fieldays is a special item in these place categories; it is the largest agribusiness exhibition in New Zealand. All questions about it were asked by one participant (P5) and he/she was at Fieldays for the family business.

Figure 3.10 gives an overview of all topics of informational needs by all participants over one week of the study. In all, 123 questions of informational needs from Figure 3.10 were recorded in the diaries with an average of 10.3 per participant. The most frequent topic of informational needs being asked by the participants was the information which is published by authorities or organizations. This is followed by personal information which was the second more frequent category recorded in the diaries. In total, information was the most frequent category of informational in the study whereas *health* was the least with only one question. *Home* was the most common location of informational needs accounting for 51 questions in the diaries. It was followed by *campus* as the second common location in the informational needs group with 11 questions. In total, home was the most common location of informational in the diaries although no question was asked of the petrol category. Overall, information and personal information were the top two topics of informational with the most question numbers as users usually stay at *home* or on *campus*. However, no question was referred to informational needs by users being at *petrol station*. These results verify that users are not 'on-the-go' that their information needs are not usually affected by the place. That is, while users stay in indoors, the activity is the main context factor to affect the mobile information needs. We will discuss this further in Section 3.3.3.

Figure 3.11 gives an overview of all topics of geographical needs by all partic-

| | | Schedule | Food | Trivia | Personal Infor. | Infor. | Real-time Infor. | Contact Infor. | Entertain ment | Shopping | Study | Travel | Gift | Health | Public Transport | Amount |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Private Place | Home | 3 | 8 | 5 | 8 | 8 | 6 | 2 | 2 | 2 | 3 | 2 | 2 | 0 | 0 | 51 |
| | Related Home | 3 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 11 |
| Public Place | Others | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 |
| | Petrol Station | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Transport Station | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 |
| | Shopping Place | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 10 |
| | Campus | 1 | 0 | 1 | 5 | 4 | 1 | 0 | 1 | 0 | 3 | 1 | 0 | 0 | 0 | 17 |
| | Working Place | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Moving | In the car | 1 | 1 | 0 | 0 | 3 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 9 |
| | On the way | 0 | 0 | 0 | 5 | 2 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| Others | Fieldays | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| Sum | | 9 | 11 | 7 | 23 | 25 | 13 | 3 | 8 | 4 | 9 | 3 | 3 | 1 | 4 | 123 |

Figure 3.10: Results of # questions of informational needs by topic of the place category (*Orange highlight = the most popular location, Yellow highlight = the less popular location*).

| | | Direction | Location | Nearby | Distance | Time | Short-cut | Amount |
|---|---|---|---|---|---|---|---|---|
| Private Place | Home | 2 | 3 | 2 | 0 | 1 | 0 | 8 |
| | Related Home | 0 | 2 | 0 | 0 | 1 | 0 | 3 |
| Public Place | Others | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| | Petrol Station | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | Transport Station | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| | Shopping Place | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| | Campus | 1 | 1 | 2 | 0 | 1 | 1 | 6 |
| | Working Place | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Moving | In the car | 1 | 2 | 5 | 0 | 0 | 1 | 9 |
| | On the way | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Others | Fieldays | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| Sum | | 4 | 15 | 10 | 1 | 3 | 2 | 35 |

Figure 3.11: Results of # questions of geographical needs by topic of the place category (*Orange highlight = the most popular location, Yellow highlight = the less popular location*).

| | | Food | Shopping | Gift | Health | Travel | Amount |
|---|---|---|---|---|---|---|---|
| Private Place | Home | 1 | 0 | 0 | 0 | 0 | 1 |
| | Related Home | 2 | 0 | 0 | 0 | 0 | 2 |
| Public Place | Others | 0 | 0 | 0 | 0 | 0 | 0 |
| | Petrol Station | 0 | 0 | 0 | 0 | 0 | 0 |
| | Transport Station | 1 | 0 | 0 | 0 | 0 | 1 |
| | Shopping Place | 1 | 1 | 0 | 0 | 0 | 2 |
| | Campus | 3 | 0 | 0 | 1 | 1 | 5 |
| | Working Place | 0 | 0 | 0 | 0 | 0 | 0 |
| Moving | In the car | 2 | 1 | 0 | 0 | 0 | 3 |
| | On the way | 0 | 1 | 0 | 0 | 0 | 1 |
| Others | Fieldays | 0 | 0 | 1 | 0 | 0 | 1 |
| Sum | | 10 | 3 | 1 | 1 | 1 | 16 |

Figure 3.12: Results of # questions of geographical information needs with advice (GA) information needs by topic of the place category (*Orange highlight = the most popular location, Yellow highlight = the less popular location*).

ipants over one week for the study. In all, 35 questions of geographical needs from Figure 3.11 were recorded in the diaries with an average of 2.9 per participant. The most common location for geographical needs was found to be *in the car*, as it accumulated 12 questions in the diaries. Followed by that was the *campus*,the second common location of geographical needs accounted 11 questions. In total, in the car was with the greatest number of geographical questions in the diaries although no question was asked at working place. Generally, location and what is nearby were the top two topics of geographical needs across all different locations. In addition location was most frequently asked about shopping place but what is nearby was most frequently asked *in the car*. The results confirm that the geographical needs are required mostly when people are moving by car.

Figure 3.12 gives an overview of all topics of geographical information needs with advice (GA) by all participants over one week for the study. GA is the user goal with duplex intent because it involves geographical and used experience. In all, 16 questions of GA from Figure 3.12 were recorded in the diaries with an average of 1.3 per participant. The most common location for GA found to be the *campus*, as it accumulated 5 questions in the diaries. Followed by *in the car*,the second common location of GA accounted for 3 questions. In total, the *campus* produced the greatest number of questions (GA) in the diaries although no question produced at *others*, *petrol station* and *working place*. Generally, food was the number one topic of GA across all different locations. In addition food was most frequently asked on the campus; 2 out of 3 questions were asked by participants leaving from the campus and one was asked by the participant new to the campus. The results confirm that people usually require the GA needs of food that include

*"Where is the restaurant? "* or

***"Where is the place selling [food name]? "***.

### 3.3.2 Answer Issue

In this section the answer of the information needs will be examined. It includes the subsection of *answer-arise time*, *expected answer type*, and *similarity check*.

#### 3.3.2.1 Answer-arise Time

We found that the participants had different time requirements for their information needs. Some of their information needs required the answer immediately and some had no time requirement. Thus when information needs arose is the first topic of the answer issue. Table 3.14 shows a breakdown of time category by the answer needs. Over 60% of questions showed that people addressed the answer needs *at the time*. Almost 25% of questions marked the answer needs as *later in the day* or *tomorrow*. They were demanding the answer within 24 hours as the time required. 9% of questions needed the answers in the *near future* or *this month*. Only 3% of questions showed that people addressed the answer-arise time as *open* that it had no time frame for requiring a answer to the question.

Table 3.14: Results of answer-arise time by categories.

| **Category** | **Description** | **%of questions** |
|---|---|---|
| At the time | The answer is needed immediately. | 63% |
| Later in the day | The answer is needed later in the day. | 18% |
| Open | The answer is needed without time limit. | 7% |
| Tomorrow | The answer is needed following day. | 6% |
| Near future | The answer is needed during the next two weeks. | 6% |
| This month | The answer is needed within this month. | 3% |

We observed the results of the answer-arise time with the user goal on Fig-

ure 3.13. Most questions of each user goal required the answer *at the time*. The second popular answer-arise time is *later in the day*. The results verify that most of mobile information needs require their answers immediately, especially for information needs involved with geographical needs. Over 75% of questions required the answer *at the time* for geographical and GA needs each. We could summarized that the information needs with geographical needs are strongly time dependent.

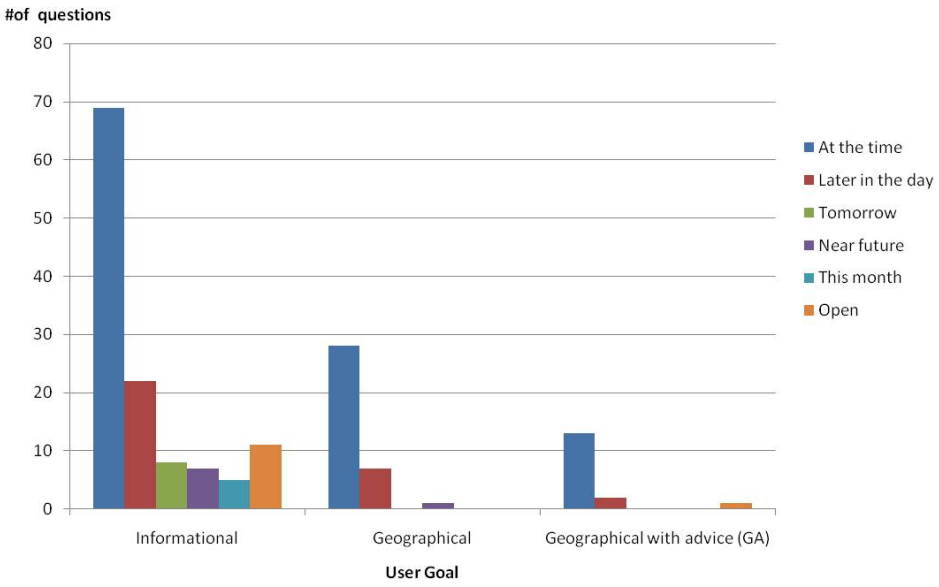



Figure 3.13: Distribution of answer-arise time by user goal.

We further examined the answer-arise time combined with the location context on Figure 3.14. The results confirm that most of mobile information needs required the answer-arise time to be *at the time* across the location contexts. These information needs usually require the answer immediately. On the distribution of question numbers, participants required most of answer-arise time being *at the time* especially when they are away from their home or their desk (i.e., the location context is moving).

We also examined the answer-arise time associating with the relationship type of the context factor on Figure 3.15. The results shows that the questions requiring the answer *at the time* that it must involved with at least one con-

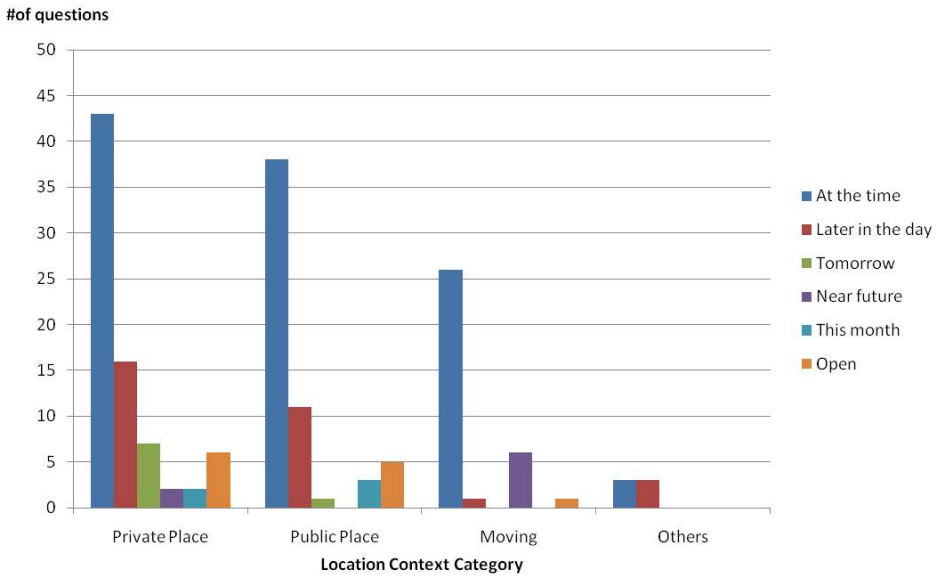



Figure 3.14: Distribution of answer-arise time by place category.

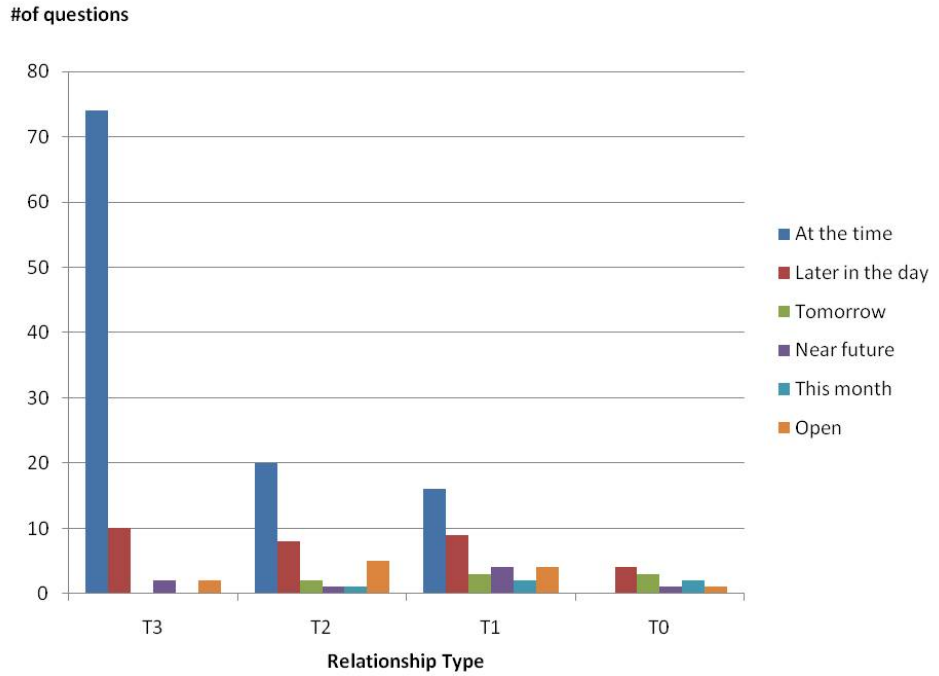



Figure 3.15: Distribution of answer-arise time by relationship type.

text factor. We read this to mean that when the question does not require the answers *at the time* it could be an independent question (T0 = no context factor is involved). Furthermore the question is related to more context factors and the answer-arise time is more urgent. The results shows that over 84% of questions called the answer *at the time* on T3 (related to the place, current activity and next activity).

We concluded that the mobile information needs required the answer immediately. We further found the answer-arise time is influenced by the context factors. When the question is T3 (related to the place, current activity and next activity) it needs the answer immediately. Otherwise, when the question is T0 (related to zero context factors) there is no time limit on the answer.

#### 3.3.2.2 Expected Answer Type

We analysed the expected answer with the same methodology of user goals (see Section 3.3.1.1): two main categories of the expected answer: *information* (problem solving) and *location* and *direction* (geographical references). Then each category was further divided into a number of sub-categories, some of which were again sub-divided.

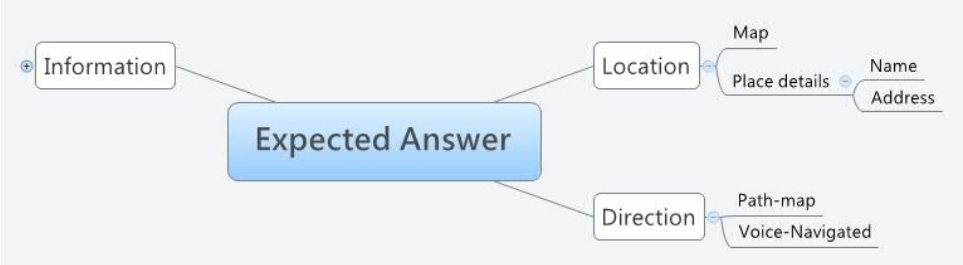



Figure 3.16: Concept map illustrating the structure of geographical expected answers: location and direction.

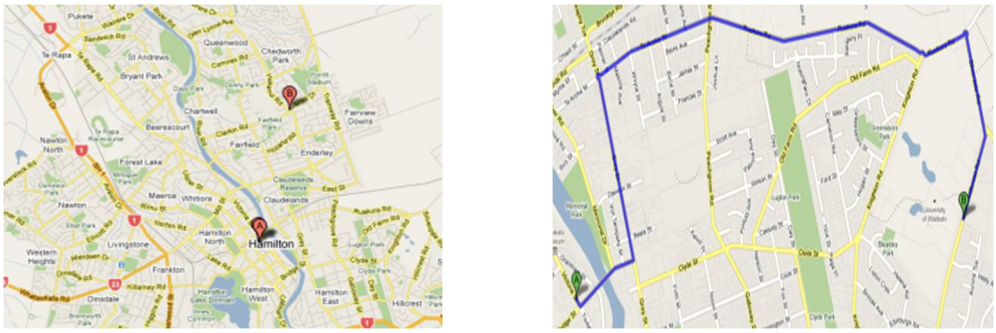
We start with the expected answer of the geographical category and Figure 3.16 presents the concept map illustrating the geographical expected answer for *location* and *direction*. In general, there are two expected answer types of geographical and it depended on the familiar with the contextual influence of people. Table 3.15 shows the breakdown of geographical expected answers for *location* and *direction*.

*Location* is for people who have the basic concepts about the place, therefore the map of *location* only presents the location of where people are and where the place is (see Figure 3.17a). *Direction* is for people who have no idea about

the place, thus the map describes the route to arrive at the place and we named it 'path-map' (see Figure 3.17b).

Table 3.15: Geographical expected answer of **location** and **direction**.

| **Category** | **Description** |
|---|---|
| Location | people have geographical concepts about the place. |
| - Map | denoting the map is assisting people in confirming place's location (see example map in Figure 3.17a). |
| - Place details | denoting people get brief information (the name and the address) of the place for assisting them to arrive. |
| Direction | people have no idea about the place. |
| - Path-map | denotes the path-map indicating the route to arrive the place (see example path-map in Figure 3.17b). |
| - Voice-navigated | denoting the path-map is transferred to voice-navigation for assisting people to drive. |




(a) Map (b) Path-map

Figure 3.17: Examples for map

*Information* shows that the answer is not related to geographical references and analysed the questions for expected answers by the length of words. Figure 3.18 illustrates the concept map of the informational expected answer. The length of the answer is the criterion to classifying the informational expected answers: the *short-text* and the *long-text*. Table 3.16 shows the breakdown of topic for the *short-text* category and Table 3.17 shows details of *long-text*

category.

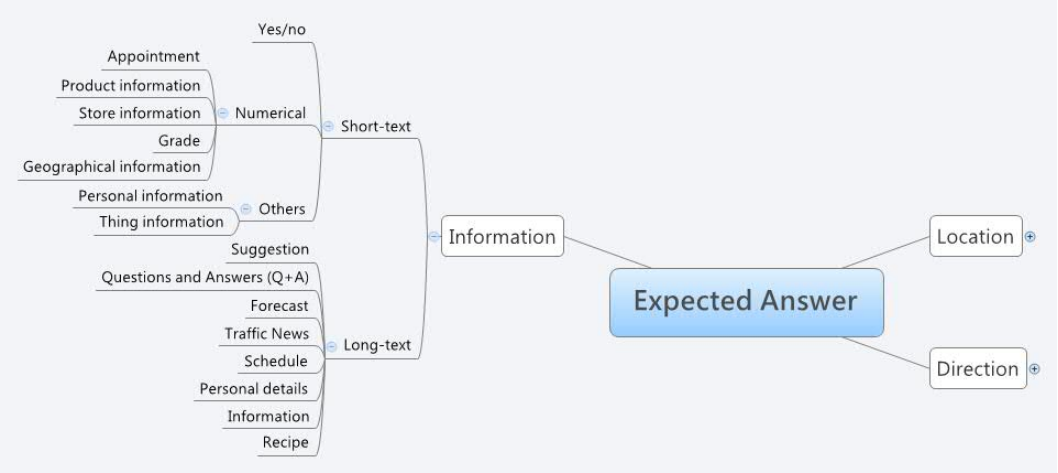



Figure 3.18: Concept map illustrating the structure of informational expected answers.

*Short-text* includes the three topics: *yes/no*, *numerical* and *others*. In the short-text, the maximum words number in the answer is 15 words and the details are listed on Table 3.16. *Long-text* consists of the seven topics: *suggestion*, *questions and answers (Q+A)*, *forecast*, *schedule*, *personal details*, *information* and *recipe*. There are no word limits on the *long-text* category.

Figure 3.19 gives an overview of the types of expected answer sorted by categories over the study. There were two groups based on the structure of the answer. There were *individual answer* and *composite answer*. The expected answer referred to was only one category in that was an *individual answer*, such as information, direction and location on Figure 3.19. Otherwise, the expected answer involves more than one category. That was a *composite answer*, such as 'information + location' or 'information + location + direction'. In total, information was the most often expected answer for questions during this study.

The most often expected answer in this study data was *individual answer*, accounting for 80% of the questions totally in this study. *Individual answer* included information (64% ), location (11% ), and direction (5% ). 20% of the

Table 3.16: Topics for informational expected answer by **short-text**.

| **Topic** | **Description** |
|---|---|
| Yes/no | the answer is yes or no only. |
| Numerical | the answer is numerical references. |
| - Appointment | denoting *date* or *time*. |
| - Production information | denoting *brand name*, *price*, *quantity* or *date(released date)*. |
| - Store information | denoting *opening times*, *level of store* or *phone number*. |
| - Grade | |
| - Geographical information | denoting distance or driving-time. |
| Others | the answer is **no more than 15 words**. |
| - Personal information | denoting the brief information of the *person*. |
| - Thing information | denoting the brief information of a *product or event*. |

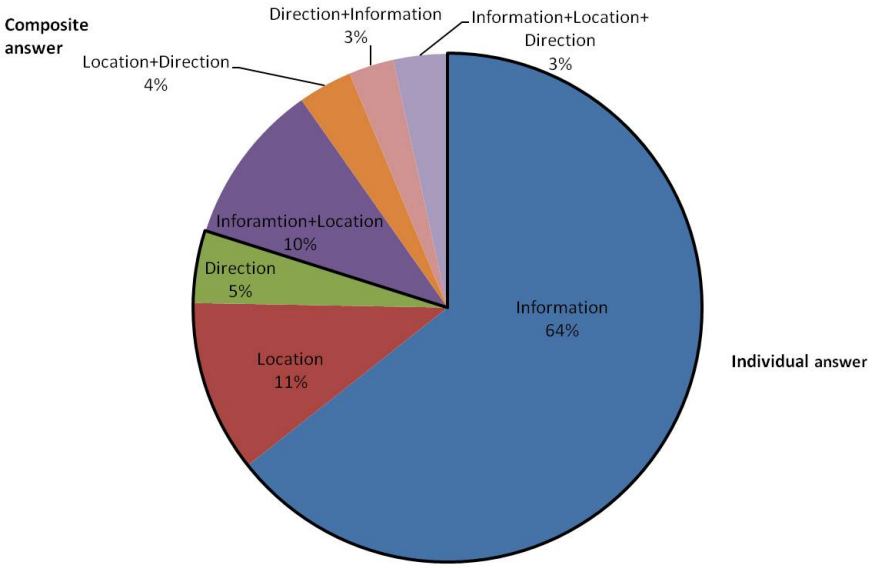



Figure 3.19: Results of expected answer by categories.

questions needed composite answers to express information needs. In *composite answer*, 'information + location' required was the most frequently asked by participants. We conclude that the most mobile information needs is an *indi-*

Table 3.17: Topics for informational expected answers by **long-text**.

| **Topic** | **Description** |
|---|---|
| Suggestion | the answer is related to by someone regarded as knowledgeable or experiential. |
| Questions and Answers (Q+A) | the answer is indicated the same purpose. |
| Forecast | the answer is indicated the real-time information of weather. |
| Traffic news | the answer is indicated the real-time information traffic. |
| Schedule | the answer is listed the intended *TV program* or *sport game*. |
| Personal details | the answer is the resume of a person. |
| Information | the answer is published by authority or organization. |
| Recipe | the answer is a set of instruction for cooking. |

*vidual answer* and that means to people ask 'simple' questions in mobile search.

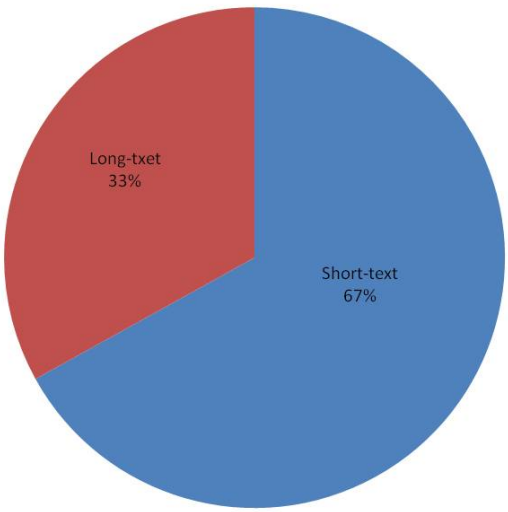



Figure 3.20: Results of informational expected answer by short-text and long-text.

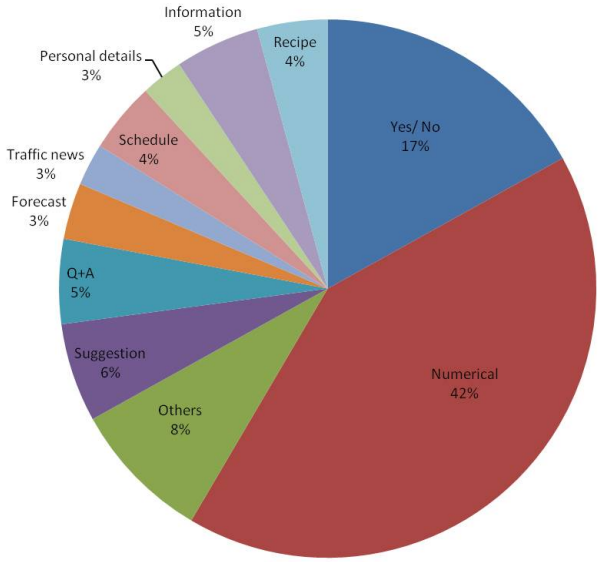



Figure 3.21: Results of informational expected answer by topic.

Informational category was a category that does not involve with the geographical information. The results show that over 67% of questions required the answer being *short-text* on Figure 3.20. In the *short-text* category, the most frequently required answer was *numerical*, accounting for 42% of the answer needs, followed by *yes/no* (17% ) during the study on Figure 3.21. The answer of *numerical* and *yes/no* both are closed and simple. We conclude that people mainly expected the type of answers for mobile search to have a simple structure.

*Location* and *direction* were the two categories that mentioned that the answer needs referred to were geographical information. Therefore, a map was the most common answer required for them, and two types of map (map and path-map) were mentioned during this study. Figure 3.22 gives an overview of the types of map provided by all questions which had also been referred to location or direction category. 51% of questions of composite answer required a map for answer needs; when path-map were required 49% of questions. We observed a path-map could always have been one of the answers while a composite answer set was composed of a direction category. However, a map was a compulsory answer for location category as composite answer set was 'location

+ information'.

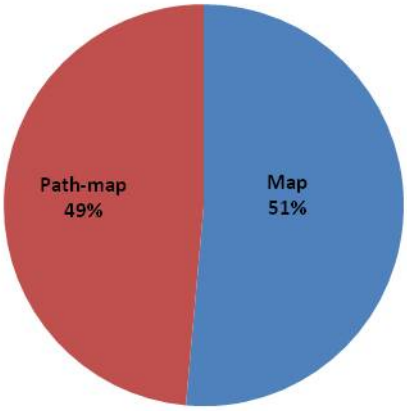



Figure 3.22: Results of expected answers by maps.

#### 3.3.2.3 Similarity Check

The similar or related search functions are provided by some websites for helping doing efficient search work. People use these similar or related search functions to speed up search work. We therefore examined the similar or related search functions on the mobile search to find how they function on the mobile search. During the interviews, we asked the participants if they would like to check questions that were similar with them, and questions that were referred to their current location or answers location. In regard to these questions, we named them as 'similarity check'.

In total, 148 questions were reported by participants interested in *similarity check* during the study. 81 of the questions were reported by participants interested in a similarity check of the answer location, followed by similar question (48 questions).

There are three topics of similarity check; *similar question*, similarity refers to the *current location* and similarity refers to the *answer location*. The most frequently asked similarity check in our diary data was referred to the *answer location*, accounting for 55% of questions. The second most frequently

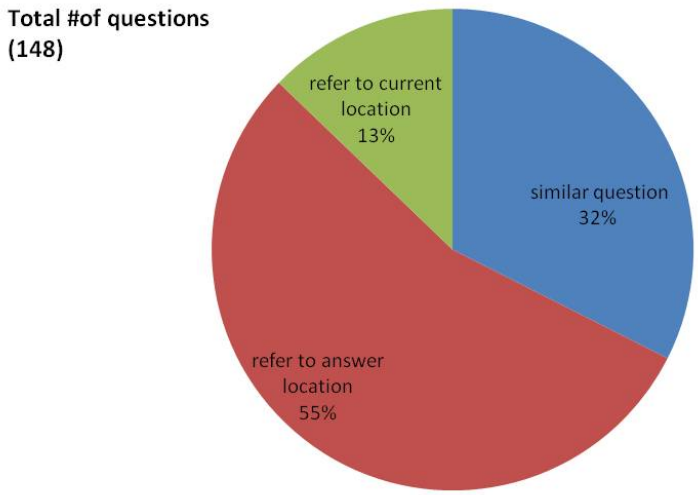



Figure 3.23: Results of similarity check by type.

asked similarity check was referred to the *similar question*, accounting for 32% of questions. It also is only one topic which is not related to the 'location'. *Current location* was the least topic in similarity check that was not asked frequently by participants. Figure 3.23 gives an overview of the kinds of similarity check required by all participants over the study. Participants reported a similarity check about the *current location* that was not really useful especially of they were in their own home or a related home. On the other hand, participants believed that the similarity check about the answer location could provide more useful information needs in a mobile search.

### 3.3.3 Activity Issue

In this section the activity related to the information needs will be examined. It includes the subsection of *current activity*, *next activity*, and *next action type*.

#### 3.3.3.1 Current Activity & Next Activity

We start with identifying the activity of this study. Table 3.18 provides the definition of the activity category from diary-study which was the activity participants were carrying out.

Table 3.18: The category of activity.

| **Category** | **Description** | **Example** |
|---|---|---|
| Conversing | face to face talking<br>talking via the phone | chatting with friends<br>calling friends |
| Enjoying | playing<br>exercising<br>watching<br>others | playing a TV game<br>playing basketball<br>watching the World Cup<br>reading books/feeding pets |
| Food | eating<br>cooking | have breakfast<br>cooking the dinner |
| Internet accessing | on-line talking<br>searching information<br>checking information | on MSN<br>searching the direction on Google map<br>checking the mark on the Moodle |
| Living | housework<br>going to bed | mowing/cleaning |
| Moving | shifting<br>walking | walking from office to the parking lot<br>walking at Fieldays |
| Planning | planning things to do | waking up but still in bed<br>thinking to the supermarket |
| Preparing to go out | dressing<br>collecting | |
| Shopping | | go to see doctor |
| Commuting | driving/riding<br>taking public transport | driving the car<br>taking the bus |
| Visiting | | visiting friends |
| Working | working at a jobs<br>studying | working<br>doing assignments |
| Keep doing the current activity | Next activity only | |
| Depend on the answer | Next activity only | |

In this study, the current activity and the next activity both are the context factor. Thus we examined the results for each and then compared them. We first calculated the question numbers of the activity for the current and the next and grouped the four groups on Table 3.19:

1. # questions of current activity >$\#$ questions of next activity:
   moving, working, enjoying, planning and preparing to go out.

2. # questions of current activity <$\#$ questions of next activity:
   commuting, shopping, food, Internet accessing and conversing.

3. # questions of current activity = # questions of next activity: living.

4. # questions of current activity / # questions of next activity = 0: visiting and waiting.

Table 3.19: Breakdown of question numbers of the activity for the current and the next.

| **Category** | **Current Activity** (#of questions) | **Next Activity** (#of questions) |
|---|---|---|
| Moving | 50 | 5 |
| Working | 22 | 11 |
| Enjoying | 16 | 12 |
| Planning | 14 | 1 |
| Preparing to go out | 5 | 2 |
| Commuting | 11 | 30 |
| Shopping | 9 | 22 |
| Food | 12 | 15 |
| Internet accessing | 13 | 14 |
| Conversing | 3 | 8 |
| Living | 8 | 8 |
| Visiting | 0 | 4 |
| Waiting | 11 | 0 |

The first group focuses on the *current activity* by which participants do the activity when they had the question. Thus the attribute of the group has # questions of current activity >$\#$ questions of next activity. For the *current activity*, there are 107 questions in this group equalling 62% of the total questions of this study. Over 46% of these questions asked by participants were on *moving*. 36% of these questions asked by participants when they were away from their home and 18% was reported by participants considering or preparing to leave their house. The result of *moving* confirms the mobile information needs arise regularly when people are on 'mobile' on Church's study [6]. Further the

results justify that participants do/think the activity refer to 'changing their location' which all caused the mobile information needs to arise. The meaning of the mobile information needs, the 'moving' activity includes people's action and thinking, these mean the same for the mobile information needs.

The second group focuses on the *next activity* by participants who had the question before they did the activity. Thus the attribute of the group has # questions of current activity <# questions of next activity. For the *next activity*, there are 89 questions in this group equalling 51% of the total questions of this study. About 34% of questions occurred before participants did the *commuting* and 25% of questions were asked before participants did the *shopping* activity. 17% of questions were asked by participants prepared for *food* (cooking or eating) and 16% of questions were asked before participants accessed the *Internet*. Participants had only 9% of questions happen before they conversed with people. We found that most of these activities occurred as participants stayed indoors such as at their home/friend's house or at a shopping center. *Commuting* happened at the bus station or on the transport which mean the 'indoors' to participants. In addition, these activities are the 'interacting action' which means these mobile information needs involve two or more people.

The third group focuses on the attribute of the group which has # questions of current activity = # questions of next activity. *Living activity* is only one category in this group. *Living activity* indicates people doing the activity related to life such as housework or going to bed. Most of living activity happened in the participant's home/friend's house.

The last group focuses on the attribute of the group which has # questions of current activity / # questions of next activity = 0. Participants were only asked questions before they did the *visiting activity* and 4 questions reported in this study. Two of questions asked the informational needs and two asked the geographical needs. We found that participants plan to do their visit-

ing activity before they asked questions. The meaning of *visiting activity* is 'dissimulating activity' for mobile information needs. Participants consider that the visiting activity is the same as the activity of *enjoying* or *conversing*. The results of the *waiting activity* are opposite to the *visiting activity*, participants were only asked questions during their waiting time. We found these questions of waiting activity required the answer immediately. In the meaning of mobile information needs, the *waiting activity* provided questions that required the high time dependency. In addition, once participants get the information, they change their current activity of waiting into another activity.

In Table 3.18, the last two columns show activities that only refer to next activity and they *keep doing the current activity (KA)* and *depend on the answer (DA)*. For *keep doing the current activity (KA)*, participants do not change their activity **after** they have asked the question otherwise *depend on the answer (DA)* is participants do not change their activity **until** they have the answer. The results of these two activities both depend on the answers to determine the outcome.

#### 3.3.3.2 Next Action Type

In this section, we focused on the next activity and three types were classified:

**Anticipatory action** participants know what is going to happen.

**Decision-making action** decisions have to be made.

**Non-changing action** participants do the same action after asking the question.

Figure 3.24 shows the distribution of new action type by user goal. *Decision-making action* and *anticipatory action* had questions referring to all three needs of informational, geographical and GA. *Non-changing action* had questions only referring to informational and geographical. Informational needs accounted for the largest number of the questions on the user goal category. In total, an average 73 % of questions were grouped into informational needs. Geographical needs had an average of 19 % of questions in this study. GA had

the small percentage of questions; even zero on non-changing action.

We conclude from these observation that the majority mobile information needs depend on the answer of these needs to do the next action. Regardless of information needs type, the majority needs rely on the answer to determine the next action. Some of needs do not influence people's next action because people already know what is going to do. We also understand that people just ask needs that do not concern with the next action. However these non-changing action do not exist on the GA information needs. We conclude that people's next action must changed by GA information needs.

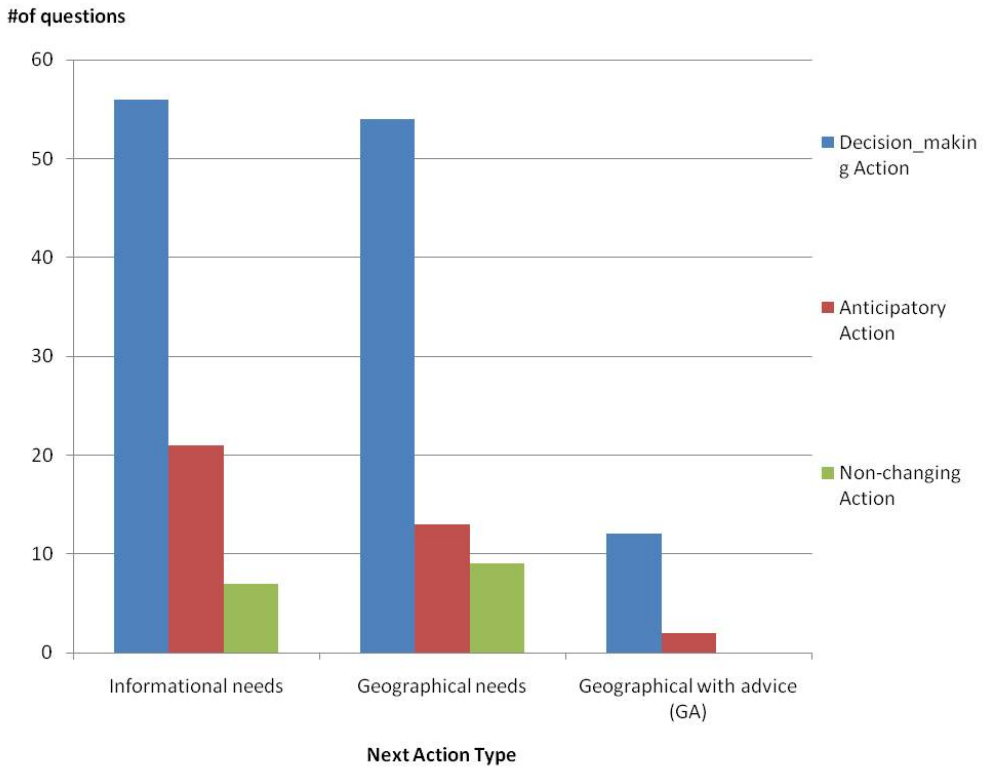



Figure 3.24: Distribution of new action type by user goal.

Figure 3.25 shows the the distribution of new action type by relation types. Most questions were influenced by at least one context factor (T1, T2, T3 $\neq$ 0) but a few questions were independent (T0 $\neq$ 0). For *anticipatory action*, 41% of the questions were T3 (controlled by all context factors), followed by T1 (26% of questions were controlled by one context factor). T2 was less than

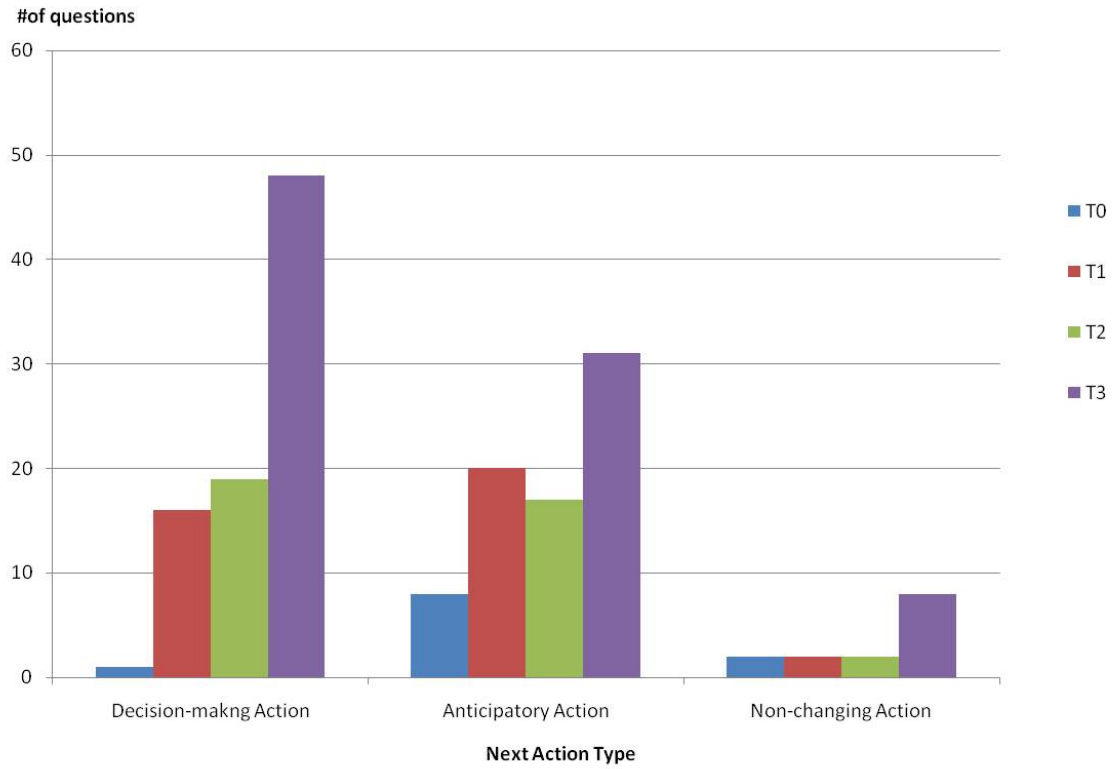



Figure 3.25: Distribution of new action type by relation types.

T1 by three questions only, accounting for 22% of questions. The result of T1 and T2 were also close but T2 (19) led T1 (16) to be second category on *decision-making action*. *Non-changing action* had two questions for T1, T2 even though T0.

We observant that each next action type has the questions regarding to T3 (refer to all context factors) mostly. Even though people's next action do not changed with the information needs, these needs still involve with at least one context factor mostly. We conclude that the context factor may influenced people's next action.

## 3.4 Summary

In this chapter, we reported about design and results of our paper diary study to investigate what mobile users search for. We examined the data with the grounded theory and used a taxonomy. We identified three issues in this study:

question, answer and activity. Each issue has several sections to discuss the results for the mobile information needs.

Previous studies [2, 3] reconfirmed *place* and *next activity* as being context factors of mobile search. However, in this study, we justified that there is one more context factor involved; consequently, there are three context factors: *place*, *current activity* and *next activity* in this study. Despite the fact of different context factors, our results are consistent with those reported showing that the *next activity* of the user is most influenced by the question emerging in both a previous study and this study. We further found that the *current activity* is the second most important context factor for mobile search. Most studies focus on place/location, but our results show that the *current activity* and the *next activity* may be more important than place/location.

*Home* is the most frequent location asked for the informational needs; while both the information and personal information are asked regularly. These results are standing along the line with our previous studies, even though there are no specific foci on the question of location. In results about the details of location in this study *petrol station* is one of the place categories and no participants ask the *informational* needs for this category. Comparing with previous studies, numbers of question of *in the car* increase dramatically on this study; *geographical* needs are the most frequently asked and the main sub-type is *geographical information needs with advice (GA)*.

Answer-arise time is a new factor in our study. However it has previously been studied in more details in our studies [5, 9]. The result of this study verified that most questions require the answer immediately *(at the time)* and rely on the answer for the following action. This seems compatible with [5, 9].

Most questions are affected by *at least one context factor* in this study and results are in accordance with our previous study. It implies one of place, current activity or next activity that accrues the question emerging. It is

worth noting that these two results, no question is asked on the visiting current activity and no question is asked on the waiting next activity in this study.

During the interviews, we investigated the expected answer for the questions in this study. The *information* is the main expected answer in this study which is fairly consentient with the previous study. This is accomplished by discovering the category of expected answers from the previous study and instead developing greater emphasis on the sub-category of expected answers in this study. For information category, the *numerical* is the most frequently type such as the price of product or the opening hours of store. Expected answers relate to *location* or *direction* which all required maps and there are two types of map. *Map* presents the location of where people are and where place is (51%) and the *path-map* indicates the route to arrive at the place (49%).

Similarity check is the new factor in this study that focuses on different concepts which are valuable to mobile search. There are also three concepts in this study referring to *answer location*, *user's current location* and *similar question*. Our observations may indicate that the participants interested in the related questions depending on the answer location believe that the answer location constitutes significant information for their information needs.

# Chapter 4

# Digital Diary Study

In this chapter, we first design the pilot user study for testing people to collect digital records. Then we use the results of the pilot user study to start with the design of the digital diary and the procedure for this study. We report on the results of a digital diary study to investigate what mobile users search for and also to explore these needs. Our focus is on the performance of results using the digital diary. Then we illustrate the analysis of the results for two subjects, *text record* and *digital record*.

## 4.1 Pilot User Study

The pilot user study is designed for collecting digital records. The purpose is to gain an understanding of how people record the physical situation when using a mobile device to ask questions.

### 4.1.1 Goal of Pilot User Study

With this pilot user study, an initial understanding of digital record types people may use and the story behind the questions has been gained. The results of this study are analysed to generate the form for the digital diary study that will be completed by members of the public.

### 4.1.2 Method

We carried out four methods in the pilot user study and analysed the test results to find the appropriate method for the digital diary study. All four methods used the mobile device to record and the digital record included the voice, video and photos.

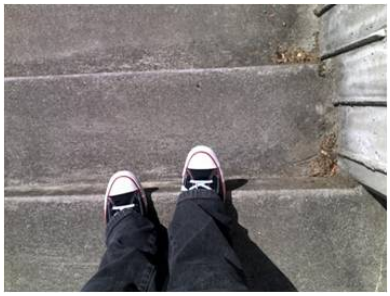
#### 4.1.2.1 Voice Record + Photo

Voice recording is the method for participants to record questions. Photos are also used to describe the surroundings and their current activity.

The advantage of this is that we could find extra information from the voice recording, such as the physical situation through the background voice. The disadvantage is that background voice could cover the actual voice records or participants may forget to take photos while doing voice recording.

- *Voice Record Transcript*
"(Bird singing on the background) I was wondering anyone can fix my bench. Because I think the bench is still on the warranty time. (People laugh in the background) I want to know the company can fix the problem or not. Figure 4.1a and 4.1b are photos that they associated with the voice record."
- *Photo*


(a) Place: G Block in Waikato University.



(b) Current Activity: Walking.

Figure 4.1: Photos for voice record.

#### 4.1.2.2 Message Text + Digital Record

Participants use the message text to record the question and take photos to describe extra information about the question, location, current activity and next activity.

(a) **Message text** Question: Where is the closest cafe?

(b) **Message text** Place: by the lake in Rotorua city centre.

(c) **Message text** Current Activity: Walking around the lake.

(d) **Message text** Next Activity: have coffee.

Figure 4.2: Photos for message text.

#### 4.1.2.3 Diary Entry + Video

Participants answer the diary question that comes from the paper diary (see Table 3.3) and make a video to record the surrounding and the current activity (see the video snip on Figure 4.3).

- *Diary Entries*

1. *What is your question?*

   Are there any soccer fields in Hamilton?

2. *Where are you?*
   Near University

3. *How strongly is the question related to the current place?*
   A little bit

4. *What are you doing NOW?*
   Walking to Ken's place

5. *How strongly is the question related to your current activity?*
   Not at all

6. *What activity you will do NEXT?*
   Cooking

7. *How much does the answer influence you next activity?*
   Not at all

8. *What kind of answer would you like?*
   Location (map), Information (soccer in Hamilton)

- *Video Record Transcript*

"(Cars passing on the video see Figure 4.3) Next to the university and we are seeing boys I think playing. . . soccer. . . and my question is umm. . . is there are any real soccer, soccer fields in Hamilton?"

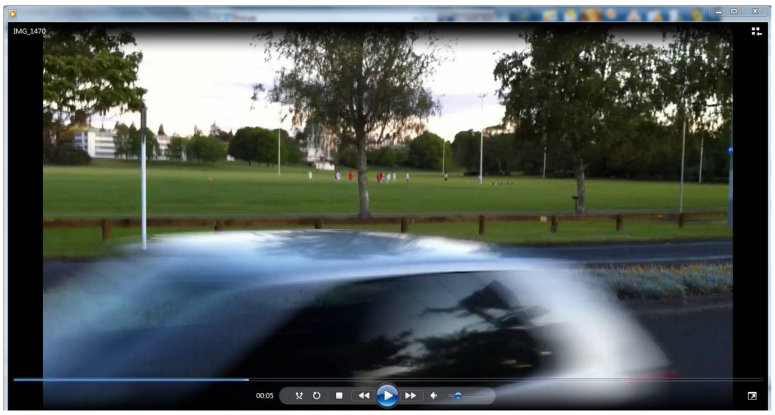


Figure 4.3: Video snip for diary entry.

#### 4.1.2.4 Twitter

Twitter is the micro-blogging service, 140 word limits per tweet (message) and most mobiles have an application for Twitter[1]. Therefore, we employed our study through Twitter by sending one tweet for the question and its details, and others for photos. Each question has two tweets. One is for the scenario and the question (red part) and the other is for the related photos (green part). Seeing Twitter example is on Figure 4.4.


Figure 4.4: Example for Twitter.

### 4.1.3 Summary

We list the test results and modifications for determining the appropriate method in the digital diary study on Table 4.1.

1. *Voice Record + Photo*

[1]Twitter Website http://twitter.com

Table 4.1: Summary of pilot user study (+: good/pros, -: poor/cons)

| | Voice Record + Photo | Message Text + Digital Record | Diary Entry + Video | Twitter |
|---|---|---|---|---|
| Test Result | +/- | - | + | + |
| Modification | + | + | N/A | + |
| Network | - | - | - | + |
| Participant Preference | - | + | - | + |

- Test Result

  Photos cannot offer enough information about the surroundings.

  We discovered the extra information which was not mentioned when participants' spoken because the background voices provided clues about the surroundings and activity.

- Modification

  Photos should include people and what they did.

2.*Message Text + Digital Record*

- Test Result

  Message text did not offer enough information. The reason was that the participant preferred using key words to sentences in the text.

- Modification

  Using words to describe the surroundings and activity. Digital records are photographs or videos.

3.*Diary Entry + Video*

- Test Result

  We can find extra information in the video that the participants may not have mentioned in the diary.

- Modification

  Unnecessary.

4.*Twitter*

- Test Result

  The part of text (tweet) could be longer which is like a scenario.

- Modification

  Twitter has a 140 word limit so words and photos need to be divided

into two tweets.

After evaluating all the data, two methods are feasible for our user study:
1) Message text + photos / videos, and
2) Twitter.

## 4.2 Design of Digital Diary Study

This user study aims at collecting data involving the real user in a behavioural context. Mobile devices are the main tool in this user study.

### 4.2.1 Goal of Digital Diary Study

This study focused on the physical situation around the mobile search, the mobile device being the tool for approaching the real mobile environment. Though the small scenario describes the story behind the question, in addition photos may capture the missing piece of the scenario. With this study, we aim to find out the physical situation of the mobile search through digital records. We also want to verify the context factors which involve the mobile users needs.

### 4.2.2 Method

There is a difference between paper diary study (see Chapter 3) and digital diary study. Paper diary study used the paper diary recording questions but the digital diary study chose the mobile device with a camera for capturing questions and digital records. We summarized the results from the pilot user study resulting in two different choices in the digital diary study. The requirement of the digital record is that a small scenario with at least three photos which describe the surroundings where the question occurred, the current activity and people who are related to the question or the activity (see Ethics Consent Approval in Appendix B).

If participants' mobile phones cannot connect to the network or they do not use **Twitter**, they could choose the **message text + digital record**. Partic-

ipants could text their questions and additional information to 021139XXXX and take photos or videos (digital record) of themselves and their surroundings. After one week, participants copy all digital recordings on to a CD-ROM and hand it in. Otherwise, participants tweet their questions and additional information in the first tweet and put photos in the second tweet. Participants are asked to send their tweets to @2010userstudy (Twitter).

This user study is employed over one week and we expect each participant to make at least 3 entries per day. We will send a text to remind participants of recording their questions or requiring participants to modify their records.

The digital diary study focused on the physical situation around the mobile search with the mobile device being the tool for approaching the real mobile environment. An advantage of this is that the participants use their own mobile devices in this user study so that the records could correspond with the actual fact of the mobile user needs. They use the small scenario describing the story behind the question with photos which may capture the missing piece of the scenario. However, some issues occurred on taking photos. Some participants reported they could not take photos which driving or in a certain situation.This contributed to a number of questions without of photos.

The follow-up interview was semi-structured and performed after one week of data collection. Questions were asked about the questions users have provided in the digital records.

The analysis of both the digital records and the interview material was followed by the grounded theory [8].

### 4.2.3 Participants

A total of 10 participants (4 females, 6 males) were recruited from the school of computer science. Based on these participant's education background, they all have reasonable computer competence to participate in this study together

with more general information about their searching experience and habits.

They can be divided into two groups depending on whether they did their search with a computer, called PC people, or used their mobile, called Mobile people. PC people prefer to use computer, and mobile people rely on their mobile for finishing a simple job. Figure 4.5 shows the number of people of each type and their choice for carrying out this study. Overall, PC people and mobile people have five participants each and all PC people chose message text for recording. However, four of the mobile people chose Twitter and only one chose message text.

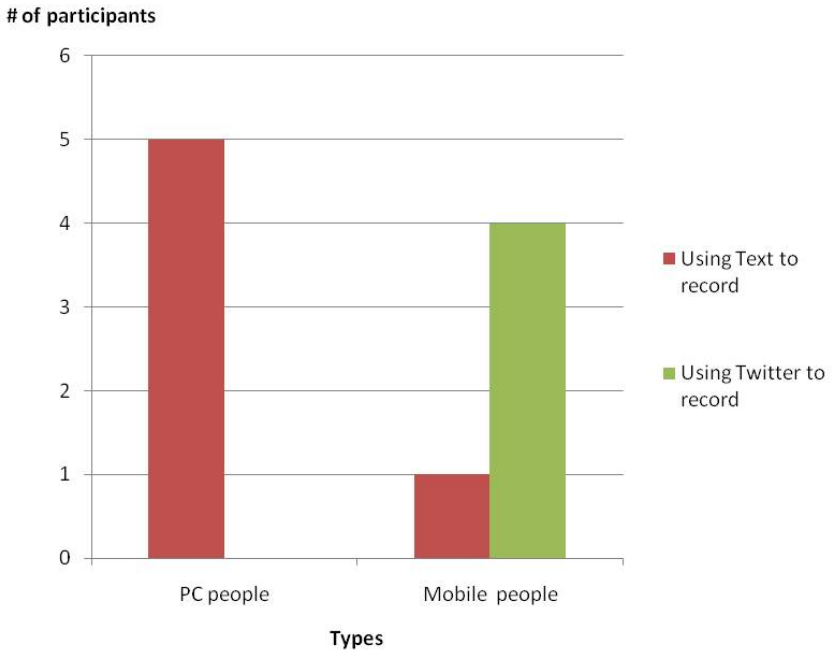



Figure 4.5: Distribution of search methods of pc and mobile people.

## 4.3 Results And Discussion

Our study generated 106 questions (see Diary records in Appendix E), with an average of 11 questions per person (min:1, max:20). Results generated two types of records: *text record* and *digital record*. We will discuss text record first. *Text record* includes the *question*, *question word* and the *scenario of the question* which presents the complete story of the question. *Digital record*

depicts the *physical situations* which are not mentioned in the word records. Through these digital records we discovered results related to *question*, *physical situation* and *answer*. In this study, participants only take photos for their digital record. They usually take photo shot in their daily life and in some situations photos can not be taken such as driving the car or in the cinema.

### 4.3.1 Text Record

The framework of analysis is based on the user goal type and the location type, which originates from the paper diary (see Section 3.3.1). The only difference is that we simplified the structure of these two types: the informational needs and the geographical needs. There are no GA (geographical with advice) needs type in this study. We understand the information needs of the digital diary are simpler than that of paper diary.

#### 4.3.1.1 User Goal

Figure 4.6 shows the distribution of both question types: the informational needs type and the geographical needs type. The geographical needs mean all the questions are about the direction such as

> *"Is Bryce Street left or right"* (P3)[2].

The informational needs mean the question could be referred to anything except the direction such as

> *"What kind of cloud is this?"* (P7).

The 81% of questions were classified into informational needs and the result implied that informational needs dominate in the mobile search. The 19% of questions were related to geographical needs mostly in the current context. These results showed roughly the same trend as were obtained in the paper diary study (see Section 3.3.1.1). The delicate difference between our outcome

[2](P3 refers to Participant# 3)

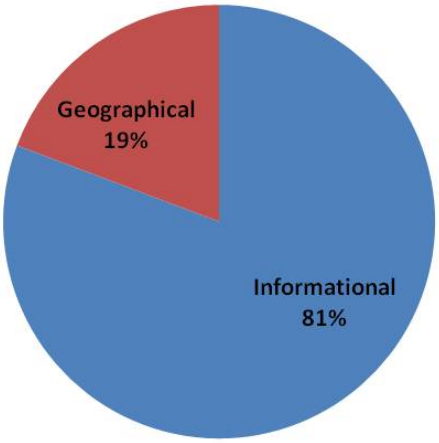



Figure 4.6: Distribution of mobile information need asking questions of informational and geographical type.

here, those from the paper diary study and from previous studies will be discussed further in the conclusion of this thesis.

The overview of question types focused that the informational needs type is the most frequently asked question in this study. Figure 4.7 shows the results of all questions sorted by two types of user goal for the participant.

Most participants presented a higher interest in informational needs type than in geographical needs in the mobile search. For P2, P3 and P5, over 70% of their questions referred to informational needs. The results of P1, P6 and P9 set much more emphasis on it with informational needs being the only type their study logs. Only one exception was that the lower numbers of geographical needs was given by P7 whose informational needs and geographical needs had the same question numbers in this study.

We found that informational needs was the main need in the mobile information needs, no matter what kind of tool used in the study. We further found that people using a mobile device search for the information needs found in simpler than using the paper dairy. The key difference between informa-

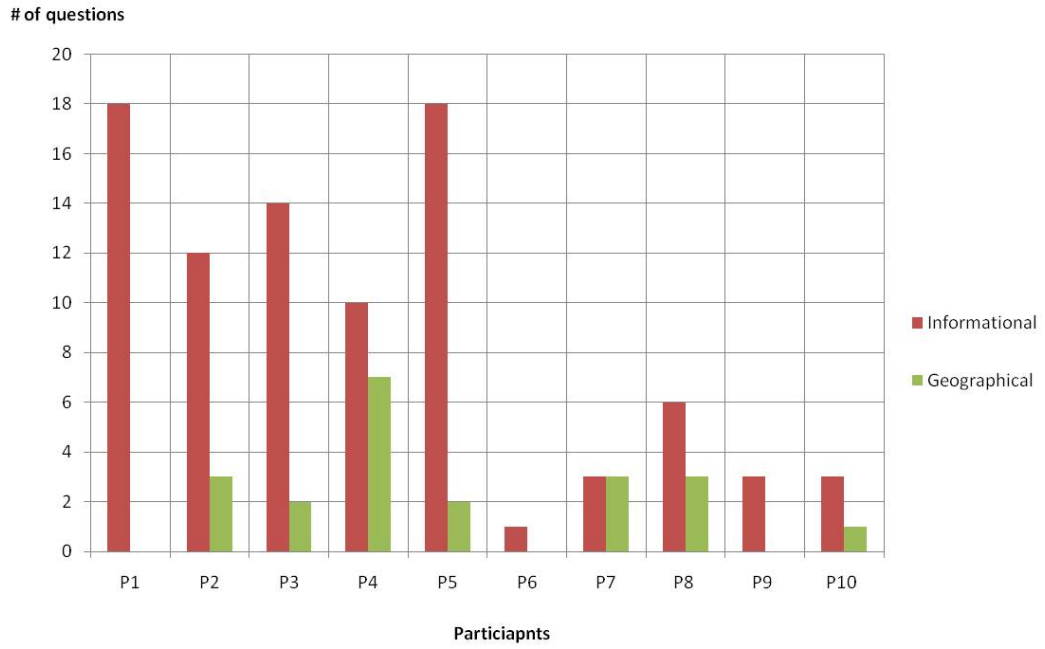



Figure 4.7: Distribution of participants of informational and geographical type.

tion needs type is people's typing behaviour. People usually type the simple term/sentence in the mobile device but they write the detailed sentence in the paper diary. We therefore believe that the results of the digital diary study present the mobile user's behaviour in the mobile device; the results of a paper diary show the integrated mobile user's needs.

- ***Informational needs type***

There are eight topics within the informational needs. The most common topic can be related to both informational needs type and geographical needs in this study which is *local*. *product*, *entertainment*, *weather*, *personal information* and *general* are emerged from the informational needs only.

Figure 4.8 shows the details of the informational needs. The 30% of questions referred to *local* as the largest group and these questions were all related to local information of the participants' current location. For example,

> *"What is the thing on the top of the Kawhia museum?"* (P1) and
> *"What kind of activity can we find in Waiheke?"* (P4).

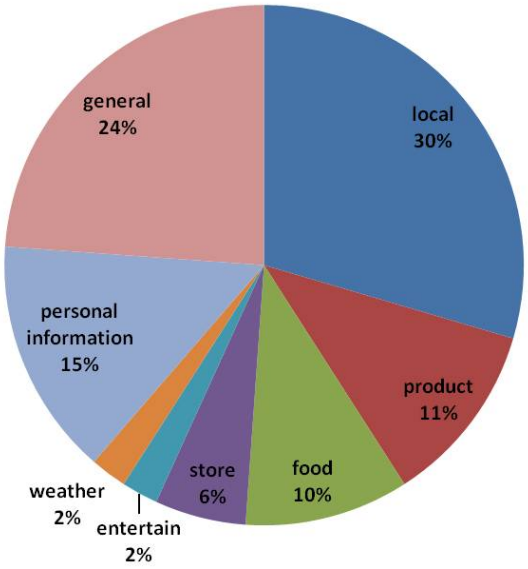



Figure 4.8: Distribution of topics of informational needs.

The meaning of local here was related to not only the local area but also the same city or country. Only one overlapping question of the *local* topic in the this study emerged twice. It was about no snakes living in New Zealand. Two participants asked the same question under different situations. For P1, it was a discussion with people during a party but P2 was curious about it on their own. The locality to this question is New Zealand.

> *"Are there any snakes in NZ?"* (P1, in Kawhia.)[3] and
> *"Why is that NZ has no snakes?"* (P2, at home).

24% of questions were referred to *general* and these questions could be asked from a conversation with other peoples to by oneself. Examples are

> *"Is there a scale for nerd rage?"* (P1) and
> *"What is the time for afternoon pray?"* (P5).

These two questions were both related to the *general* topic in the informational needs type. In addition the first one was a 'party-talking' question; the other was about general information.

[3](Participant#, the location of question asking)

The 15% of questions focusing in each grouping to *personal information* and particular person knew the answer to these questions. For example,

> *"I wonder how Mary is doing?"* (P1) and
> *"How is uncle doing now?"* (P3).

10% of questions focused on *product* and *food*. For example,

> *"How to make chicken biriyan (a dish)?"* (P2, for recipe)[4] and
> *"When will Word Lens*[5] *support Chinese?"* (P3, for product).

4% of questions referred to *store* in the informational needs type. Most questions were about the deals in the store or the store's opening hours.

> *"I wanna know which shops have sale on Boxing day?"* (P4, for store) and
> *"When does Warehouse close?"* (P7, for store open hours).

*Entertainment* and *weather* had 2% of questions each in the informational needs category. All entertainment questions were asked by P3 and all are about movies. Just like the entertainment division, all weather questions were asked by P5.

> *"Which of these movies will I actually enjoy and not fell like my time was wasted?"* and
> *"What are the imdb*[6] *ratings for these movies?"* (P3, for entertain).

> *"How the weather will be tomorrow?"* and
> *"When time the sunset today?"* (P5, for weather).

Figure 4.9 presents the details of all topics in the informational needs type for participants. Most of questions were sorted to the *local* group in the informational needs type. P6 and P9 only asked local questions within the

[4](Participant#, the description of the question)
[5]It is an iPhone application for instantaneous video translation.
[6]The Internet Movie Database http://www.imdb.com

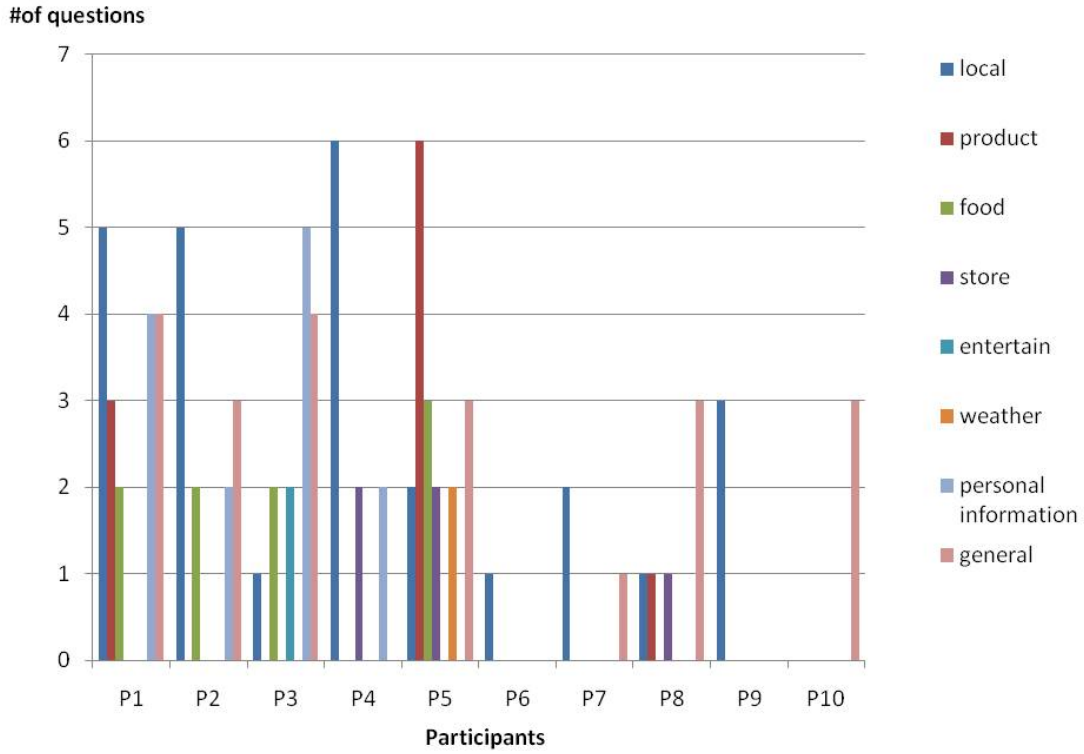



Figure 4.9: Distribution of topics of informational needs by participants.

informational needs type. P5 and P8 asked more product and general questions than the local ones. P10 did not ask any questions referring to local.

The second most asked questions were the *general* group in the informational needs type. P10 only asked questions that are associated with general. Although *product* was the third most asked question in the informational needs type these questions were only from three participants: P1 P5 and P8. P5 asked the most product questions in this study. Just like the *product* division, all *food* questions also came from four participants. P1, P2 and P3 asked two questions each about food and P5 asked three questions of food in this study. The questions of *store* were asked by P4 and P8 alone. The details of entertainment and weather have already been mentioned in Figure 4.8.

In informational needs type, people mostly asked the needs related to local. These needs were related to the local information but not involved with the geographical needs and most of them could be found in the local information

centre. In this section, the general topic included trivial needs. General needs were occurred more frequently when users were on their own.

- ***Geographical needs type***

We observed that all questions can be sorted into five topics in geographical needs type. As already noted above, three topics were related to both the informational needs type and the geographical needs type; *local*, *store* and *food*. Other questions were grouped into the fourth topic *distance* in the geographical needs. In other words, questions in the informational needs type were more complex than that of the geographical needs type in this study. This finding was in line with the previous studies, although no previous study had asked this question in detail.

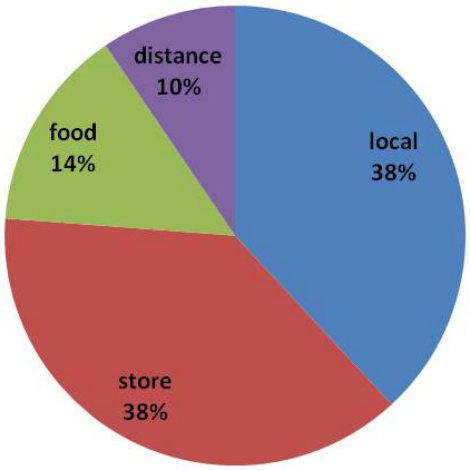



Figure 4.10: Distribution of topics of geographical needs.

Figure 4.10 shows the distribution of topics of the geographical needs type. 38% of questions was related to local and store each as two most asked questions. There were two examples of these questions.

*"Where Mahana Rd was?"* (P10, for local division) and

*"Where is AVIS company*[7] *in Hamilton? "* (P4, for store division).

14% of questions were related to food in the geographical needs type such as

*"Where is cottage cheese in the supermarket?"* (P8)

10% of questions were referred to *distance* in geographical needs type. Distance was the only topic in the geographical needs and participants asked them while moving. Two questions were

*"I want to know hoe many kilometres left to be there?"* (P4, driving the car)[8] and
*"Does it really go to Hamilton, or did I misunderstand the announcement?"* (P8, taking on the bus).

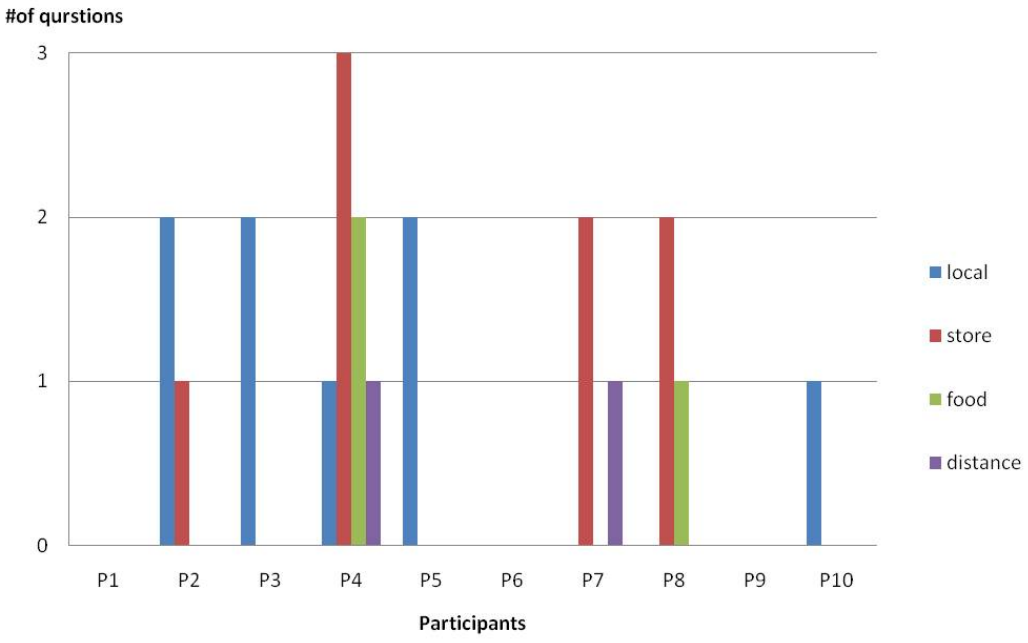



Figure 4.11: Distribution of topics of geographical needs by participants.

Figure 4.11 describes the distribution of topics of geographical needs by participants. Some participants did not have any question related to the geographical needs type, such as P1, P6 and P9. We found that they had no questions in

[7] A rental car company http://www.avis.co.nz/car-rental/avisHome/home.ac
[8] (Participant#, participant's state)

the geographical needs type but three questions related to *local* in the *informational needs* type on average.

Also some participants had questions related to one category only in the geographical needs type. P3, P5 and P10 had asked questions related to the local category only.

In addition some participants had questions related to two categories in the geographical needs type. P2, P7 and P8 had asked questions related to two categories and one of them is the *store* category.

The smallest group included participants who had questions related to all four categories in the geographical needs type. P4 is the only one of ten participants who had asked questions related to all categories. A total of eight questions was asked by P4, three are about the store category, and the food category had two questions, local and distance had one question each.

There were two main topics: *local* and *store* in geographical needs type and it is worth noting that the local topic was the main topic in informational needs type too. However here the local topic was strongly related to the geographical information and most of them required a direction guide. The *store* topic was usually followed by people's shopping behaviour.

#### 4.3.1.2 Question Word

This analysis used Chang's study [2] was to examine the relationship between question words and question types. These question words (e.g., how, where, when) were calculated by the question numbers for two question types: the informational needs and the geographical needs in this study. There were in total 109 questions crossing 12 different question words in this study. Figure 4.12 shows that most questions of the information needs type started with 'what', whereas most questions of geographical needs type used 'where' to start a sentence.

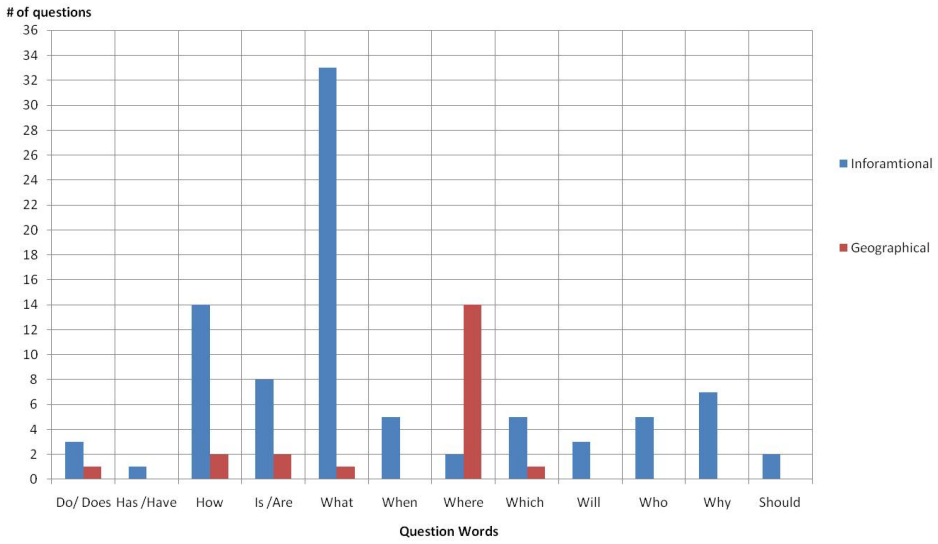



Figure 4.12: Distribution of question word by user goal.

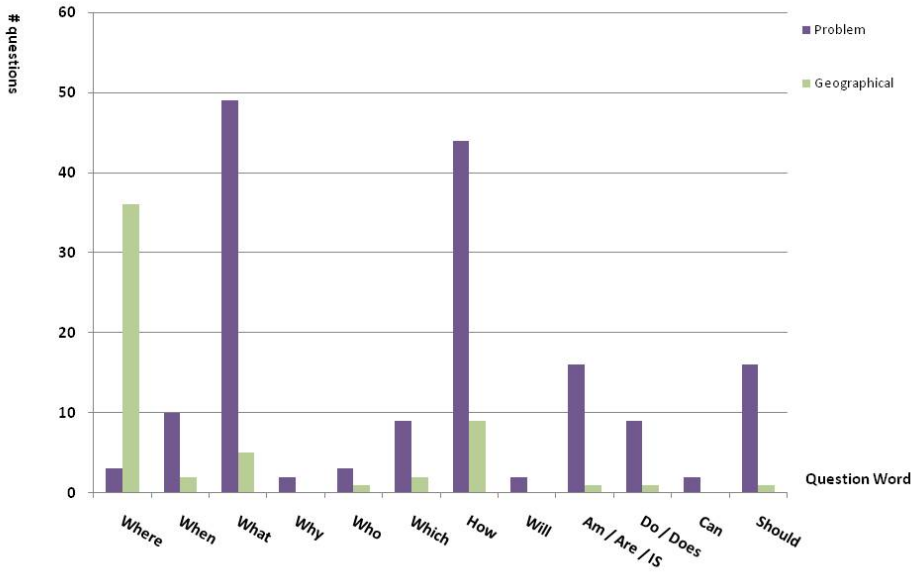



Figure 4.13: Distribution of question word by user goal. Reprinted from *Questions Not Answers: Information Needs for Mobile users* (p.31), by S-P. Chang, 2010, New Zealand, NZ: The University of Waikato. Copyright 2010 by Su-Ping Chang. Reprinted with permission.

For the informational needs type, participants used a lot of 'what' (38%) and

'how' (16%) in their questions. Of these questions starting with 'what', participants usually asked for the description. Participants asked for the solutions with their questions led by 'how'.

On the geographical needs type, participants used a lot of 'where' (67%) on most questions. These questions required directions for their destination.

Although different methods have been performed in Chang's study via paper diary [2] and this study via a mobile device, results appear to be consistent with each other. Figure 4.13 shows that 'what' and 'how' start questions related to problem-question (= informational needs in this study) and 'where' start questions regarding geographical-question (= geographical needs in this study). We justify that mobile search syntax does not change with different platforms.

#### 4.3.1.3 Location Context

Indoor place and outdoor place are only two types in this study. Home, campus and relatives home are all grouped into indoor place, and any other places are named as outdoor place.

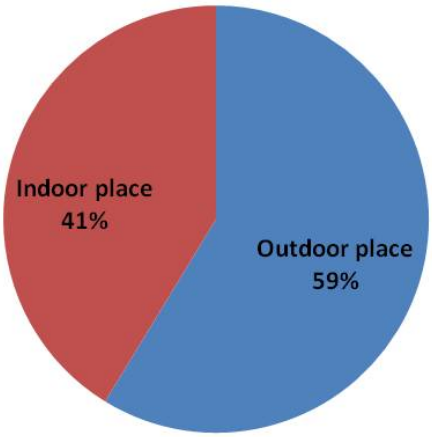



Figure 4.14: Distribution of indoor and outdoor place.

Figure 4.14 presents the breakdown of all questions by the place being outdoor and indoor. 59% of questions emerged when participants were in an *outdoor place* (e.g., travelling in the new city) and 41% of questions were asked when participants were staying in a *indoor place* (e.g., home or campus). These results were opposite to the paper diary study (see Figure 3.9 in Section 3.3.1.4).

The results indicated that participants relied on their mobile devices to search information needs when they were away from their home or computers. It confirmed that using different methods of capturing information is greatly influenced by the places in which users record their questions.

### 4.3.2 Digital Record

After analysing word records for the questions, we further evaluated the digital record in this study. We discussed the results of *question*, *answer* and *physical situation* of the digital records in this study. We found that photo shoot is the only way to record digital logs in this study. The main reason is that people are used to taking photos more than videos in their daily life.

#### 4.3.2.1 Question & Answer

We observed that photos did not just present questions but also provided answers themselves. In the beginning, we focused on questions with useful photos. Here, the useful photo means that we can find the information related to the question or answer. The results gives listing in Figure 4.15 and the question example with the photo in Figure 4.16a. The 18% questions with photos had the potential *answers within*. For example, P6 watched the Christmas Eve Service at the church and wanted to know what kind of church it was (see Figure 4.16b). We also found many people (the potential answer) in the photo might be able to answer the question.

82% of questions with photos belonged to the *questions division*. 45% of questions with photos were about place and it was the largest group in the question division. 29% of questions with photos showed that the question was *caused*

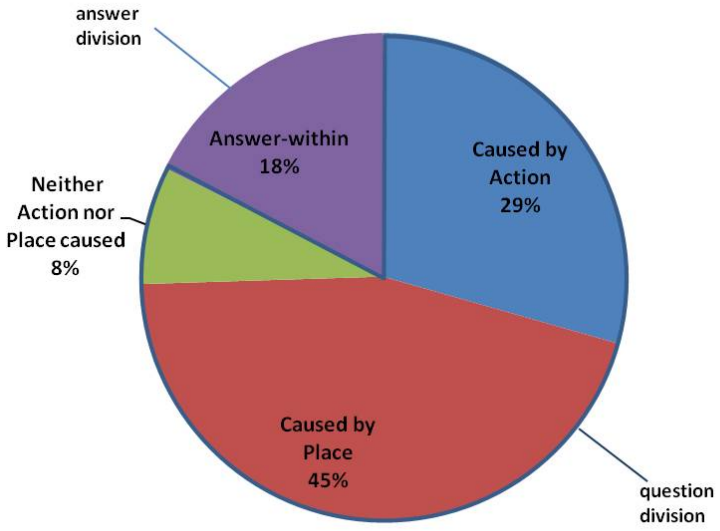



Figure 4.15: Questions with useful photos by four different types for question division or answer division.

(a) Example for 8% of photos on the question division. *Q: How long do deli olives last for if kept in the fridge? (P3)*

(b) Example for 18% of photos on the answer division. *Q: What kind of church this is? (P6)*

Figure 4.16: Photo examples for the question division and answer division. (Adapted with permission.)

*by action* and it means that the action was ongoing when users took the photos. Only 8% of questions with photos showed that the question was *caused by neither action nor place*. For example of Figure 4.16a, P3 took a photo of deli olives and then asked how long they stay fresh in the fridge. It is worth to noting that all 8% of questions with photos are asked by P3 (see Figure 4.17a

(a) *Q: According to the local culture, should I have taken down my Christmas light by now?*

(b) *Q:Is this the Japanese "yum yum sauce"my friend wanted for her boss?*

Figure 4.17: Example photo for the question is *caused by neither action nor place* for P3. (Adapted with permission.)

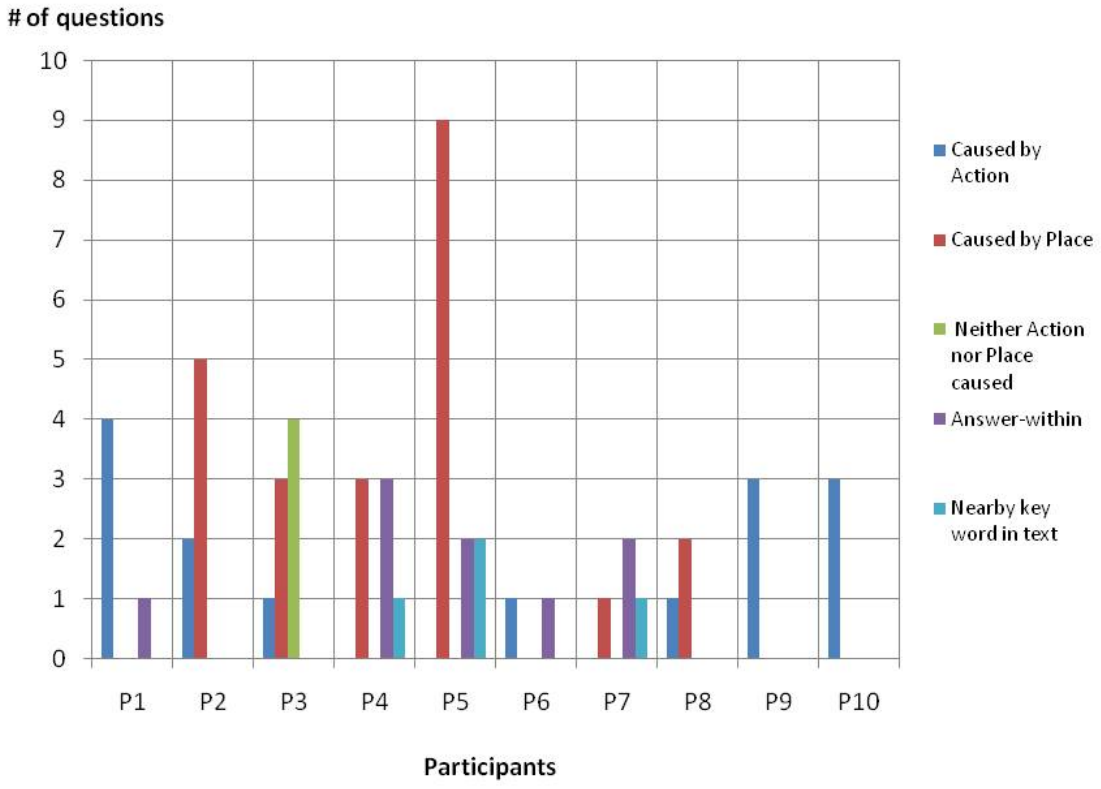



Figure 4.18: Distribution of questions only with valid photos and they are sorted by five categories of digital records for each participant.

and 4.17b).

The outcome of the digital record confirmed that place and action were context

factors of mobile information needs. The digital record indicated either the context factor or the potential answer within. The paper diary only provided the context factor in the text words but the digital diary found the physical situation that includes the potential answer.

Figure 4.18 shows the distribution of all the questions only with valid photos by five categories of all the digital records for participants. One finding was that the word records of the question contained the synonym of nearby for searching the particular places from the surroundings. These questions all had photos to show where the participants were. These questions were not only the geographical needs type but also the *caused by place* type. We took it as one result of digital records.

There were seven participants having questions that were caused by their current action and the relevant photos show the question themselves as well. P9 and P10 both had questions *caused by the current action* only with photos (see example photo on Figure 4.19a and 4.19b).

Six participants had questions caused by place and relevant photos also show the question themselves. P5 had the most questions caused by place with photos. P2, P3 and P8 had questions caused by place and action in this study (see example photos on Figure 4.20a and 4.20b). Furthermore all of them had questions caused by place more than questions caused by action.

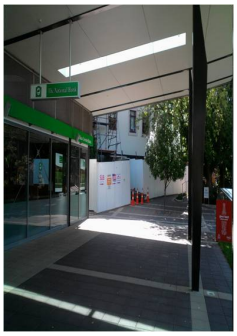
On Figure 4.18, P3 had questions with relevant photos that caused by action, place and other factors. P3 is the only one participant with questions caused by other factors (*neither place nor action*).

Five participants had a total of nine questions with relevant photos which include potential answers within. For example, P1 asked how to import the contact list into the new mobile and one of the relevant photos shown the laptop (see Figure 4.21a). The laptop could offer the answers that P1 wanted.

(a) *Q: I do not have yogurt and wondering if I can find it in a store near my place.* (P9 was at home and wanted to cook.)


(b) *Q:Will CX107 be on time?* (P10 was in the airport for picking up friends.)

Figure 4.19: Example photo for the question is *caused by action.* (Adapted with permission.)



(a) *Q: How can I know when is the next public holiday.* (P2 went to the bank in the university premises without knowing it was a public holiday.)

(b) *Q:Is Bryce street left or right?* (P3 was at the supermarket on Tristram street.)

Figure 4.20: Example photo for the question is *caused by place.* (Adapted with permission.)

This kind of question is named *answer-within*.

P5 asked about the exchange rate when passing by the bank and one relevant photo was shown in Figure 4.21b. The scenario is that P5 asked the question when he/she saw the exchange rate board of the bank. In this case, the bank could answer this particular question. Therefore, these questions with relevant photos offer questions and answers together. We also can find the question and the answer together from P6's relevant photos (see Figure 4.16b). The only difference is that people are the potential answer.

There were three participants' questions including the synonym of *nearby*, accounting for four questions in total. We found the physical location for these questions from relevant photos. For example,

> *"Where is the nearest Westpac bank to the Waikato University?"* (P5) and
> *"Where can I get a decent pizza near my place?"* (P7).

Figure 4.22 shows the results of all the questions by five categories of digital records for each participant. Most questions came along with no information within photos for each participant's question numbers. There were two participants' questions all with valid information: P6 and P9. P6 had one question only in this study but their photos presented questions and answers together (*P6 watched the Christmas Evening lights in the church with a crowd*). P9 had three questions with photos that included the current action of these questions (*P9 picked up friends at Auckland airport*).

For the category of digital records, the most common set is the participant's questions sorting in three categories in this study. Additionally, six participants had a total of 85 questions in this three-category set. The category with the largest numbers of questions was the *no information within* with 58% of questions in this set. The second most common category was the location with 23% of questions. The third most common category was the answer-within with 9% of questions and action caused with 8% of questions was the

(a) *Q: How to import contact into the new phone?* (P1)

(b) *Q:What is the exchange rate right now?* (P5)

Figure 4.21: Example photo for the question is *answer-within*. (Adapted with permission.)

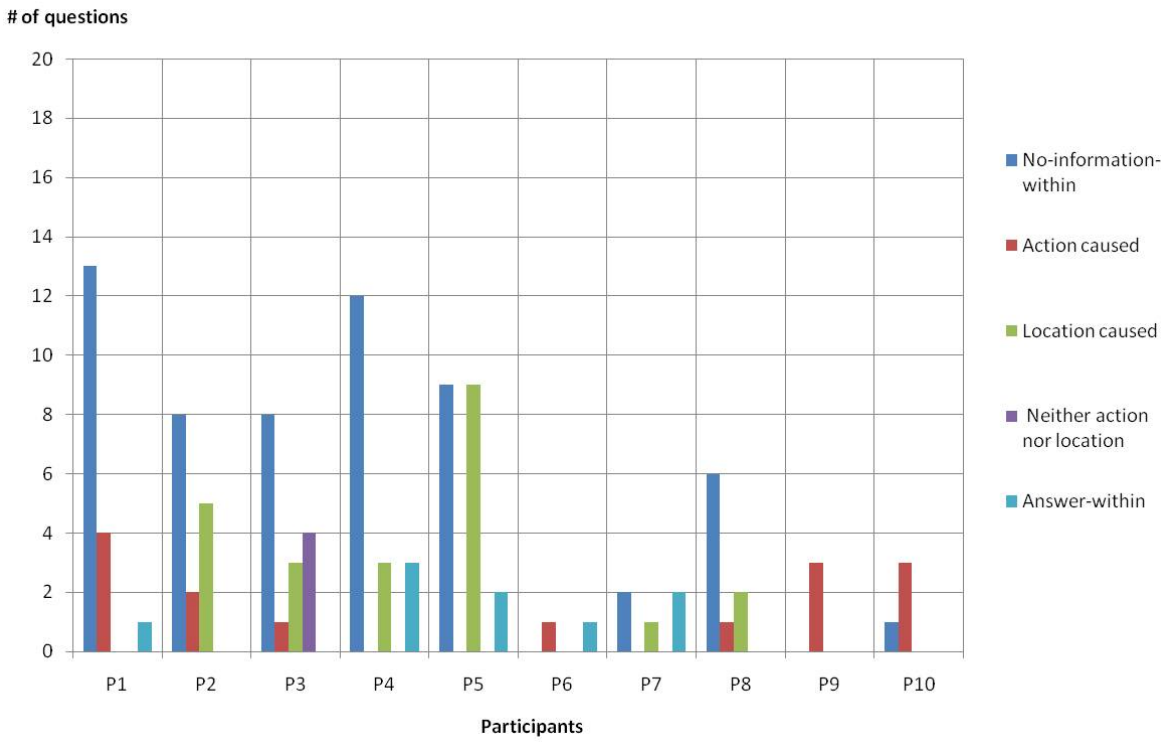



Figure 4.22: Distribution of topics of digital record by participants.

smallest category in this set.

The second common category set was the participants' questions sorting by two categories in this study. The combination of this two-category set were either answer-within and action caused or action caused and no information-within. Questions of P6 and P10 was a part of this duel set.

The smallest category set was the participant's questions sorted by one category only or with four categories together. P3 was the only participant with the four-categories set in this study. Four categories are *neither action nor location*, *location caused*, *action caused* and *no-information-within*. P9 was the only participant with one category alone in this study and all questions are related to the *action caused* category.

This study focused on the mobile information needs in the digital diary, although we found the actual mobile user preferred to simplify their questions in the digital diary. There were the same results in the question word of the sentence in the digital diary and Chang's study [2] (paper diary). Mobile users agreed to use 'where' for searching geographical needs type and 'what' and 'how' for seeking informational needs type in the mobile search. We conclude the results of mobile search that should combines the findings of the paper diary study and the digital diary study. The paper diary study expresses the mobile information needs and the digital diary study indicates the mobile user behaviours.

#### 4.3.2.2 Physical Situation

This study identified the scenario for each question thus enabling analysis of these scenarios for the results from different situations of the participants and the questions. This is the first time that analysing situations of the participants or the questions has been included in our research. Participants reported some questions happened during their conversations with other people. A notable example is

*"Is there a scale for nerd rage?"* (P1).

We named it a 'party-talk' question in the interview. We also believed it could be a factor affecting the mobile search.

In this study, we found that *question's situation* could be changed with its scenario so that other factors affected the mobile search. The scenario offered the story of the question and we found the question's situation could be individual or continuous. Another notable example was that P8 had three questions which started for searching for the nearby supermarket, for buying yogurt, asking the direction for the nearby supermarket and to looking for the yogurt in the supermarket.

- ***Participant Situation***

In all, there were 109 questions in this study. Participant's situations were grouped into two types: *alone* or *with people (a conversation with people)*. In this study, 60 questions were asked when alone and 49 questions were asked during a conversation.

Figure 4.23 presents the distribution of all questions in different situations for each participant. Most participants had questions in both situations but P6, P7 and P9 only had questions when they were with other people. These three participants had fewer numbers of questions thus we would excluded these questions from this study. For both these two situations, participants asked many more questions when more alone than when with people. However P4 and P10 asked many questions when they were with people than when they were alone. We had some explanations for these two exceptions. For P4's question records, timing is the reason since P4 did this study during the holidays. For P10s question records, timing and location play a major role as P10 had one question during the meeting, two questions on holiday and one question when driving.

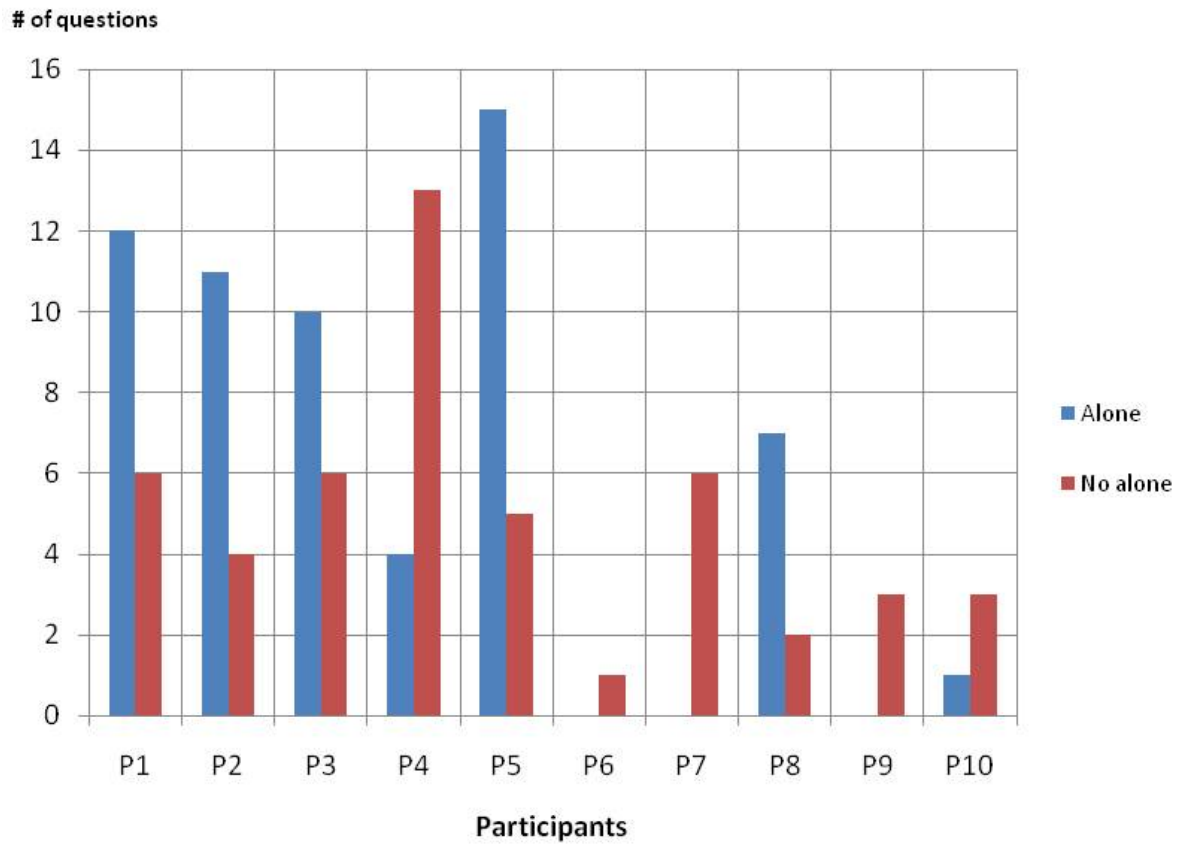



Figure 4.23: Distribution of questions of two participant's situation.

- ***Question Situation***

The question situation focused on the question only. All questions were grouped into two main types: *individual type* and *continuous type*. The individual type was a single question that described no connection with other questions in this study. The continuous type was a group of questions that had a relationship between questions in this study. There were four groups on continuous type: *go and back*, *cause to effect*, *location* and *scenario*.

The group of *go and back* and *location* both concentrated on the location of the question. The example of *go and back* was

> *"What kind of activity can we found in Whaiheke?"* and the following question is
> *"Which is the way we should take to reach the ferry? "* (P4, going on a trip to Waiheke).

The example of location was that P2 asked two questions on the *same location*.

> *"Does the carving in wood symbolize mean any thing?"* and the following question is
> *"What will happen to the tree on the sitting place?"* (P2, in Christmas BBQ in Kawhia).

The groups of *cause to effect* and *scenario* both concentrated on reasons for the questions. The example of *cause to effect* was that P8 asked three questions which started with searching a nearby supermarket for yogurt, followed by the direction about the supermarket and finally with looking for yogurt at the supermarket.

> *"I do not have yogurt and wondering if I can find it in a store near my place."* (P8 needed yogurt for cooking at home)
> *"Where is New World?"* (P8 looked for the supermarket)
> *"Where is it?"* (P8 looked for yogurt in the supermarket).

The example of *scenario* was that P7 asked if the bus goes to Hamilton or not and what kind of cloud it is as being on the bus.

> *"Does it really go to Hamilton or did I misunderstand the announcement?"* (P7 was on the bus back to Hamilton)
> *"What kind of cloud is this and what does it mean?"* (P7 saw the cloud on the bus).

Figure 4.24 shows that for each participant most of the questions were related to the *individual type*, except for P9. Moreover, each participant had questions related to the *continuous type* in the same scenario but questions of P2, P5 and P6 were related to the individual type only. P9's questions were all related to the *continuous type* in the same scenario. All three questions were based on people arriving in New Zealand and further dealing with the mobile network and renting a car.

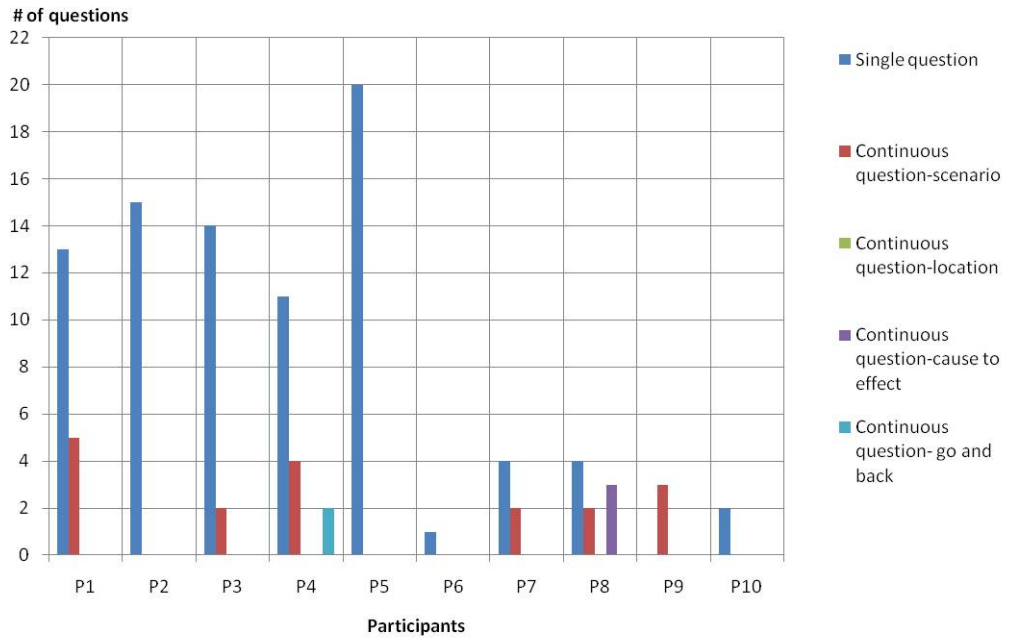



Figure 4.24: Distribution of questions of question's situation by participants.

> *"Will CX107 be on time?"* (landing New Zealand)
> *"How does Vodafone 3G broadband work? Does it suit my needs?"* (searching mobile network)
> *"I need to rent a car for a short term trip. Which car rental company should I choose?"* (renting the car) (P9).

P4 was the only participant who had questions related to the continuous type in the *go and back* group and P8 was the only one who had questions related to the continuous type in the *cause to effect* group.

In summary, most questions of the mobile search are most related to the individual type. If a question was not the individual type, it was most likely to be the same *scenario* as *continuous type*.

## 4.4 Summary

In this chapter, we reported about a digital diary study, using digital records of a mobile search. The main focus was on the digital records capturing the physical situation for the mobile search. This study consisted of two compo-

nents: *text record* and *digital record*. *Text record* includes the question and the scenario of the question which describes a complete story of the question. *Digital record* depicts the physical situations where questions emerged. Through these digital records we observed results related to questions, physical situation and answers.

We began with the analysis of text record. These questions are classified into two major type groups: *informational needs* and *geographical needs* and eight topic groups: *local*, *store*, *food*, *product*, *entertainment*, *weather*, *personal information* and *general*. Comparing the topic groups numbers, the paper diary study is more complex than this study because it has 12 sub type groups in total. We therefore concluded that participants asked more simple questions with the mobile device in this study. Furthermore, we analysed places where the question emerged and found that questions emerged when users are at outdoor places more frequently than when they stay indoors. This result is in contrast to the previous studies and a more likely explanation rests with the nature of participants; people rely on a mobile search when they are outside much more than when they stay indoors.

In this study, we analysed the question words for comparing outcomes conducting from different methods (paper diary and mobile device). The results were that the most questions are associated with the informational needs type in this study. In addition, 'what' and 'how' are two question words that get used in the most questions related to the informational needs type. Most questions related to the geographical needs type started with 'where' for a question. The result of these question words agree well with the previous studies.

Then, we described the analysis of the digital records in this study. The questions with relevant photos are classified into two major type groups: question-division and answer-division and five sub type groups: caused by action, caused by place, neither action nor place, answer within and nearby key word in the text. In general, nearly half questions with the valid photos here are related

to the location where participants are. Over quarter questions are caused by participants' actions and a few questions are caused by neither locations nor actions. Some questions with useful photos show the potential answers within themselves. We also found four questions with the answer of 'nearby' for searching the particular places from the surroundings.

However, the questions with the valid photos are at a low percentage in all questions we obtained in this study. Most participants reported that they cannot (or forget) take photos because they are moving (e.g., walking or driving). The other reason is that some questions emerged from a conversation so that photos cannot describe the situations.

From this study, we found that the question is affected by the participant's situation. We identified two situations of participants, asking question of oneself or when with other people. Most questions were asked when participants were not interacting with others but each participant asked questions when they were with people. Senseless questions were asked by participants while they got into a conversation with people and they identified the 'party-talk'. In addition, we also studied the question situations. There are two major groups of question situations: the *individual type* and the *continuous type* and four sub type groups of the continuous type: *go and back*, *cause to effect*, *location* and *scenario*. The group of 'cause to effect' and 'scenario' both concentrate on the reason for the question. The group of 'go and back' and 'location' both concentrate on the location of the question. Most questions are the *individual type* and each participant had questions of the individual type except for P9. For the *continuous type*, most questions had the same scenario but for questions of 'cause to effect' and 'go and back', they were from by two participants only (P4 and P7).

In summary, analysis of the digital diary study observed the results on word records and on digital records. By comparing results on different platforms, we confirm the question from the digital record is usually simpler than that of

the question of the paper diary and questions asked by people outside more than were inside. Otherwise the question words used to start a question and the question types both show no difference with different platforms. We also verified that the location and the action affect the mobile search a lot. Finally, we explored the situation of participants and then questions that two factors also play a big role of determining the questions from the mobile search. Most questions are the individual type and most questions in the continuous type had the same scenario. Participants ask more questions that do not need to interact with others but a social conversation causes them to ask senseless questions.

# Chapter 5

# Conclusions

In this chapter, we summarize what we have accomplished in this project. We first review the results and the findings of the paper diary study and the digital diary study. We then compare the results between the paper diary study and the digital study. Finally, we suggest possible future work.

## 5.1 Overview

As detailed in Chapter 1, our goal for this project was to explore the context factors which influence mobile information needs and the expected answers which help us to find the pattern for the mobile search. Chapter 2 summarized the results from previous studies and these results identified that location and activity influenced mobile information needs. We also explored the expected answers and similarity check for the mobile information needs related to the answers.

We explored three aspects using two studies: paper diary and digital diary in Chapter 3 and 4. In Chapter 3, the results of the paper diary study indicate three issues of mobile information needs: question, answer and activity. In Chapter 4, the outcome of the digital diary study provided two types of records: text record and digital record. We used the concepts from the paper diary study to analyze the data of the text record. We used grounded theory to develop another analysis concept for the digital record. We classified the

data of the digital record into three categories: question, answer and physical situation.

## 5.2 Findings of Paper Diary Study

In the paper diary study, there of our findings are interesting. Firstly, we identified three context factors which are influenced by the mobile information needs: place, next activity and current activity. The *next activity* is the one most influenced by the question emerging from the mobile search. Most studies focus on place/location, but our results show that the *current activity* and the *next activity* may be more important than place/location.

Secondly, we found two types of map for expected answers related to *location* or *direction*. *Map* presents the location of where people are and where the required place is and the *path-map* indicates the route to arrive at the required place.

Finally, we identified two new factors in this project: *answer-arise time* and *similarity check*. For answer-arise time, we find that geographical information needs always require the answers *'immediately'*. We further found that the quantity of context factors seems to be closely connected to the answer-arise time. When a question is involved with zero context factors to three, mobile users require the answer from no time limiting to immediately. There are three topics of the similarity check refer to *answer location*, *user's current location* and *similar question*. Our observations may indicate that the participants interested in related which questions depended on the answer location believe that the answer location provide significant information for their information needs.

The results provide a new concept of context factors which could develop an interface for the mobile search. The new findings of the answer-arise time and the similarity check may be used to design a recommender system for mobile

search.

## 5.3 Findings of Digital Diary Study

In the digital diary study, we understand that most mobile information needs are triggered by the participant's actions. We found that mobile user used the key word 'nearby' for searching for particular places in the surroundings.

The physical situation is a new aspect in the mobile information needs and we found that the physical situation of the users and the questions both influence the mobile information needs. People asked most questions in a mobile search when they are alone. However, senseless questions were asked by people while they got into a conversation with other people and they initiated *'party-talk'*. Most questions are an individual type in a mobile search. However, when the question is a continuous type, most of them relate to the same scenario.

We found that the questions with valid photos had low percentage in all questions we obtained in this study. The reason of this that most participants cannot (or forget) to take photos because they are moving (e.g., walking or driving). The other reason is that some questions emerged from a conversation so that photos cannot describe the situation. Therefore increasing the digital records percentage could be help us to explore the relationship between the physical situation and the mobile information needs.

## 5.4 Comparison

In this section, we compared the results of our study with previous studies to confirm aspects of mobile information needs. Then we compared the results from the paper diary study and the digital diary study in this project.

### 5.4.1 Comparison with Previous Studies

For the context factor of an activity, our study extends our previous studies' findings [2, 3] by providing a much more detailed analysis of the activity. Our results show that the current activity and the next activity may be more important than location.

Compared to previous studies, the numbers of questions *in the car* increased markedly in this study. We believe that the difference is caused by the type of the participants. In our previous studies, participants had basic computer literacy but did not know about the user study. This nay have caused the results to slant. In this study, participants are all recruited from the Computer Science school and they also have the experience of being a participant. In any future work, the experience of participants should be a specific requirement.

We found that the current activity and the next activity are one of the context factors. In the type of mobile information needs, our results also confirmed that mobile users are interested in the informational needs type more then the geographical needs type. In our studies, we identified a new category which mixed two types of geographical and information needs together and we named GA (geographical information needs with advice).

### 5.4.2 Paper Diary Study v.s. Digital Diary Study

The recording devices in the paper diary and the digital diary are different. We believe the different recording devices should not cause the different results because a paper diary has the same function as the mobile device in the digital diary.

Comparing the topic groups, the paper diary study is more complex than the digital diary study. We therefore concluded that participants asked simpler questions with the mobile device in this study. We interpreted this to mean that mobile user behaviour tends to be 'simple' on the mobile device.

We acknowledge that the questions asked in the digital diary study are usually simpler than the questions in the paper diary study. Our results indicate that the number of questions asked by people When they are outside are greater than when inside. These results present significant differences between the paper diary and the digital diary. Otherwise the words used to start questions and the question types both show no difference with different platforms. We also confirmed that the location and the action greatly affect the mobile search.

## 5.5 Future Work

We propose to follow three main directions for future work.

In this project, we identified three context factors: the current activity, the next activity and location, and then we found all were important to mobile information needs. However, we found that the current activity and the next activity may be more important than the location context. The results of the paper diary study were limited to the quantity of the question and the participants. The future work could extend the paper diary study to find the extent of the context factor in the mobile search.

The results of the paper diary study show questions and answers of mobile users' information needs. The results of the digital diary study indicate the mobile users' behaviour in a mobile search. It would be useful to use insights to develop new search interfaces of mobile devices.

We found that for the mobile users, both the answer-arise time and the similarity check were interesting aspects of their mobile searches. A future study could explore further how to build these features into a recommendation system for mobile devices to offer alternative (similar) queries and answers to a user.

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# Appendix A

# Ethics Consent Approval for Paper Diary Study

**Computing and Mathematical Sciences**
*Rorohiko me ngā Pūtaiao Pāngarau*
The University of Waikato
Private Bag 3105
Hamilton
New Zealand

Phone +64 7 838 4021
www.scms.waikato.ac.nz

THE UNIVERSITY OF WAIKATO
*Te Whare Wānanga o Waikato*

28 May 2010

Su-Ping Chang
C/- Department of Computer Science
**THE UNIVERSITY OF WAIKATO**

Dear Su-Ping

**Request for approval to conduct a user study involving human participants**

I have considered your request to conduct a user study involving human participants in May this year. The purpose of this study is based on my project "Questions Not Answers" research, a new mobile search technique. I wish to identify what kind of information mobile users need.

This will be done initially by the participants using a diary for one week to record their questions. Detailed instructions will be provided in the diary. There will be a follow-up interview where notes will be taken.

The diaries and all related data will be stored in the FCMS data archive for five years. They will be destroyed after that period.

The procedure described in your request is acceptable.

I note your statement that participant anonymity will be strictly maintained and all information gathered will be used for statistical analysis only; no names or other identifying characteristics will be stated in the final or any other reports.

The research participants' information sheet and consent form meets the requirements of the University's human research ethics policies and procedures.

Yours sincerely,

**David Nichols**
Human Research Ethics Committee
Faculty of Computing and Mathematical Sciences

# Appendix B

# Ethics Consent Approval for Digital Diary Study

**Computing and Mathematical Sciences**
*Rorohiko me ngā Pūtaiao Pāngarau*
The University of Waikato
Private Bag 3105
Hamilton
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THE UNIVERSITY OF WAIKATO
*Te Whare Wānanga o Waikato*

3 December 2010

Carole Chang
C/- Department of Computer Science
**THE UNIVERSITY OF WAIKATO**

Dear Carole

**Request for approval to conduct a user study involving human participants**

I have considered your request to conduct a user study involving human participants in December this year. The purpose of this study is based on your project "Questions Not Answers" research, a new mobile search technique with which you wish to identify what kind of information mobile users need.

Participants can choose from two options on how they will provide the information, message text and photos/CD ROM or Twitter. There will be a follow up interview.

The procedure described in your request is acceptable.

I note your statement that participant anonymity will be strictly maintained and all information gathered will be used for statistical analysis only; no names or other identifying characteristics will be stated in the final or any other reports.

The research participants' information sheet and consent form meets the requirements of the University's human research ethics policies and procedures.

Yours sincerely,

**Dave Nichols**
Human Research Ethics Committee
Faculty of Computing and Mathematical Sciences

# Appendix C

# Interview Form for Paper Diary Study

| Participant General Information Check |
|---|
| 1. Gender ○ Female ○ Male |
| 2. Do you have used mobile doing search work? ○ Yes (go to 3) ○ No (go to 4) |
| 3. What kind of information you usually search for?<br>○ Geographical-based information ○ Knowledge-based information |
| 4. Where did you usually get the answer?<br>○ Internet ○ Books ○ People ○ Did not try |

| Post Study Semi-structured Interview |
|---|
| #___ record |
| 1. Where is the location of the answer?<br>Place_____ City_____ |
| 2. What is the current activity for this question?<br>_____ |
| 3. Next Activity<br>○ Already plan it. ○ After get the answer.<br>○ No next activity. ○ Other _____ |
| 4. What is the answer you expect for?<br>☐ Location ☐ Direction<br>☐ Long text<br>☐ Short text<br>○ Yes / No ○ Choice ○ Numerical<br>○ Other _____<br>☐ Information _____ |
| 5. Would you like to know where else people had a question like yours? |
| 6. Would you like to know which other questions were pointing to your location? |
| 7. Would you like to know which questions people asked in your current location? |

# Appendix D

# Diary Records for Paper Diary Study

| Q_No | P_No | Question | Place_Details | Q_Place | Q_City |
|---|---|---|---|---|---|
| 1 | P1 | What's the song playing for 'Brothers and Sisters' ad this week? | home | Home | Hamilton |
| 2 | P1 | Does anyone want to go to city center? | home | Home | Hamilton |
| 3 | P1 | Does anyone have the movie "Letters to Juliet"? | uni | Campus | Hamilton |
| 4 | P1 | How many pages I should write on the master thesis? | uni (lab) | Campus | Hamilton |
| 5 | P1 | Where I can go for taking a short trip? | uni (lab) | Campus | Hamilton |
| 6 | P1 | Is Annika or Dave in uni now? | uni (lab) | Campus | Hamilton |
| 7 | P1 | How far is it from uni to Animal Education and Control Center? | uni (lab) | Campus | Hamilton |
| 8 | P1 | How much ferritin do I have in my blood? | GP | Others | Hamilton |
| 9 | P1 | Can we arrive at home before 5pm? | White st | On the way | Auckland |
| 10 | P1 | How plan on 7 days trip on Fiji? | home | Home | Hamilton |
| 11 | P1 | How much money is Olympus E-620? | Dick Smith | Shopping Place | Hamilton |
| 12 | P2 | Is there a near petrol station? | in the car | In the car | Hamilton |
| 13 | P2 | What is cheapest flight to Sydney? | computer lab | Campus | Hamilton |
| 14 | P2 | When is the next game of the World Cup? | friend's place | Related House | Auckland |
| 15 | P2 | Where is the best fish and chips? | at home | Home | Hamilton |
| 16 | P2 | What's the distance between Hamilton and Taupo? | petrol station | Petrol Station | Hamilton |
| 17 | P2 | Where is the motor lodge inn? | in the car | In the car | Wellington |
| 18 | P3 | What time is the NBA on? | uni lab | Campus | Auckland |
| 19 | P3 | When is airbender coming out? | home | Home | Hamilton |
| 20 | P3 | What's on TV tonight? | my house | Home | Hamilton |
| 21 | P3 | How do you get to Whakatane from Hamilton? | home | Home | Hamilton |
| 22 | P3 | How long does it take to get to Whakatane? | home | Home | Hamilton |
| 23 | P3 | Where is the Whakatane squash club? | cousin's house | Related House | Whakatane |
| 24 | P3 | What time is the All Black game? | basketball court | Others | Hamilton |
| 25 | P3 | How much is a motorbike license? | home | Home | Hamilton |
| 26 | P4 | Is the 'A Team' movie playing yet? | home | Home | Hamilton |
| 27 | P4 | Is diet coke on special at New World? | home | Home | Hamilton |
| 28 | P4 | What is the takeaway's phone number? | home | Home | Hamilton |
| 29 | P4 | What are the operating hours of the Warehouse? | supermarket | Shopping Place | Hamilton |
| 30 | P4 | Where is the nearst vet? | home | Home | Hamilton |
| 31 | P4 | What time are the FCMS office open? | home | Home | Hamilton |
| 32 | P5 | Where is the closest supermarket? | in the car | In the car | Hamilton |
| 33 | P5 | What can I get a for a thankyou present? | home | Home | Hamilton |

| Q_No | P_No | Question | Place_Details | Q_Place | Q_City |
|---|---|---|---|---|---|
| 34 | P5 | Is there a Bras and Things sale in Manukau? | Ponsonby | Related House | Auckland |
| 35 | P5 | Where is the Warehouse for Manukau Shopping Center? | Manukua shopping centre | Shopping Place | Manukua |
| 36 | P5 | What is Sarah doing tomorrow? | Ponsonby | Related House | Auckland |
| 37 | P5 | Does the uni library have information on prototype? | Ponsonby | Related House | Auckland |
| 38 | P5 | Where is a good place to get coffee? | Ponsonby | Related House | Auckland |
| 39 | P5 | How is grandmum? | home | Home | Hamilton |
| 40 | P5 | Is it going to be cold raining late? | home | Home | Hamilton |
| 41 | P5 | Where is the cheapest closed petrol station? | uni | Campus | Hamilton |
| 42 | P5 | What's on TV tonight? | car | In the car | Hamilton |
| 43 | P5 | Where have French toast? | Ponsonby | Related House | Auckland |
| 44 | P5 | How do I write a paper on lean? | Ponsonby | Related House | Auckland |
| 45 | P5 | Have my marks been posted to Moodle? | Ponsonby | Related House | Auckland |
| 46 | P5 | How long will it take me to walk to the supermarket? | Ponsonby | Related House | Auckland |
| 47 | P5 | What should I buy as a thankyou gift? | Ponsonby | Related House | Auckland |
| 48 | P5 | What is the best time to leave Auckland? | Ponsonby | Related House | Auckland |
| 49 | P5 | Is Emma goiong to be here tonight? | Ponsonby | Related House | Auckland |
| 50 | P5 | How do you cook the roast chicken? | home | Home | Te Awamutu |
| 51 | P5 | Is Scott at home? | home | Home | Te Awamutu |
| 52 | P5 | What time are parents lave from Fieldays? | home | Home | Te Awamutu |
| 53 | P5 | Where should I buy a thankyou gift for Lyn & Phil? | Fiekdays | Others | Hamilton |
| 54 | P5 | Where is Ridgeline site? | Fieldays | Others | Hamilton |
| 55 | P5 | What time does Ag Art Wear Show start? | Fieldays | Others | Hamilton |
| 56 | P5 | Where is Dad? | Fieldays | Others | Hamilton |
| 57 | P5 | Where sells Brandy? | Fieldays | Others | Hamilton |
| 58 | P5 | How bad is the traffic going to be? | Fieldays | Others | Hamilton |
| 59 | P5 | Is Glen Gary having a sale? | home | Home | Te Awamutu |
| 60 | P5 | How bad is the Fieldays traffic? | home | Home | Te Awamutu |
| 61 | P5 | Is Pak'n'Save having a wine sale? | Hamilton uni | Home | Hamilton |
| 62 | P6 | When will the bus be here? | Info Centre | Transport Station | Rotorua |
| 63 | P6 | Are any café's open around the Rorotrua information centre? | Info Centre | Transport Station | Rotorua |
| 64 | P6 | What's the weather like in Hamilton? | Parent's home | Related House | Rotorua |
| 65 | P6 | What time is the camputer labs shut? | campus | Campus | Hamilton |
| 66 | P6 | What time does Bunnings warehouse shut? | R-labs, uni | Campus | Hamilton |

| Q_No | P_No | Question | Place_Details | Q_Place | Q_City |
|---|---|---|---|---|---|
| 67 | P6 | Is there a Bunnings closer than the base Te Rapa? | uni | Campus | Hamilton |
| 68 | P6 | Is there such a thing as rust proof wire? | home | Home | Hamilton |
| 69 | P6 | What is the quickest way to get to work from uni? | uni | Campus | Hamilton |
| 70 | P6 | Will it rain in next few hours? | home | Home | Hamilton |
| 71 | P6 | What time is my meeting with supervisor this week? | university | Campus | Hamilton |
| 72 | P6 | Is campus Koisk still open? | campus | Campus | Hamilton |
| 73 | P6 | What is my account balance? | VTSNZ | Shopping Place | Hamilton |
| 74 | P6 | When will it next rain? | home | Home | Hamilton |
| 75 | P6 | What is the address to ssh into labs at uni? | home | Home | Hamilton |
| 76 | P6 | Where is the Bunnings Warehouse? | The Base | Shopping Place | Hamilton |
| 77 | P6 | Where can I buy paneer cheese from? | uni | Campus | Hamilton |
| 78 | P6 | How should I get hold of Carole? | home | Home | Hamilton |
| 79 | P6 | Where can I buy muslim cloth from? | uni | Campus | Hamilton |
| 80 | P7 | What time is it? | bus stop | Transport Station | Hamilton |
| 81 | P7 | Is my baby hungry at home? | Waikato uni | Campus | Hamilton |
| 82 | P7 | Does my baby like her lunch? | home | Home | Hamilton |
| 83 | P7 | What kind of questions are they going to ask me? | home | Home | Hamilton |
| 84 | P7 | Where is B block of Waikato Uni? | shopping centre | Shopping Place | Hamilton |
| 85 | P7 | Who is Bernia? | on the way to home | On the way | Hamilton |
| 86 | P7 | When is mum group meeting this month? | bus stop | Transport Station | Hamilton |
| 87 | P7 | Is my old sister ok in China? | home | Home | Hamilton |
| 88 | P7 | Does the plumer's job have guarantee? | home | Home | Hamilton |
| 89 | P7 | How is about my test? | internet lab | Campus | Hamilton |
| 90 | P7 | Are there many people at lunch bar? | home | Home | Hamilton |
| 91 | P7 | Does Farmers still have 50% off today? | home | Home | Hamilton |
| 92 | P7 | Who is Bernia? | on the way | On the way | Hamilton |
| 93 | P7 | Can I find a job next week? | computer lab | Campus | Hamilton |
| 94 | P7 | What does that house look like? | coffee shop | Shopping Place | Hamilton |
| 95 | P7 | How is the weather tomorrow? | classroom | Campus | Hamilton |
| 96 | P7 | Is ABC childcare available for my little baby? | bus | Transport Station | Hamilton |
| 97 | P7 | Who is that lovely girl? | city centre | On the way | Hamilton |
| 98 | P7 | How can I go to Grassland Pl? | uni | Campus | Hamilton |
| 99 | P7 | How much is the power bill for this month? | home | Home | Hamilton |

| Q_No | P_No | Question | Place_Details | Q_Place | Q_City |
|---|---|---|---|---|---|
| 100 | P7 | Where is that IT Soloton company in Auckland? | coffee shop | Shopping Place | Hamilton |
| 101 | P7 | Is it raining at 5.00 this afternoon? | friend's home | Related House | Hamilton |
| 102 | P7 | What kind of business are they doiong? | coffee shop | Shopping Place | Hamilton |
| 103 | P7 | Who will be my classmate next semester? | classroom | Campus | Hamilton |
| 104 | P7 | Where can I get that bicycle? | on the way | On the way | Hamilton |
| 105 | P7 | Shall we open our own business next year? | home | Home | Hamilton |
| 106 | P7 | How do I earn more money? | coffee shop | Shopping Place | Hamilton |
| 107 | P7 | How can I pass AA next month? | city | On the way | Hamilton |
| 108 | P7 | Do I have to make up for interview? | city | On the way | Hamilton |
| 109 | P8 | Are the roads open between Hamilton to Gisborne? | at home | Home | Hamilton |
| 110 | P8 | How do you deep fry ice cream? | at home | Home | Hamilton |
| 111 | P8 | Do I need to take the brout early on a public holiday? | at home | Home | Hamilton |
| 112 | P8 | What time does bus no.13 arrive at the transport center? | transport centre | Transport Station | Hamilton |
| 113 | P8 | Who do I call to complain about slow drivers? | on the road | On the way | Tirau |
| 114 | P8 | Are we on the right road for the shortcut behind lake Rotorua? | in the car | In the car | Ngongotaha |
| 115 | P9 | Which supermarket is having special on cake? | driving to Hamilton | In the car | Cambridge |
| 116 | P9 | Name of a TV program (playing on TV now) | friend's flat | Related House | Taranga |
| 117 | P9 | Should I waite there or leave? | in the car | In the car | Taranga |
| 118 | P9 | What is the phone number for Steel & Tube? | Hewletts rd | On the way | Taranga |
| 119 | P10 | Where is a Waikato University? | in the car | In the car | Hamilton |
| 120 | P10 | Where is the international office at Waikato University? | university | Campus | Hamilton |
| 121 | P10 | Where I have lunch in Waikato uni? | university | Campus | Hamilton |
| 122 | P10 | Is there Espirt clothing shop in Hamilton? | shopping centre | Shopping Place | Hamilton |
| 123 | P10 | Where is the best shop to buy shoes? | shopping centre | Shopping Place | Hamilton |
| 124 | P10 | Where are Acer agents in New Zealand? | shopping centre | Shopping Place | Hamilton |
| 125 | P10 | Where is the library which has Athonsand Sublanded Sun? | city centre | In the car | Hamilton |
| 126 | P10 | Where is a closer swimming pool? | city centre | In the car | Hamilton |
| 127 | P10 | Where can I play soccer? | home | Home | Hamilton |
| 128 | P10 | What activities are closed to my current location? | outdoor | On the way | Hamilton |
| 129 | P10 | Can you give me some activities location for bungee jumping? | city centre | On the way | Hamilton |
| 130 | P10 | What are the facilities they are offeret by Victorica Hotel in Hamilton? | city centre | On the way | Hamilton |
| 131 | P10 | Where can I find a closer backpacker on Rotorua? | close lodging | In the car | Rotorua |
| 132 | P10 | Where can I find a flatmate who lives in university area? | at university | Campus | Hamilton |

| Q_No | P_No | Question | Place_Details | Q_Place | Q_City |
|---|---|---|---|---|---|
| 133 | P10 | Where is an airport direction? | city centre | In the car | Hamilton |
| 134 | P10 | Where are the cinema in Hamlton? | home | Home | Hamilton |
| 135 | P10 | What are movies on show in each cinema? | shopping centre | Shopping Place | Hamilton |
| 136 | P10 | What are coming soon movies at each cinema? | city centre | Shopping Place | Hamilton |
| 137 | P10 | Is my chosen movies recommended by others? | city centre | Shopping Place | Hamilton |
| 138 | P10 | Where can I find the seconed hand goods? | city centre | In the car | Hamilton |
| 139 | P10 | Is the seconed hand shop close to my location? (nearby) | city centre | In the car | Hamilton |
| 140 | P10 | Does my chosen second hand shop has what I want? | city centre | In the car | Hamilton |
| 141 | P10 | Which stadium hold the rugby game for New Zealand vs Australia? | railway station | Transport Station | Hamilton |
| 142 | P10 | Can I have information about the first game for NZ in the rugby world cup? | Enderley | Home | Hamilton |
| 143 | P10 | Where is a dentist in Hamilton? | Enderley | Home | Hamilton |
| 144 | P10 | Can I know the last news in Hamilton? | city centre | In the car | Hamilton |
| 145 | P10 | Can I know the weather at the next city I will visit? | city centre | In the car | Hamilton |
| 146 | P10 | Where is the Indian restaurant in Hamilton? | city centre | In the car | Hamilton |
| 147 | P10 | Which restaurants offer butter chicken? | city centre | In the car | Hamilton |
| 148 | P10 | Where can I do X-ray for immegration purpose? | university | Campus | Hamilton |
| 149 | P11 | Where is the neatst fish shop(pets)? | at home | Home | Hamilton |
| 150 | P11 | Is there a carpark in gate 1? | at work | Home | Hamilton |
| 151 | P11 | Is there traffic on Hillcrest busy? | home | Home | Hamilton |
| 152 | P11 | What time does the service station close? | gate 1 | Campus | Hamilton |
| 153 | P11 | Where is a good sushi bar?(nearby) | DIO (Diocesan school) | Others | Hamilton |
| 154 | P11 | How much is the UFC game? | home | Home | Hamilton |
| 155 | P11 | Are there leftovers for me? | Karate, Frankton | Others | Hamilton |
| 156 | P11 | What date should I host the midyear a gathering? | work | Working Place | Hamilton |
| 157 | P11 | Is Hamilton gym open in school holiday? | work | Working Place | Hamilton |
| 158 | P11 | How much are flights to Australia? | home | Home | Hamilton |
| 159 | P11 | What is a good 18th birthday present? | home | Home | Hamilton |
| 160 | P11 | How many type of fish are in the sea? | couch | Home | Hamilton |
| 161 | P12 | Is Khmer open? | driving | In the car | Hamilton |
| 162 | P12 | How much does it cost to park at the airport? | car | In the car | Manukua |
| 163 | P12 | Where can we eat at 9pm? | Manukua | Shopping Place | Manukua |
| 164 | P12 | Do I have new mail? | home | Home | Hamilton |
| 165 | P12 | Is Avatar still playing in Chartwell? | home | Home | Hamilton |

| Q_No | P_No | Question | Place_Details | Q_Place | Q_City |
|---|---|---|---|---|---|
| 166 | P12 | Is my lab exercise due? | home | Home | Hamilton |
| 167 | P12 | How do I bake a block forest cake? | home | Home | Hamilton |
| 168 | P12 | I need a sweet and sour pork recipe. | home | Home | Hamilton |
| 169 | P12 | How much does gym member cost? | home | Home | Hamilton |
| 170 | P12 | Is the Gateway open? | home | Home | Hamilton |
| 171 | P12 | When are my class presentation due? | home | Home | Hamilton |
| 172 | P12 | Where can I find a chocolate cake recipe? | home | Home | Hamilton |
| 173 | P12 | Is the dissertation paper $1500? | Gateway | Campus | Hamilton |
| 174 | P12 | Is the uni open on the Queen's birthday? | home | Home | Hamilton |

| Q_No | P_No | PlaceScore | CurrentActivity_Details | CurActScore | NextActivity_Details |
|---|---|---|---|---|---|
| 1 | P1 | 3 | watching TV | 3 | watching TV |
| 2 | P1 | 2 | checking e-mail | 0 | if someone want to go to the city then I will go or stayin at home |
| 3 | P1 | 1 | reading the comment about "Letters to Juliet" | 3 | asking friend who has it |
| 4 | P1 | 3 | writing the related work chapter | 3 | going home |
| 5 | P1 | 1 | writing the related work chapter | 0 | going home |
| 6 | P1 | 3 | writing the related work chapter | 0 | If answer is YES then talking to them or going home |
| 7 | P1 | 3 | walking to the carparking | 3 | going to the Animal Education and Control Center |
| 8 | P1 | 3 | waiting to see doctor | 3 | going to see the docotr |
| 9 | P1 | 3 | walking to take car | 3 | driving back to Hamilton |
| 10 | P1 | 0 | MSN with friends | 0 | searching information about traviling Fiji |
| 11 | P1 | 3 | looking for the printink for my printer | 0 | buying the inks |
| 12 | P2 | 3 | sitting in the car | 0 | going to friends place |
| 13 | P2 | 0 | looking for the cheapest flight ticket | 3 | have lunch |
| 14 | P2 | 2 | watching TV | 2 | watching World Cup highlights |
| 15 | P2 | 1 | playing video games | 1 | have dinner |
| 16 | P2 | 3 | traveling to Taupo | 3 | drive |
| 17 | P2 | 3 | driving | 3 | going to the motel |
| 18 | P3 | 1 | doing assignment | 0 | google NBA time |
| 19 | P3 | 0 | listening to music, drawing | 1 | finding out release date for airbender |
| 20 | P3 | 2 | watchign TV | 2 | watching TV |
| 21 | P3 | 0 | cleaning | 0 | finding out the directions |
| 22 | P3 | 0 | getting directions to Whakatane | 2 | going to Whakatane |
| 23 | P3 | 2 | sitting in the driveway | 2 | finding the squash club |
| 24 | P3 | 0 | playing basketball | 0 | going home |
| 25 | P3 | 0 | finished riding a motorbike | 1 | check online for license pricce |
| 26 | P4 | 0 | sitting at my computer at home | 0 | check to see if 'A Team' is playing and booking ticket |
| 27 | P4 | 0 | watching TV at home | 0 | going to the supermarket for drink |
| 28 | P4 | 0 | studying | 0 | looking up the takeway place phone number |
| 29 | P4 | 0 | sitting in the car | 2 | driving to the Warehouse |
| 30 | P4 | 0 | looking for the vet's information | 0 | look up where the nearest vet is and booking the appointment |
| 31 | P4 | 0 | studying | 3 | taking this diary to the FCMS office |
| 32 | P5 | 2 | in car | 2 | buying dinner food to cook |
| 33 | P5 | 0 | lying in bed | 0 | get up and make breakfast |

| Q_No | P_No | PlaceScore | CurrentActivity_Details | CurActScore | NextActivity_Details |
|---|---|---|---|---|---|
| 34 | P5 | 0 | lying in bed | 0 | go shopping |
| 35 | P5 | 3 | leaving shopping center to go to the Warehouse | 3 | go to the Warehouse |
| 36 | P5 | 0 | studying | 0 | go to bed |
| 37 | P5 | 0 | studying | 3 | search for information on prototype |
| 38 | P5 | 3 | walking | 3 | get coffee |
| 39 | P5 | 0 | watching TV | 0 | go to bed |
| 40 | P5 | 1 | going to Auckland form uni | 1 | go to uni |
| 41 | P5 | 3 | going to Auckland from uni | 3 | get patrol |
| 42 | P5 | 0 | driving | 0 | visiting friend in Auckland |
| 43 | P5 | 3 | going for breakfast | 3 | eat breakfast |
| 44 | P5 | 0 | researching Lean and papers | 2 | try to write my own paper |
| 45 | P5 | 0 | watching a movie | 0 | research for uni |
| 46 | P5 | 3 | thinking about going to supermarket | 3 | going to supermarket or watching TV |
| 47 | P5 | 0 | lying in bed | 0 | got ready to drive to Hamilton |
| 48 | P5 | 3 | lying in bed | 2 | get ready to leave Auckland |
| 49 | P5 | 0 | lying in bed | 0 | go back to Heamilton |
| 50 | P5 | 0 | studying | 0 | cook dinner |
| 51 | P5 | 1 | writing uni paper | 3 | cooking dinner or send Scott my draft |
| 52 | P5 | 2 | watching TV | 0 | go to bed |
| 53 | P5 | 3 | walking around Fieldays | 2 | spend day at Fieldays |
| 54 | P5 | 3 | walking around Fieldays | 3 | spend day at Fieldays |
| 55 | P5 | 3 | walking around Fieldays | 3 | want to watch show |
| 56 | P5 | 3 | walking around Fieldays, lost Dad | 3 | spend rest fo day at Fieldays |
| 57 | P5 | 3 | looking for Brandy store / site at Fieldays | 3 | walking around Firldays |
| 58 | P5 | 3 | headly back to car | 3 | drive home from Fieldays |
| 59 | P5 | 0 | having breakfast | 0 | study |
| 60 | P5 | 3 | leaving to go to Hamilton | 3 | Driving to Hamilton and try to avoid the traffic jam |
| 61 | P5 | 1 | going to a meeting | 0 | having meeting |
| 62 | P6 | 3 | waiting with my parent for her bus ti Auckland to arrive - alr | 3 | go home to parent's house, unless bus ganna be a long while |
| 63 | P6 | 3 | waiting for delayed bus | 3 | try to find a cooffee and hot chocoloate |
| 64 | P6 | 0 | packing some stuff up | 1 | driving to Hamilton |
| 65 | P6 | 2 | about to walk to place to get lunch | 1 | go home unless labs shut soon |
| 66 | P6 | 0 | assignments | 0 | try to buy a part for a weed-eater |

| Q_No | P_No | PlaceScore | CurrentActivity_Details | CurActScore | NextActivity_Details |
|---|---|---|---|---|---|
| 67 | P6 | 0 | assignments | 0 | try to buy something for weed-eater |
| 68 | P6 | 1 | fixing dish washer | 3 | go work on assignment |
| 69 | P6 | 3 | running to car park | 2 | drive to work |
| 70 | P6 | 2 | breakfast | 0 | going to uni or spray weeds this afternoon if no rain |
| 71 | P6 | 1 | group meeting | 0 | work on assignment |
| 72 | P6 | 3 | walking to labs | 3 | get food / drink |
| 73 | P6 | 2 | waiting for WOF | 1 | pay for WOF |
| 74 | P6 | 0 | house work | 2 | spray weeds |
| 75 | P6 | 3 | assignment | 3 | get files from uni |
| 76 | P6 | 3 | parked- waiting for phone call | 0 | going to Bunnings |
| 77 | P6 | 0 | going to car park | 0 | buying food for dinner |
| 78 | P6 | 2 | homework | 0 | shopping |
| 79 | P6 | 0 | housework | 3 | try to buy mulism cloth |
| 80 | P7 | 3 | waiting for the bus | 3 | go home |
| 81 | P7 | 3 | walking towards to bus station | 3 | feed my baby |
| 82 | P7 | 2 | talking with my friends | 0 | I may go to buy lunch for her |
| 83 | P7 | 0 | looking for a job | 1 | prepare for tomorrow interview |
| 84 | P7 | 1 | shopping | 1 | check the map if I have |
| 85 | P7 | 0 | walking | 0 | checking Bernia details by internet |
| 86 | P7 | 0 | waiting for the bus | 0 | go school |
| 87 | P7 | 0 | sleeping (lie down) | 0 | sleeping |
| 88 | P7 | 3 | checking my leaking water tab | 3 | ring the plumer |
| 89 | P7 | 1 | looking for paper for the next semester | 3 | find the appropriate paper to enrol |
| 90 | P7 | 2 | looking for food | 3 | buy lunch |
| 91 | P7 | 3 | dress | 3 | go shopping |
| 92 | P7 | 0 | shopping | 0 | shopping |
| 93 | P7 | 2 | searching from internet | 3 | ring SJS office |
| 94 | P7 | 1 | drinking | 1 | check the house details |
| 95 | P7 | 2 | doing homework | 1 | going home to check weather |
| 96 | P7 | 1 | by bus, go to uni | 1 | ring ABC |
| 97 | P7 | 3 | shopping around | 3 | shopping around |
| 98 | P7 | 1 | studying | 2 | go to lab abd search it |
| 99 | P7 | 2 | talking | 3 | checking it |

| Q_No | P_No | PlaceScore | CurrentActivity_Details | CurActScore | NextActivity_Details |
|---|---|---|---|---|---|
| 100 | P7 | 1 | lunch | 1 | checking the company's details |
| 101 | P7 | 3 | chatting | 3 | go to childcare and pick up baby |
| 102 | P7 | 1 | lunch | 1 | go back to study |
| 103 | P7 | 3 | having a lecture | 2 | asking around |
| 104 | P7 | 3 | walking | 3 | go to ask the rider |
| 105 | P7 | 2 | make a plan for next year | 3 | check our balance |
| 106 | P7 | 2 | lunch | 3 | talking with bank |
| 107 | P7 | 2 | driving | 3 | go home |
| 108 | P7 | 2 | shopping | 3 | go to hair dress |
| 109 | P8 | 0 | sitting down getting ready for bed | 0 | staying in bed or watch TV |
| 110 | P8 | 3 | eating ice cream | 3 | eating my ice cream |
| 111 | P8 | 3 | watching TV | 0 | go for a smoke |
| 112 | P8 | 3 | waiting for bus | 3 | catch bus no.17 |
| 113 | P8 | 1 | travelling in the car | 1 | keep travelling |
| 114 | P8 | 2 | driving out of Ndongotaha | 2 | keep on driving along this road |
| 115 | P9 | 0 | driving to Hamilton | 2 | going to find a supermarket to check price |
| 116 | P9 | 0 | chatting to friends | 3 | chattign about TV servial |
| 117 | P9 | 3 | waiting in the car | 3 | driving or waiting |
| 118 | P9 | 0 | driving | 0 | got to Steel & Tube or go home |
| 119 | P10 | 2 | driving to Hamilton | 2 | going to the university |
| 120 | P10 | 3 | waking inside the uni | 3 | visiting the adviser in the International office |
| 121 | P10 | 3 | waking inside the uni | 2 | have lunch |
| 122 | P10 | 2 | driving the car | 0 | shopping |
| 123 | P10 | 2 | setting at home | 2 | shopping |
| 124 | P10 | 1 | shopping | 1 | sending my laptop to fix |
| 125 | P10 | 2 | walking in the city | 0 | reading a book |
| 126 | P10 | 1 | driving to Hamilton city | 2 | swimming |
| 127 | P10 | 0 | setting at home | 0 | playing soccer |
| 128 | P10 | 1 | driving car from Auckland to Hamilton | 0 | doing some acttivities |
| 129 | P10 | 1 | planning for my holiday | 3 | doing activities |
| 130 | P10 | 3 | visiting Hamilton with my familiy | 3 | sleeping in a good hotel |
| 131 | P10 | 2 | driving to Rotorua | 2 | sleep at backpacker |
| 132 | P10 | 2 | looking for flat to live | 3 | moving to the new flat |

| Q_No | P_No | PlaceScore | CurrentActivity_Details | CurActScore | NextActivity_Details |
|---|---|---|---|---|---|
| 133 | P10 | 1 | driving to airport | 3 | picking up my family form airport |
| 134 | P10 | 2 | planning to watch movie | 3 | watching a movie at cinema |
| 135 | P10 | 3 | walking in a shopping centre | 2 | watching a movie |
| 136 | P10 | 2 | shopping | 1 | watching a movie |
| 137 | P10 | 2 | shopping | 1 | watching a movie |
| 138 | P10 | 2 | looking for goods | 2 | buying some stuff |
| 139 | P10 | 1 | driving a car | 0 | buying a stuff form a second hand shop |
| 140 | P10 | 1 | driving a car | 0 | buying a stuff form a second hand shop |
| 141 | P10 | 0 | travilling to Wellington | 0 | watching football game |
| 142 | P10 | 0 | staying at home | 0 | travelling to watch a rugby game |
| 143 | P10 | 1 | staying at home | 0 | going to see a docotr |
| 144 | P10 | 3 | driving a car | 0 | visiting friends |
| 145 | P10 | 1 | journy | 3 | visiting a next city (Wellington) |
| 146 | P10 | 1 | driving a car to the resturant | 3 | having a dinner |
| 147 | P10 | 1 | driving a car to a resturant | 2 | having a dinner |
| 148 | P10 | 0 | leaving a university | 0 | going to x-ray lab |
| 149 | P11 | 1 | unwrapping birthday presents, get a fish book | 1 | go to work |
| 150 | P11 | 0 | just finishing work | 0 | go to uni for a meeting |
| 151 | P11 | 1 | getting ready for Karate | 1 | driving to Tamahere |
| 152 | P11 | 0 | driving to Karate | 1 | do Karate class |
| 153 | P11 | 3 | pickng up a friend for lunch | 3 | going to get food |
| 154 | P11 | 1 | homework | 1 | eat dinner |
| 155 | P11 | 0 | lunchtime training | 1 | get lunch |
| 156 | P11 | 1 | planning the event | 3 | continue working |
| 157 | P11 | 0 | planning the event | 2 | continue working |
| 158 | P11 | 0 | eatting dinner | 0 | go to bed |
| 159 | P11 | 0 | eatting dinner | 0 | bed |
| 160 | P11 | 1 | looking at a fishtank | 2 | feed the fish |
| 161 | P12 | 0 | driving | 0 | head into town |
| 162 | P12 | 2 | in the car | 2 | park |
| 163 | P12 | 2 | in the car | 1 | continue driving |
| 164 | P12 | 3 | waking up | 1 | get up |
| 165 | P12 | 0 | breakfast | 0 | exercise (homework) |

| Q_No | P_No | PlaceScore | CurrentActivity_Details | CurActScore | NextActivity_Details |
|---|---|---|---|---|---|
| 166 | P12 | 1 | waking up | 1 | check moodle |
| 167 | P12 | 2 | planning dinner | 2 | cook |
| 168 | P12 | 2 | internet surfing | 1 | find a recipe |
| 169 | P12 | 1 | internet | 1 | do homework |
| 170 | P12 | 1 | dressing | 2 | go to school |
| 171 | P12 | 1 | homework | 1 | do more homework |
| 172 | P12 | 0 | homework | 0 | do more homework |
| 173 | P12 | 2 | paying fees | 2 | go to class |
| 174 | P12 | 1 | going to bed | 0 | sleep |

| Q_No | P_No | NexAct Score | ExpectedAnswer_Details |
|---|---|---|---|
| 1 | P1 | 0 | Information |
| 2 | P1 | 3 | Information |
| 3 | P1 | 3 | Information |
| 4 | P1 | 0 | Information |
| 5 | P1 | 0 | Location+Informaion |
| 6 | P1 | 3 | Information |
| 7 | P1 | 3 | Direction+Information |
| 8 | P1 | 2 | Information |
| 9 | P1 | 3 | Information |
| 10 | P1 | 3 | Information |
| 11 | P1 | 0 | Information |
| 12 | P2 | 3 | Location+Direction+Information |
| 13 | P2 | 0 | Location+Informaion |
| 14 | P2 | 3 | Information |
| 15 | P2 | 2 | Location |
| 16 | P2 | 3 | Direction |
| 17 | P2 | 3 | Location+Direction+Information |
| 18 | P3 | 3 | Information |
| 19 | P3 | 2 | Information |
| 20 | P3 | 3 | Information |
| 21 | P3 | 3 | Direction |
| 22 | P3 | 3 | Information |
| 23 | P3 | 3 | Direction |
| 24 | P3 | 1 | Information |
| 25 | P3 | 2 | Information |
| 26 | P4 | 1 | Information |
| 27 | P4 | 2 | Information |
| 28 | P4 | 3 | Information |
| 29 | P4 | 2 | Information |
| 30 | P4 | 3 | Location+Direction+Information |
| 31 | P4 | 3 | Information |
| 32 | P5 | 3 | Location+Direction |
| 33 | P5 | 0 | Information |

| Q_No | P_No | NexAct Score | ExpectedAnswer_Details |
|---|---|---|---|
| 34 | P5 | 3 | Location+Informaion |
| 35 | P5 | 3 | Direction |
| 36 | P5 | 0 | Information |
| 37 | P5 | 3 | Information |
| 38 | P5 | 3 | Direction+Information |
| 39 | P5 | 0 | Information |
| 40 | P5 | 2 | Information |
| 41 | P5 | 3 | Location+Informaion |
| 42 | P5 | 1 | Information |
| 43 | P5 | 3 | Location+Informaion |
| 44 | P5 | 3 | Information |
| 45 | P5 | 0 | Information |
| 46 | P5 | 3 | Information |
| 47 | P5 | 1 | Information |
| 48 | P5 | 2 | Information |
| 49 | P5 | 0 | Information |
| 50 | P5 | 2 | Information |
| 51 | P5 | 2 | Information |
| 52 | P5 | 0 | Information |
| 53 | P5 | 2 | Location+Informaion |
| 54 | P5 | 3 | Information |
| 55 | P5 | 3 | Information |
| 56 | P5 | 3 | Information |
| 57 | P5 | 3 | Location+Informaion |
| 58 | P5 | 3 | Information |
| 59 | P5 | 0 | Information |
| 60 | P5 | 3 | Information |
| 61 | P5 | 0 | Information |
| 62 | P6 | 3 | Information |
| 63 | P6 | 3 | Location+Direction+Information |
| 64 | P6 | 2 | Information |
| 65 | P6 | 3 | Information |
| 66 | P6 | 2 | Information |

| Q_No | P_No | NexAct Score | ExpectedAnswer_Details |
|---|---|---|---|
| 67 | P6 | 3 | Location+Direction |
| 68 | P6 | 0 | Information |
| 69 | P6 | 3 | Direction |
| 70 | P6 | 0 | Information |
| 71 | P6 | 2 | Information |
| 72 | P6 | 3 | Information |
| 73 | P6 | 1 | Information |
| 74 | P6 | 3 | Information |
| 75 | P6 | 3 | Information |
| 76 | P6 | 3 | Location+Direction |
| 77 | P6 | 3 | Location |
| 78 | P6 | 1 | Information |
| 79 | P6 | 3 | Location+Direction |
| 80 | P7 | 3 | Information |
| 81 | P7 | 3 | Information |
| 82 | P7 | 3 | Information |
| 83 | P7 | 2 | Information |
| 84 | P7 | 1 | Location |
| 85 | P7 | 2 | Information |
| 86 | P7 | 2 | Information |
| 87 | P7 | 0 | Information |
| 88 | P7 | 3 | Information |
| 89 | P7 | 3 | Information |
| 90 | P7 | 3 | Information |
| 91 | P7 | 3 | Information |
| 92 | P7 | 1 | Information |
| 93 | P7 | 3 | Information |
| 94 | P7 | 3 | Location |
| 95 | P7 | 0 | Information |
| 96 | P7 | 3 | Information |
| 97 | P7 | 1 | Information |
| 98 | P7 | 3 | Location |
| 99 | P7 | 3 | Information |

| Q_No | P_No | NexAct Score | ExpectedAnswer_Details |
|---|---|---|---|
| 100 | P7 | 3 | Location+Informaion |
| 101 | P7 | 3 | Information |
| 102 | P7 | 1 | Location |
| 103 | P7 | 3 | Information |
| 104 | P7 | 3 | Location |
| 105 | P7 | 3 | Location |
| 106 | P7 | 3 | Information |
| 107 | P7 | 1 | Information |
| 108 | P7 | 3 | Information |
| 109 | P8 | 0 | Information |
| 110 | P8 | 0 | Information |
| 111 | P8 | 0 | Information |
| 112 | P8 | 3 | Information |
| 113 | P8 | 1 | Information |
| 114 | P8 | 1 | Location+Direction |
| 115 | P9 | 3 | Direction+Information |
| 116 | P9 | 0 | Information |
| 117 | P9 | 3 | Location+Informaion |
| 118 | P9 | 3 | Location |
| 119 | P10 | 3 | Direction |
| 120 | P10 | 3 | Location |
| 121 | P10 | 3 | Location |
| 122 | P10 | 3 | Direction+Information |
| 123 | P10 | 2 | Location+Informaion |
| 124 | P10 | 2 | Location+Informaion |
| 125 | P10 | 0 | Location+Informaion |
| 126 | P10 | 3 | Direction |
| 127 | P10 | 3 | Location |
| 128 | P10 | 3 | Location+Informaion |
| 129 | P10 | 3 | Location+Informaion |
| 130 | P10 | 3 | Direction+Information |
| 131 | P10 | 3 | Direction+Information |
| 132 | P10 | 3 | Location+Informaion |

| Q_No | P_No | NexAct Score | ExpectedAnswer_Details |
|---|---|---|---|
| 133 | P10 | 3 | Direction |
| 134 | P10 | 3 | Location |
| 135 | P10 | 3 | Location+Informaion |
| 136 | P10 | 3 | Location+Informaion |
| 137 | P10 | 3 | Information |
| 138 | P10 | 3 | Location |
| 139 | P10 | 3 | Information |
| 140 | P10 | 3 | Information |
| 141 | P10 | 3 | Location |
| 142 | P10 | 2 | Location+Informaion |
| 143 | P10 | 3 | Location |
| 144 | P10 | 0 | Information |
| 145 | P10 | 3 | Information |
| 146 | P10 | 3 | Location |
| 147 | P10 | 3 | Information |
| 148 | P10 | 3 | Location |
| 149 | P11 | 0 | Location+Direction |
| 150 | P11 | 2 | Information |
| 151 | P11 | 3 | Information |
| 152 | P11 | 0 | Information |
| 153 | P11 | 3 | Location+Direction+Information |
| 154 | P11 | 0 | Information |
| 155 | P11 | 2 | Information |
| 156 | P11 | 0 | Information |
| 157 | P11 | 0 | Information |
| 158 | P11 | 0 | Information |
| 159 | P11 | 0 | Information |
| 160 | P11 | 0 | Information |
| 161 | P12 | 2 | Information |
| 162 | P12 | 1 | Information |
| 163 | P12 | 3 | Location |
| 164 | P12 | 2 | Information |
| 165 | P12 | 1 | Information |

| Q_No | P_No | NexActScore | ExpectedAnswer_Details |
|---|---|---|---|
| 166 | P12 | 2 | Information |
| 167 | P12 | 2 | Information |
| 168 | P12 | 1 | Information |
| 169 | P12 | 0 | Information |
| 170 | P12 | 2 | Information |
| 171 | P12 | 1 | Information |
| 172 | P12 | 0 | Information |
| 173 | P12 | 0 | Information |
| 174 | P12 | 0 | Information |

# Appendix E

# Diary Records for Digital Diary Study

| P_no, Q_no | Scenario | Question |
|---|---|---|
| P1, 1 | Xmas BBQ with colleagues and students in Kawhia, discussion about badminton game | Why is it called a shuttlecock ? |
| P1, 2 | Xmas BBQ with colleagues and students in Kawhia | Are there any snakes in nz? |
| | Xmas BBQ with colleagues and students in Kawhia, discussion with students about life in NZ | That happens if you have a large operation in nz and you do not have private insurance? |
| P1, 3 | Xmas BBQ with colleagues and students in Kawhia | What is the greek plural of logo? |
| | Xmas BBQ with colleagues and students in Kawhia, having some cookies that a student bought earlier that day | Why are the cookies called afghans? |
| P1, 4 | Xmas BBQ with colleagues and students in Kawhia, canon ixus problem | How to open the usb cover on this canon ixus? |
| P1, 5 | Xmas BBQ with colleagues and students in Kawhia, in talking about the fact that the conversation is weir and nerdy | Is there a scale for nerd rage? |
| P1, 6 | Xmas BBQ with colleagues and students in Kawhia, seeing the thing | What is the thing on top of the kawhia museum? |
| P1, 7 | Xmas BBQ with colleagues and students in Kawhia, talking about university | What does powhiri mean? |
| P1, 8 | Xmas BBQ with colleagues and students in Kawhia, about a statue in Kawhia | Why is he wearing a cross? |
| P1, 9 | At home, hearing about a friend having fallen ill | What is guillain-barre syndrome? What are the prospects of recovery ? |
| P1, 10 | At home, hearing about a friend having fallen ill, wanting to tell friends about Min's illness | Who is in the study group? Which of min's friends do i need to contact? |
| P1, 11 | Min is in hospital in Brisbane, I going towards my car on the university car park | I wonder how min is doing. |
| P1, 12 | On the way into town, I am about to meet dayna but she has a meeting before that. I am driving | Have andrew and dayna finished their meeting? |
| P1, 13 | Wanting to phone a friend in the car | Why is it so hard to get a usefull phone-in-the-car tool? Does it have to be bluetooth? Will it be easier with my new android phone? |
| P1, 14 | Driving, wondering about the study | Do questions always come in groups or only because i am participating in a study? |
| P1, 15 | Trying to set up my nw phone at home | How to import contact into the new phone? how to take a picture oof myself on the new phone? (several questions!) |
| P1, 16 | Making dinner from what I have in the fridge and wondering if this combination is one of the healthy ones | It's a combination of egg and vegetables healthy for dinner? |

| P_no, Q_no | Scenario | Question |
|---|---|---|
| P2, 1 | I was simply walking around my house and came across this plant | WHAT KIND OF A PLANT IS THAT ?<br>WHERE CAN I FIND MORE INFORMATION ABOUT THE PLANT ? |
| P2, 2 | I went to national bank in university premises without knowing it was a public holiday | HOW CAN I KNOW WHEN IS THE NEXT PUBLIC HOLIDAY ?<br>I actually thought I took three fotos , I ll send the other one by tomorrow evening |
| P2, 3 | I am back home from the national bank and I know that I forgot the mobile | HOW CAN I REMEMBER TO TAKE MY MOBILE<br><br>DID I FORGET MY MOBILE COZ I AM NOT USING MOBILE THAT MUCH |
| P2, 4 | I am at my home and I came to know that there is going to be GST hike from tomorrow | WHERE CAN I FIND A SHOP TO BUY SMOKES ? |
| P2, 5 | I am at my home and I was thinking to send the questions via twitter and realized I fotgot the password and the secret answer | WOULD IT BE GOOD IF THERE IS A SINGLE PLACE TO STORE ALL YOUR PASSWRODS SECURELY |
| P2, 6 | I am at my home and this random question comes up | WHY IS THAT NZ HAS NO SNAKES? |
| P2, 7 | I am at my home and I was thinking to learn photography | Is there any places in hamilton where I can learn photography? |
| P2, 8 | I am at my work place and I keep getting this error always | WHY IS THAT I KEEP GETTING THIS ERROR<br><br>WHICH IS THE NEST PLACE TO LOOK FOR ERRORS |
| P2, 9 | I am planning to go to Hamilton gardens and I am not sure about which bus should I take | WHICH BUS SHOULD I TAKE TO GO TO HAMILTON GARDENS |
| P2, 10 | I am at my home and was planning to drink coke | HOW MUCH CAFFEINE DOES THE COKE CONTAIN or DOES T CONTAIN CAFFEINE AT ALL |
| P2, 11 | I am at my home and planning to cook | HOW TO MAKE CHICKEN BIRIYANI(a dish) ? |
| P2, 12 | I am the BBQ for x mas with Annika, Michael etc... and I see this carving in wood and the sitting place | DOES THE CARVING IN WOOD SYMBOLIZE ANY THING |
| P2, 13 | | WHAT HAPPENED TO THE TREE IN BETWEEN THE SITTING PLACE |
| P2, 14 | | WHY DID I FORGET TO TAKE A PICTURE OF MINE SO THAT I COULD USE PASS THIS TO CAROLE FOR HER USER STUDY (since , it does not fully satisfy the criteria of user study of getting the context completely) |
| P2, 15 | I am clicking fotos of places which I find interesting with my new cam | WHERE CAN I FIND SUCH PLACES TO TAKE MORE SNAPS |

| P_no, Q_no | Scenario | Question |
|---|---|---|
| P3,1 | I will be late! Just leaving work. | Are my friends and family at the restaurant yet? |
| P3,2 | ? Walking down the street after dinner. | What decision process led to somebody to think this was fit make into a sign |
| P3,3 | At home on my couch.<br>*wirdlens = WordLens | When will wirdlens support Chinese? |
| P3,4 | Getting dressed for a wedding. | So what is the programme for the wedding today? Who am I driving? Where to? When? |
| P3,5 | At home in my office | How long does IJD take to process submissions? |
| P3,6 | At home. | According to the local culture, should I have taken down my Christmas lights by now? |
| P3,7 | At home | How long do deli olives last for if kept in the fridge? |
| P3,8 | At home in front of the TV | Which of these movies will I actually enjoy and not feel like my time was wasted? |
| P3,9 | At new save on Tristram st. | Is Bryce street left or right? |
| P3,10 | At New Save. | Is this the japanese "yum yum sauce" my friend wanted for her boss? |
| P3,11 | Days later and no news! Waiting in the checkout queue at New Save. | How is uncle doing now? |
| P3,12 | Who was the girl who knocked at my door? She is all dressed up and now partying at the neighbour's place. | Who was the girl who knocked at my door? |
| P3,13 | Want to watch a movie but can't stand another bad one. At home | What are the imdb ratings for these movies? |
| P3,14 | In whanganui at the infomation centre by the river | How long is the paddle steamer cruise? |
| P3,15 | At the wanganui information centre. | Did I close my friend's garage door? |
| P3,16 | So ugly! At whanganui airport. | Who designed the whanganui airport sign? |

| P_no, Q_no | Scenario | Question |
|---|---|---|
| P4,1 | Mumraiz and I are with our friends at Hamilton Lake and we want to find some place here to eat. | Where is the closets restaurant? |
| P4,2 | I've just finished of taking a shower and I'm ganna go 2 uni and I need a coffee. | Is the cafe at uni open 2day? |
| P4,3 | Mumrise and I are very hungry and we want to have lunch, we were n the car and I'm the driver so i couldn't text u. | Where is best Indian restaurant? |
| P4,4 | I'm walking n the city with myself. | I wanna know, which shops have sale n Boxing day? |
| P4,5 | I'm shopping now & I wanna pay sth from Harvey Norman. | Where's is Harvey Norman n Hamilton? |
| P4,6 | My friends r going to Waiheke. We wanna do some activities there. | What kind of activity can we found in Waiheke ? |
| P4,7 | We r on the beach n Waiheke land and we wnna back to Auckland , | which is the way we should tack to reach the ferry ? |
| P4,8 | My friend and I were at home and planning to go to Routorua to do new activities. | Where can we find some activities we have not done before? |
| P4,9 | My brother and I are playing Play Station at home in Wellington, We want to pay a new video game. | .Where can we find a place to pay video games? |
| P4,10 | My brother and I are walking belong a beach. | What's the name of this bay? |
| P4,11 | My friends and I were at home ant we rented a car from AVIS (Wellington branch), and now we wanted to return it in Hamilton branch. | Where is AVIS company Because we want to return the car? |
| P4,12 | My friend and wants meet the adviser in the Management School. | Whose is the student adviser there? |
| P4,13 | My friend and I wanted to go to the waterfall which is located next to Reglan. | When I was driving, I wanted to know how many kilometers left to be there? |
| P4,14 | My friend and I wanted to go to the waterfall which is located next to Reglan. | During taking photos for us we asked, What's the waterfall height? |
| P4,15 | My friend and I wanted to go to the waterfall which is located next to Reglan. | We looked at a plant and we don't know its name, so we asked: What its name? |
| P4,16 | My friend and I wanted to go to the waterfall which is located next to Reglan | There are lots of stairs and we asked: how many stairs are there? |
| P4,17 | I'm feeding the birds on my house's back yard. | I want to know: when my friend Ali will arrive to Auckland? |

| P_no, Q_no | Scenario | Question |
|---|---|---|
| P5,1 | It was Sunday afternoon in my way to home with my brother who was the driver while I saw a house for rent and I used Google to know the streets' name. | What are the names of the streets close to Cameron Rd Hamilton, NZ? |
| P5,2 | I'm at home on Friday night thinking of going to the zoo tomorrow. And I'd like to check the weather. | How the weather will be tomorrow? |
| P5,3 | I was at the supermarket and I saw this thing and I like to know if I can use it to make a traditional food. | What the uses of "CHIAO TZU PASTRY"? |
| P5,4 | It is Monday afternoon, I'm heading to the car parking and I need to deposit money to a company account for a service. | Where is the nearest West back bank to the Waikato University? |
| P5,5 | I received a text message from friend of mine late at night while I was on my bed and he told me there is a serious problem on Tunisian. I used my mobile to Google it. | What happened on Tunisian? |
| P5,6 | I was heading to my office with a friend and I thought it might good idea to transfer some money back home if we have a good exchange rate. | What is the exchange rate right now? |
| P5,7 | I'm on my way to Waikato university car parking the time is 5:30 pm and I'm thinking of going for shopping. | What are the open hours for the Chartwell? |
| P5,8 | I was at home it is Thursday night walking around house when I notice my home spray will be empty soon and I wondered what other smells they have because if they don't have my favourite smells I won't go I'll ask someone to bring me one similar to what I have now. | What kind of home sprays does body shop have? |
| P5,9 | I was at the base for shopping I saw car for sale and I like it and I was thinking of buy it and I'd like to know the specifications. | what are specs of the car Celica? |
| P5,10 | I was at the beach with my friends and I planned to watch the sun seat. | When time the sunset today? |
| P5,11 | I was walking near to Hamilton leak I saw the bird and I became interesting in knowing it name. | What is the name of the bird that has blue and black colours and lives on New Zealand? |
| P5,12 | I was walking in Hamilton city centre then I saw this building and I like and I was thinking it might be a good idea to move here. I Google it to see more information and the how much will cost me by a week. | Is there any apartments available on ACACIA? |
| P5,13 | It is weekend I was at kitchen trying to cook the dinner and I cooked the shrimp and I had no idea if it cooked or not. | How can I know when the shrimp is cooked well? |
| P5,14 | I'm at home playing with my cat. It is Monday night and I've just shut down my laptop and I need to just know if there is any book talk about the invention. | What is the best book talking about the invention? |
| P5,15 | I was with my family and friends at Juice bar at Auckland airport when friend of mine told me the yogurt contains some ingredient we should not eat. | What kind of yogurt does Juice bar use? |
| P5,16 | I was at university during the New Year holiday and I feel hungry I want to the shops there were closed and I was wondering when they will reopen. | When the University of Waikato will open 2011? |
| P5,17 | I was at the Hamilton Zoo with other friends and I know that the males in birds prettier than females and I like to know if this fact applies to this bird as well. | What does the Banded Rail male look like? |

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|---|---|---|
| P5,18 | I'm on university car parking. I went to my car and I remember that the shops are still open<br>So I think it might be a good opportunity to go and see if I can get an offer on Mac laptops. | How much is the new Mac laptop in New Zealand? |
| P5,19 | It is a Saturday afternoon. I'm at university of Waikato library alone when I remember that I forget to feed my plant at home ☹ then it just comes to my mind to look if there is any iphone App helps me to take care of my plant. | Is there any iphone App can help me take care of my plant? |
| P5,20 | I'm at my office and it is afternoon and I need to know when we should pray the afternoon prayer. I used my mobile because I need Arabic keyboard. | What is the time for afternoon pray? |

| P_no, Q_no | Scenario | Question |
|---|---|---|
| P6,1 | After having BBQ at the beach we drove to Temple View to see the lights at this church.<br>Some of us decided to drive on to Hamilton, A and me stayed to see the lights.<br>We were too early, the we needed to wait around 30min for the enlightening.<br>While waiting we listen to the performance of a choir and a speech (Photos a and b)<br>Parts of this were boring. | what kind of church this is. |

7

| P_no, Q_no | Scenario | Question |
|---|---|---|
| P7, 1 | I'm sitting in my hotel room. I want to find out where I can watch "TRON" in the afternoon. | where I can watch "TRON" in the afternoon. |
| P7,2 | In my hotel room. | Where can I get a decent pizza near my place? |
| P7,3 | I'm in backpackers at Napier. Just finished lunch | First visit the spa and then see the town, or first the town walk and then the Spa? |
| P7,4 | Sitting in an InterCity bus. | does it really go to Hamilton, or did I misunderstand the announcement?<br>What kind of cloud is this, and what does it mean? |
| P7,5 | I'm at the Christmas BBQ at Kawhia. | What do they show in the museum? |

| P_no, Q_no | Scenario | Question |
|---|---|---|
| P8,1 | Am at home and want to cook a Pakistani dish for which I need yogurt. | I don't have yogurt and wondering if I can find it in a store near my place. |
| P8,2 | Am out, going to NEWWORLD. Could not remember it exactly but I know it is somewhere nearby. But it's been almost 15 mins now. | Question: Where is NEWWORLD? |
| P8,3 | Am at NEWWORLD and searching for cottage cheese. | Question: Where is it? |
| P8,4 | Am with friend in city center and its tuesday. | Question: Why are things cheaper on Tuesdays? |
| P8,5 | Am sitting with friend at Momento and while chatting he said "A life without wife is like a kitchen without knife". I asked him "who's quote is this" and he does not remember. | Question: Who's quote is this? |
| P8,6 | Am at home and looking for tickets for a cricket match between Pakistan Vs New Zealand. | I can find tickets online but some of my friends are yet not sure that whether they want to watch it or not. So thinking that "Will tickets be available at the gates if someone wants to join in the last minute and if yes, how much it will cost more than buying it online". |
| P8,7 | Just saw an advertisement of Warehouse on TV and they are having massive sale on things. | Question: "When does Warehouse close"? |
| P8,8 | Am studying and reading annika's comments. I can't understand one of the comments. | Question: What has Annika written? |
| P8,9 | Am writing on some topic and there are few things that I know I read somewhere but could not remember where I read them. | Question: Which paper/book/article I read that had information about the stuff am writing? |

| P_no, Q-no | Scenario | Question |
|---|---|---|
| P9,1 | I am at the Auckland International Airport to pick up my friend and wondering if CX107 is gonna be on time. | Will CX107 be on time? |
| P9,2 | | How does Vodafone 3G broadband work? Does it suit my needs? |
| P9,3 | | I need to rent a car for a short term trip. Which car rental company should I choose? |

| P_no, Q_no | Scenario | Question |
|---|---|---|
| P10,1 | ISDB meeting time | wondering what questions you want for your study while in our meeting |
| P10,2 | 6.30pm was wondering exactly where mahana rd was (didn't know if I had passed it or not, I had) - driving so no photo | where mahana rd was |
| P10,3 | Andy wants to know where to get the quince jelly in the picture | where to get the quince jelly in the picture |
| P10,4 | | where is gate island? Raick is telling stories about it |