Mobile Searching: The Search Patterns on Different Mobile Phones. A Comparative Study of User Searching Behaviour between iPhones and Other Mobile Phones.

A study submitted in partial fulfillment of the requirements for the degree of Master of Information Management at THE UNIVERSITY OF SHEFFIELD

by

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September 2012
ABSTRACT

Background. The literature reveals different key issues on the mobile users’ information needs and the contextual factors which trigger the information needs emerging. Previous studies have all indicated mobile users’ information needs are becoming diverse and hard to be captured. They also stated that understanding users’ information needs by topics, intentions, and contextual factors is important if the search services suppliers want to improve the effectiveness of the mobile applications.

Aims. The study aimed to investigate whether users’ information preferences have difference between different smartphone users, furthermore the potential impact of gender and age on the information preference were conducted. Finally, how users’ information needs emerging was analysed.

Methods. The study combines with the questionnaire and diary study. The questionnaire survey targeted to investigate the differences of information preference between different smartphone users. It also tested the impact of gender and age on information preference. The diary study targeted to investigate the motivations on users’ information needs emerging.

Results. Firstly, the results showed that the overall tendency of users’ information preferences seem the same between different smartphone users. Secondly, the influences of gender and age on users’ information preference are significantly. Additionally, from the diary study, the results showed that more than a half of mobile search activities were conducted when users on the move. Furthermore, users’ information needs were driven by contextual factors.

Conclusion. It is concluded that although the research solves the objectives, a more extensive survey need to be conducted in the further work. Further work could investigate impact of users’ education and occupations on the information needs and how to design system to support more complex search activities on the mobile. A lots of works need to be done in order to improve the effectiveness of mobile applications.
ACKNOWLEDGEMENTS

I would like to express my gratitude to all those who have given me some useful suggestions and encourages during the writing of this research. Firstly, I would like to extend my sincere gratitude to my supervisor, Dr. Robert Villa, for his careful instructions and some useful suggestions for my dissertation when I was designing the questionnaire and analysing data. I am deeply grateful for his help in the completion of this research. Also, I would like to thank my friends for their valuable suggestions, which are of useful, and importance in improving my research.

Last but not least, I would also like to extend my gratitude to my family who have been given me supporting and encouraging.
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CHAPTER I
INTRODUCTION
1.1 Introduction

Mobile phones act as representative mobile devices are outpacing desktops and becoming a more popular way for accessing information on the Internet (Church, et al., 2008). In recent years, with the widespread of third-generation (3G) wireless technology, the mobile Internet usage presents a breathtaking growth. Accessing the Internet for searching information has become a pervasive part during people’s daily life (Kamvar, et al., 2009). Recent research on the Communication Market in UK by the Ofcom (March 2012) shows that over 40% of smartphone users agreed with the statement that the smartphone plays an essential role in accessing the Internet, they highly rely on their smartphone in their daily life. The popularity of smartphone makes it now common to see people access Internet services to satisfy their information needs in-situ, such as using mobile search engine or map service (e.g. Google map service).

Moreover, except developed countries, some recent surveys were conducted in some emerging markets, such as Asia, India and some European countries. These recent surveys showed that a great amount of mobile users intend to experience the Internet through mobile devices instead of PC. Smartphone like iPhone and Android phones are making a notable influence on the amount of users who surf online (Church & Smyth, 2009). The survey by Emarketer (May 2012) reported that Apps provide an important method for accessing the Internet in the emerging market, and showed that 63% of smartphone users in these emerging markets surf online per day after the first few months of using.

Furthermore, The Ofcom did a research on mobile users’ activities conducted on the phone among UK adults who have smartphones on March 2011, the results show that users use smartphones frequent for Internet surfing (44%), E-mail (51%) and Social Networking (42%), which pointed out that communication and check-in to a place or location through Social Networking such as Twitter and Facebook, are becoming a more regular mobile activities among smartphone users in UK. Similarly, the survey by Google and IPSOS Research (2011) showed that 64% of smartphone users in China access Internet via their
devices, and the social networking was the most preferred activities conducted on the phone by Chinese smartphone users, with 66%.

1.2 Background and Motivation

Mobile phone users increasingly use networked service to address their information needs (Hinze et al., 2010). The mobile search engine acts an essential role for locating content on the Internet, accessing information via mobile search engines increasing explosively in the last few years, and this growth trend will last continuously (Kamvar et al., 2009; Kamvar & Baluja, 2006). Church and Smyth (2009) stated that there is no doubt the mobile search engine will dominates as a major method of accessing information on mobile devices in the near future.

The researcher believes that the core competition of the mobile search market in the future will provide advanced personality and effective search services. Unlike the current traditional search mechanism, the mobile search engine will be more intelligent which can return search results based on users’ unique information needs or interests. In order to make this happen, it is necessary for search service providers to understand mobile users’ preference on information demands in detail, such as whether exists different significant of information preference for different smartphone user groups, and different preference on information topics for different gender and age user groups. In addition, users’ mobile activities always accompany the mobile phones, which can sense some characteristics of users’ current contexts, furthermore, users’ information needs can arise on any topic, in anywhere and at any time. Sohn et al. (2008) pointed out that a considerable number of mobile information needs are failure to be satisfied, often being abandoned or postponed. Therefore, search service providers also need to have a good understanding of what contextual motivated mobile users’ information needs emerging, aiming to provide effectiveness search application.
1.3 Aim and Objectives

The paper is aiming to show different mobile information search patterns between different smartphone users. The mobile information needs was once regarded as a significant factor has a profound effect on the mobile search patterns, but have now became more diverse and personality due to the increased amount of smartphone users and variety types of smartphones like iPhone and Android Phone. This study was launched in the Chinese mobile searching market, looking at users’ information needs in this faster developing mobile service market.

The primary objective of this project is to carry out whether exists different preference on different information categories of topics between different smartphone users. Secondly, different preferences on information topics affected by users’ gender and age are carried out. Finally, a comprehensive analysis on how contextual factors trigger information needs emerging is analysed in this research.

This research presents two contributions as below: Firstly, this research provides a comparative analysis of information needs (categories of information topics) for different Chinese smartphone users, previous studies about this in mobile space rarely focused on different smartphones and did not investigate whether users’ preferences exist difference between different smartphone users. Thus, with comprehensive analysis in sequence and sorting them in descending order, the rank score of each information category, this project aiming to find users’ different preference on categories of information topics. Secondly, a small-scale of diary study was implemented to analyse actual users’ searching intentions behind information needs. The diary entries provide a natural of social data about users’ mobile search behaviour rather than using log-based study to investigate users’ search queries in prior studies. This paper also presents a better understanding about how contextual factors would trigger particular information needs emerging in mobile space.
1.4 Research Questions

1. Do users’ preference on information needs exist differ for different smartphone users?
2. Do users’ gender and age affect their preference on information needs for different smartphone users?
3. How does the mobile information needs emerge?

1.5 Outline

Chapter 2 is the relevant literature reviews, which summarises the key findings from a considerable amount of previous studies. It describes and summarises the tendency of information preference between mobile phone users. Moreover, with discussing the merits and limitation of previous studies, the guidelines for the research are illustrated in final.

Chapter 3 illustrates the methodology implemented in this research. In this section, the reasons for the data collection methods are documented, detail information about the participants and the procedure are described. Furthermore, the ethical concerns are also briefly described.

Chapter 4 is the data analysis section, which analyses the data collected from questionnaire survey and the data collected from diary study respectively. The mobile users’ preferences on the information needs are carried out and the impact of the gender and age on users’ information needs are analysed. Finally, the contextual factors trigger users’ information needs are analysed and summarised.

Chapter 5 gives the discussion based on the data analysis. Main findings relate to the research objectives are summarised and discussed. Furthermore, some additional findings are also presented in this section.

Chapter 6 presents the conclusion of this study. Additionally, the implications and suggestions for future work are illustrated in this section.
CHAPTER II
LITERATURE REVIEW
2.1 Introduction

Accessing information on the mobile internet can satisfy mobile users’ information at a certain extent (Church and Smyth, 2009; Sohn et al., 2008). Compare with the traditional mobile phone, current smartphones provide various functionalities and effective mobile applications to meet users’ information needs, such as the E-mail pushing service, voice memos, online calendars, SMSs are considered as preferred sources of information in the mobile users (Heimonen, 2009). Nevertheless, in despite of these powerful functionalities provide a good platform for the information service providers, it seems mobile users’ information needs are hard to be fulfilled due to the diverse mobile search patterns between different users. Therefore, to obtaining a better understanding of different mobile users’ information needs is necessary in order to develop effective mobile search applications (Chua et al., 2011).

In the following section, the literatures on issues are discussed, both on mobile query topics and users’ intentions behind users’ queries. Furthermore, contextual factors that trigger information needs are also discussed.

2.2 Understanding Information Needs

Information seeking activities rely on interactions among information seeker, tasks, search systems, domain setting and search results (Marchionini, 1995). Marchionini (1995) described the relationship between these elements in detail, and stated that information seeker plays as a central role in the framework. He presented that the reasons why information seekers conduct search activities are that they have information needs or a problem that need to be solved at once. Understanding users’ information needs can contribute to obtain a better understanding of what categories of information topics are the most preferred information for solving the problem (Marchionini, 1995). As the mobile information searching is different from the traditional Web searching, both the different devices and different users’ information needs (Church & Smyth, 2008). It is important to obtain a better understanding of mobile information needs, in order to providing effective mobile services (Church & Smyth, 2008).
2.2.1 Mobile Query Topics

Kamvar and Baluja (2007) conducted a large-scale research about Google mobile users based on an analysis of 1 million queries, the result showed the mobile search behaviour is changing. The queries are becoming more diverse through the comparative analysis to their prior study (Kamvar & Baluja, 2006). They found that Adult-related queries show a growth trend among US users. The reason for the growth trend could be concluded that users might feel more comfortable for looking or searching adult-related contents through their mobile phones. Furthermore, users might regard mobile phones as personal and private device, when compare with the computer. Secondly, Kamva & Balujia (2006) hypothesis the reason for adult content searched frequently by users is the extent of the mobile web search market matured or different mobile search patterns in different countries.

Nevertheless, Church et al. (2007) argued that the study by Kamvar and Baluja (2006) has some significant limitations, they considered that the previous study suffers from the method of accessing mobile information, they argued that Kamvar and Baluja (2006) only focused on the Google mobile search engine, suggesting probably the results unable to recognize any special features of mobile search patterns in the mobile domain. Therefore, Church et al. (2007) conducted a wide survey in 600,000 European mobile users at the end of 2005. Furthermore, they took a broader approach that more than 32 different mobile search engines are involved in their research, these different mobile search engines covers both main search engines (Google and Yahoo!) and some particular engines such as Click4Wap and TagTag. Moreover, in order to providing a more comprehensive analysis, they also investigated both WML and XHTML content that are searched by mobile users. Church et al. (2007) reported in their findings that 53% of the top 500 mobile search queries targets to the Adult content, followed by Multimedia and Email, Messaging & Chat, with about 10% and 8% respectively. These results are similar but a very smaller difference when compare to the study by Kamva and Baluja (2006). Additionally, Church et al. (2007) pointed the phenomenon that Adult-related queries are the most preferred information
needs in mobile users might be implied by early Web search studies, most previous studies which investigate on the Web searching also reported the same phenomenon that adult-related contents are searched frequent in early Web users.

Furthermore, Church et al. (2008) adopt a similar research method in the recent study, which still investigated Europe mobile users. The results highlighted the percentages of Adult-related queries once again ranked the most popular query category, 61% of the most top 500 popular mobile queries were classified into the adult category. The result keeps consistence with the investigation by Kamvar and Baluja (2007) and their prior study in 2007. Interestingly, Church et al. (2008) also stated that there seems users’ searching preferences on the information have a modest shift, when compare with the prior research by Church et al. (2007). Church et al. (2008) found that mobile users search for Entertainment, Multimedia and Game show decline rapidly, whereas emergence information needs such as email, messaging and socializing/dating show a growth trend. They speculate the emergence information needs relating to user-generated content seems to be an interesting trend at a certain extent.

A recent study by Yi and Maghoul (2011) who presented a log-based analysis of Yahoo!, 20 million US mobile search queries were selected for data analysis. The result presented the amount of unique queries has grown rapidly from 2007 to 2010 (4.49M to 6M). Comparative analysis of findings with previous study (Yi et al., 2008), they found that users’ preference on information topics had changed at quite a certain degree, and mobile users’ queries are becoming more diverse. Additionally, an interesting finding was found in their results is that entertainment queries that included adult-related contents decrease dramatically, whereas Location-based queries and e-commerce queries are becoming increasing at a quite fast rate. The same findings also were found in the recent study by Church and Oliver (2011), they manually classified the top 1000 queries and found the significant shift in search topics with their dataset when compared to their previous mobile research, the results showed that searches for adult-related content decreased dramatically, only find 14% of the top 1000 queries classified into this category. By contract, the
“Socializing/Dating” category ranked the most popular search topics, with over 40% of the most top 1000 queries. These notable findings confirm the previous speculation by Church et al (2008). The exchanges of mobile searching are similar to the Web users’ interests changing in the early years (Yi & Maghoul, 2011). On the other hand, this particular user’ interests shift could be explained by the study (Baeza-Yates et al., 2007). Baeza-Yates et al. (2007) conducted an investigation in the most matured mobile search market---the Japan mobile search market. The results highlighted that “Life style information” was the most preferred resource searched in Japanese mobile users, such as Weather, Online Shopping and Sports.

Additionally, Kamvar et al. (2009) implemented a survey to compare users’ search pattern between three different devices: computer, iPhone, and other conventional mobile phones. The finding confirms the assumption which was referred to by Amin et al. (2009), the results showed that the query topics of iPhone-based search are almost similar to the computers-based search, and the gaps between iPhone-based search behaviour and computer-based search behaviour are becoming small. Furthermore, they also reported there has some difference of query topics between iPhone-based mobile search and other mobile phones.

According to the previous large-scale analysis based studies (Kamvar & Baluja, 2007; Church et al., 2008; Yi & Maghoul, 2011), the results clearly showed that the mobile interests are changing and are becoming diverse. Furthermore, these previous studies also illustrated that the mobile users in different mobile markets have different information preference due to the maturity of the mobile search market. However, Amin et al. (2009) argued that these log-based study unable to present the actual users’ intentions behind the users’ queries. As evidence, it can be explained with the finding by Kamvar and Baluja (2007), they looked at UK mobile users and found UK users seems less likely do searching for Adult-relate content by log-based study. Furthermore, another study which investigated the image-search logs show that queries-related to adult content ranked the top category, as same as the results finding in the US mobile users. Additionally, Amin et al. (2009) stated
that different devices might have influence on mobile users’ search patterns. They conjectured that users who do mobile searching with Qwerty keyboards have different search patterns, when compare to users who do mobile searching with 12-keypad mobile devices. The small difference is considered as a reason for the length of per query and different interests (Amin et al., 2009). Additionally, without a high-end mobile device, users’ information needs are hard to be satisfied, they always rely on contacting other people to get the answer (Perry et al., 2001; Sadler et al., 2006)

2.2.2 Clarifying Users’ Intentions behind the Information Needs

In order to understanding mobile users’ information needs better, it is necessary to discover the intentions/goals behind mobile users’ search queries – in order to examining the users’ actual purposes of accessing information through mobile phones (Church et al., 2008; Church & Smyth, 2009; Amin et al., 2009).

Church et al. (2008) analysed the previous study by Broder (2002), who classified Web queries into 3 taxonomies based on Web users’ actual intentions: (1) Informational; (2) Navigational; (3) Transactional. Church et al. (2008) implemented this taxonomy analysis to investigate on mobile users’ intentions behind queries. They also gave a definition of these three intentions in their study. The **Informational** intentions mean the goal of mobile users to search information is want to obtain information about a general topic. For these informational intentions, mobile users seem just only interested in a topic at one time, and no further interaction is expected. The **navigational** intentions refer to the immediate intentions that users want to search a particular answer, which targets to a particular site, services or interests. Finally, the **transactional** intentions refer to the purpose of users is to visit a site where extra interactions will emerge, such as downloading network resource. Church et al. (2008) extracted top 500 queries in a single day and classified these queries into one of three categories. In their findings, the results showed that transactional rank a high percentage (>60%), followed by Navigational (>29%). They stated that the navigational intentions featured significantly in the mobile space even though the amount
of users’ queries to navigational in nature is not very high. Additionally, Church et al. (2008) stated that mobile users prefer to search something very specific (transactional or navigational) rather than search for general information online through their mobile devices.

More recent work by Church & Smyth (2009), they conducted a diary study to investigate the mobile users’ intentions behind mobile information needs in depth. They found that the previous classification of intentions behind the users’ queries was not suitable in mobile space when mobile users on the move. Thus, with analysing users’ intentions, they divided mobile users’ queries by using new three categories: (1) the informational intentions; (2) the geographical intentions and (3) personal information management (PIM) intentions. Compared to the previous popular taxonomies by Broder (2002), they went into the same category as informational intentions and transactional intentions, and also presented the relationship between information topics searched and intentions/goals behind the topics (See Figure 1).

![Figure 1](image.png)

**Figure 1:** The relationship between topics and users’ intentions (Church & Smyth, 2009)

In their findings, they reported that over 58% of diary entries presented mobile users’
intentions were informational, followed by geographical intentions, with 31.1%. Geographical intentions mean users’ goals are focused on finding an answer to a particular question. The expected answer to the question is related to the location contexts (Church & Smyth, 2009). Amin et al. (2009) defined the geographical intentions of some information needs are focused on finding location-based information relates to users’ current geographical location, they also gave a definition of location-based search as: “Search for business or some places of interest that relate to a particular geographical location.”

Many previous researchers all stated that the geographical intentions could be regarded as the major mobile search pattern, especially for when users on the go (Kamvar & Baluja, 2007; Yi et al., 2007; Sohn et al., 2008; Church & Smyth, 2009; Amin et al., 2009). For example, an early large-scale study which was conducted by Google (Kamvar & Baluja, 2007) show that “local services” are the most frequent search queries, mobile users often have information needs on local information either directly or indirectly e.g. searching for “nearest restaurant” or “where can I buy the ticket”. The same findings were also reported in other large-scale mobile query researches (Baeza-Yates et al., 2007; Church et al., 2007).

Additionally, according to the study (Church & Smyth, 2009), the results showed that many mobile users have information needs when they stay in an unfamiliar location context, over 34% of information search activities are conducted in this situation. The results also reported that over 30% of participants’ entries are associated with the geographical intentions, 75% of geographical needs emerging when users on-the-go. Amin et al. (2009) stated that the mobile search could be considered as emergency information searching. Mobile users always conducted searching activities for problem solving while in the move (Sohn et al., 2008; Church & Smyth, 2009).

Personal information Management intentions were focused on finding answers to private information relates to individual information, these answers were typically stored in private account/space online or mobile phones, such as messages and the calendar (Church & Smyth, 2009). In their findings, 11% of diary entries were related to PIM needs, but they also stated due to the limitation of technology of the current mobile device, the PIM
intentions behind users’ queries are hard to answer.

2.3 Contextual Factors

Sohn et al. (2008) highlighted that it is essential to obtain a better understanding of the details surrounding mobile device use. In their findings, the results reported that 72% of their participants’ information needs were motivated by some contextual factors. The early work by Kamvar and Baluja (2007) already noted that the location-based information needs was important in mobile search space, they also pointed out location context has proven that it is useful to improve the quality of search results in mobile search applications. Some recent researches (Kamvar & Baluja, 2006; Baeza-Yates et al., 2007; Church et al., 2007) also gave a similar conclusion. However, Amin et al (2009) argued that these previous researches only illustrated the tendency of query prediction in mobile space would focus more on the location-based search. They stated that these past log-based studies which investigated in a large domain of interests, and have not given any explanation for this phenomenon in detail——why, where, when and how the location-based mobile search emerge (Amin, et al., 2009). They launched a diary study in investigating mobile users’ intentions by location-based information needs and contexts. In their findings, the results showed the most common places for their participants’ information needs emerging were the public place, at work, on the move and at home, and also found their participants’ location-based information needs triggered by various contextual factors. Heimonen (2009) also noted that contextual factors have significant effects on where and when information needs emerging. A recent study by Teevan et al. (2011), they did a survey of 929 employees at Microsoft, all of the mobile users’ searching activities reported in their survey data were local searches. The results showed that participants’ search intentions were triggered by many different causes, and these motivations appear highly by contextual factors, these factors consist of mobile users’ current activity, location, time or conversation with other people. Interestingly, Heimonen (2009) reported that users’ information needs can emerge as the result of complex situations, he also found that besides four contextual factors, sometimes the information needs emerging without any
influences by contexts. He categorised the users' motivations of these information needs by no contexts which ranked the first place of contextual factors

The activity context acts as the most frequent contextual factor (23%) influence users’ information needs was found by Heimonen (2009). He implemented a diary study to analyse how contextual factors affect the information access. Heimonen (2009) stated that activity reflects what the participant was doing at the time and the place, thus the activity has temporal relationship to the current time and users’ location. Sohn et al. (2008) stated that along with location and time, the activity was an essential contextual factor that can obtain a better understanding of users’ information needs. The activity contexts always relate to the task or job in which users are engaged (Amin et al., 2009). Users often do mobile searching in order to help them complete the activities (task/goal for work) that they engaged (Heimonen, 2009)

The location context is obviously an essential contextual factor in the mobile search space, both because mobile users are conducting mobile search activities while on the move and often using geographic terms to search places (Dearman et al., 2008; Amin et al., 2009; Church & Smyth 2009; Teevan et al., 2011; Heimonen, 2009; Nylander et al., 2009). Verkasalo (2009) found that mobile users use mobile phone to search frequently at home, office and on-the-go. Information needs prompted by location were based on the current geographical area, typically relate to users’ current activities (Heimonen, 2009). According to the study by Teevan et al. (2011), the result showed that people seems more likely to be on the move while information needs emerge than at a particular location, they reported 64% of the time that searching activities emerge when in a car or bus, searching while walking rank 11% of the time, and respondents who were moving reported that the triggers for searching information were target to find a place near their current location, or to find a place at or near their destination or the best route to their destination. Nylander et al. (2009) noted that location could affect use in several ways, including the geographical terms used in queries (Churn & Symth, 2009), the type of mobile device selected to use by users (Nylander et al., 2009), and users’ current geographical areas mostly target to the
destination (Amin et al., 2009). Sohn et al. (2008) stated that the location context is the most significant factor triggering their participants’ contextual information needs. Most participants in their study also mentioned explicitly that their desire to access the relevant information triggered them to use their mobile phone access Internet services while driving. Church and Smyth (2009) noted that using mobile devices for searching places with geographical terms increased significantly when their participants were “on-the-move”. However, Nylander et al. (2009) found that participants do searching for something relates to the information about geographical areas only presents 15% of their data.

**Time** is another influential factor that often likely to trigger users’ information needs (Sohn et al., 2008; Heimonen, 2009; Teeven et al., 2011). The previous research by Beitzel et al. (2004) found the time of day influence significant on users’ information searching. In the recent study in mobile space by Church and Smyth (2007), they mentioned explicitly that 8% of their participants’ mobile queries relate to the time. Heimonen (2009) found the time rank the second category of contextual factors, and pointed out these information needs has temporal relationship to users’ current activities. According to Teeven et al. (2011), they found that the mobile local searches are almost aimed at visit the place on the same day or in the near future, and 26% of all respondents stated that it is important for a search engine to be represented the result for estimating the arrival time to reach the destination. The findings also pointed out users preferred time related information about the search result. Teeven et al. (2011) also found that 12% of respondents mentioned that they wanted information on the time of business’ operating hours, and 5% of respondents wanted movie times. This is similar to the finding by Sohn et al. (2008), where 7% of information needs emerges relate to business hours and 2% want to search movie times.

**The social contexts** can be defined that some mobile search activities are done in the presence of other people (Sohn et al., 2008; Amin et al., 2009; Heimonen, 2009). Several studies reported that the social contexts influence significant on users’ mobile Internet usage (Sohn et al., 2008; Wigelius et al., 2009; Dearam et al., 2008; Brandt et al., 2007). Teeven et al. (2011) pointed out that mobile search sometimes can be seen as collaborative
search activities. Morris (2008) found that 53% of users search the Web in the presence of other people at least once. The same phenomenon is also reflected in the mobile search area. According to the study by Amin et al. (2009), they reported that a majority of location-based searches are triggered by users’ activities and situations, and more than three quarters of the location-based searches occur under social context, they found that an individual location-based information need always relates to group information needs. These findings keep consistence to the previous study by Sohn et al. (2008). Furthermore, Amin et al. (2009) reported that most location-based search activities are triggered by the conversations with people; the recommendations by people and necessity. They stated that most location-based search activities are not merely an individual activity but are strongly affected and triggered by social interactions in despite of the mobile phone is a personal device. This phenomenon observation was similar to the study by Cui et al. (2008), who stated that the mobile could be seen as a conversation enhancer. Mobile searches support social conversation to start a new discussion or an ongoing discussion with searching for ideas, collaborating search for making a decision and sharing others’ recommendations (Cui et al., 2008; Amin et al., 2009).

2.4 Summary

In summary, the literatures above illustrate that mobile users’ information needs are becoming diverse and the tendency of users’ information preference seems changing with the development of networked services and mobile techniques, the mobile users’ preference on the information needs seems hardly to be captured by information service providers. The early log-based analysis studies show that the adult-related content was the most preferred queries, however, recent researchers found that information relate to local information and lifestyle are becoming more preferred source of information in mobile users, and also stated that different mobile users have different mobile search patterns by comparative analysis between the survey in US and in Japan. Additionally, based on the statement by previous researchers, they all stated that it is important to understand users’ intentions behind queries, in order to obtaining a better understanding of why users conduct mobile search, what information they really want to find. Understanding users’
actual searching intentions can help information provider develop more effective mobile search applications. Finally, previous researchers also pointed out the importance of the contextual factors. Understanding the contextual factors on users’ information preferences can help to bridge the gap between mobile users’ information needs and their actual intentions.

Therefore, with analysing the mobile users’ information needs by topics, users’ actual intentions and contextual factors, information service providers can gain a better understanding users’ information preference and then provides relevant effective services. However, there are few studies are focused on different mobile devices and there no prior studies investigate the potential influence of gender and age on users’ information needs. The research thus was launched in the mobile search area.
CHAPTER III
METHODOLOGY
### 3.1 Data Collection Methods

The nature of this research is combined both the quantitative approach and the qualitative approach to meet objectives, which are related to information preference between different smartphone users, and how users’ information needs emerge in various situations. Due to mobile search activities often emerges in a ubiquitous environment, Amin et al. (2009) pointed out that to obtain a better understanding of mobile users’ search patterns between different users is a challenge. To understand mobile users’ information needs better, from literature reviews, previous researchers have followed two main paths: analysis of logs-based of actual mobile search queries (e.g. Kamvar & Baluja, 2007; Church et al., 2007; Yi et al., 2008; Yi & Maghoul., 2011); Kamvar and Baluja (2007) pointed out the limitation of log-based study, they stated that users’ query logs are valuable data to analyse users’ information needs but don not tell the story behind a user’s experience – “we know for what and when a user queried, but have no context for what inspired the search.” Amin et al. (2009) also stated that log-based study unable explain on users’ actual searching intentions behind the query. To complement log analysis results, qualitative methods such as small-scale diary study have been used to investigate in the mobile search space (e.g. Church et al., 2008; Amin et al., 2009; Church & Smyth, 2009; Heimonen, 2009; Teevan et al., 2011). Diary studies allow the researcher captures some specific aspects of user search behaviours in specific environments (Church & Smyth, 2009). As the diary study allows more realistic observations, the method has been adopted in recent studies on observing mobile users’ information search behaviours in particular location context, such as how contextual factors influence users’ information needs (Sohn et al., 2008, Church & Smyth, 2009; Amin et al., 2009). Similarly, early work by Jones et al. (2004), they also used diary study to investigate the influence of contexts on mobile information searching behaviour.

Due to the objectives of this study, the approach of this study is to combine two methods, which are questionnaire survey and diary study, the rationale to for combining two methods as follows:
Firstly, this study is to examine information preference between different smartphone users and the possible impact of gender and age on the preference for information needs by collecting data, the researcher decided to conduct a questionnaire survey online at various information categories of topics in order to: 1) verify the effect relationships between variables, for example, between different aged users and preference of ranking information needs on smartphone; 2) obtain an understanding of the nature of social data, which is related to users’ general motivations on information needs. Secondly, this study is to address the peoples’ motivations on information needs. In order to obtain a better understanding on smartphone users’ motivations on information need, the researcher needs to explain on how users’ information needs emerge from, which is difficult to be observed directly through quantitative approach. A small-scale of diary study therefore was implemented in this study.

3.2 Research Design

The survey questionnaire consists of 14 questions in an electronic format, and it needs to cost 127 seconds in average to complete (through pilot experiment). The questionnaire was structured into three main parts. The first section, which is related to the respondent’s demographic information, is including gender, age, occupation and type of smartphone. The second section emphasises on examining users’ preference for information needs. The third section asks questions about the relationship between information needs emerge and contextual factors in a general way by using rate scale.
Figure 2: Screenshot showing the preference options provided to the respondents for the selection of information topics (English Version)

For users’ preference on categories of information topics, the respondents were given 16 categories to select (see Figure 2). These information categories by topics were derived from previous literature researches and improved through pilot study. The respondents were asked to select less than eight options, in this way, it means that respondents were allowed to select from “at least one” to “no more than eight” options. Respondents were not forced to select all categories, which created a more natural selection of choices, and therefore reduced participant bias. If respondents selected more than one option (categories), they were asked to sort categories of topics in descending order\(^1\), by selecting “first preference”, “second preference”…., “eighth preference” for each category of topic (opinion). For example, if one respondent selects “News/Weather”, “Social Networking”, “Local information” and “Shopping/E-commerce” categories as choices, they need to sort these four categories of information topics (e.g., first preference – “Social Networking”, second preference – “News/Weather”, third preference – “Shopping/E-commerce”, fourth preference – “Local information”).

Diary entry. The researcher conducted the diary study is similar to the study by Amin et al.

\(^1\) Ranking top eight frequent topics, from the first one (most frequent or valued need) to the eighth (least frequent)
(2009). Participants were asked to submit the descriptions of their mobile search activities at the end of every day through social networking tools (e.g. MSN). Furthermore, participants also need to answer some additional questions that are related to their search activities based on the diary entries at the end of diary study. During the diary study, participants need to identify their search activities done on mobile phones and participants were asked to describe their mobile activities with following questions:

- *What information needs emerging*;
- *Why the information needs occurs or what purpose for scanning/searching the information*;
- *Where the information need emerging*;
- *What search engine or application that you used for accessing information*;

Additionally, the researcher records all data manually that submitted by participants, and then the researcher documented these data into an electronic format after clarifying participants’ search activities. Every participant was labeled with a unique trial number with his/her basic information (e.g. age, occupation, gender, type of smartphone).

### 3.3 Participants

According to the research objectives, the population of this research is only target to Chinese smartphone users. That is to say, both questionnaire survey and diary study should choose participants who used smartphone. In order to avoid collecting non-representative sample that respondents’ mobile device was not smartphone, for the survey questionnaire, the researcher manually classify the responses. The researcher discard some of the responses from users who selected the “other mobile phone” option if respondents did not specify their mobile phones (Maker & Model) or the answer to this option is not belong to smartphone. Moreover, for the diary study, the researcher asked participants who are voluntary to participating in this research to complete a simple questionnaire, which includes questions about demographic information (e.g. gender, age, type of smartphone). Therefore, the representativeness of the sample is ensured in these ways.
Additionally, the researcher illustrates the information on how questionnaire survey was distributed and how participants were selected and recruited for diary study in detail below.

For the questionnaire survey, the questionnaire was distributed randomly on various social networking websites and the researcher also asked some friends send the questionnaire to their friends to answer, aiming to reach a large and diverse enough amount of data. Additionally, for the diary study, all participants were approached by the E-mail with the detail information sheet. 19 participants were recruited for a short period diary study (12 Days) from those who are voluntary to participating in this research among 24 volunteers. All participants who recruited have at least half year of using their own smartphone and have experience on accessing online via their smartphones in daily life. The researcher recruited participants with different ages, occupations and types of smartphones (5 iPhone users, 5 Android users, 4 Blackberry users, and 5 other types of smartphones users). The sample population in the diary study contains 11 female and 8 male participants, aged between 18-35 years old. Furthermore, regarding occupations, selected participants consist of students, business personnel, manager, journalist, shipbuilding blocker, and marketing people.

3.4 Procedure

The questionnaire survey and diary study were implemented at the same time.

3.4.1 Pilot Study

Pilot study was conducted in this project prior to launch the questionnaire survey online. The pilot study in this study aims to assess whether respondents have a clearly understanding on each question and whether there is necessary to add some additional questions. Additionally, aiming to avoid participant bias by respondent error and ensure collecting high-quality data as possible, the researcher did an experiment to test how much time did questionnaire cost in average, which were used to assess whether respondents do

\[\text{Other types of smartphones here means all smartphones which exclude iPhone, Android, Blackberry}\]
the questionnaire carefully after the researcher really started to collect data, the questionnaire survey website which namely Sojump (http://www.sojump.com/) make it possible that allow the researcher access the information on how much time the questionnaire cost after respondents finish it. If the completion time of responses to this questionnaire were less than 120 seconds, these responses would be regarded as invalid responses (the average fastest completion time was 127 seconds based on the test pilot). The Figure 2 shows examples of invalid responses which were discarded by the researcher. The pilot study was contributed to improve the questionnaire survey and frame an efficient questionnaire. High quality questionnaires make the high quality data collection possible. The final questionnaire was documented based on valuable suggestions from respondents and supervisor during the pilot study.

![Figure 3: Screenshot showing the examples of Invalid Responses by Respondents](image)

### 3.4.2 Questionnaire Survey

After the pilot study, the final version of the questionnaire was launched in a professional questionnaire survey website (http://www.sojump.com/) in an electronic format. The researcher sent the questionnaire link through social networking tools (e.g. MSN) and the researcher also ask friends to send the questionnaire link to everyone around them, aiming to obtain a large amount of data. Secondly, the researcher examined every received response and analysed manually to take out some invalid responses from the collected database.

### 3.4.3 Diary Study

Pre-diary study: With the supervisor’s assistance, the information sheet with explicit
explanations about this researcher, the participant content form were sent to the 19 participants who are entirely voluntary to participating in this research. The information sheet provides detailing directions for descriptions that participants need to record and submit during the diary study. Every participant was told about the procedure and attention prior to the diary study.

*Chat-based diary.* The study ran for a short period time, from 23th July 2012 until the 3th August 2012. During the period of diary study, all participants were asked to record and submit descriptions of their daily mobile search activities per day. Because of geographical difference, the researcher was in the Sheffield, United Kingdom while the participants were in China. Therefore, participants were asked to submit rich descriptions of their mobile search activities through Web-based tools such as MSN. The primary purpose of the diary study was to investigate how information needs triggering by evaluating users’ actual intentions. In order to avoid participants’ bias and loss of data as possible, the researcher also encouraged participants to describe in detail with any additional rich descriptions which they considered might be relevant to this study, furthermore, a detail sample of description was illustrated in information sheet, giving a guideline for participants to get a better understanding what they need to do.

Additionally, in order to avoid in the case that some participants might forget to submit description online or unable to access the Internet, the researcher sent a reminder message to each participant every two days, it also allowed participants sent E-mail to describe their search activities if they felt more comfortable with this method. The researcher also asked participants answer additional questions if descriptions were unclear during the diary study. This procedure of diary study makes agreement with every participant.

*Post-study interview.* At the end of the diary study, some participants were interviewed individually for a very short time. Some additional questions were discussed based on their diary entries and wider issues about their mobile searching experience in their daily life were also considered, the questions in the semi-structured interview are relatively open
3.5 Ethic Concerns

During the small-scale diary study, participants were asked to submit rich descriptions of their mobile search activities that last 12 days. The researcher considered the ethic issue so some relevant practices to avoid potential psychological distress to participants. Firstly, participants in this study are entirely voluntary and were told in detail about this study with information sheet. Secondly, Participants were told that they are free to withdraw from this study at any time and their personal data were kept confidential, any potential information relate to personal information were presented in an anonymous way. Furthermore, if participant unwilling to see his/her data to be published in this project, the researcher promised them that his/her data would be destroyed before the data were conducted to analysis.
CHAPTER IV
RESULTS
4.1 Quantitative Findings with Statistical Analysis

This project collected totally 281 online questionnaires. 260 responses were valid, which in the main analysis of the database. Meanwhile, 13 responses were considered as invalid responses with the invalid respondents filtering rules. The responses did not consider Q6 & Q7 well or only cost a very short time (less than 120 seconds). Additionally, 8 responses from Windows mobile phone users were discarded due to the small amount of data collection. Exceptionally, the researcher analysed an interesting small amount of data collection from Blackberry users, as these respondents are in the same occupation (Businessperson). The group that namely “other smartphone users” is defined in this research means for all users who use smartphone except iPhone, Android and Blackberry phones.

Due to the data that obtained from the survey questionnaire was non-parametric, medians and the interquartile range of the preference choices were involved in our data analysis, in order to shows the median rank of each information topic. In this way, the significance of preference for each information topic, among and across different smartphone users were performed. Meanwhile, the Mann-Whitney U Test was uses to measure the significant difference of some most preferred categories of topic between different user groups.

4.1.1 The Most Preferred Information Needs by Topics

As can be seen from the Table I, which clearly illustrated the users’ preference rank score of each category of information topic. These ranking results were obtained through collecting the frequency of each category which being selected on by respondents. The results were divided into four groups relate to the different type of users, which represents iPhone users, Android user, Blackberry users and other smartphone users (Results from 90 iPhone users, 126 Android users, 6 Blackberry users and 38 other smartphone users). The results show that in these four groups, 7 categories of information topics were most preferred searched, which are “News/Weather”, “Social Networking/Apps”, “E-mail Service”, “Location information”, “Shopping & E-commerce”, “Gaming” and “Entertainment”.
### Table I: Median and Interquartile Range for the users’ preference Rank Score of each information topics (Q1 and Q3 are 1st and 3rd quartile)

<table>
<thead>
<tr>
<th>Row. No</th>
<th>Category</th>
<th>iPhone Median (Q1-Q3)</th>
<th>Android Median (Q1-Q3)</th>
<th>Other smartphone Median (Q1-Q3)</th>
<th>Blackberry Median (Q1-Q3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>News/Weather</td>
<td>1(1-3)</td>
<td>1(1-2)</td>
<td>1(1-3)</td>
<td>2(1-2)</td>
</tr>
<tr>
<td>2</td>
<td>E-mail Service</td>
<td>2(2-4)</td>
<td>2(1-4)</td>
<td>7(2-7)</td>
<td>2(1-3)</td>
</tr>
<tr>
<td>3</td>
<td>Social Networking</td>
<td>1(1-2)</td>
<td>2(1-2)</td>
<td>1(1-2)</td>
<td>1(1-3)</td>
</tr>
<tr>
<td>4</td>
<td>Shopping/E-commerce</td>
<td>3(2-6)</td>
<td>3(2-4)</td>
<td>2(1-3)</td>
<td>2(1-4)</td>
</tr>
<tr>
<td>5</td>
<td>Local information</td>
<td>3(2-5)</td>
<td>4(3-5)</td>
<td>4(2-6)</td>
<td>5(2-5)</td>
</tr>
<tr>
<td>6</td>
<td>Entertainment</td>
<td>4(2-5)</td>
<td>4(3-5)</td>
<td>3(2-4)</td>
<td>2(1-2)</td>
</tr>
<tr>
<td>7</td>
<td>Gaming</td>
<td>3(2-5)</td>
<td>4(3-5)</td>
<td>4(2-5)</td>
<td>3(3-3)</td>
</tr>
<tr>
<td>8</td>
<td>Tourism information</td>
<td>6(5-7)</td>
<td>5(4-7)</td>
<td>4(3-6)</td>
<td>4(4-6)</td>
</tr>
<tr>
<td>9</td>
<td>Industry/Employment</td>
<td>6(4-7)</td>
<td>4(3-5)</td>
<td>6(4-7)</td>
<td>8(8-8)</td>
</tr>
<tr>
<td>10</td>
<td>Stock information</td>
<td>5(3-6)</td>
<td>4(3-6)</td>
<td>4(4-4)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Sport</td>
<td>4(3-6)</td>
<td>5(4-6)</td>
<td>3(2-5)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Network Resource</td>
<td>5(4-7)</td>
<td>6(4-7)</td>
<td>4(3-5)</td>
<td>5(5-7)</td>
</tr>
<tr>
<td>13</td>
<td>Novel</td>
<td>5(4-7)</td>
<td>4(3-6)</td>
<td>3(1-5)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Academic</td>
<td>5(4-6)</td>
<td>5(4-6)</td>
<td>7(4-7)</td>
<td>4(4-4)</td>
</tr>
<tr>
<td>15</td>
<td>Adult content</td>
<td>7(5-7)</td>
<td>6(5-6)</td>
<td>8(8-8)</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Lifestyle Information</td>
<td>6(4-7)</td>
<td>6(5-7)</td>
<td>4(2-5)</td>
<td>5(5-8)</td>
</tr>
</tbody>
</table>

However, based on analysing of the four groups, the researcher found there were slight numbers of notable differences of information preference between these four user groups. To be specific, for the iPhone users, most respondents indicated that “News/Weather” and “Social Networking” were their most preferred categories of information topics (row 1 and 3 in Table I), the second preference was the category of the “E-mail Service” (row 2 in Table I), followed by the third most preferred categories of information topics were the “Shopping/E-commerce” and the “Local Information” (row 4 and 5 in Table I). Whereas, for the Android users, the “News/Weather” was the prime category of information topic sought by most respondents, the “Social Networking” and the “E-mail Service” categories were second preferred types of information topics, next followed by the “Shopping/E-commerce” category. The researcher found that the “Local Information”, the “Entertainment” and the “Gaming” were equally ranked to the fourth preference categories of information topics for Android users (row 5, 6 and 7 in Table I).
Table II: Mean Rank Score and Mann-Whitney U Test Results for iPhone Users (N=90) and Android Users (N=126)

<table>
<thead>
<tr>
<th>Experiment Group</th>
<th>News/Weather</th>
<th>E-mail Service</th>
<th>Social Networking</th>
<th>Shopping/E-commerce</th>
<th>Local Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>iPhone users</td>
<td>4.625</td>
<td>9.125</td>
<td>6</td>
<td>6.125</td>
<td>7.5</td>
</tr>
<tr>
<td>Android users</td>
<td>12.25</td>
<td>7.25</td>
<td>10.75</td>
<td>10.625</td>
<td>9.5</td>
</tr>
<tr>
<td>U test</td>
<td>2</td>
<td>27</td>
<td>14</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td>Two-Tailed Probability</td>
<td>0.0016*</td>
<td>0.5995</td>
<td>0.0587</td>
<td>0.0742</td>
<td>0.4008</td>
</tr>
</tbody>
</table>

*The difference between the frequencies is statistically significant at p<0.05.

As the results described above, for both iPhone users and Android users, the “News/Weather” and the “E-mail Service” were respectively ranked firstly and secondly in preference categories of information topics. However, by using Mann-Whitney U test analyses, it suggested that the two user groups vary in preference for these two categories of information topics according to its extent (Table II). The figure shows that Android users had a more preference for the “News/Weathers” (at p<0.05; p=0.0016); thus suggesting Android users use their smartphone for looking up the newest news or weathers more frequently than iPhone users. No significant difference was found on the “E-mail Service” between iPhone users and Android users (at p=0.5995). Another interesting result was observed from this research (although not statistically significant difference; p=0.0587) is that iPhone users are less likely to choose the “Social Networking” category (rank score = 6) in searching than Android users (rank score = 10.75). Furthermore, according to the statistics between “E-mail Service” (at p=0.5995) and “Shopping/Ecommerce” (at p=0.0742) categories, no significant differences were found.

Additionally, a significant difference was found in the “other smartphone users” (row 2, 4 and 13 in Table I). Furthermore, the result shows that this user group selected the “Novel” considerably more frequently than the other three groups (iPhone users, Android users, Blackberry users). Moreover, “other smartphone users” have less preference for searching
“E-mail Service” but the “Shopping/E-commerce” is the preferred source of information searched by them.

Finally, for the group of the Blackberry users, even though the amount of data collected was considerably small, but the researcher found that Blackberry smartphone users express the same preference degree (2st preference) for the popular topics which are “News/Weather”, “E-mail Service”, “Shopping/E-commerce” and “Entertainment” (row 1, 2, 4, 6 in Table I). Moreover, Blackberry users indicated that the “Social Networking” is their most preferred category of topic (row 2 in Table I).

Overall, the results show that users’ preference for the “Adult” and “Networking Resource” categories were lower than other categories, the finding was significant different between the previous studies in the US and the Europe by Kamvar and Bajua (2007); Church et al. (2007).

4.1.2 Users’ Preference Affected by Gender and Age

In order to measuring how gender and age affect users’ preference for information needs, the researcher selected two popular groups which are iPhone users and Android users. The relationship between the independent variables (categories of information topics) and the dependent variables (users’ gender and age) was investigated. The result of preferred information demands were also measured by Median, Interquartile Range Analysis and the Mann-Whitney U Test Analysis.

Table III: Median and Interquartile Range for the Users’ Preference Rank Score For Different Gender (Q1 and Q3 are 1st and 3rd quartile)

<table>
<thead>
<tr>
<th>Row. No</th>
<th>Category</th>
<th>iPhone (Male)</th>
<th>Android (Male)</th>
<th>iPhone (Female)</th>
<th>Android (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Median (Q1-Q3)</td>
<td>Median (Q1-Q3)</td>
<td>Median (Q1-Q3)</td>
<td>Median (Q1-Q3)</td>
</tr>
<tr>
<td>1</td>
<td>News/Weather</td>
<td>1(1-2)</td>
<td>1(1-1)</td>
<td>2(1-3)</td>
<td>1(1-2)</td>
</tr>
<tr>
<td>2</td>
<td>E-mail Service</td>
<td>2(1-2)</td>
<td>2(1-3)</td>
<td>2(1-4)</td>
<td>3(2-6)</td>
</tr>
</tbody>
</table>
As statistics shown in the Table III, most female respondents indicated the “Social Networking” category is the most preferred category of information topic, whereas male respondents comparatively preferred to search latest “News/Weather” (row 1 and 3 in Table III). Moreover, another notable difference was found between the male users and the female users (row 2 in Table III). The results illustrate that the “E-mail Service” category was more preferred category of information topic by most male users, than female users, while the "Novels" category was much more marked preferred information topic by most female users than male users (13th row in Table III). Additionally, male users are more likely to search “Sport” information than female users. Finally, in general, “Network Resource”, “Academic”, “Adult content” and “Lifestyle information” categories were same preferred information between male users and female users (row 12-16 in Table III).

Interestingly, analysing the results based on the iPhone users and Android users respectively, the figures (row 4 and 5 in Table III) showed that iPhone female users are more likely to search “Local information” and “Shopping/E-commerce” information than iPhone male users. However, in the Android user group, the male users are more likely to search “Local information” and “Shopping/E-commerce” which the figures vary in the figure of the iPhone user group. Moreover, iPhone male users are more likely to search “Entertainment” and “Gaming” information than iPhone female users (row 6 and 7 in
Table III). Nevertheless, in the Android user group, it seems that the “Entertainment” and “Gaming” categories were equally preferred to search between Android male users and female users.

Based on analysing by the Mann-Whitney U Test Analysis, the results show the difference of information topics between iPhone male users and Android male users in five categories (Table IV); iPhone Female users and Android female users (Table V). The results show that Android users are more likely to search “News/Weather” information than iPhone users, regardless of gender influence. Moreover, Android male users are more likely to search “Social Networking” (at p=0.0459; p<0.05) and “Shopping/E-commerce” (at p=0.0157; p<0.05) information than iPhone male users. However, the results (Table V) illustrate the preference on the “Social Networking” and “Shopping/E-commerce” was no difference between iPhone female user and Android female users. Another interesting result was observed from this research (although not statistically significant difference; p=0.0587) is that Android male users are more likely to search “Local information” than iPhone male users, whereas no difference in statics was found on the “Local information” category (at p=0.4622) between iPhone female users and Android female users. Finally, no differences of preference were found in the “E-mail Service” categories.

Table IV:  Mean Rank Score and Mann-Whitney U Test Results for iPhone Male Users (N=37) and Android Male Users (N=64)

<table>
<thead>
<tr>
<th>Experiment Group</th>
<th>News/Weather</th>
<th>E-mail Service</th>
<th>Social Networking</th>
<th>Shopping/E-commerce</th>
<th>Local Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>iPhone male users</td>
<td>4.125</td>
<td>7.625</td>
<td>5.25</td>
<td>5.5</td>
<td>6.125</td>
</tr>
<tr>
<td>Android male users</td>
<td>12.375</td>
<td>7.75</td>
<td>10.875</td>
<td>11.375</td>
<td>10.75</td>
</tr>
<tr>
<td>U test</td>
<td>1</td>
<td>38</td>
<td>13</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>Two-Tailed Probability</td>
<td>0.0011(^a)</td>
<td>0.5286</td>
<td>0.0459(^a)</td>
<td>0.0157(^a)</td>
<td>0.0587</td>
</tr>
</tbody>
</table>

\(^a\)The difference between the frequencies is statistically significant at p<0.05
Table V: Mean Rank Score and Mann-Whitney U Test Results for iPhone Female Users (N=53) and Android Female Users (N=62)

<table>
<thead>
<tr>
<th>Experiment Group</th>
<th>News/Weather</th>
<th>E-mail Service</th>
<th>Social Networking</th>
<th>Shopping/E-commerce</th>
<th>Local Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>iPhone female users</td>
<td>5.875</td>
<td>9.375</td>
<td>8.75</td>
<td>7.75</td>
<td>9.375</td>
</tr>
<tr>
<td>Android female users</td>
<td>10.875</td>
<td>6.875</td>
<td>7.625</td>
<td>8.75</td>
<td>7.375</td>
</tr>
<tr>
<td>U test Two-Tailed Probability</td>
<td>13</td>
<td>25</td>
<td>30</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Probability</td>
<td>0.0459(^a)</td>
<td>0.4622</td>
<td>0.8336</td>
<td>0.8336</td>
<td>0.4622</td>
</tr>
</tbody>
</table>

\(^a\)The difference between the frequencies is statistically significant at p<0.05

Through analysis below, the age difference was also considered as another influential factor affects the users’ preference on information needs. The researcher selected the top six categories of information topics for further analysing. According to the figures shown in the graph (Table VI), the results clearly show that the preferences were different in categories of topics between age groups, which are users aged 18-25 group, aged 26-34 group and aged 35-45 group. For example, for iPhone users, the user group who aged 35-45 expressed less preference for the “Social Networking” and “Shopping/E-commerce” categories, when compared to the other two groups (row 3 and 4 in Table VI).

Table VI: Median and Interquartile Range for the Users’ Preference Rank Score For Different Age (Q1 and Q3 are 1st and 3rd quartile)

<table>
<thead>
<tr>
<th>Row. No</th>
<th>Category</th>
<th>iPhone (18-25)</th>
<th>iPhone (26-34)</th>
<th>iPhone (35-45)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>News/Weather</td>
<td>1(1-2)</td>
<td>2(1-4)</td>
<td>1(1-2)</td>
</tr>
<tr>
<td>2</td>
<td>E-mail Service</td>
<td>2(1-4)</td>
<td>2(1-4)</td>
<td>2(2-4)</td>
</tr>
<tr>
<td>3</td>
<td>Social Networking</td>
<td>1(1-2)</td>
<td>1(1-2)</td>
<td>3(1-3)</td>
</tr>
<tr>
<td>4</td>
<td>Shopping/E-commerce</td>
<td>3(2-4)</td>
<td>3(2-4)</td>
<td>5(1-6)</td>
</tr>
<tr>
<td>5</td>
<td>Local information</td>
<td>4(3-4)</td>
<td>3(2-4)</td>
<td>5(2-6)</td>
</tr>
<tr>
<td>6</td>
<td>Entertainment</td>
<td>4(2-6)</td>
<td>3(2-5)</td>
<td>4(1-7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Median</th>
<th>Median</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Android (18-25)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Android (26-34)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Android (35-45)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
However, analysing results by the Median, Interquartile Range Analysis method are unable to illustrate the preference of information needs changes with age dynamics. Therefore, the Mann-Whitney U Test Analysis method is chosen in this section to analyse the difference preference in the same category according to user age dynamics.

### Table VII: Mean Rank Score and Mann-Whitney U Test Results For Android Users by Different Age Level, A= aged 18-25; A2= aged 26-34; A3=aged 35-45

<table>
<thead>
<tr>
<th>Experiment Groups</th>
<th>News/Weather</th>
<th>E-mail Service</th>
<th>Social Networking</th>
<th>Shopping/E-commerce</th>
<th>Local Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 - A2 U test</td>
<td>4.375 – 11.875</td>
<td>5 – 11.5</td>
<td>5.75 – 10.875</td>
<td>5.75 - 11</td>
<td>7.125 – 9.75</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>8</td>
<td>13</td>
<td>12</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>0.0045&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0117&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0459&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0356&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.2936</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>12</td>
<td>9</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>0.0033&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0086&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0016&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0063&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0274&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>The difference between the frequencies is statistically significant at p<0.05

As statics shown in the Table VII, the change of preference on information topics according to age dynamics could be summarsed as a trend in the Android user group.

The research defined three age groups named A1, A2 and A3. The figures illustrate that with age increasing, “Shopping/E-commerce”, “E-mail services”, “Local Information” and “News/Weather” are more increasingly highlighted by Android users. Nevertheless, the preference for “Social Networking” is decreased with age increasing.
4.1.3 General Motivations to Users’ Information Needs

In some cases, when users' information needs are triggered by different motivations under different locations, the smartphone is the natural method for accessing information. In this project, the survey questionnaire also measured users’ general motivation to information needs by quantitative way (see Figure 4), the figures showed that approximate 65% of respondents (N=260) agreed that they always have mobile information needs in their daily life, and more than 80% of respondents agreed the statement “I use my smartphone for searching information under an urgent context” (31.72% of users absolutely agree this statement). Interestingly, most respondents indicated that the reason of their information needs emerge is for leisure in different situations (e.g. on transportation, in a queue). Furthermore, 79% of smartphone users stated that when they want to know more about something or knowledge to solve their questions, their information needs would emerge.

Figure 4: General motivations to information needs for smartphone users (Data collection from survey questionnaire, N=260)

4.2 Qualitative Findings

This project also conducted a short diary study, we collected 256 valid diary entries (total
263), with an average of 13.5 entries per participant. While, seven invalid entries were discarded due to these entries were unable regarded as mobile information need (e.g. playing games without any additional related search activities) or classified into same categories during the semi-structure interview at the end of the diary study. During the diary study, we ask participants submit rich descriptions to describe their mobile search activities – what, why and where they search for the information.

4.2.1 Task View

The participants’ entries provide rich descriptions of users’ mobile search activities and users’ motivation behind search activities. The term of “search activities” described in diary entries is not only means participants in order to search a particular information by using mobile search engines (e.g. searching information which is needing), but also means participants general read internet pages for selecting interesting information (e.g. wondering any interesting information on internet pages). The reason is that when participants reading web pages, they always select some interested information to read. The researcher highlights three main intentions behind users’ information needs: Fact finding, information gathering and non-goal oriented intention. This classification of these three intentions is similar to the previous study used by Amin et al. (2009). All participants’ entries from the data were classified into these three main categories to represent users’ searching intentions (see Figure 3). Furthermore, all participants’ entries from the data were classified by the location contexts e.g. Move and Non-move (see Table IX).

![Figure 5: Percentage of diary entries associated with participants’ intention](image-url)
Table VIII: Percentage of diary entries associated with location contexts

<table>
<thead>
<tr>
<th></th>
<th>Move</th>
<th>Non-Move</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Office</td>
<td>Home</td>
<td>Outside</td>
</tr>
<tr>
<td>Fact Finding</td>
<td>24.30%</td>
<td>13.38%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Information Gathering</td>
<td>5.37%</td>
<td>6.11%</td>
<td>7.12%</td>
</tr>
<tr>
<td>Non-goal oriented</td>
<td>17.40%</td>
<td>9.28%</td>
<td>2.65%</td>
</tr>
</tbody>
</table>

*Fact Finding search intentions.* It means the goal of these mobile “search activities” always aims to a specific factual answer. The motivations for these “search activities” are usually straightforward; users have explicit goals of answers, e.g. searching for the ticket price of the nearest flight. From Figure 3, the results illustrate 46.67% of the searching activities were classified into the fact finding intentions. The researcher found a majority of searching activities related to the geographical information is categorised into the fact finding intentions. Take participants’ diary entries as examples, “I want to discover which bus line is guided to my destination (a company of News papering Group).” (P09). “When I am driving, I need to know nearest gas stations.” (P06). Also, all work-related information needs or personal information requirements were classified into the fact finding search intentions, e.g. “I want to recheck an out-date E-mail.” (P19) or “I was searching Google translate for improving my English academic essay writing.” (P17). Such requests for problem solving were likely relate to the participants’ current or further activities. Additionally, From the Table IX, the results illustrate that there seems fact finding oriented “search activities” often emerge regardless of participants’ location context (move and non-move). Furthermore, for participants conducted mobile search activities under the Non-move location context, the results show that 13.38% of “search activities” which associate with fact finding search intentions were conducted in office, whereas only 3.8% of “search activities” were conducted at home.
Information Gathering search intentions. It refers to the goal of “search activities” may be complex. Users sometimes need to conduct multiple searching to compare different information so that satisfying their information needs. Information gathering “search activities” often relate to users’ activities in the future or help users to carefully make a decision through compares different information they searched. For example, as a participant mentioned as “I compare different prices in different online shops for selecting a perfect gift for my girlfriend.” (P18). This participant’s statement proves that the user gathering different information to support an individual decision. Additionally, from Figure 3, the results which are related to users’ location context show that 17.3% of information gathering search activities were conducted when users in a non-move location context (office, home, outside), whereas only 5.37% of information gathering search activities were conducted under mobile location context.

Non-goal oriented search intentions. It refers to users have not explicit intentions on “search activities” which searching motivation is difficult to be explained. Non-goal oriented search intentions is explained by Amin et al. (2009) that users’ searching motivation is to see what is newest or interesting without any other purposes. From participants’ entries, the researcher found 30.66% of “search activities” are classified into the non-goal oriented search intentions that the figure is ranked number two in users’ searching intentions ranking. Furthermore, the reason why searching activities with non-goal oriented search intentions ranked number two is participants look up the newest news/event or access social networking websites for following up their friends’ news more frequent than other “search activities” during the diary study. Moreover, the results (see Table IX) show that more than a half of non-goal oriented search activities emerging when participants in the move, which is ranked about 17.4%. From participants’ rich descriptions, the researcher observed that a majority of Non-goal oriented search activities also can be seen as the recurring information demands (the users’ goal only for leisure time), PIM (e.g. checking if there were the newest mail), and daily information requirements (e.g. accessing social networking website).
4.2.2 Contextual Factors for Location-based Search

From the rich descriptions of diary entries, the researcher manually analysed each diary entry to investigate that why / where participants did these “search activities”. These “search activities” were further analysed to identify how these information needs emerge (see Table X). Because of the participants were not asked to describe when did these “search activities” occur, the researcher thus discuss in the following four main contexts triggered users’ information needs except time context: no context, location contexts, social context and activity context.

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Contexts</th>
<th>Location</th>
<th>Social</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fact Finding</td>
<td>No context</td>
<td>8.7%</td>
<td>18.2%</td>
<td>10.7%</td>
</tr>
<tr>
<td>Information Gathering</td>
<td>No context</td>
<td>1.2%</td>
<td>3.7%</td>
<td>6.3%</td>
</tr>
<tr>
<td>No-goal oriented</td>
<td>30.67%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table IX: Percentage of “search activities” associated with each searching intentions by the contexts. (Percentages sum to less than 100% because the description of some diary entries were not explicit mentioned)

No Contexts

As mentioned above, some participants’ “search activities” emerge with no-goal oriented intentions, it can be considered as these “search activities” (20.67%) prompted by no contexts, the result which was similar to the previous study by Heinomon (2009), he also stated that a large percentage of mobile users’ search activities emerge without any intentions or were influenced by any contexts. However, it was captured in this study that a majority of no-goal oriented search activities can be considered as recurring information needs, such as frequent for looking up the latest news or accessing social networking websites/Apps. These “search activities” mentioned frequent in participants' diary entries, and most participants indicated that these information needs could be seen as their daily information needs. During the diary study, some participants had several some entries do explicitly indicate that these recurring information needs emerge frequent, and they also did mention that the purpose of these recurring searching activities was just for leisure or
keeping up-to-date with the latest news/emails when they on the public transportation, in a
queue or outside of the workplace. Here, the researcher defined these recurring information
needs are motivated from personal habitual.

Personal habitual can be explained that information needs often motivated by usual
individual habits and personal information requirements (e.g. E-mail, the calendar). For
example, almost all participants had a similar habit, they always look up the latest news,
check the E-mail or access social networking app e.g. one of the participants had several
entries that describe that she accesses Google calendar service repeatedly, the researcher
considered these recurring activities occurred due to her particular occupation, which also
could be regarded as personal usual habits, as she mentioned in the diary entries e.g.

“I need to check the managers’ scheduling while starting my working, I use my
smartphones to coordinate and update managers’ calendar, including appointments,
meeting, and travels, and my smartphone would push notification that reminder me
to make sure that all necessary documentation”. (P10-Secretary)

Interestingly, a truth needs to be noted from participants’ entries. These recurring
information needs are searched were rarely accompanied by using mobile search engines.
Participants used PIM tools only for checking latest messages, scheduling, and personal
information except when they search out-of-date E-mails or scheduling for some specific
purposes.

**Social Contexts**

This contextual factor refers to some users’ information needs triggered under social
contexts, such as communication or group information needs. From diary study, the results
show that 21.9% (see Table X) of “search activities” were conducted in the presence of
others. As mentioned above, previous studies pointed out users’ information needs occur
frequently when users are talking with other people. Hinze et al. (2010) found that 24% of
the participants conducted mobile local search activities with another person. They called
these searches are “collaborative searches”. From the data, for example, a considerable number of diary entries mentioned that some “search activities” were motivated by: requests by other people “My manager ask me the phone number of a previous partner.” (P15). “My colleague asks me how go to the Shanghai shipping institute.” (P14); a conversation or group meeting/discussion, “Our colleagues decided to have the dinner together while chatting in the office today, we used Meishihui (App) search all information of restaurants near the company.” (P16)

It is interesting noted that these information needs almost unable to be regarded as individual information needs. The reason for mobile users do searching was often due to other people's requests or strongly triggered by the interaction with other people. This observation is similar to some previous studies (e.g. Cui et al., 2008; Amin et al., 2008; Hinze et al., 2010).

**Location Contexts**

Furthermore, the local information (Geographical) is the most important information in the eyes of all smartphone users when users in an unfamiliar location context. The local information needs often emerge based on the current location (9.9%) of users, these information needs are always in relation to users’ current geographical location or what were users doing at that time. Participants’ entries mentioned that these “search activities” were often triggered by: Looking for surrounding geographical areas, such as one participant illustrated in the diary entries when he was on the travel, “as what I searched yesterday, except searching routes to some interests in this unfamiliar city, I also search the business hours of the restaurant which namely Waipojia, because I decide to have the dinner tonight.” (P11); Searching for directions to a destination: such as one participant mentioned in the interview at the end of diary study “I use Baidu map services to search the bus line frequently when I outside of the workplace, as I need to collect material for journalism at any place in this city.” (P08 -Journalist)

The researcher also observed a majority of these local information needs often emerged in
an urgent context, e.g. finding the nearest route to the hotel while driving, checking the platform in which the train leaves. The weight values for these needs in mobile users’ mind were more important than others, which feature significantly in the interview data.

**Activity Contexts**

Considerable amounts of “searching intentions” have closely related to the activities what user is doing at that time. The researcher found that 10.7% (see Table X) of these “search activities” target to fact findings, and usually relate to their current tasks/actions for work, for example, one participant had the following description: “*When I draft a business mail to our business partner, I search for some business terms for writing a business letter.*” (P10). Furthermore, the results show that these “search activities” also prompted by people interaction (social) or location in sometimes. Heimonen (2009) observed a similar result in his study. For example, as described in the above section, one participant descried, “*I was in the rush hour when I drive to the hotel, so I stopped my car and then searched for alternate route line to the Hangzhou Hotel from my current place.*” (P08). These users who generated these entries was driving at the time (current activity), and want to find the nearest facilities or the most appropriate route. Interestingly, a common implicit search pattern seems emerging frequent in the smartphone users through the following up interviews at the end of the diary study, because there had no much diary entries did not explicit mentioned. Only one participant illustrated in the diary entries e.g. “*I scan information shared by my friends on the Weibo (similar to Twitter), I got a good news that Sun Yang win the gold of men’s 400m freestyle swimming in the London Olympic Games, and I am very interested, I want to know more about this event, because you know it is a surprise.*” (P05). These particular extra information needs were featured significant in the interview data. Most participants stated that it is a very common search pattern that extra information needs emerging while they are reading the news or friends’ shared information via social networking websites.
CHAPTER V
DISCUSSION
5.1 Introduction

The aim of the study is to investigate smartphone users’ preference for information demands and to understand the context in which users’ information needs emerging. From the results, a number of key findings and additional findings were found:

5.2 Main Findings

Finding 1: Smartphone Users have Common Diverse Information Preference. From an overall perspective, all smartphone users’ preferences on information needs are presenting multilayered and diverse form. Based on the result analysis of section 4.1, even though there has a small difference between different smartphone users, the overall tendency for the most preferred information seems similar, the most preferred 7 categories of information topics are: “News/Weather”, “Social Networking/Apps”, “E-mail Service”, “Location information”, “Shopping & E-commerce”, “Gaming” and “Entertainment”.

Furthermore, the “News/Weather” and “Social Networking” are the most preferred categories of topics considered by all smartphone users; this finding keeps consistence with the previous survey by Google and Ipsos (2011). Google and the Ipsos Market Research Agency launched a worldwide survey shown that 64% of Chinese smartphone users access the Internet service every day. Landing social networking websites (including updating personal information, viewing messages or friend's newest information) was their major mobile search behaviour. The survey also reported that young adult users are becoming the leader of the tendency. Young adult users prefer using social networking apps (e.g. Twitter, WeChat) instead of traditional SMS for contacting. The reason could be conjectured that social networking websites have become popular and effective multimedia channels for providing information and sharing information.

Additionally, in despite of the frequency of the “E-mail Service” category had been selected by all smartphone users was considerable lower, the “E-mail service” category still rank the most second preferred category of information topic in smartphone users (except the other type smartphone users). The main reason might be explained by the response of one participant from the interview at the end of the diary study: e.g. “The main reason is convenience. Firstly, the function of notification is very helpful compare with the
computer, you know, it can help me to track the newest mails at a real-time, furthermore, I only need to “click” the app for accessing mail service at once.” (P06)

Finding 2: Users’ Gender and Age Influence the Information Preference. From the section 4.2, the results show explicitly that users’ preference affected by gender and age.

Firstly, from an overall perspective, the female users are more likely to access “Social Networking”, whereas male users relatively prefer to look up the latest news or weather. For this result, the reason would be inclined to the explanation from the psychology perspective. The psychology stated that women do better at developing and maintaining an online social networking relationship than men.

Moreover, the results also show that different gender has vary in preference for particular information topics, for example, the figures illustrate that the female users indicate that the “Novel” category was more preferred information, whereas male users seem often search sport-related information via smartphone. Interestingly, the figures which are collected from iPhone users show that women are more likely to search “Local information” and “Shopping/E-commerce” information than men, whereas figures in Android users were almost exactly the reverse of, furthermore, there is no significant difference was observed in terms of the “Shopping/E-commerce” category between iPhone female users and Android female users. It is not surprising that users’ preference for categories of information topics were different between male users and female users, these users’ characteristics of information preferences were easily to be tracked by service providers.

Secondly, users’ preferences on information topics vary with increasing age. For example, from an overall perspective, “Social Networking” seems to be preferred by most young adult users, the results describe that the information needs on the social networking shows a decline with users’ increasing age, by contrast, searching information such as “News/Weather”, “Shopping/E-commerce”, and accessing “E-mail Service” are preferred by most older users.

Finding 3: The Importance of the Location-based Search. One finding from diary study is the importance of location contexts that trigger users’ information needs, especially when the user is on the move. Because of most participants had stayed in their hometown,
only two participants went to a business trip and traveled away from their familiar places during the period time of diary study, the result only show 9.9% of “search activities” are classified into the location-based search. Furthermore, these location-based search activities often emerge under an urgent context, in which participants need the local information surrounding their current geographical when on-the-go. Participants searched local information to help them realize the new area or navigate to a place/destination. All participants stated that local information is very important when they traveled away from their hometown even though these location-based searches are searched not very frequent. Furthermore, participants emphasized the effectiveness of the location-based searching is very important.

**Finding 4: Most Mobile Search Activities are conducted with Others.** Social interaction/conversation is an important factor in the types of information needs that arise. According to the diary study, the results show that 21.9% of “search activities” are conducted with others e.g. *their friends, colleagues, family, etc.* On the other hand, these “search activities” could be considered group information needs rather than individual needs (Amin et al., 2008). Furthermore, the results illustrate that a majority of the group “search activities” target to the fact-findings search intentions (only have one right answer e.g., *what the time of the opening ceremony, what the name of the movie*). Moreover, some “search activities” with gathering information search intentions for making a further decision are significant influenced by social contexts, such as decided together “*the restaurant which is more suitable to have a dinner tonight.*”

These types of users’ information needs are easier to be captured. This is because these search tasks closely tied to group activities are often target to the local information (e.g. where to go have dinner, what the business hours of the shopping mall); work-related information (e.g. PIM, translation, industry information); general information needs are relation to the latest news/events or products/services.

**Finding 5: Instant Search Pattern – Extra Information Needs Prompted by Current Information.** From participants’ diary entries, participants have several entries mentioned a common mobile search pattern and featured significantly in the interview data. These mobile search activities often occurs under any location context, and mobile users stated that they always want to find the latest relevant content from a basis of current search tasks.
These information needs were defined here as “instant needs” or “real-time needs”,

For example, current smartphone apps could push notification for some hottest news/events, some of which mobile users might be interested in, resulting in an extra information needs emerging (e.g. comments or other related content for the information). In this case, they often use the site search engine or major mobile search engines for searching additional latest information. Our study mentioned explicitly that the instant search pattern often emerge frequent while mobile users were reading information shared by their friends on social networking websites (e.g. Twitter, Facebook, Weibo). These needs of the latest information were very particular, current major search engine service providers had already noticed this search behaviour, and provided instant search engines, such as Google Instant. However, these current instant search engines are still not enough powerful, due to the user's query to these information needs always in natural language with no structured queries, the search engine unable to identify users' actual intent.

5.3 Additional Findings

**Finding 1: Lower Preference for Adult Content and Network Resources.** It is interesting to note that at Chinese smartphone users expressed a very limited demand to adult content. The result for the users’ preference on adult content has a great difference with previous researches that were investigated in US and Europe. The reason for the difference could be explained by the different culture. However, it still unable excludes the possibility that respondents in this study might have a flawed understanding of the adult contents. Additionally, comparing with previous researches that were conducted in developed countries, the results show that Chinese smartphone users are less likely to search “Network Resource/Multimedia” information (e.g. Video, images and mp3). The main reason might be due to the limitation of mobile network, Chinese users need to pay fees for any extra data after their account reached a certain amount. The expense of these extra data is more expensive than developed countries. However, some participants who joined in the diary study expressed their preference for multimedia information in the interview at the end of diary study, e.g.

“I often searched some video and downloaded music via my smartphone if the Wi-Fi was available, you know, the expense for the overage mobile data is expensive in
“I did not do searching for network resource is not means that I have no this information needs, actually, I hope I can download music and watches video in anywhere, but my phone unable to supporting China Mobile’s 3G standard (TD-SCDMA), and also the TD-SCDMA technology is immaturity.” (P10)

Finding 2: Failure to Fulfill Mobile Users’ Gathering Information Oriented Search Activities. From the data analysis, diary entries are associated with users’ intentions show that the percentage of gathering information search intentions ranks the lowest place, only 23.67% of entries are classified into this category. Furthermore, the results also show that a majority of gathering information oriented search intentions are conducted under Non-move location contexts. The reason can be explained the due to the limited input capabilities and interfaces of current mobile phone, it seems it is hard to conduct a multiple search tasks on the mobile phones, when compare to the desktop. These limitations of mobile phones also can be seen the main reason why mobile users rarely do complex searching activities via their mobile phones.
CHAPTER VI

CONCLUSION


6.1 Conclusion

The objectives of the research are to investigate the different information preference between different smartphone users and the potential influence of gender and age on users’ information preference. Furthermore, the researcher also investigated contextual factors affect users’ information needs emerging in different situations. Through the data analysis, this paper presented the results from the questionnaire survey and a diary study of smartphone users’ information needs. The study revealed some interesting results of information preference between different smartphone users. Furthermore, the diary study presents some key findings about users’ intentions behind the information needs by topics, and the influence of contextual factors on the motivations to users’ information needs.

From the questionnaire survey, firstly, relate to the first objective of the study, the results show that the overall tendency of users’ information preference is similar regardless of different smartphones. Furthermore, the “News/Weather” and “Social Networking” categories of information topics are the most preferred source of information by most participants. Moreover, the results also highlight the “E-mail Services” is the second most preferred category of information topic in smartphone users except the user group of other types of smartphones. Secondly, for the second objective of this paper, the results highlight that mobile information preferences differ significantly between male users and female users, and the information preference also influenced by different age.

The diary study was targeted to complete the third objective in this research, the results present that most of the diary entries mentioned that information needs were driven by different search intentions. Many mobile search activities were conducted with the fact finding intentions (46.67%), with the No-goal oriented search intentions (30.66%) and the Gathering information search intentions (22.67%). The results also highlight the importance of location-based information needs, as the results show a majority of mobile search activities were conducted when users on-the-move. Additionally, the diary study also investigates the information needs triggered by contextual factors. The results highlight that the mobile search activities were often conducted in the presence of other people. Furthermore, a common search pattern was found from diary entries named “instant search”. The results also state that information service suppliers need to enhance the performance for gathering information search activities.
6.2 Implications

The mobile users’ information needs can be fulfilled by taking gender, age, searching intentions and context into consideration.

**Predicting Users’ Information Needs and Generating Search Results in Descending Order.** As the researcher found that the influences of the gender and age on information needs are significant. Furthermore, the mobile phone acts as a personal device, which allows search servicer easy to capture users’ preferred information needs. The researcher recommends that when users access the service via mobile application at first, the service providers can send requirements that ask users to select their gender and age. It allows search engines to analyse the query associated with users’ age, gender and location-based context, then generate and represent most relevant results in descending order.

**Taking Advantages from the Social Networking Websites for Provide Information.** As the results mentioned that the social networking ranked the first preferred information between different users. It seems that social networking websites are becoming the most important multimedia channels for providing information. The researcher recommends that information services provider can generate the users who have a common interest, providing information service integration – aiming to provide relevant information for a particular topic. For example, the services provider publishes the healthcare information through the social networking and attracts some users who have these information needs, the information suppliers can provide an extra particular search engine that the results only return healthcare related information.

**Taking Benefits from the Location-based Search.** A mentioned in the results that a majority of location-based search activities were conducted when users in the move and always oriented with fact finding intentions. Location-based search has been confirmed that the features can help improve the effectiveness of search results. Furthermore, users always use the geographical terms for searching the surrounding geographical are when on-the-go, these geographical terms not only include directions to a destination, but also including business hours, names relate to the entertainment. Therefore, the researcher
recommends that whenever search engines receive a query which contains “geographical terms”, the search engines should generating location-based search results priority.

**Support Instant Search based on Current Information Content.** In order to satisfy users’ instant information needs and obtain a good understanding of users’ “instant query”, the researcher recommends that search engine service can make cooperate with major news service providers and major social networking websites. As the results show that these instant search emerge frequently while users reading web pages with interesting news or shared information that published by their friends on the social networking. The search engine servicer can provide mobile applications, which integrate the service between social networking and the instant search engine. The search engine can analyse the information on the web pages while users do a search activity. It also needs to allow users just only click the words which they want to know more, in order to improving the experience of mobile searching and enhancing users’ stickiness to the services.

### 6.3 Limitation of the Study

Two limitations are acknowledged in the research. Firstly, the questionnaire survey was failure to collect enough data from the Blackberry user group, causing the researcher unable to analyse the influence of gender and age on the information preference for the Blackberry user group. Additionally, this research is a short-term research, which is within two months, therefore, according to the time limitation; the diary study only lasted 12 days. Thus, in order to summary participants’ searching behaviors, the 12-days diary study may not collect enough data to represent mobile users’ regular search behaviours.

### 6.4 Suggestions for Future Study

There is still much work to be done on whether users’ education and occupation have influence on the information preference, which was failure to be identified in this paper. Moreover, how to support the mobile phone implements gathering information search activities more effectiveness needs to be done. Additionally, the researcher believes that the instant search will be an even more important need as well as location-based information
needs, a new interface need to be provided to interact with users, as users’ query for the instant search are less structured natural language.

Word Counts: 13662
Reference


Church, K., & Smyth, B. (2008). Understanding mobile information needs. *In MobileHCI.*


Appendix

1. This questionnaire was launched on the Internet, the major data collection of the quantitative findings collected from this questionnaire.

ONLINE QUESTIONNAIRE SURVEY

Q1: Age?
   A. 18-25
   B. 26-34
   C. 35-45
   D. Over 45

Q2: Gender?
   A. Male
   B. Female

Q3: Current Occupation
   A. Student
   B. Business Person
   C. Self employed professional
   D. Service personnel (Gov./Public officer)
   E. Others, please specify here ____________

Q4: What type of mobile phone do you use?
   A. iPhone (iOS) 3GS/4/4S
   B. Android mobile phones (e.g. HTC desire S/C, Samsung Galaxy S series)
   C. Blackberry
   D. Windows phone (WP 6.5/7.0/7.5)
   E. Other Smartphones (please specify here) ____________

Q5: If the response to the above question is “Blackberry” then answer the question: Whether the Blackberry fulfilled your information needs
A. YES
B. NO

**Q6:** What is your primary purpose for using Internet on your mobile phone the most?

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Most Frequent (over 5 times per day)</th>
<th>Normal (2-4 times per day)</th>
<th>Low Frequent (at least 1 time per day)</th>
<th>Don’t use it</th>
</tr>
</thead>
<tbody>
<tr>
<td>Browsing WWW (e.g. reading books)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading News</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Read/send E-mail</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use online application/services (e.g. GPS, chatting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other purposes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
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<td>2.</td>
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<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Q7:** What information topics are useful to you when you conducted a mobile search activity? Please select the most 1-8 preferred information, sorting them from most preferred one to less prefer.

<table>
<thead>
<tr>
<th>Category</th>
<th>Preference</th>
<th>1st</th>
<th>2st</th>
<th>3st</th>
<th>4st</th>
<th>5st</th>
<th>6st</th>
<th>7st</th>
<th>8st</th>
</tr>
</thead>
<tbody>
<tr>
<td>News/Weather</td>
<td></td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>E-mail Service</td>
<td></td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Social Networking</td>
<td></td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Shopping/E-commerce</td>
<td></td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Local information</td>
<td></td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Entertainment</td>
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<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Gaming</td>
<td></td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Tourism information</td>
<td></td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Employment/Industry</td>
<td></td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Stock Market information</td>
<td></td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Q8: Would you consider search service as an important part of mobile phone?
A. Yes  
B. No

Q9: Always searching information under a particular location context (e.g. Using GPS service when on-the-go or on-the way home)
A. Totally Disagree  
B. Disagree  
C. Not Sure  
D. Agree  
E. Absolutely Agree

Q10: If the response to the above question is “D” or “E”, then answer the question: What information needs you often search when on-the-go. [Multiple choices]

<table>
<thead>
<tr>
<th>Preference</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>News/Weather</td>
</tr>
<tr>
<td></td>
<td>E-mail Service</td>
</tr>
<tr>
<td></td>
<td>Social Networking</td>
</tr>
<tr>
<td></td>
<td>Shopping/E-commerce</td>
</tr>
<tr>
<td></td>
<td>Local information</td>
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<tr>
<td></td>
<td>Entertainment</td>
</tr>
<tr>
<td></td>
<td>Gaming</td>
</tr>
<tr>
<td></td>
<td>Tourism information</td>
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<td>Employment/Industry</td>
</tr>
<tr>
<td></td>
<td>Stock Market information</td>
</tr>
<tr>
<td></td>
<td>Sport</td>
</tr>
<tr>
<td></td>
<td>Network Resource</td>
</tr>
<tr>
<td></td>
<td>Academic Resource</td>
</tr>
<tr>
<td></td>
<td>Adult Content</td>
</tr>
<tr>
<td></td>
<td>Lifestyle information</td>
</tr>
</tbody>
</table>

Q11: I always have mobile information needs
A. Totally Disagree  
B. Disagree
C. Not Sure  
D. Agree  
E. Absolutely Agree

Q12: I use my mobile phone for searching when I need to solve problem in a urgent context.  
A. Totally Disagree  
B. Disagree  
C. Not Sure  
D. Agree  
E. Absolutely Agree

Q13: The purposes of searching information on the mobile are just for leisure or pass time.  
A. Totally Disagree  
B. Disagree  
C. Not Sure  
D. Agree  
E. Absolutely Agree

Q14: I have the needs on mobile information searching when I need to obtain a particular knowledge  
A. Totally Disagree  
B. Disagree  
C. Not Sure  
D. Agree  
E. Absolutely Agree
2. This questionnaire is target to approach the participants who were voluntary participating in the diary study, it help the research to select some representative participants.

Department of Information School

Researcher: Yu Ye
Supervisor: Dr. Robert Villa
Tel: +4407429353229
E-mail: YYe4@sheffield.ac.uk

SIMPLE QUESTIONNAIRE
MOBILE PHONE USER BASIC INFORMATION SERVEY

Name of Respondent:

Trial No:

Q1: Age?
   A. 18-25
   B. 26-34
   C. 35-45
   D. Over 45

Q2: Gender?
   A. Male
   B. Female

Q3: Current Occupations
   A. Student
   B. Business Person
   C. Self employed professional
   D. Service personnel (Gov./Public officer)
   E. Others, please specify here ____________

Q4: What type of mobile phone do you use?
   A. iPhone (iOS) 3GS/4/4S
   B. Android mobile phones (e.g. HTC desire S/C, Samsung Galaxy S series)
   C. Blackberry
   D. Windows phone (WP 6.5/7.0/7.5)
E. Other Smartphones (please specify here) ________________

Q5: If the response to the above question is not “iPhone (iOS)” or “Blackberry” then what Maker & Model of the phone?

☐ HTC ☐ Samsung ☐ Motorola ☐ LG ☐ Nokia ☐ Sony Ericsson
☐ Lenovo ☐ OPPO ☐ MEIZU ☐ Other Maker, specify here________

Please specify detail model of your phone ________________ (e.g. HTC desire S)

Q6: What is your primary purpose for using Internet on your mobile phone the most?

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Most Frequent (over 5 times per day)</th>
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<tr>
<td>Use online application/services (e.g. GPS, chatting)</td>
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<tr>
<td>Other purposes 1.</td>
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<td>3.</td>
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</tbody>
</table>

Q7: What would you consider as the main advantage of accessing the Internet on mobile phone? (Several answers possible)

A. For leisure time or pass my time (e.g. when on transport or in queue)
B. Allowing me search information that I need urgently
C. It allows me access internet service anywhere (e.g. read/send E-mail, SNS etc)
D. Others, please specify here________________________

Q8: Would you consider search service as an important part of mobile phone?

A. Yes
B. No

Q9: If the response to the above question is “Yes” then what search engine or App is your favorite?

A. Google.com
B. Yahoo.com
C. Baidu.com
D. Bing.com
E. Others, please specify here _______________ if you use app for searching, please specify its name here (e.g. Google Map Service app; Online Google Calendar) _______________
3. The Information Sheet of The Research

PARTICIPANTS INFORMATION SHEET

Title of research project: Mobile Searching: The Search Patterns on Different Mobile Phones. A Comparative Study of User Searching Behaviour between iPhones and other Mobile Phones

Dear volunteers:

You are warmly invited to take part in this research project. It is important for you to understand the purpose of this research and what this study will involve before you accept to participate in this research as a volunteer. Please take some time to read following sections carefully.

Why am I doing this study?

Recent research shows that Mobile Searching activities have been increasing explosively over the last few years due to the development of mobile techniques. Variety of mobile devices provides more convince interface access to information comparative to traditional PC-based searching, especially in a mobile location context. Information providers recently pay more attention on offering better search service in this emerging market, in order to improving the user searching experience. Hence, it is important to understand mobile user information needs or interests.

There is no evidence that mobile users have different information needs or care more about a unique information category with their multiple mobile phones (different mobile OS). For example, young
people care about entertainment more than businessman, they may prefer that search engine can represent search results relate with entertainment at first result page.

The main purpose of this study is to investigate whether different mobile users exist different information preference between different smartphone users and the potential influence of gender and age on information preference. Furthermore, a diary study will be involved in this research, aiming to observe how users’ information needs emerging in different situations.

**Do I have to take part in the study? May I withdraw from the study?**

For the dairy study, firstly, your participation in this study is completely voluntary, and you can withdraw from the study at any time before the data is analysed without having to give me any personal reason for your decision. Just let me know when you make the decision.

Additionally, if you decide to withdraw from the study before the data is analysed, the data collected through your dairy records prior to withdraw will be analysed, in order to reduce the influence on the overall quality of data. However, if you unwilling to see your data to be published in this project, you need to tell me when you decide to withdraw. I promise your data will be destroyed at once.

**What are my responsibilities in this study if I take part?**

Participants will be recruited who use mobile search in their daily life. You will be asked to a diary over a two-week period by submitting descriptions of your mobile search activities from day to day. You can submit this information via MSN or send E-mail to me if you prefer. The detail information about diary study is described in the next section.

After the 12 days period diary study completed, you will be asked to participate in a short interview. It is estimated that this interview will take about 15-20 minutes to complete through a mobile or online chat tool. It will be organised at a time convenient for you prior to the interview.

**What type of information will be sought from me and why is the collection of this information relevant for achieving the research project’s objectives?**
As described above, during the diary study period, you will be asked to submit a description of your mobile search activities. The description should include Q1: what information did you want to find for each mobile search activity in this day? Q2: why did you want to find or what purpose for this mobile search activity? Q3: what context for searching or where did this search activity happens? (e.g. Location?) Q4: what searching tool you are using.

*Sample of description about searching:* I want to find information about how to cook spaghetti but I do not know what ingredients I need to buy or which sauce is the best, I did searching online via my phone (WP phone) with using the Google mobile search engine/Apps when I was in supermarket on this morning. Also, you can describe like this: how to cook spaghetti; what ingredients and sauce I need to buy; supermarket; Google mobile search engine/Apps. This is just a simple sample, please give description of your per searching activity in detail as possible. If you used a particular App for searching, please tell me its name.

For the interview, you will be asked some questions about your search experience and additional questions based on the mobile searching you did in diary study if necessary. Furthermore, the expectation of search service will be discussed.

The information collected from the follow up interviews will be analysed to clarify what type of information that user more care about and whether difference exists between different OS-based mobile phone users. Additionally, the collection of data with user’ exception will gives some suggestion to search service providers.

**Will I be paid for participation?**

Participants will not be compensated for participation in this study.

**Will the data about my records in this study be kept confidential?**

All records in this study will be treated as strictly confidential. Participant’ information will be labeled with a unique trial number with his/her basic information. All data collected from the dairy study and
responses from interviews about your personal information will be presented on an anonymous basis in this study. Under no circumstances will you to be identified in any other reports arising from this study. The study will not use your full name or disclosed to anyone unless you have agreed. All data will be destroyed after data analysis, both electronic and paper records.

What if I want to know more?
A copy of this information sheet will be given to every participant, and you will be given a copy of consent form with your signature. If you have any questions about this research, please feel free to ask me at any time.

If you prefer you can contact me at any time through E-mail or leave a phone message, I will call you back as soon as possible:

Telephone: +4407429353229         MSN: asterye@hotmail.com
E-mail: asterye@hotmail.com         QQ: 188990989

Thank you for taking time to read this information sheet and considering taking part in this research project.
University Research Ethics Application Form
for Undergraduate & Postgraduate-Taught Students

This form has been approved by the University Research Ethics Committee (UREC)

Complete this form if you are an undergraduate or a postgraduate-taught student who plans to undertake a research project which requires ethics approval via the University Ethics Review Procedure.

Your Supervisor decides if ethics approval is required and, if required, which ethics review procedure (e.g. University, NHS, Alternative) applies.

If the University’s procedure applies, your Supervisor decides if your proposed project should be classed as ‘low risk’ or potentially ‘high risk’.

*PLEASE NOTE THAT YOUR DEPARTMENT MAY USE A VARIATION OF THIS FORM: PLEASE CHECK WITH THE ETHICS ADMINISTRATOR IN YOUR DEPARTMENT*

This form should be accompanied, where appropriate, by all Information Sheets / Covering Letters / Written Scripts which you propose to use to inform the prospective participants about the proposed research, and/or by a Consent Form where you need to use one.

Further guidance on how to apply is at:
http://www.shef.ac.uk/ris/gov_ethics_grp/researchethics/approval-procedure/review-procedure

Guidance on the possible routes for obtaining ethics approval (i.e. on the University Ethics Review Procedure, the NHS procedure and the Social Care Research Ethics Committee, and the Alternative procedure) is at:
http://www.shef.ac.uk/ris/gov_ethics_grp/researchethics/approval-procedure/ethics-approval

Once you have completed this research ethics application form in full, and other documents where appropriate, check that your name, the title of your research project and the date is contained in the footer of each page.

If your Supervisor has classed the project as ‘low risk’:
- Email this form, together with other documents where applicable, to your Supervisor; and
- Sign and date Annex 1 of this form and provide a paper copy to your Supervisor.

Important Note for Supervisors:
Following the ethics review the Supervisor must provide the academic department’s Ethics Administrator with a copy of the ‘low risk’ research ethics application that s/he reviewed and with a copy of the ethics decision that s/he took in relation to it. The Ethics Administrator reserves the right to consult the Chair of the academic department’s Ethics Review Panel (or equivalent) if s/he has concerns that projects classed as low risk should in fact have been classed as potentially high risk.

If your Supervisor has classed the project as potentially ‘high risk’:
- Email this form, together with other documents where applicable, to your department’s Ethics Administrator; and
- Ask your Supervisor to sign and date Annex 2 of this form and provide a paper copy of it to your department’s Ethics Administrator.

Ethics Administrators are listed at:
http://www.shef.ac.uk/ris/gov_ethics_grp/researchethics/approval-procedure/review-procedure/3.1-3.1.2.html
University Research Ethics Application Form
for Undergraduate & Postgraduate-Taught Students

I confirm that I have read the current version of the University of Sheffield ‘Ethics Policy Governing Research Involving Human Participants, Personal Data and Human Tissue’, as shown on the University's research ethics website at:  http://www.shef.ac.uk/ris/gov_ethics_grp/researchethics/index.html

A1. **Title of research project:** Mobile Searching: The Search Patterns on Different Mobile Phones. A Comparative Study of User Searching Behaviour between iPhones and other Mobile Phones

A2. **Name of Student:** Yu YE
   Department:  Information School at University of Sheffield
   Email: YYe4@shefied.ac.uk  Tel.: +4407429353229

   **Name of Supervisor:** Dr. Robert Villa

A3. **Proposed Project Duration:** Three-weeks (including 12-days period diary study)
   Start date: July 23th  End date: August 12th

A4. **Mark ‘X’ in one or more of the following boxes if your research:**

   - involves no access to identifiable personal data and no direct contact with participants
   - involves adults with mental incapacity or mental illness
   - involves prisoners or others in custodial care (e.g. young offenders)
   - involves children or young people aged under 18 years
   - involves using samples of human biological material collected before for another purpose
   - involves taking new samples of human biological material (e.g. blood, tissue) *
   - involves testing a medicinal product *
   - involves taking new samples of human biological material (e.g. blood, tissue) *
   - involves additional radiation above that required for clinical care *
   - involves investigating a medical device *

* If you have marked boxes marked * then you also need to obtain confirmation that appropriate University insurance is in place. To do this email insurance@shef.ac.uk and request a copy of the ‘Clinical Trial Insurance Application Form’.

It is recommended that you familiarise yourself with the University’s Ethics Policy Governing Research Involving Human Participants, Personal Data and Human Tissue before completing the following questions. Please note that if you provide sufficient information about the research (what you intend to do, how it will be carried out and how you intend to minimise any risks), this will help the ethics reviewers to make an informed judgement quickly without having to ask for further details.
A5. Briefly summarise:

i. The project's aims and objectives:
   (this must be in language comprehensible to a lay person)

   This study is aiming to understand different search patterns across multiple mobile phones. A comparative analysis between iPhone and other mobile phones will be involved.

   Firstly, the research is to investigate different information preference between different smartphone users, and the impact of gender and age on information preference.

   Secondly, a diary study will be implemented to investigate how users' information needs emerging.

ii. The project's methodology:
   (this must be in language comprehensible to a lay person)

   This study will combine the questionnaire survey and diary study.

   The questionnaire will be conducted online, and will be distributed through various social networking websites.

   The diary study covers 12 days; all participants will be asked to submit detailed descriptions of their mobile searching activities per day. They can submit this information through MSN or send message if they prefer.

   The semi-structure interview at the end of the diary study will aim to realize user mobile search patterns in detail with some additional questions based on the diary entries.

A6. What is the potential for physical and/or psychological harm / distress to participants?

   All participants who are participating in the diary study are entirely voluntary, and anyone can withdraw from the study at any time before data is analysed without having to give any reason.

   Additionally, if participant decides to withdraw, the data collected through dairy records prior to withdraw will be analysed, in order to reduce the influence on the overall quality of data. However, if participant unwilling to see his/her data to be published in this project, I promise them that his/her data will be destroyed at once when he/she decides to withdraw.

   The diary study will use web-based chat tool to collect data and use anonymous basis with special naming (every participant will be labelled with a trial number), in order to reducing potential psychological harm.

A7. Does your research raise any issues of personal safety for you or other researchers involved in the project? (Especially if taking place outside working hours or off University premises)
If yes, explain how these issues will be managed.

A8. How will the potential participants in the project be:

i. Identified?

Firstly, all participants in this study are completely voluntary. Secondly, participants contain two main different groups of mobile users, iPhone users and other mobile phones users. Thirdly, participants cover different professions with different ages, and everyone has mobile search experience in their daily life.

ii. Approached?

For the questionnaire survey, the participants are approached by E-mail and social networking websites, the researcher will publish the links of the questionnaire online, in order to approach a large amount of different smartphone users.

For the diary study, all participants are approached by E-mail. The email will be sent to all potential participants with simple description of this project and gives some conditions that participant need to posses (e.g. has mobile search experience). The objective of this research and the reason that I do this research will be described in the E-mail.

iii. Recruited?

If someone replies to me that he/she is interested and he/she meet the requirement, I will tell him/her about this study in detail. Also, participants will be given detail information with information sheet before they accepted to participation.

A9. Will informed consent be obtained from the participants?

YES ☑️ NO □

If informed consent or consent is NOT to be obtained please explain why.
Further guidance is at:
http://www.shef.ac.uk/ris/gov_ethics_grp/researchethics/policy-notes/consent

A9.1. This question is only applicable if you are planning to obtain informed consent: How do you plan to obtain informed consent? (i.e. the proposed process?):

As mentioned above, every participant will be told in detail about this study with information sheet, and answer everyone’s questions if someone confused on some aspects of this study. Participants will be told they are free to withdraw from this study at any time and their personal data will be kept confidential. Any potential information refer to personal information will be presented in an anonymous way.
A10. What measures will be put in place to ensure confidentiality of personal data, where appropriate?

As mentioned above, using diary study will be in an anonymous way. Every participant’s information will be labeled/identified with a unique trial number against with his/her basic information. All personal data collected in this study will be kept as strictly confidential. All information that participants submit in diary study will be securely stored, in both electronic format and paper records, and will be destroyed after data analysed.

A11. Will financial / in kind payments (other than reasonable expenses and compensation for time) be offered to participants? (Indicate how much and on what basis this has been decided)

All participants in this study will not be compensated for taking part in diary study and interview.

A12. Will the research involve the production of recorded media such as audio and/or video recordings?

YES □   NO ☑

A12.1. This question is only applicable if you are planning to produce recorded media: How will you ensure that there is a clear agreement with participants as to how these recorded media may be stored, used and (if appropriate) destroyed?

Guidance on a range of ethical issues, including safety and well-being, consent and anonymity, confidentiality and data protection’ are available at: 
http://www.shef.ac.uk/ris/gov_ethics_grp/researchethics/policy-notes
For Undergraduate & Postgraduate-Taught Students

Student Declaration

(The student completes Annex 1 if the Supervisor has classed the student’s proposed research project as ‘low risk’)

The Supervisor needs to receive an electronic copy of the form, and other documents where appropriate, plus a signed, dated paper copy of this Annex 1 ‘the Student Declaration’.

Full Research Project Title: Mobile Searching: The Search Patterns on Different Mobile Phones. A Comparative Study of User Searching Behaviour between iPhones and other Mobile Phones

In signing this Student Declaration I am confirming that:

- The research ethics application form for the above-named project is accurate to the best of my knowledge and belief.
- The above-named project will abide by the University’s ‘Good Research Practice Standards’: [http://www.shef.ac.uk/ris/gov_ethics_grp/grpstandards.html](http://www.shef.ac.uk/ris/gov_ethics_grp/grpstandards.html)
- The above-named project will abide by the University’s ‘Ethics Policy Governing Research Involving Human Participants, Personal Data and Human Tissue’: [http://www.shef.ac.uk/ris/gov_ethics_grp/researchethics/index.html](http://www.shef.ac.uk/ris/gov_ethics_grp/researchethics/index.html)
- Subject to the above-named project being ethically approved I undertake to adhere to any ethics conditions that may be set.
- I will inform my Supervisor of significant changes to the above-named project that have ethical consequences.
- I will inform my Supervisor if prospective participants make a complaint about the above-named project.
- I understand that personal data about me as a researcher on the research ethics application form will be held by those involved in the ethics review process (e.g. my Supervisor and the Ethics Administrator) and that this will be managed according to Data Protection Act principles.
- I understand that this project cannot be submitted for ethics approval in more than one department, and that if I wish to appeal against the decision made, this must be done through the original department.

Name of Supervisor: Robert Villa

Name of student: Yu YE

Signature of student: Yu YE

Date: 20/07/2012
For Undergraduate & Postgraduate-Taught Students

**Supervisor Declaration**

(The Supervisor completes Annex 2 if s/he has classed the student’s proposed research project as potentially ‘high risk’)

The Ethics Administrator needs to receive an electronic copy of the form, and other documents where appropriate, plus a signed, dated paper copy of this Annex 2 ‘the Supervisor Declaration’.

**Full Research Project Title:** insert name

**In signing this Supervisor Declaration I am confirming that:**

- The research ethics application form for the above-named project is accurate to the best of my knowledge and belief.
- The above-named project will abide by the University’s ‘Good Research Practice Standards’: [http://www.shef.ac.uk/ris/gov_ethics_grp/grpstandards.html](http://www.shef.ac.uk/ris/gov_ethics_grp/grpstandards.html)
- The above-named project will abide by the University’s ‘Ethics Policy for Research Involving Human Participants, Data and Tissue’: [http://www.shef.ac.uk/ris/gov_ethics_grp/researchethics/index.html](http://www.shef.ac.uk/ris/gov_ethics_grp/researchethics/index.html)
- Subject to the above-named project being ethically approved I will undertake to ensure that the student adheres to any ethics conditions that may be set.
- The student or the Supervisor will undertake to inform the Ethics Administrator of significant changes to the above-named project that have ethical consequences.
- The student or the Supervisor will undertake to inform the Ethics Administrator if prospective participants make a complaint about the above-named project.
- I understand that personal data about the student and/or myself on the research ethics application form will be held by those involved in the ethics review process (e.g. the Ethics Administrator and/or reviewers) and that this will be managed according to Data Protection Act principles.
- I understand that this project cannot be submitted for ethics approval in more than one department, and that if I and/or the student wish to appeal against the decision made, this must be done through the original department.

**Name of Supervisor:** insert name

**Name of student:** insert name

**Signature of Supervisor:** sign here

**Date:** insert date