The Need for Technology to Support Creative Information Sharing Whilst Mobile: Identified Activities and Relationship Groups

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Abstract. Social computing technologies are becoming increasingly popular as it allows people to create and share their own content. Given that most social computing technologies are limited to fixed environments, this paper outlines an exploratory study which investigates the characteristics of people's creative information sharing process; identifying user needs and difficult scenarios during the process, focusing particularly on mobile scenarios. The results give an indication about people's potential needs to create and share whilst mobile. It describes the characteristics of creative information sharing process and suggests that supporting the process of information sharing by harnessing context-aware elements could be a potential solution.

Keywords: social computing, mobile environment, context-awareness.

1 Introduction

Social computing, as one of the growing fields of HCI, aims to support people's social interaction, knowledge sharing, and collaboration in multi-user environments ranging from working in small groups to participating in virtual communities and forums. Social computing technologies (e.g. Blogs, Wikis) are moving from niche to mass market and becoming increasingly important in people's lives by enabling individuals to increasingly take cues from one another rather than from institutional sources such as corporations, and media outlets [3].

Mobile devices have traditionally been used for communicating, and more recently, accessing information. The recent wave of innovations including increased connectivity (e.g. Bluetooth, WIFI, etc), processing power, storage space and enhanced multimedia capabilities, is supporting an increased social interaction (e.g. create and share) based on mobile computing. One trend, discussed by both the academic and popular press, is that people are starting to create and share their own content using mobile facilities although at the moment this is limited to basic content, such as photos [4], [5], [6]. A recent press article [12] on the dismal uptake of 3G multimedia revealed that the network companies have failed to persuade the consumer to buy premium content so far. Consumers' genuine demands were strongly stated in the

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report as easily creating and sharing their own content, which reflects the basic human need for self-actualization [11]. This trend is also compatible with Shneiderman's view that "following *information* technology and *communications* technology, is *innovative* technology" that supports creativity and dissemination within the community [14]. To assist in the development of technology innovation, he separates creative information sharing process into four stages: *collect* (e.g. read), *relate* (e.g. ask questions), c*reate* (e.g. write), *donate* (e.g. advise).

However, further research is needed to determine how technologies can help improve user experience of social interaction, knowledge sharing and collaboration whilst mobile as well as in a fixed environment.

The aim of the research in this paper is to capture and analyse the characteristics of the creative information sharing process, and also to identify user needs and difficulty scenarios during the process, focusing particularly on real life mobile scenarios. The objectives of the research were:

- to understand the characteristics of people's current creative information sharing processes when mobile, and with whom they need to share;
- to identify requirements/difficulties in the creative process;
- to identify the contexts in which the needs arose.

2 Method

A field study approach is the most appropriate for identifying needs whilst mobile because it enables the research to be carried out in 'the real world', rather than a laboratory setting, to match the target environment of mobile use. Moreover, it enables a better understanding of 'context' which is critical to mobile applications [7]. Therefore, an exploratory field study approach was adopted to identify requirements of creative information sharing process whilst in a mobile environment (two terms used to describe people's environment are 'fixed' and 'mobile'. 'Fixed' is defined as people working on a fixed PC with a relatively stable context, whereas 'Mobile' is defined as all other scenarios).

The study adopted a three phase approach incorporating the following techniques:

1. Shadowing;
2. Diary Studies;
3. Semi-interview.

Shadowing enabled rich context data to be gathered and was not reliant on participant recall. However, one potential limitation of shadowing is that the amount of time spent shadowing only represents a small proportion of participants' time. Another potential problem is that participants may mask their normal behavior. These limitations were overcome by extending the period using other two techniques and by there being no pressure placed on the participant to produce a certain amount of 'data'. *Diary Studies* were used to cover a longer period of time to capture a wider range of needs. *Semi-interviews* were used to validate the experiments interpretation of the collected data and to further explore problems and solutions.

2.1 Participants

The sample chosen was based on a high need to create and share content and potential for use of mobile devices. Young adults have been identified as the primary mobile user group with a focus on maintaining their social group by Nokia's business to consumer market summary [8]. Married, professional parents with lack of time were identified as having a very tight schedule and strong information needs. They are also proved to be heavy mobile users [2], [10].

Due to the exploratory nature and resource-heavy methods, a small group of 10 participants (two groups) were involved. They were: 'Young adults', aged 18-30, unmarried, with no dependants, working or studying full-time; 'Working parents', aged 31-45, married and with dependants, working part-time.

2.2 Procedure

All the studies were carried out within a town in Central England (population 60,000) between July and August, 2006. To gather rich data and avoid the limitations of each method if used singly, for every participant a three phase approach was applied. Before the trial, a participant information sheet was given out which explained the process of the study and stated that the information required in this study was details about obtaining information from people and sharing information with people. Moreover, each participant was asked to draw a social communication map [1] to show all the people with whom that person had regular social contact and described the related information, e.g. how the group interacts what image & role the participant has in the group, issues of privacy& trust,. The preparation before the trial was mainly to help the participant understand the trial and to help the experimenter to plan the following steps (e.g. choosing the time period for shadowing).

Shadowing. Each participant was asked to choose a period of 2-3 hours which would represent a typical time period when performing several tasks and being very mobile. For the working parents group, this tended to be a period focused around school drop-off and pick-up time, with the latter often involving follow-on activities (e.g. swimming lessons). For the young adults, this tended to be leisure/hobby periods (e.g. shopping trip, meeting friends).

Diary Study. Following the shadowing period, each participant was asked to record the activities for the rest of a 24 hour period in a diary book. S/he was asked to record the content and context data (see Table 1) each time s/he has an impulse to search and/or share information.

Semi-structured Interview. Each participant was asked to validate the shadowing data and diary data interpreted by the experimenter and also to provide extra information about difficulties with the creative information process and potential solutions.

3 Results

The data collected from both groups on the shadowing, diary studies, and the semi-structured interviews were combined in a database. All data where participants were

actively using a fixed device with information and communication capabilities (e.g. working at a PC) were eliminated from the analysis. As a result, there were 165 qualified instances of creative information sharing needs (e.g. a pedestrian whilst using a dangerous crossing will have the need to report the crossing to the local authority as well as warn other road users) gathered in the study and each of them was described according to 4 main sections of attributes listed in Table 1.

Shneiderman's framework on creative information sharing process was used to help analyse the data [14]. According to the framework, each activity was classified into four stages. For example, in the purchase of a car, the first stage is to *collect* information (e.g. read brochures); the second is to *relate* communication (e.g. ask questions from trusted parties); the third is to *create* an idea (e.g. a decision about which car to purchase) and, finally, to *donate* or disseminate (e.g. share feedback with the community). Apart from the activity classification, the framework also classifies human relationships into four growing circles: *self* (e.g. person him/herself), *intimate* (family & friend), *regular encounters* (e.g. neighbors) and *citizen & market* (e.g. ebay participants) according to size difference and the degree of interdependence, shared knowledge, and trust.

Table 1. Description of Recorded Data

Sections	Attributes
Activity-Relationship (section 3.1)	Activity description; Activity classification Relationship classification
Current ability to achieve Needs (section 3.2)	Level of difficulty (e.g. easy, hard, or impossible); Reason for difficulty; Consequence (e.g. damage, frustration, annoying, or no consequence)
Content (section 3.3)	What type of information do people share?
Context data (section 3.4)	Data collection phase; Date; Time; Location; Current task; Triggers (what caused the need to occur)

3.1 Activity-Relationship Data

This data was collected to capture the details of activity & relationships-- who does what, with whom. Two properties (i.e. activities and relationships) were combined to build an Activity-Relationship Table (see Table 2). Also, for each creative information sharing need, participants were asked to rate how hard it was to accomplish the activity. A three point difficulty scale was used: *impossible*, *hard*, and *easy*. To avoid bias, the framework (i.e. classification of activities and relationship) was validated by three other experienced human factor researchers and a consensus was reached.

The total number of creative information sharing needs which were identified in the study is listed in each cell. For example, the first cell shows there are 9 needs gathered in the study. It is a result of the human relationship category = 'Self' e.g. himself/herself and the activity stage = 'Collect' e.g. internet searching, in sum, 9 instances of someone collecting information him/herself (e.g. search information online).

Table 2. Combined Activity- Relationship Table

	Collect	Relate	Create	Donate	Total
Self	9	0	**29** [1]	0	38
Close Intimates	10	**31**	6	6 [2]	53
Regular Encounter	10	**25**	13	13	61
Citizen & Market	13	3	18	18	52
Total [3]	42	59	66	37	

1 Bold represents a figure which is greater than 20 (which is double the value of the average participant);
2 A shaded cell represents where more than three quarters of participants expressed difficulty;
3 These figures may add up to more than 165 because some of the data could be classified into more than one category.

The most frequently stated needs were:

- Relate-Close intimate (31 instances), e.g. "I need to call my sister to ask my nephew's top size. Tomorrow is his birthday. I still haven't got anything for him yet". (Female, 25)
- Relate-Regular encounters (25 instances), e.g. "I cannot believe I forgot it again! I need to ask Jane (neighbor) if she can take care of the cat when I am on holiday next week". (Female, 43)
- Create-Self (29 instances), e.g. "I have to remember to buy envelope on my way home". (Male, 37)
- The difficult scenarios were mainly with create and donate information:
- Donate-Close intimates, e.g. "I would like to tell all my friends who love exercises, especially Tom, the gym on campus is absolutely great .The program I got worked really well on me! Look…but I always forget when I meet him". (Male, 25)
- Create&Donate-Regular encounters, e.g. "Sharing the idea- really I wanted to share my thoughts with all other parents in school about the new coming school events. It would be very nice to know other parents' opinion. Maybe we can even make some constructive suggestions together. But our communication relies on random chatting…" (Female, 42)
- Create&Donate-Citizen&market, e.g. "The health & safety problem around this area is getting worse. People who go past should really pay more attention. How to let them know? Maybe put a big sign here…" (Female, 43)
- Collect-Citizen&market, e.g. "What do I need to know about road regulations in France? I really have no time to read the whole document". (Female, 43)

In this study, as rated by participants, *create* and *donate* information are identified to be a lot more difficult than the first two stages of activities. It suggests that the first two types of needs are supported well by current information technology (e.g. Internet, phone communication). The next section describes in more detail the difficult scenarios as identified by the shaded areas in Table 2 as the participants rated these information sharing needs to be more difficult to achieve.

3.2 Current Ability to Achieve Needs

In order to analyse the qualitative data obtained from the descriptions given by the participants in the level of difficulty it takes to accomplish an individual information sharing need the 2x2 Thinking approach was adopted. Lowy *et al.* defines this as 'a thoughtful analysis of the nature of the conflict between the X and Y axes in a 2x2 matrix, as well an explanation of how changing the context of the problem space helps to iterate the issues to the point where new and more powerful solutions emerge [9].' This approach was used to analyse the difficult scenarios related to the shaded areas in Table 2 above.

Table 3 adopts this approach. The 'X' axis refers to the 'difficulty level' (impossible, hard, easy). For this axis the rating anchors 'impossible' and 'hard' were redefined as 'High Difficulty' and 'easy' as 'Low Difficulty'. The 'Y' axis refers to the 'consequence descriptors' (damage, frustration, annoyance, no consequence). Here 'damage' and 'frustration' were grouped into 'Major consequence and 'annoyance' and 'no consequence' were grouped into 'Minor consequence'. This group of data was very informative and plays an important role in identifying the difficult scenarios together with the Activity-Relationship data. More details are displayed in the table below:

Table 3. Difficulty vs. Consequence

	Low Difficulty	**High Difficulty**
Minor consequence	- Self-reminder; - Relate to Intimates;	- Self-reminder; - Create(organize event) for Regular; - Share recommendations to Citizen;
Major consequence	- Relate with Regular; - Relate with Intimates;	- Share experience with Citizen; - Relate with Intimate; - Self reminder.

3.3 Content

Overall, the *Content* that people share mainly included plans (e.g. event plans), experiences (e.g. holiday experience), and recommendations. More details are shown in Fig. 1.

3.4 Context Data

In this section, context data is made up of 3 subsections – location, task and trigger.

By analysing the *Location* data (see Fig 2), 'Home' and 'Car' were two locations where the activities occurred most frequently.

For the *Current Task* (see Fig 3), 'Moving around' and 'relaxing' were identified as being the most commonly performed task by both groups. 'Moving around' includes driving and walking; 'relaxing' includes shopping, having a shower, watching TV, eating, doing exercises, etc.

Trigger (see Fig 4), which is important to describe the situation, has 9 different options that represent different influencing contexts. The most common were 'current task', 'what does the participant see/hear', 'relevant history'.

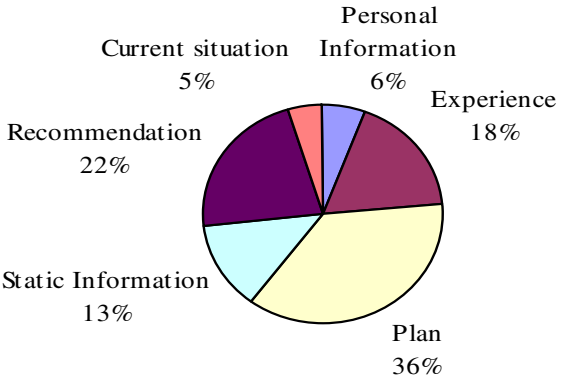

Fig. 1. The type of content shared

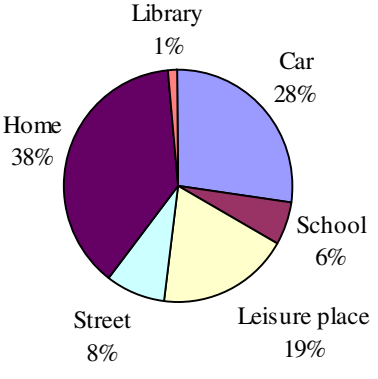

Fig. 2. The location where the need occurred

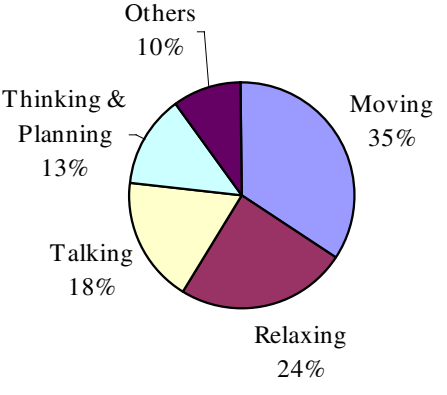

Fig. 3. The current task when the need occurred

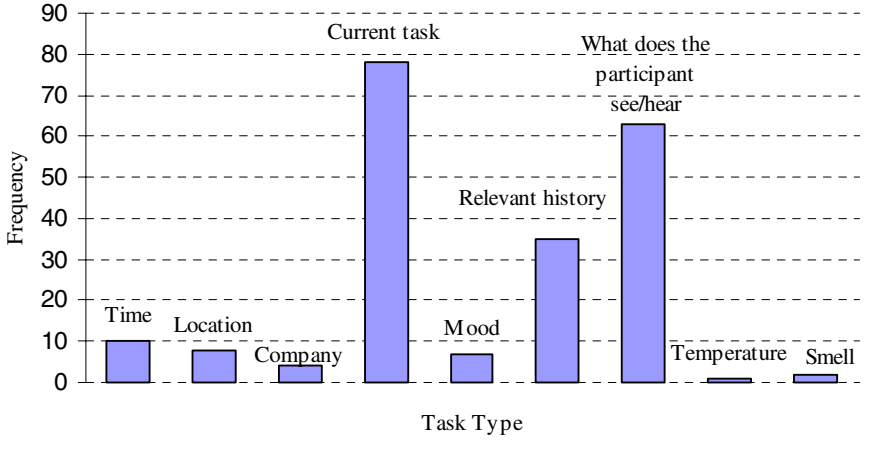

Fig. 4. The 'trigger' for the need

4 Discussion

The research findings are discussed in relation to the four circles of relationship to help clarify the problems and difficulties. Each section also describes the findings in relation to the four stages of activity defined by Schneiderman [14].

Self. Within this relationship level, people's creation mainly concerns self-reminders. The problem with forgetting things was highlighted as high difficulty with possible major consequence for people who have a heavy work load. The study showed that the time when participants think about the potential tasks wasn't the time when they actually were able to do them. Trying to remember and be triggered to perform the task caused heavy memory load and stress for people. The study suggests that reminders could be harnessed by context-based triggers.

Trigger, as the important factor for reminder, has proved to be slightly different from previous research. Rather than identifying location as the common trigger [13], 'task', 'history', and 'What they see at that moment' proved to be the most regularly identified triggers.

The Close Intimates. Within this level, people have been identified as having needs to relate communication with family and friends. However, lacking the knowledge of their availability is still an unsolved problem that has been identified in the study. Also, the need to create and share within this group is very common. The main information shared is experiences and knowledge which is characteristically context-triggered (e.g. current task) and generally succinct. It is probably because this group has much shared knowledge and a high level of trust. Also, more details could be further shared through other approaches, such as, face-to-face or phone communication. Within this level, a common problem is sharing rather than creating: the content is succinct and creation could be achieved using current multimedia capture abilities of the mobile facilities. The main problem in the creative information sharing process is that the person receiving the information does not currently have this information 'filtered' for them on the basis of context.

The Regular Encounters. This group is the group that remains in most frequent contact. Compared to the intimate group, the communication is generally a daily connection, and therefore was called 'the basic connection that needs to be maintained' by the participants. The current communication mainly relies on random face-to-face moments (e-mail & phone calls were also an option available to some groups, such as among colleagues), which creates inefficient contact within the certain types of group.

Problematic scenarios within these groups were identified mainly as creating, i.e. planning an event or organising a social event (e.g. resident meeting planning, school events arrangement, children's activity planning). More specifically, group-awareness (e.g. be aware of members' backgrounds) and trust building (e.g. personal information exchanging, such as calendar between group members who are involved with certain event) are two potential barriers to information sharing.

Sharing is also problematic as people within this group tend to only have a basic connection because of the low level of interdependence and trust, i.e.: they tend not to

exchange email addresses and contact numbers within the group. Also, this group contains larger numbers of people (i.e. 50-5000 people) than the Intimates group, which makes the logistics of communication even harder.

The Citizen & Market. The results show a high level of demand but potential problems for collection, creation and donation within this group.

The main content sharing within this group is experience and reviews (e.g. about services, products, holiday). For collecting, the main problems they met were 'too much unrelated information' and getting information that 'fits into my situation/background'. For creating, the problems focused on a lack of ways to create more detailed information when on the move. For sharing, rather than sharing reviews with anybody, people usually have a specific condition regarding who s/he wants to share with. It includes: 1) People who need the information to make corresponding changes (e.g. city council, complaint manager of leisure centre); 2) People who share a similar background (e.g. share the review about one type of skincare product with others who have the similar type of skin). Also, for an individual, these groups are likely to be fluid and change over time.

Therefore, an extra relationship layer, *Potential Community*, was separated from the Citizen and Market circle. It could be used in future studies to point towards groups of people who share some links but don't currently know each other, e.g. have the similar skin texture, park in the same car park, share the same interests or reviews about the certain product / service.

5 Conclusions

This exploratory study gives an indication that people do have needs to create and share a range of content whilst mobile and supports Shneiderman's prediction that future technologies should be used to support people's desire to create and share information with others. Moreover, it describes the scenarios in which these activities may occur and the current difficulties in the creative information sharing process. It describes the content of shared inforamtion when people are mobile as mainly plan/experience/recommendations. Creative information sharing needs are usually context-triggered (e.g. current task, what does the participant see, relevant history), instant and succinct. For longer, more detailed sharing, a fixed environment is required.

The study indicates that creating (i.e. capturing) experiences is now a lot easier with the development of mobile technologies, but the process of sharing is still problematic. It suggests that supporting the process of information sharing by harnessing context elements could be a potential solution. Further research will be conducted to fully understand this scenario for a larger sample and propose mobile HCI solutions to support these aspects of the creative information sharing process and to find out how to harness the possibilities of the mobile context together with the fixed environment to support people's creative information sharing process.

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