Using laddering and association techniques to develop a user-friendly mobile (city) application

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Abstract. In this paper, we present an ongoing project on the concept of interaction among people via a mobile (city) application. The focus of our research lies on its usability and sociability, i.e., on all aspects that are related to community forming and development in a city context. In order to analyze them, we have developed a method that combines two techniques that are not common in usability studies: the association technique and the laddering method. We have called this combination the ‘connotation chain’ technique. In this paper, we will first introduce this technique showing its advantages and disadvantages in a usability study. Then, we will present the results of applying this technique to our specific objective and, finally, we will discuss its implications for the further development of the interface of this application.

Keywords: Mobile communication within a city context, Communities, Association technique, Laddering and User-centered design.

1 Introduction

People interact with each other and some of them do so by sharing or exchanging information. Mobile applications make it possible to do this whenever and wherever people want while they are wandering around in a city [6]. The kind of information they interchange and the ways people communicate in a city context depends, in general, on the intimacy of the contact they are interacting with, but more specifically, on the contingent status of both the sender and the receiver: where they are located, what they are doing, what and how much they want to disclose about themselves to the other. In this setting, not only communication but also information retrieval is important: users indeed need to be able to find information about the city, about the events taking place in the city. It is precisely the aim of the A4MC³ (Architecture for Mobile Community Creation Content) project to explore the possibilities of community building using state of the art technology, like, i.e., mobile terminals, wireless networks, multimedia and metadata technology, to create a new user-friendly experience.

In this paper, we refer to this but only focus on the research aspects related to the usability (in a wide sense) and sociability of the application to ensure that users can easily add metadata, communicate with other members within the community (who share the same interests) and navigate through its 3D interface. During this project, a

series of demonstrators of this (social mobile) application will be developed and evaluated through an iterative process. The basic principle of user-centered design is that end-users evaluate whether a product is user friendly. We use a combination of two existing techniques - that are quite unusual in this research field - to get to this conclusion.

The paper is structured as follows: Section 2 presents a brief overview about the state-of-the-art in social mobile technology and introduces the topic of community building based on sociability. Section 3 illustrates the methodology that was developed and defines the experimental set-up. Section 4 discusses the results of this study, while Section 5 analyses user values related to the interface. Finally, in Section 6, we draw some conclusions.

2 The concept of ‘sociability’ in a city environment

The technology available today allows to realize a wealth of services for mobile people. Such services may be very diverse in nature: they may support mobility as such, e.g., by supplying information about transportation or other practical facilities needed by traveling or commuting people, but they may also supply additional services in the form of any sort of information that may be needed while moving, like for instance, shopping facilities, tourism advice, cultural content [4]. It is precisely the combination of these two components (i.e., practical transportation information together with additional move-related services) in the specific context of a mobile city setting that is further investigated in the framework of the project A4MC³. In this sense, the final system will have many of the features of a mobile guide [2] where, by means of information retrieval techniques, users can find information about the city, or about events taking place in the city.

Because this application encourages the establishment of social relationships, we have to get a good idea of what sociability is. People want to be part of a group of peers whom they respect and like, whose values they share. Their social relationships speak to who they are, say that they are social (human) beings whose existence is not complete unless they care for others, and are in turn cared for by them [5], [7].

From this social perspective, the project identifies four different user categories based on their typology and related goals (see [2] for details). They are: advertisers, professional content providers (like journalists), moderators and end users (i.e., somebody on the street who is using a digital camera, a personal digital assistant or a smart phone). This last group is rather heterogeneous and can be further subdivided into four subcategories with different, although sometimes overlapping goals: (1) the inhabitants of a city, (2) shoppers, (3) tourists, and (4) people who work in the city. After a preliminary analysis, it was decided to study further the city inhabitants, since they seem to be more appropriate for the focus of the current research because they present more social contacts in a city setting than the other subcategories.

A special technique was developed to analyze the needs of this user category. This is presented in the following sections, together with the results of the preliminary evaluation of the interface for a mobile city application.

3 Experimental setting

3.1 Methodology

In this section, we introduce the ‘connotation chain’-technique showing its advantages and disadvantages in a usability study. This is a novel usability methodology that we have derived by combining two existing methods that are not used often in usability research (see further). But before we do this, both techniques will be briefly reviewed.

(1) *The association technique*. By using this method we are looking for the connections that users see between the developed interface and the context in which this application will be used. It is very important to investigate if the functions and relations that are identified by the developers are the same as those that the users have in mind. This qualitative research method is a projective technique to get accurate information about the thoughts and feelings of the respondents. Indirect questions are used to get some answers [3]. Within the usability domain, this is an interesting technique because we can get an idea of the mental model of the users for whom we are developing a certain product. That is why it is very important to check carefully if our interpretations and the relations we see are similar to the one seen by the users of this application.

(2) *The laddering method or ‘means-end’ approach*. For many products (and the mobile city application we are developing is an example of that), it is not enough to evaluate usability only in the narrow sense of the word, namely to look at how easily it is to use it. It is also important that end users like to use it too. The likeability aspect of a product can be investigated through the laddering method. By looking for the ‘attributes’ (A) of a product or service and their ‘effects’ or consequences (C), we try to reveal its expected ‘values’ (V), its deeper meanings for the users. By asking what characteristics are preferred, what is important for that application or why users (dis)like that certain aspect, a ladder (formed by a list of connected items) is build. ‘Why’ and ‘what’ questions are being asked by the reviewer until s/he has found the users’ personal values(s) [3], [8]. This is why the laddering method was originally used in marketing research, where the ‘sell ability’ of a product stands central. In the field of Human-Computer Interaction (HCI) it is less used (see however an example of it in [10]), although it is still very useful to explore what the user prefers, which deeper goals are being solved by using a particular application, what the emotional aspects of the user experience are and the way users perceive it, as in [9]. There are however some drawbacks related to this method. It is possible that the interviewer leads the respondent during the laddering interviews and causes him/her to give wrong connotations. Laddering can also become quite annoying for the respondent, when this method is strictly implemented, because the issues that are questioned can be too personal for a respondent or s/he might not know why that particular attribute or consequence is important for him or her. These ‘problems’ can be solved often by reformulating the question or ask what s/he would feel when that certain aspect would be missing for this application. Respondents will look then for non-existing relationships between the attitudes and values [3], [8]. In our research, we experienced that we better start with ‘why’-questions at the beginning of the interview and specify them into a ‘what’-question later, if we feel a respondent is getting it hard

to keep finding an answer, when we ask questions to reveal the underlying feelings. This is in line with results formulated by other researchers (see, for instance, in [9] and [10]).

The combination of these two methods gives us a unique and more complete idea of what users want/expect and what they find usable for that particular product. The first method, i.e., the association technique, focuses more on the usability aspects of the application which are evoked by the user's feelings and mostly elicited by graphical material. The laddering method, instead, investigates the likeability of that same application in a verbal way, i.e., by asking questions, waiting for answers. By combining these techniques, complementary aspects related to the users and their attitudes can become evident. Moreover, because of the different reasoning and learning styles they impinge upon, the whole spectrum of cognitive profiling can be addressed.

3.2 Experimental Setup

The needs of the users identified in Section 2 were translated into a conceptual model (Figure 1). This model already gives a first indication of how the system should look like and what its functionalities, which form the attributes (A) of the ladder, should be.

Fig. 1. The 3 major functions of this mobile application based on the user and task analysis.

With these indications in mind, a paper prototype of the interface was built for the usability tests. The aim of these tests is twofold: 1) to check if all major functions are available (on the first screen after users have logged in), if all symbols are recognizable, if they are placed logically and if the relationship between the functions is clear; 2) to explore what the users want to accomplish by using this mobile device,

which functions they will use mostly, which not and what is missing according to them in its current form to accomplish their goals.

The left Figure 2, which is a direct translation of the conceptual model (see Figure 1) into the first screen of the user interface, was being used during these interviews.

In the first part (where we looked for associations), we asked the ten respondents - which were all inhabitants of a big Flemish city and heterogeneously chosen in terms of gender, age, familiarity with technology and professional background - separately to give word associations to our graphical icons and group them according to what they place together. Then, we asked what they prefer: only textual or graphical labels or a combination of both and this for the first level of functions and some sublevels. In the last part of this test, we asked them to explain what they expect to see when they press a certain button, what they think will happen and what they associate with a mobile city application.

In the second part, we tried to develop a ladder based on the associations users translated out of the attributes of the product through the different questions.

Fig. 2. Overview of high-level tasks for the application (on the left: tested version (1, 2 and 3); on the right: after testing (1', 2' and 3'))

4 Preliminary results

The data, which are presented below, are derived from the analysis of the interviews. Because of the limited space, we will especially focus on the consequences for the interface, which are related to:

- (1) *The contact function*: In its current state, the four icons look a bit like chat buttons for some respondents, because of the graphical similarity with MSN Messenger (which is very popular in our country). This wrong connotation can easily be solved by changing 'the MSN-icon' (in the left figure) with a much more common drawing of a unisex person. Because the chosen icons for 'call', 'voicemail' and 'message' are standard, all respondents understand their meaning.
- (2) *The options navigate & share (~ interact)*: Although we originally combined the navigation through a city function with the option to leave comments in the form of pictures or notes, this combination is not as obvious as we thought. The first function is a bit related to a GPS and the second to a forum or blog where people can interact. Every respondent finds this navigation function very useful (and even necessary) when they visit a town that is not their hometown; not everybody is instead interested to read comments from others or certainly not post them him/herself (what we call 'build a social environment'). It is also not clear in the original interface that there is a possibility to take pictures with this mobile device and upload them on the application itself. That is why we made a new button on the main screen for this function, next to the 'read and add comment' functions, i.e., the two last buttons in row 2'.
- (3) *The info (& search) - function*: People who look for a place or other related stuff often want more information about it. That is why it looks much more logical to combine these two aspects. The three most important sub-functions under this are: navigate and zoom (to search for a place); info-city (to what information about e-government belongs) and info-events (to know what is happening when in a city).

In the right drawing of Figure 2, the suggested changes are shown. They will be tested later on, but their look and feel is already based on the one we have used for the original 'info-events'-icon, because most respondents preferred a more pictorial style instead of a detailed one. We also chose to display a graphical image in combination with a text label, because most respondents indicated to prefer this option for functions that are not known very well by everyone (like i.e. the add comment, etc.) or for new functions (i.e., info-events) that are shown on the first 'introduction' screen.

From the test, it became clear that the designers' model is not totally similar to the one that our respondents have in mind (what is already explained in detail above). In Figure 3, the new structure is sketched based on the users' mental model. It differs from the previous one on the level of exploring the city and exchanging content with others. A good overall structure is very important because it will make the application much more logical, and as a consequence of that more usable to work with.

Fig. 3. The 3 major functions of this mobile application based on the mental model of the users.

Our results enable us to identify three different groups within the inhabitants community based on their interest and (related to that) the functions they use and require on a mobile application. In Table 1, we give an overview of the characteristics of each group and review which implications this has for the application. The biggest question that will come out of this subdivision is: what makes that most people are not interested in the contributions of online communities (*~ see group 1*), while a smaller group of users are curious enough to look at the comments of people they barely know (*~ group 2.1*), take the time and effort to write own comments (*~ group 2.2*) or even try to moderate the whole thing (*~ group 3*)? As predicted by many theories (like for instance by [1]), individuals contribute more when they are reminded of their uniqueness and when they are given specific and challenging goals. Otherwise they will maybe read comments of others out of curiosity or do not look at the interaction function at all. This non-contribution can become a problem, because if there is not enough interaction, an online community can fall apart. That is why the moderator function is so important, because moderators are able to keep the community dynamic and others will feel the need to participate as a community is more 'alive'.

Table 1. High-level tasks for the application based on the characteristics of the community.

User group characteristics	Consequences (C) for functions of application.
(1) People who will use the application only to <i>communicate</i> with others and to <i>find their way</i> i.e.; if they have to be somewhere new where they have never been.	a) Standard mobile phone function, like i.e. the possibility to call someone, leave a message or listen to your voicemail & send/read written messages. b) A GPS function which is combined with an option to get more information about specific city aspects when required. → (a & b): <i>Basic mobile phone combined with a GPS</i>
(2) The next one can be subdivided into two subgroups. 2.1. People will read the	a) The communication & navigation/info function. b) A read comments option (which gives a possibility to download stuff that others have posted), but without

<p>comments of others, take a look at the uploaded pictures & reviews and maybe let themselves guide to visit a certain place, but will not contribute content themselves.</p> <p>2.2. People who will read the comments of others; react on some of them and place new posts on the forum.</p>	<p>any pressure of personal contribution (~ 2.1).</p> <p>c) An up-/download possibility to add pictures (taken with the device) and text to the virtual city map, with the opportunity to give ratings to places, events, etc. when they are limited in time to write a summary (~ 2.2).</p> <p>→ (a, b & c): <i>The possibility to read comments, look at pictures, and upload own contributions in case they want this.</i></p>
<p>(3) People who are acting as a moderator. Their function is related to the one of the moderators that are selected by the city itself, but they do this out of their own interests. This means that they can check posts and look for new info of events or other topics.</p>	<p>a) A basic mobile phone combined with a GPS (= communication & navigation/info function)</p> <p>b) The possibility to share 'stuff'.</p> <p>c) The option to change or delete comments from others (when i.e. the content isn't correct, etc.) and start new topics.</p> <p>→ (a, b & c): <i>An application which makes it possible to read posts, contribute own 'stuff' and moderate.</i></p>

Of course this demarcation, into three subgroups, is not so strict, but most people will be able to see themselves as belonging to one of these groups. The important thing of this subdivision is that it has got consequences for the final demonstrator. It would be a good idea to develop one 'basic' version of this application with the possibility to get extra options (like an integrated photo camera) for those (user groups) who want this. This will also change the design of the interface. It would be a waste of screen space to show icons on the main (selection) screen when some user groups are not interested in the functions on it. Because of that particular reason, it should be better that the basic functions are being selected for each group based on their specific needs which is related to the selected 'user-profile' that is asked when the user logs in on his/her device direct when they put it on. Based on this identification, the main functions on the device can change. Future research will show if this is a good approach according to the users.

5 Likeability aspects discussed

The values (V) derived from the ladder (Figure 4), which indicate the likeability of the interface, are considering two aspects: first, the abstract consequences for the users when they use this product; then, the preferred habits or goals that users want to reach related to this usage [3]. Our most notable findings (ordered from more important to less according to our respondents and the mentioned values placed between brackets) are:

- People can get the wanted information (contributed by volunteers or employees of the city) almost immediately. If they decide at the last minute to visit a big city like for instance Brussels, they can check if there is still a room for two, what that will cost them and if there is anything special organised when they are interested in; what fits much better with our current lifestyle. The time and efforts that they can save by getting information more quickly gives them more time for other activities and people, what will make them feel more "fulfilled".

- Some get a bigger feeling of freedom, because they can reach others and can be reached via this application whenever they want and wherever they are, and this in a way they prefer ('call, voicemail or message'). This aspect is quite important for some respondents, because some get a bit an uncomfortable 'big brother is watching you' feeling when they hear that others can see where they are at any time if their status is available. The value that is related to this location-specific content that helps them interact with others is the "(emotional) security".
- They can get new social contacts or find out about activities that take place just by reading stuff that is posted by others who share the same interests. This gives them the opportunity to "build new relationships" or "explore new things".
- People, who are planning to put their own contributions on the mobile application, have the feeling that they can mean something for their city and for others just by looking for interesting things and share that on the computer-mediated communication system. This can give them "satisfaction". The posts that others (especially strangers like i.e. tourists) see can change their opinion of a city in a positive way, which is also related to the possibility to "explore new things".
- They can get more social recognition if other read their posts or take a look at their pictures and give it a good average rating score. This could be a way to "distinguish themselves" for those who find this important.
- And last but not least, in its current form, this application will be most useful for tourists according to our respondents provided by the city as a rent service. They see themselves use it for when they visit a strange city but are not planning to use it all the time. That is why further research, of what is missing for the inhabitants in its current form is necessary.

Fig. 4. Hierarchical value map (or ladder) for this application.

In the next phase of the design process, a usability test will take place in the natural environment of the users to analyze the impact of the (city) context while they perform real task scenarios. For this field research, we will make use of a mobile lab.

6 Conclusion

In this paper, we have presented a novel methodology that was developed to test a mobile context-aware application for users who move around in a city and the results that we obtained by applying it. These methods are not often used for evaluating the usability of a system but were combined here. Our results were better specified by the association technique where we explored what users see, think and feel while using the device. But we found the laddering method very interesting to complement them, to get an idea of what the inhabitants want, like and dislike. We may conclude that the 'connotation chain'-method is a useful and cost-efficient technique in this research domain because it gives a holistic picture of the users' needs in a very quick way.

Given the heterogeneity of the users (as reported in Table 1), our conclusion is that it would be better to group people who share the main needs and interests and present the same system features to them. This is related to the community building within a user group like (in this case) the inhabitants of a city.

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