Usability Issues Confronting Mobile Devices as Internet Interfaces for General Purpose Navigation

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Abstract. Mobile devices are the newest Internet Clients but they are quickly achieving an important position due to the use of great number of these devices around the world. Companies which grant access to Internet, the net of nets, to this new kind of net, are pushing hardly, but they do it in order to get more and more profit. We suspect that in this fast evolution the main subject has been forgotten, that is the user interest. A lot of emphasis has been done in marketing and technology but, does the user get all the things companies promise?. In this paper we analyze the interfaces provided to the users and how them affect the usability of Internet through these devices, from our experience in different related fields, Mobile Devices Programming, Web Interfaces Adaptability or Internet Basics.

1 Introduction

At the present time, we can consider Internet development evolution is in saturation phase [1] (see Fig. 1). Although this technology is still being developed, many people consider it as the base technology for creating higher level technologies. So, now the emphasis is in these higher level technologies.
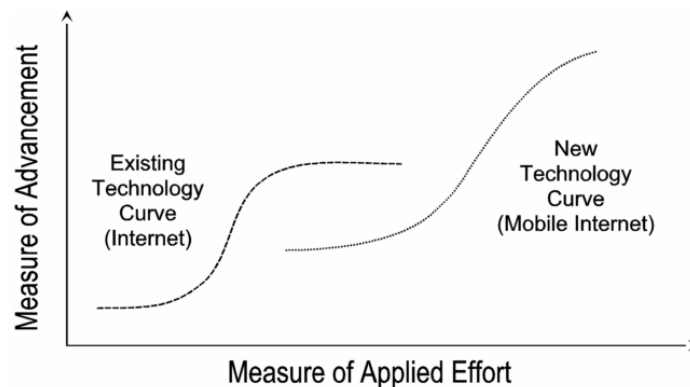

Fig. 1. S-Curve for new al existing technologies, which relate effort and advancement

It is interesting to consider from an historic point of view that there have been technologies which represented an advance for the human civilization, this includes Internet. All of these Technologies with the passage of time became a daily fact, a normal and necessary tool for the social construction and maintenance. Examples of this kind of technologies are water conduction, gas conduction, electricity, and, more recently the telephone and radio and television broadcasting. All of these technologies are assumed today like basics needed for the support of modern society. Internet, depending on the country and continent (unfortunately like the others) is reaching this status of basic technology for society.

In this frame, there are two main tasks to fulfill to keep on developing Internet. The first one is the net development itself. The second one is the advance in the creation of new technological ideas based on the network.

In Science Computer Department in Alcalá University there are several teacher teams with shared members among them which have worked in the last few years in Internet areas. Works about the net and about areas based on it or built directly on itself have been realized [2, 3]. Works about adaptability interfaces, internationalization interfaces and disabled people access to interfaces have been developed.

In SC Department, we have also realized works about the new technologies of third (3G) and 2'5 (2'5G) generation mobiles [4].

The present work seems very disparate in the beginning from those research thread. It shows the confluence of the accomplished works for Internet about classic interfaces with works on these new mobile interfaces and the usability and accessibility problems for users accessing through them.

Since the moment of appearance of 2'5G services, the introduction of WAP service (Wireless Access Protocol) [5] which allows the Internet access from a mobile terminal is being tried. This technology had not the expected success [6, 7] because of its high costs and advertising campaigns which offered the service as more advanced user experience than it was.

Now with the GPRS introduction (other 2'5G service) [8] the costs have been reduced considerably. With GPRS and contents improvement, WAP starts to spread, having the apparition of real access from mobiles to Internet.

Our pursuit, participation and promotion of the work about the line of programming and use of the 2'5G terminals, allow us to have a proper position to discuss from the usability experience and the necessary or possible improvements in these terminals interfaces.

Based in all those previous works, we will study terminals usability and their interfaces for an easy navigation through Internet. We will also analyze the availability of these terminals for handicapped users.

Finally we will propose some advices to increase the comfort and friendly use of the interfaces in order to achieve extensive use of these terminals for Internet access which is the main goal the industry seeks and is still very far away.

2   Actual Mobile Phone Interface

Every machine interface which allows human interaction has two control sorts; input and output (form the machine point of view). The input interface for a mobile device is its keyboard, and actually the only one. In the near future, navigation with voice or by means of pointed devices will be added although.

It is true that PDA include as part of they interface a tactile screen and a pointer which let us to compare it with the mouse for the navigation in Internet. The output interface is a small graphic screen which in the last versions is able to draw colors. Also in this case, sound communication could be used but there is no still news of its used in terminals or systems.

In this point we must mark that along this work we are mainly referring to mobile telephones. The medium PDA which includes a mobile connection can be consider as hand computer with wireless connection instead of mobile device which offers less computing, memory and interface capabilities.

There are several works which study the screen utility and efficiency of these devices [9] and the existing improvement possibilities. These works are based in the existing limitations due to the small size screens, the limitations in colors and the effect in the device productivity of these characteristics. These limitations will determine that device will be used or not by the users to access to advanced services as WAP.

Fig. 2. Mobile Phone Emulator with Interface Devices Indicated

The interface which allows the user to transfer demands to the device, the keyboard, has been less studied in these works. Probably, due to the fact that the classic works about usability in general web systems have been focused on the graphical interface. This is because the input interface was successfully implemented with many standard devices. On the other hand, in mobiles devices, this interface is far of being enough perfected to allow a handy use (ergonomic) by the users of these services.

2.1 Mobile Phones input interface

On these devices, we have the keyboard as the main interface.

If we analyze historically the device interface development, we have the following stages:

- A first stage in which the phones only handed a numerical keyboard and some special keys because it was only possible to send and receive voice calls.
- This keyboard was growing to contain letters in the same buttons than the numbers to let the storage of names in the phone notebook. Some key other keys were added to simplify the navigation in the notebook.
- Then, the small messages service (SMS) came, the keys with letters were then used to create messages. The navigation keys extended their function towards the navigation on a menu system growing more complex. The frequent use of this kind of service showed that the keyboard was not efficient to create the messages. A very positive improvement for the user was introduced then, the text predictive writing, although the users planted their own solution with the creation of all kind of abbreviations for the words, reducing and adapting them to the keyboards shape. This user's option is also useful for them because they can include more words in a message which have a maximum of 160 characters.
- In the present stage, we have access services to Internet from the mobile, i-Mode and WAP. Also multimedia services with multimedia messages adding photos, video and their creation with video cameras which in the terminal and touching-up programs. To use these services, only the keyboard is not good enough as a tool by several reasons. Firstly, the keyboard has not enough sensitivity to manipulate an image pixel by pixel. In fact, the keyboards are thought to face a hostile environment, like the user pocket, a handbag and others, and there are models which can resist liquids immersion. These keyboards have not the sensitivity required and there are no rules to issue the necessities of specific keys to the required applications by these new services. There are also models which have special keys, or covers which slide to hide or to show the keys, but these covered keyboards continue being equal strong or rough. To finish, there are keyboard which have multidirectional keys or joysticks, but we continue with the same problem because of the sensitivity lack (see Figs, 3, 4 and 5). The most adapted models, in this way, incorporate pointers and tactile screen, but their size and weight makes them to be nearer of a PDA but neither with the same capacities than these ones nor their high value. (see Fig. 6).
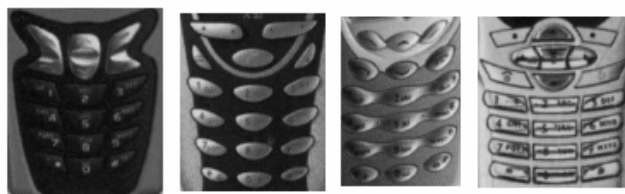
Fig. 3. Mobile phones with "only buttons" interface

Fig. 4. Mobile phones with "direction button" interface

Fig. 5. Mobile phones with "circular joystick button" interface

Fig. 6. Other Mobile Phones with adapted interfaces

The answer to these problems is not new in the interfaces development. In fact, the problems related with these devices, are problems which appeared time before in the computer general evolution. So, the solutions are the same which have showed their utility in general purpose computers, and they are:

– To carry out improvements in the keyboard and in the rest telephone elements to achieve a greater flexibility and comfort in their use for general tasks.

- To create or adapt external devices like navigation mouse in a similar way as it is done with the camera to take photos which are external devices. These external devices can be a mouse or trackball in a small size, easy to carry and connect to the mobile terminal. This kind of devices must have a good industry backing to avoid the multiple kind proliferations of connectors and communication formats which would rend them impossible from an economic point of view.
- To design telephones with PDA functions, smaller and comfortable to carry than the PDA, but more flexible and powerful than the present telephones. There are telephones of this type, but they have the same size that the PDA and are too great with so the telephone advantage is lost.
- Navigation by voice. This option can be very interesting although perhaps a greater calculation power in processors of telephones is needed and to establish common rules which give security to the manufacturers about the effort they are going to realize is useful.

An new devices example with more adaptation to user necessities can be Hand-spring`s Treo 600 (Fig. 7), but this device do not comply with the needed specifications for Mobile Internet. This device is a new and small PDA with a fully *qwerty* keyboard.

Fig. 7. PDA fashioned like Mobile Phone and including QWERTY keyboard

2.2 Mobile Device Interface and Handicapped People

In all the related works it is made a special notation in the subject of Mobile Phone Internet Access called to be the generalized method to access to the net of nets. This is summed in the sentence "Mobile Internet is Internet for all".

We have faced interface problems, centered in the input interface. We did it from the perspective of comfort and usability, assuming in every case that the interface al-

lows access and use of the contents of the chunks of information that reside in Internet with the telephones format need.

These problems cause the motto "Internet for all" not fulfilled, since the users are able to use these devices for accessing the net, but the effort involved in its difficult use prevents them from using it, this has been demonstrated in several studies [10].

This stands for general public, but, what happens with the handicapped people? How much influence is a handicap in the use of this interface?

Multiple possible handicaps exist, but from the point of view of the interface of the mobile device we can simplify reducing the study to the handicaps that limit the reception of the visual, sound and tactile information produced by the terminal and the introduction of information in the terminal, made by means of tactile, visual and sound interaction. Therefore we will consider visual and listening handicaps.

In the case of the people with auditory handicap, the main problem that can be found in the use of the mobile phone is the normal communication that is the use of the voice. Navigation by Internet is visual almost in its totality in the interaction of the user and in the access to information. Therefore, the new services do not create problems for these users. Even though it's interesting to raise the possibility of using the services to improve the phone utility. The conflicting service could be replaced of several forms:

- The first solution consists on the use of the answering service by someone without the auditory limitations to create a voice message indicating that the terminal belongs to a user with auditory problems and asked for the shipment of text messages instead of voice calls. This simple system leans in the text messages and the answering machine. The implementation cost is null, but it has the problem of not solving the service completely. In the case of the calls made from telephones that are not mobile, it is still not extended the possibility of shipment and reception of text messages.
- The second proposed solution would be able to totally replace totally the service of voice calls by means of text messages service. This solution would imply the telephony operator which gives service to the handicapped user. In order to obtain it is necessary the operator knows the user who is acquiring a terminal and a telephone number presents a handicap. The operator will have to be in charge to receive all the calls towards that number in a voice mailbox, to process them and to transform them into text messages that will be sent to the user. In addition the user will need a special number from the operator to which to send text messages with a certain format. These messages will be transformed in voice messages from the original text message using a voice synthesizer. This voice message will be sent by means of a voice call to the number indicated as a part of the user text message. This solution presents some technical problems (voice analysis to generate text) and some special development necessities by the operator, who must see a profit to implement them, this is the reason why it is more difficult then to implement.

In the case of the people with visual deficiencies, the basic problem found is that they cannot know the state in which is the telephone, within its different options. This problem could be solved in an easy and simple way if the mobile phone indicates with

certain sonorous messages when a key is pressed or it is acceded to an option of the menus. By sound the person must know which key he has pressed.

For example, when a user with a visual deficiency wants to send a SMS through a mobile phone, the solution will be the following, when it is acceded to the menu; the device reproduces several sonorous aid messages to determine in any moment the situation in the menu of options. The pressing keys during the message body writing must generate a sonorous message which would indicate him the pressed letter.

But it won't be enough with simple sonorous information, because when the telephone receives some messages or when the user interrupts temporally the use of the terminal and the situation in which it is within the menus of the device is not known. The device must implement several added functionalities. The telephone must have a voice synthesizer to reproduce the text messages, with special attention to the messages with abbreviations that could cause an inexact or non understood reproduction by the user. This synthesizer will also serve to solve the problem of which the user does not know at a certain moment the state of navigation among the different menus from the terminal. The device must have a key which informs to the blind user with a message where it is established the phone situation and then can continue with the predicted action. This would have to be translated in the incorporation to the mobile device of new keys.

The access to Internet (WAP) can be feasible for the blind users, extending the presented synthesizer capacities. Then sonorous messages of menus WAP and the chosen options by the user will be generated. The solution must consider how to inform about the new situation to the blind user, for example: the existence of a link in the WML page, the WAP server change caused after clicking a link, etc.

These recommendations we raised would enable to the blind users to be able to use and to obtain all the functionalities from the mobile phones.

3 Conclusions

The main conclusion we can obtain is that the purpose "Internet for all" which lies under the intents of extending Internet access from mobile phones (WAP) is still a hope. Interface difficulties, the lack to obtain a really useful keyboard and a big enough screen, make this objective to be very far away for the moment.

We have centered this paper in the problems with the input interface. We have analyzed the problems and reasons why this interface makes, not impossible, but improbably that common users want to use these devices to access Internet. Also, we took a look to the necessities of handicapped people in their use on these devices in general services of navigation services.

So, as second conclusion, we affirm that to achieve this objective, industry needs to stop the present lines of work to dedicate particular efforts to get a correct interface. This is because all companies in this industry dedicate most of their effort to create services which can be new and amazing but mostly useless. And it would be better if they tried to improve the potentially useful existing services improving the accessibility and usability of the interfaces, it would produce profits for users and companies, and it would cover some existing and real necessities.

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