Work 41 (2012) 3438-3442
DOI: 10.3233/WOR-2012-0621-3438
IOS Press

Point Navigation Map method to track low-income mobile user´s interaction

Leonardo Abreu[a] and Anamaria de Moraes[b]
[a]*ESPM/PUC-Rio, Rua do Rosário, 90, Rio de Janeiro, Brazil*
[b]*PUC-Rio, Rua Marquês de São Vicente, 225, Rio de Janeiro, Brazil*

Abstract. Mobile phones obtained large popularization in Brazil thanks to pre-paid (pay as you go) contracts. This kind of contract represents 82% of mobile phone connections in Brazil, corresponding to 143 million in a total of 174 million mobile phone accesses in the country. In this scenario, a research about the usability of mobile phones with 17 to 24 year old youngsters, living in poor communities, enrolled in the NGO Spectaculu. Usability tests were carried through with 30 youngsters from a NGO in Rio de Janeiro. Was made a extraction of the navigation sequence with data information of input and output from the system. Point Navigation Map was created to track low-income mobile user´s interaction.

Keywords: Human Factors, Universal Usability, Low-income users, Track Navigation, Navigation Map.

1. Introduction

While Brazil still suffers with problems such as lack of housing and basic sanitation, access to credit combined with a small drop in prices made possible the acquisition of several durable goods by the popular classes that, according to Aguiar et al. [14], it is something that we could have not imagined 25 years ago. "Not just the TV and the refrigerator, but in many cases also the mobile phone, the DVD, the computer, the microwave and the washing machines are present in most Brazilian homes." In June 2009, the Real plan[1] celebrated 15 years since the beginning of a stability economic period that was a crucial condition for the increase of credit concession to people of lower classes. The sales strategy in several installments adopted in different retail chains helped to make possible and encouraged the consumption of those who have lower and tight monthly budget. Besides the purchase of a simple mobile phone, many users of the popular classes ventured to a greater indebtedness level in order to have more expensive and sophisticated equipment.

Prahalad [15] asserts that the consumers of popular classes have an unprecedented ability to access information and intercommunication within their group going beyond their redoubt limits, allowing the establishment of new communication patterns. According to the author, the potential market and the high growth rates transform developing countries markets into a crucial factor for the cell telephony expansion in the world. This technology leap made possible by the mobile phone is also highlighted by Marsden [9] who says that thanks to mobile phone networks the Communication technologies (ICT) are having a spectacular success in developing countries. [*]This success mainly happened in the BRIC countries group, which includes Brazil, besides Russia, India and China.

Despite there are different informatics democratization projects, it is the mobile phone and not the personal computer, that has been configured as the technology which users from popular classes are entering in the knowledge society by mastering a high technology interactive instrument of access to information. This is also the central issue of a BBC article named "The Invisible Computer Revolution" [5], that shows if a prediction had been made 10 years ago on a full computerization and connection of networks for all citizens of the world, in fact, this would be now confirmed if we consider that the networks and people interconnection was done by cell telephony and not through the personal computer, which still remains financially impracticable for many people in the world.

In Brazil, much of the informal economy expansion was due to the new communication possibilities offered by the mobile phone. The arrival of the mobile phones, especially with the prepaid plans proliferation, has facilitated and enabled many businesses of workers classified within the informal economy. Now, their offices are not and do not have costs like a fixed address. The street itself may be a contact point to their customers, even during the execution of their services. Currently, according to IPEA[2], the city of

[*] Corresponding author: email: leomarques@gmail.com

Rio de Janeiro is the metropolitan area that has the largest percentage of this type of self-employed workers.

In this scenario, a research about the usability of mobile phones with 17 to 24 year old youngsters, living in poor communities, enrolled in the NGO Spectaculu, located on the Wharf Port in city of Rio de Janeiro that offers technical training courses in the areas of stage setting and theater was carried though. Respondents attended high school or are in their final year and do not have college study. Many of the respondents are studying and working to help their family financially. In April 2010, the Ministry of Education released a list made from the ENEM [3]test placing the best and the worst schools in Brazil and in its States. In the result, most of the best schools were private, and the state and municipal schools were included at the end of the list as the worst in the test. In a class of 55 students of the NGO Spectaculu, 70% had their schools in positions below 600 and 22% with positions below 1,000, before 1,893 schools in the State of Rio de Janeiro, Brazil.

2. Methods

Usability tests were carried through with 30 youngsters from NGO Spectaculu. The tests involved four basic tasks of these users´ everyday operation. The first task was to add a name and phone number to the phonebook. Only this first task will be analyzed in this article. The first task is important because it is the initial effective contact between the user and the device, although the user has previously handled, before the test, the devices to be used.

The technique was performed using a small portable usability lab [6] formed of a movie camera, tripod, task cards, mobile phones for testing, consent forms and checklists. The lab was transported and assembled in a room granted by the NGO. In it, the equipment was assembled to turn it into a small usability lab. Four cards were produced with the tasks written in easy reading letters. To execute these tasks, five devices of the largest mobile phone manufactures were selected: Motorola Z6, Nokia 5200, LG KM500c, Samsung SGH-450 and Sony Ericsson w380 (See Figure 2). The selection criteria for the devices were: 1- Similar colors (predominantly black), 2- Having music functions, 3- Belong to the same price range. Cheaper models in the market were not used because it was found that these users desire, and most of them already had Mid Tear devices, despite their unfavorable financial situation. All devices selected for the tests had the same contacts in their agendas and even the same songs. Each user performed the tasks with two drawn devices and with their own. The brand of current user device did not take part in the raffle. In all, each device was used by 12 users.

The times and the number of taps the user needed to perform to accomplish the tasks were computed. Furthermore, there was a video recording of the mobile phones being manipulated during the test. This video recording allowed the extraction of the user surfing sequence with data information of input and output from the system and user opinions during the tasks execution [1].

The Point Navigation Map were made based on systematic observation of this usability testing video records. Padovani (1998), stated that it is possible exhibit a hypertextual navigation strategy with graphic form. The method used in this research consisted to do a graphic representation of user navigation trough tasks of usability tests. Was mount a matrix with X and Y axes and main screen and areas used on tasks with mobile phones. The user dislocate was registered by a red thinner line. The green thicker line indicated the quicker way. Padovani(1998) named this ideal way as "economic navigation" and says that is possible to identify elements of system navigation that cause doubts and mistakes with users.

This method was also based on Interaction Units that was based on GOMS (Goals, Operators, Method and Selection Rules) Technique. The Interaction Units consists in relate three design keys: the user, the system and the interaction. (Monk, 1998).

The first Column is designated "Screen" and inform which part of the system the user was. The second column is "Option" and show what was the option selected by user. The third column is called "Trigger" indicate the kind of trigger was used by user. The forth one is the " System Info" and show the information provided by system to user. The last column is called "Behavior and Use Comments" and show the comments made by user through tasks of usability testing.

User 19	LG KM500C	TASK 1		
Screen	**Option**	**Trigger**	**System Info**	**Behavior and User Comments**
Start Screen		> Typing: "75381057"		
Screen with numbers	75381057	SK Left - Options		
Options	Save as new contact	SK Left - Ok		
New Contact	Field for name	> Typing "Eloísa Melo"		Pressed Play/Pause, started music and pressed again stop soon
New Contact	Eloísa Melo	SK Left - Save	Complete	
END	Taps	45		Concluded

SK: SOFTKEY

Figure 1. Point Navigation Map – good efficiency of User 19

Users were encouraged to "think aloud" about the task they were performing. Because of this, the completion time of the tasks was not considered for efficiency comparison means, since that the user eventually stopped the task to comment on some issue related to the handled device. Thus, the comparative data of tasks performance in devices was based on the amount of taps made to complete the respective task.

Figure 2. Mobile phones used in this research: MotorolaZ6, Nokia5200, LG KM500c, SamsungSGH-450 e SonyEricsson w380

Figure 3. User during usability test.

3. Results

The averages of taps for executing the task were relatively close in all devices. All users managed to accomplish the task. However, one factor that contributed to worsen the efficiency result of the task was the involuntary activation of the MP3 player function. The problem occurred in a quite infrequently and impacting way on the task using the Motorola device and in a very frequent and impacting way on the task with the LG device. The Samsung and the Sony Ericsson devices, although they have the music activation key together with the main keys, did not have the problem of activating this function during the task.

During the accomplishment of task of inserting a contact in the agenda it was usual that the user activated the MP3 function through the access keys present in the keyboard of all devices, except for the Nokia device, which positions such key on the side of device.

The LG device, despite having had good results with some users, had serious problems with two users as may be seen in the Points Navigation Maps [1] below, which show their long and tortuous paths to complete the task (See Figure 5). These users faced problems after activating the MP3 function accidentally and almost could not make the music stop. The user 13 needed to turn the device off so the music stopped and then he turned it on again to continue the task.

Although the Nokia device did not have problems with the MP3 player function involuntary activation, its result was not good due to cultural adequacy issues concerning the priority of the last name over the name on the insertion of the task contact, as in Brazil, on the contrary of other countries, usually the first name is initially used and then the last name.

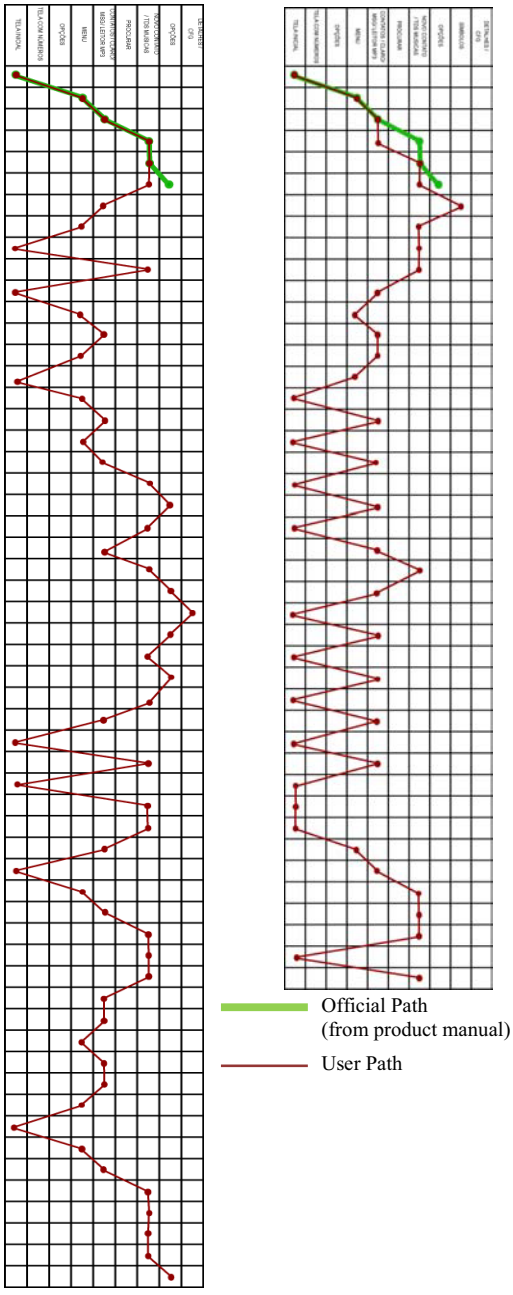

Figure 5. Point Navigation Maps - trouble with users 3(left) and 13(right)

All devices used in the research had a shortcut key to activate the MP3 player function. However, it was noticed that when such shortcut keys were positioned within the set of the control buttons, they caused more involuntary accesses during the task execution. The Mp3 player key of the Nokia 5200 model, located on the side of the device, next to the display, is the farthest one from the main set of buttons. The LG KM500c model shortcut key also appears relatively prominent on the main set. However, the activation of the music function in the LG device was also possible through the music control keys together with the navigation keys.

The music control keys in the LG device are very close and similar to the navigation keys as may be seen in Figure 6. Thus, different users, when they wanted to move the selection down, they distractedly pressed the more external key, related to music reproduction, which was promptly turned on and, sometimes, the user did not notice what had been done to make it happen. Some comments of users who had more problems with the LG device were: "(The song started) because I clicked down here. Folks! This mobile phone is crazy, I did not like that!" "Oh (the key that was activating the music) is very strange to those who do not know how to use it is too difficult. …you are in a place where the mobile phone sound is not allowed and then, spontaneously by your mistake, it plays a sound, do you understand?" This is not cool. It should be something that the person programs and knows how to annul easily, do you understand? Like this is very confusing. Imagine if we press the button accidentally, and then?

Turn off the music after it was activated, although apparently simple, caused a lot of work to two users as may be seen in the navigation map in Figure 5.

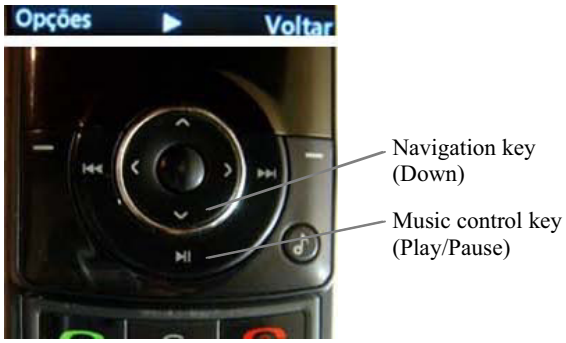

Figure 6. Position of navigation and music control keys on LG mobile phone model

4. DISCUSSION

The Point Navigation Map helps to show the user dislocated at mobile phone system with different situations. The information gathered in this method give cues to find the cause of usability user problems with mobile devices.

Different reasons contributed to decrease the efficiency of the task performed in the tests, measured by the amount of taps to complete the task. However, it was found that the most striking reason was the MP3 player activation. This involuntary access to the music function was one of the main problems, as slightly occurred in the Motorola device and more seriously in the LG device through the Play/Pause key that due to the position was very confused with the down navigation key. The access to the music player function should be only through the exclusive music key or through the system. It is concluded the Play/Pause key should not start the music function.

It is also understood that it is important that the instructions of the music control keys are clear. Even if there are already exclusive keys with control printed indications, as in the LG device case, it is believed to be important to map the music control keys on mobile phone screen, as in the Motorola and Samsung devices, even if there is redundant.

Although functions such as the MP3 player have become increasingly accessible and sought in mobile phones by low-income users, it is necessary to be attentive so that this convergence does not create an indiscriminate accumulation of resources such as in mobile phone designs of Chinese brands and damage the accomplishment of the daily tasks most used by low-income users.

References

[1] Abreu, L.Usabilidade de telefones celulares com base em critérios ergonômicos. Rio de Janeiro. Mestrado. Pontifícia Universidade Católica do Rio de Janeiro - Programa de Mestrado em Design Departamento de Artes e Design. 2005. < http://www.maxwell.lambda.ele.puc-rio.br/Busca_etds.php?strSecao=resultado&nrSeq=6705@1>

[2] Abreu, L.Uso de celulares nas camadas populares.Revista Marketing São Paulo: Editora Referência. Nº432, Ano42, jan. 2009.

[3] ANATEL - Quantidade de Acessos/Plano de Serviço/Unidade da Federação - Dezembro/2009. <http://sistemas.anatel.gov.br/SMP/Administracao/Consulta/AcessosPrePosUF/tela.asp> Retrieved

[4] ANATEL - Relatório de Acessos Móveis em Operação e Densidade por UF. <http://sistemas.anatel.gov.br/SMP/Administracao/consulta/AcessosMoveisOpDensidade/tela.asp> Retrieved 27/05/10.

[5] BBC. The invisible computer revolution. <http://news.bbc.co.uk/2/hi/technology/7106998.stm>. Retrieved 27/05/10.

[6] Chisnell, D. & Rubin J. Handbook of Usability Testing – How to Plan, Design and Conduct Effective Tests. Second Edition. Indianapolis: Wiley Publishing, 2008.

[7] IPEA - Boletim Mercado de Trabalho - Conjuntura e Análise nº 33, Julho 2007 em <http://www.ipea.gov.br /sites/000/2/boletim_mercado_de_ trabalho /mt32/09_anexo_Informalidade.pdf> Retrieved 06/10/2010.

[8] Jordan, P. W. Designing Pleasurable Products: An Introduction to the New Human Factors. London: CRC PRESS, 2002.

[9] Marsden, G.; Jones, M. Mobile Interaction Design. London: John Wiley and Sons, 2006.

[10] Miller, D.; Horst, H.The Cell Phone – Na Anthropology of Communication. Berg: New York. 2006.

[11] Monk, Andrew. User-Centred Design: Making the tecnology fit the user. London: British HCI Group, 2002.
[12] _____.; WRIGHT, P.; HABER, J.; DAVENPORT L. Improving. Your Human-Computer Interface - A practical Technique. Hertfordshire: Prentice Hall, 1993.
[13] Padovani, S. Avaliação Ergonômica de Sistemas de Navegação em Hipertextos Fechados. 1998. Dissertação (Mestrado) - Pontifícia Universidade Católica, Rio de Janeiro, 1998.
[14] Parente, J.; Vidigal, T.; Barki, E. Varejo para A Baixa Renda. São Paulo: Artmed, 2007
[15] Prahalad. C.K. A riqueza na base da pirâmide. Porto Alegre: Bookman, 2005.
[16] Rheingold, H. Smart Mobs – The next social revolution. New Caledonia: Perseus Publishing. 2003
[17] Stuart K. Moran.; T Alen; Newell, A. The Psychology of Human-Computer Interaction. London: Lawrence Erlbaum Associates, 1983.

[1] The **Plano Real** (*Real Plan*, in English) was a set of measures taken to stabilize the Brazilian economy in early 1994, under the direction of Fernando Henrique Cardoso as the Minister of Finance, during the presidency of Itamar Franco.

[2] IPEA – *Instituto de Perquisas Econômicas Aplicadas* - Institute of Applied Economics Research/IBGE – *Instituto Brasileiro de Geografia e Estatística* - Brazilian Institute of Geographic and Statistics.

[3] ENEM – *Exame Nacional do Ensino Médio* - High School National Test.