

A zero prototype as an usability tool

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Abstract

In this paper, we describe on-going work about zero-prototype development focusing on quantitative data collection methods as applied in evaluation and usability methods development of mobile service and appliance development. As the zero-prototype we used a PDA and a GSM-phone realizing mobile Internet usage.

The aim of the work was to find out, what kind of quantitative usability knowledge can be collected from the usage situation of a mobile service with methods that suit in early phases of service development work. The idea of using mobile Internet as zero prototype for more advanced mobile applications stems from the need to integrate usability knowledge and the results gained from usability evaluations more firmly to the overall process, and to get quantitative data about the use as early as possible.

Discussing and trying out different measurement methods gave knowledge of the important factors to the experts from other fields (than usability) in their own terms, and helps the usability specialist to understand the application more clearly.

A zero prototype

Prototyping as a software product usability development method has been discussed in literature and used in practice for quite a long time. There are for example studies about the suitability of different types of prototypes for different types of usability and user testing (see [5]). The prototypes are built to illustrate new quite concrete and finalised product idea, which will probably be developed in some or other form in the future.

Mobile, hand held products and services, are however, being marketed and used as consumer products, by a quite large and heterogeneous user population. And when users like a product, they start to interact the product, which again starts to change the behaviour of the users and environment in unexpected ways. [12]

Usability research apply quite much the methods of anthropology. When we are studying how the users perform, and what are their needs in their contemporary tasks, we must use the existing products that the users are familiar with; and when doing usability test we need of course to use the product(s) we are trying to improve. When improving products with usability tests, it is not enough to see only what the user does – we need also to see how the product behaves for the users (for example in which states users need functions, how the users perceive the states and state changes and so on). This need is not easily met when trying to figure out how users perform with services they are already familiar with (although extensive study over the matter for collecting and analyzing logs for example for Web

services exists), but the information is even harder to access when we are trying out completely new products or services. [10][11]

The need of a zero prototype of usability rise, when we needed to study what and how the users might do when they had access and lived with new technology. The task was twofold: on the other hand there was the need to know how the users start to use and adapt the new functionalities at their disposal, and how to study the use for a longer time and in more natural settings than the usual laboratory setting would allow.

The prototype

At the time of the study, we needed to know how “always-on” mobile Internet access would benefit the users.

We knew, that the users of our user group move quite a lot between their different studies, hobbies and usually two to three places of living (home, boy- or girlfriend and parents home). The users were given a set of three devices: a PDA (“Personal Digital Assistant” or a “palmtop computer”), a GSM cell phone, and a wireless Infrared modem that were attached to the phone for making a connection with the PDA.

The dimensions of the mobile phone with the Infrared modem attached were 12,8cm*4,8cm*2,3cm, and the weight is 155g. The dimensions of the PDA with the carrying-case are 17,8cm*11,5cm*4,3cm and it weighs 451g. The dimensions of the PDA without the case are 16,9cm*9cm*2,4cm and it weighs 354g. The dimensions of the screen of the PDA are 13,8cm*5,5cm. The whole device, meaning the PDA, GSM, the modem and carrying-case weights 607g. The users were also given a phone subscription free of charge, but they were instructed to use the subscription only for things related to Internet use.

The connection to the Internet was made when the PDA prompted the GSM phone to make a data call to an Internet Provider (IP), in this case the university’s dial-up network. (see Figure 1) The GSM phone and the PDA were communicating and transferring data with Infrared modem (IRDA) on the speed of 96-110kb/s. The Internet Provider had 100 Mb line to Internet services around the world.

The content visited in the Internet was stored and pre-processed in a special kind of proxy-server, [8] the black box in Figure 1. (Proxy servers in general are computers connected to Internet, dedicated to storing often visited WWW-pages for faster loading time).

In this setting, the proxy was only to collect information about events invoked by the PDAs browser. This decision was based on the quite low performance of the PDA’s processor, and low memory capacity. This limited the types of results we would get, but we were not interested – at the time – of low level events like key-presses or single files handled by the PDA (for levels of log data collection, please see [4]).

Known bottlenecks in the environment

The slowest part of the network shown in Figure 1 is the 9.6kb/s GSM-data connection. The PDA's processor was quite slow when compared with the speeds of contemporary PDAs, and the browser software that is pre-installed to the PDA is quite slow in handling nested tables. To overcome these known problems, the proxy server was configured to make the following modifications to all pages visited with PDAs:

- Since the PDA has a LCD-display with 256 shades of grey, the proxy server manipulated all pictures to have 256 shades of grey.

- There is a pre-parser algorithm in the proxy that "cleans up" the HTML-code and makes the HTML-code syntactically valid.
- Unnecessary media types (Java-applets, streaming media) were left out from the regular transmission. However, the user was able to request them separately.

These benefits were described shortly to the users, to emphasize the using the proxy. The users were also informed that the proxy will collect log of the use, but that all collected information is kept secure and confidential.

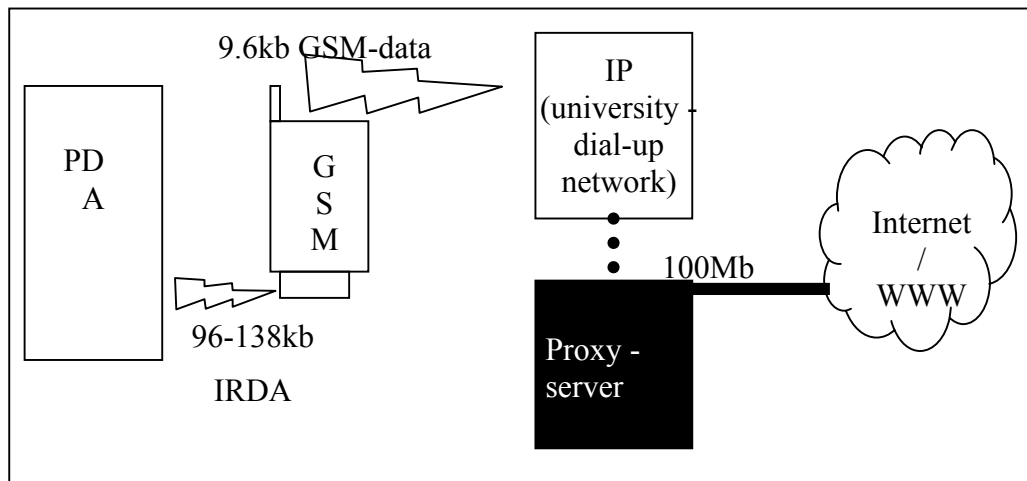


Figure 1. Technical arrangement of the PDA-internet connection.

Qualitative methods

As qualitative methods, we used cultural probes [1] and interviews (for example [2]). The results and comparison of the methods are reported in more detailed level in [6]

Users

Seven students (two male, five female, 18-23 years old), were interviewed and asked to use a PDA and a mobile phone to surf the Internet and use as they please.

All of the users were students at a technological university, in a masters' degree program that aims to give students multidisciplinary skills to be able to develop user-friendly applications to fit the complex needs of society and the economy. One student was studying at three universities at the time. These particular users were chosen based on the information about their nomadic way of life - they were very likely to have a need for mobile Internet and its services. They also made up a fairly uniform group of students with multidisciplinary skills, which was considered to be an asset when evaluating methods.

Log-file analysis

The proxy server was set to record the URLs (Uniform Resource Locator, usually known as "the Internet address") and the files visited. The PDAs were identified by giving them unique port numbers in the proxy server, thus allowing us to see which request originated from which PDA.

The proxy was able to collect only the addresses visited using the built-in Internet browser, so other kinds of usage was not recorded by electronic means. Use of other programs (such as electronic mail, games and word processing) was tracked with interviews and essays only.

From the log-files, we analyzed:

- How many page requests the users made with the PDA browsers (overall and per PDA), what was a typical session time, and how many sessions the users had.
- What kind of services the users had tried to access
- What was the typical time per session of use (The proxy sent a request to the browser every one minute, so the results are more informative than exact).

Services

From the interviews we knew that this "mobile Internet" was not a big hit. Adding to the unmet expectations, there were problems with PDA's ability to handle nested tables, the use of Java-applets and overall poor performance of the browser-software.

We wanted to focus on positive findings, meaning findings that describe how people would use the mobile Internet. The services the users had tried to access, or had accessed successfully, were easily gathered from the logs by using the framework from He and Goker [3]. These results were confirmed with the interviews.

The most interesting successful service use scenarios employed by the users were:

- a user had uploaded some Microsoft Word® documents under her personal WWW home pages, and with the mobile connection she was able to load the documents to her PDA and modify them. Later, she e-mailed these on with the PDA's E-mail program.
- Three users had looked for information about the courses at the university they were attending to.
- One user reported being very sick one evening, and looking for information about how to treat himself, while still being able to lie in bed.
- Five users had used the PDA to look at their own and their spouses' personal WWW pages with this somewhat untraditional browsing environment.
- One user had sought for information in WWW for a friend. Later, he reported sending a copy-paste of the crucial information by using the SMS (short message system) messages, sent fairly easily with the PDA.

Use

From the log files, it seems that the use of the zero prototype decreased quite rapidly after the first phase. The first two weeks gave 57% of the overall log, and 80% of events took place during the first seven weeks (fig. 2)

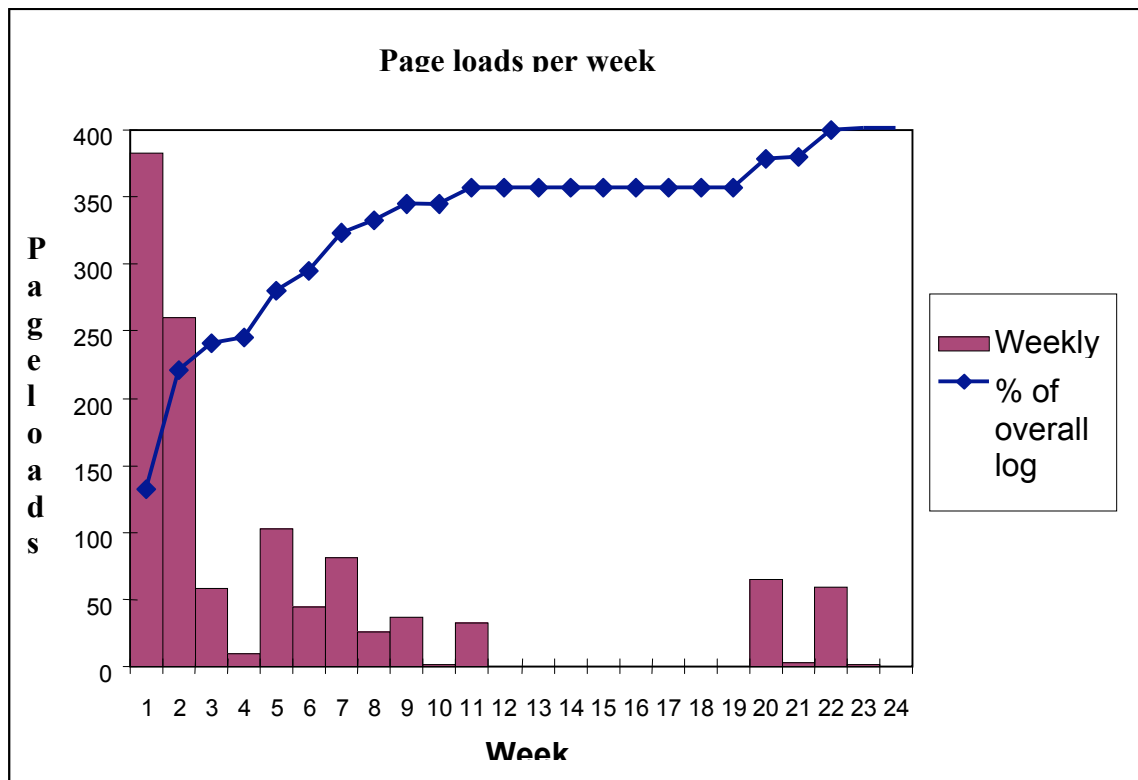


Figure 2. Weekly usage

Discussion

In this work, the evaluation process used was planned quite linear from the beginning. The log was collected from the same reference point during the whole period of use. The interviews and probes were conducted quite at the beginning and at the end of use period. However, from the results of probe and interviews, it was found that the users who used the zero prototype most intensively, did not use it in ways that left any marks to the log.

As the study by Koskinen & al [7] suggests that the amount of use per task behaves similarly as in our study when using novel mobile application, we propose that in ideal duration for a use and user behaviour study is about 6-8 weeks. After that time, the users have lost their interest over the novelty and have either adopted the (prototype)application in their use, altered their ways of use or abandoned the gadgets.

When doing research of use patterns and their change over a longer time, there is the need of re-evaluating the use and to build new ways of collecting data to gather the new, interesting behaviour and needs of users. In the Fig 3, there is a visualization of the different processes.

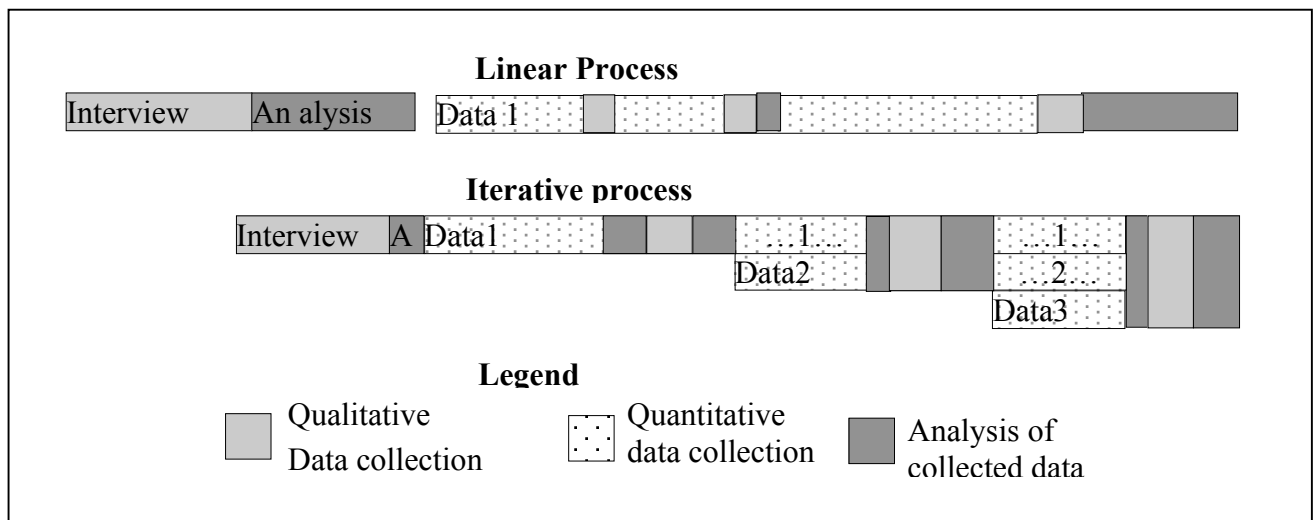


Figure 3. Linear and iterative processes compared

A logging system that had collected all the events on the PDA and GSM would have revealed these phenomena, but as mentioned earlier the available systems did not support such an extensive log collecting, and the handling of such a vast amount of information is it's own research field altogether. As an afterthought, however, a permission from the users to gain access into the GSM-call times and numbers (from the GSM operator bill) would have been good and readily available source of information.

Co-operation

From and usability specialist viewpoint the human behaviour is most interesting and easiest to collect and analyse. Co-operating with the more technical people when developing data collection methods, logging systems and defining layers of data to be collected, is quite rewarding as it makes the reporting of found phenomena easier and more accurate. The more iterative method needs more interaction with different kinds of specialist in order to get the process going smooth and fast enough.

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