# Semantics in Mobile Phones  Design
## Laboratory Studies as a Tool of Collecting Information About Semantic Requirements

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## Introduction

During the last ten years, the penetration of mobile phones into the mobile device market has grown significantly. Today, almost everyone in Finland has a mobile phone and many of us even own several. The world is going mobile – at least world communications are going mobile. Almost everyone in every part of the world would like to own a mobile phone, while numerous people use cell phones and laptops daily and are intent on owning other mobile devices as well. Never before in history has such a remarkable large part of the population carried a communication device with them on a daily basis. This situation has changed mobile phones from luxury devices to mass-market objects. Phone users do not see mobile phones as durables, rather as objects of instant consumption.  In Finland, for example, on average, mobile phones are owned for only one and a half years. Consequently, mobile phone models change rapidly and users must familiarize themselves with new devices and new ways of interacting with them on a regular basis.  The semantic aspects in the mobile phones, and especially the user interfaces, is research area where focus on the research work has traditionally been more in practical R&D questions than in deep semantic questions. We have had IT devices as mobile phones for such short time in the history that research traditions could not have developed yet.

Design of a mobile phone is a challenging process where the designer must fill the technical requirements as a platform or size of the circuit board.  Simultaneous designer must meet the demands of brand and even design the product to a desirable object for the end user. In this rapidly changing world we need to get more understanding about user experience, what does the shape of an IT-device represents for the user and do designer have any possibilities to understand the semantic "message" of the device before it will be launched to the market.

The need for this study and the research approach arose from the practical demands of mobile device product development. Due to this we had a possibility to use the theoretical framework of cognitive science, psychology and engineering sciences. The research methodology as well as analysis methods are from the same disciplines.

### Purpose of this paper

In this paper we present one study where the original objective was to produce information to  product development about small, but critical, operations in mobile phone use. This means critical well-defined actions such as answering the phone. We wanted to reach the facts behind user's answering process, by understanding and detecting the significant factors effecting to action. We also wanted to test possibilities to enhance our skills in user centred product development by using research and analysis methodology from cognitive science. In the analysis phase we understood that the results

of these studies can also be interpreted as an investigation of semantic functions and even further semantic requirements of a mobile phone and its user interface keypad layout design. In the discussion part of this paper we will present ideas and opinions about the possibilities and benefits of laboratory studies as a part of the R&D process in order to produce information to the designer about the semantics of device design.

**The Study**

The goal of this study was to find out how the mental model generated by the use of a certain mobile phone keypad layout affects behavior in a situation where the user has to answer a call using an unknown mobile phone. Answering a mobile phone is usually performed in the middle of another activity. In this experiment a secondary task, playing a PlayStation game, was used in order to create a situation that was at least partly analogous to real life situations

We had two hypotheses in this study:

1. The user's previous mental model concerning the answering of a mobile phone guides the user in the situation where only a limited number of perceptual cues are present. Errors occur if the layout of the answering keys is not consistent with the user's mental model.

2. When more perceptual information is provided, errors are less likely to occur. Nevertheless, the recently active mental model guides the user's action strongly in situations where the user encounters a new phone.

Twenty students (8 male, 12 female) participated in the study. Three kinds of phone design were used in the study (figure1). Each one of the phones was a Benefon Twin GSM 900 and the phones differed from each other regarding the coding and the location of their answering keys. Blanc, De facto Standard (DFS= Nokia style) and reverse order.



**Figure 1** *Phones used in the study from left to right: the BLANK phone, the symbol coded DFS phone and the non-DFS phone.*

**Figure 2** *A closer view for the keypad*

**Task**

The participant's task was to play a PlayStation game called Driver and answer a mobile phone while driving. The participant received driving instructions through a mobile phone. The participant received one of six simple driving instructions (1.Speedup forward, 2.Drive slowly forward, 3.Turn right, 4.Turn left, 5.Drive backwards, 6.Turn around.) per call and s/he had to obey these instructions and wait for new ones while continuing the game.

The experiment consisted of three situations and different phones were used in each situation (BLANK, DFS or non-DFS). All the participants answered the BLANK phone first. In the two following situations half of the subjects (group 1) answered the DFS phone first and then the non-DFS phone.

The remaining half of the participants (group 2) had the reverse order (non-DFS, DFS) phones given to them. Ten phone calls were answered with each phone and the time between the calls varied randomly between seven and 22 seconds. The order in which the driving instructions were given was also random. Each participant also took part in a short interview related to the experiment after the task.

The first key press is the most interesting one when considering the participants' previous mental models. This is also the "moment of the truth" from design point of view, can user understand the semantics and metaphors of the user interface so clearly that device can be adopted to the users life immediately.

Results

In the post-test interview only fifteen participants (N=20) noticed that the answering key layouts varied between the test phones. Five participants did not notice any difference between the phones. These phenomena explain very clearly the high amount of errors when using (table 1) non-DFS phone and it gave us a clear picture of the importance of design.
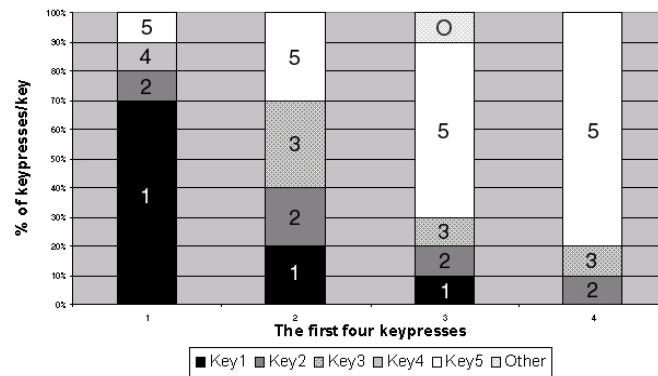
**Table 1** *Results of the first keypress*

Discussion

After this study we had a possibility to produce valuable information to the designer about the semantic requirements of mobile phone keypad layout when it is designed for the Scandinavian markets. Even if this study had academic interests behind it, we obviously had a possibility to produce valuable information to the designer and for whole product development team. At the time this study was done it was obvious that Nokia like keypad layout was a De Facto Standard. Even if non DFS layout feels logical (deny and backward to the left – accept and forward to the right) the R&D team got the information that this logic is not valid because the metaphor is against users mental models and even in best cases it will cause confusion. After the phone launched (with non-DFS keypad layout) market feedback validated the result of this study – unfortunately.

A laboratory study seemed to be useful, efficient and a low-priced tool for collecting information about semantic requirements of the mobile phone keypad layout. How accurate the information is always depends on the set up of the test and the analysis methodology.