

# Individual Differences in Usability of Cell Phone SMS Menus

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*Abstract:* - Nowadays there are wide range and different cell phones but there are not any standardized produced cell phones. Menu systems of the cell phones create complications according to usability of the cell phone user interfaces. One of the main usability problems is encountered in SMS (short messaging services) sending procedure. In this study, we investigated usability issues of the SMS sending menu hierarchies and functions of the cell phones. Individual differences, technological experiences, symbol perception test, previous cell phone usage experiences and SMS sending frequencies of the subjects are observed and evaluated in the laboratory environment. Also, subjects ordered to perform SMS sending according to the well defined scenario. During the implementation of this scenario, SMS sending performances and subject satisfactions are evaluated by help of the inventories. Scope of this work includes sort of observations, implementation of the inventories and questionnaires by different data collection methodologies. These dependent and independent variables are evaluated with sort of statistical methods. Pearson correlation values and ANOVA results show us that there is a significant correlation between extraversion personality types with SMS sending frequency. Also, we observed that when the SMS sending amount is increased in a day, SMS sending period decreased by help of the learning effect.

*Key-Words:* - Cell phone, Mobile phone usability, Usability Evaluation, User Interface Evaluation, Human Computer Interaction

## 1 Introduction

Mobile phone trends advances with rapid changes in mobile communication technologies. Mobile phone users eager to buy and use different cell phones that have sort of capabilities. Changing and advancing cell phones include different hierarchical menu systems that based on according to the previous versions of their menu system structures. Mobile phone producers are trying to design most efficient and usable equipments with limited hardware possibilities.

Most selling successful cell phones provide increased usability conditions for the different personality having cell phone users. By this way, it gives a chance to be used frequently and widely by users who have different personality types, cognitive abilities, and different levels of technological understanding and experience. Cell phone producer can achieve to appeal ever single user and give them the opportunity to use the phone effectively and efficiently by solving keypad and user interface usability issues. Besides the efficiency and effectiveness, the cell phone and its interface should also satisfy the users.

It is vital to make a proper usability evaluation when in the product development level to prepare an easy too use user interfaces. For this reason, there have been so many usability evaluation methods in the literature. According to Rosson and Carroll [1] usability evaluation methods (UEM) can be divided into two different groups: analytic methods and empiric methods.

Analytic methods are the studies that contain modeling and analyzing of system properties. The heuristic evaluation and cognitive walkthrough could be given as an example of the usability studies. Also the “Goals, Operators, Methods, and Selection Rules” (GOMS) and the “Keystroke Level Model” (KLM) models can be given as example of user models.

Empiric methods can be defined as studies that make observations and gathering data collection methods. In this group laboratory includes tests, inquiries, user interviews and

other observation methods that can be implemented.

Basically, hierarchical menus of the cell phones are not much more different than the software user interfaces. Small screens create complications to interact, and interfaces not give access to the previous selections and actions in the menu. Because of these difficulties, users have to remember the previous actions he had done.

Additionally, there is no standard for the cell phone screen and menu design for this screen. Today there are hierarchic menu systems in cell phones to make a better usability but navigation with these menus is still a usability problem. It is so hard to design an apparent menu hierarchy [2].

The cell phone interfaces can be analyzed with quantitative and empiric methods. In ISO/IEC 9241-11, efficiency, effectiveness and satisfaction are the quantitative properties. As defined in (Nielsen, 1993), learnability is another important metric [3].

The purpose of the usability inventories are preformed to evaluate the cell phone interfaces and its operations according to ISO 9241-1 (1) standards and also according to the criteria of efficiency, effectiveness, satisfaction, and learnability [4].

Efficiency is the completion of the targeted task correctly and exactly. Effectiveness is the resources used for succeed to complete the targeted task. The resource in the cell phone usage can be assumed as time. The satisfaction can be defined as getting comfortable and having fun with product. Learnability focuses on the quick and easy perception of the interfaces.

In this study, we implemented personality test, technological experiences inventory, symbol perception test, and a SMS sending scenario is put on the practice to observe users performance in the laboratory environment. Also, SMS sending scenario is practiced second time to obtain learnability ratio.

## 2 The Research

We have established our research in two parts. In first phase we have studied with 34 subjects and with 21 subjects of them had been

selected for second phase for learnability test. By using the personality test, we are expecting to find that there is a low relationship between the usability performance of cell phone and SMS sending period of time, because of this kind of model of cell phones are designed to provide conform for regular users.

We also suggested that the users' symbol perception can be a factor in completing the message text input and message sending process. We expected to find a relationship between user's symbol perception levels and task completion time.

Furthermore we have tried to find out the relevance of cell phone usability and user technological skills.

Comparison of usability factors of cell phones, obtained by evaluating of SMS sending function and its attributes according to ISO 9241-11. We have conducted some usability tests.

Users' symbol perceptions rates are evaluated by a survey for clarify users' capability of focusing, concentrating and usage of short time memory.

### 2.1 The Aim

We aimed to determine data correlations at factors obtained from tests, inquiry and user performances result with the cell phone to find out usability values. Following relationships were tested and analyzed:

1. Relationship with individual differences and personality types with cell phone SMS sending function on SMS sending time period and error counts.
2. Relationship with user symbol perception rates with cell phone SMS sending function on SMS send time period and error counts.
3. Relationship with technological skills of users with SMS sending function and usability metrics.
4. Users' frequency of SMS sending and its relation with SMS sending time period.
5. The relations of SMS sending time periods and error count while performing tasks.

### 3 Methodology

“Cognitive Walkthrough” methodology is implemented in our study to discover the usability factors of NOKIA 3310 with users’ interactions with SMS sending menu.

In Cognitive walkthrough, the designers contribute to think and act as a user through out the whole design and development process.

For this reason, we prepared a scenario for users’ sequential steps in the phone SMS sending processes. Then we draw a mock-up diagram to record each interaction of the users.

Also cognitive walkthroughs take into account for the user's thinking processes that contribute to decision making, such as memory load and ability to reason [6].

In that manner, we have conducted a cognitive schema of each user’s interactions

#### 3.1 Scenario and Modeling

Nokia 3310 had broad usage area in Turkish market; therefore we chose to use this well known model for in the tests. Then we have conducted a research to find out the cell phone usage relations with usability properties that have been given above. These scenarios are performed with 34 subjects in the first phase and 21 subjects in the second phase.

#### 3.2 Process

Steps of the work to be done by preparing a scenario are modeled on paper as a draft.

While determining the scenario it is anticipated that besides the menu navigation of the equipment was being tested. A task should be determined which would include text entry / keypad functions. It is decided that a task which is based on sending messages to a contact in the phone book can measure the desired functions.

The task includes the phases below;

1. Let reach to the message writing menu,
2. Let write the given text,
3. Let send the message to someone in the phone book,

After editing the scenario, by having more than one user practice on the equipment to see the suitability of the scenario, necessary work flow diagram to totally apply to the scenario

phases. During this work flow, the mock-up drawings of the users are prepared which states interfaces and different transitions among these interfaces.

#### 3.3 Participants

Subjects are selected from graduate program of Information Technologies as volunteers. In the first phase 34 subjects are attend to the test works and 21 subjects whom are chosen from the first group has been studying in the second phase of the tests also.

#### 3.4 Materials, Preparation and Gathering Data

In the scenario, we tried to get the usability criteria of the telephone by practicing and observing the subjects. Applying more than one method and test helped us to gather data from different points of view and evaluate them.

Implemented tests can be listed as work-performance based scenario application, personality tests, survey of experience, survey of technological perfection, symbol perception test, and satisfaction survey.

In the work-performance based scenario application, users apply the previously determined scenario with the GSM phone. While the user applies the scenario the observers in the study examine the interaction between the user and the phone. The main objective here is to get data which will evaluate the user’s performance in the laboratory environment.

User’s browsing in the menu, carrying out the work and interaction with the keys the place in the phases. Observer also records the user errors, menu-key combinations and potential interaction combinations belonging to the previously determined scenario parts. If needed, the observer records the application performance which is affected by extraordinary situations.

In gathering data of application performance, the time which is an important factor besides interaction should also be recorded. Taking into the account of common usage, users’ writing messages and browsing in the menu take a short time.

While taking time records, we have to run two people as time-performance observer and time recorder for keeping records. By this way, he can catch the missing points and reduce human centered errors

### 3.5 Personality Traits

In our study, we examined the association of the personality over the cell phone usage. So we had run personality inventory which is using widely in businesses area in Turkish information technologies sector [6].

We aimed to find the characteristics of users such as extroverted, sensitive, balance, responsible, life wide openness.

### 3.6 Inquiry of Technological Experiences

We prepared a survey to see whether the subjects have a prior cell phone usage. Then we asked them, current and prior cell phone model and brand name.

### 3.7 Technological Skill Inquiry

We have another inquiry to find out the users technological skills. According to the subjects' declaration, we could see whether they are capable in technology or not.

### 3.8 Symbol perception test

We also have a test to find out the subjects' symbol perceptions. This test has contained some symbols numbered in a table and a list of these symbols in a list that has been conducted randomly. In this test, we asked users to match the symbols with their corresponding numbers in the list in two minutes.

Then we analyzed users' responds and scored their symbol perception rates. In this procedure, we observed correct, empty and mistaken numbered items.

We used such a test because it requires to focus on and usage of short time memory. Because of the symbol perception is related with concentration and willing to do a task, this test can give us the current perception rates of the subjects' at 22:00 o'clock in the evening. As we will mention in the test results, high perception rates, highly correlated with low number of mistakes.

### 3.9 The work Flow of Data Collection

First of all we introduced our study purposes to users. Then we started to run our tests according to work flow. Before starting tests we give directives to users.

Also we help and give directives to the subjects.

We run the symbol perception test to all users at the same time. So we gained the users instant symbol perception rating.

After introducing tasks steps in scenario, users started to perform it and the observers' records subjects' performance of time.

As soon as the user finished scenario tasks, we asked him to answer the surveys.

When we finished all the study and collected all data we were ready to conduct analysis.

## 4 Test and Results

### 4.1 The Relation of Subjects' Personality Traits and SMS Sending

We had conducted 5 factor personality tests to find out whether personality has a role on cell phone usage. Our test results divided into personality traits as the extroverted, emotional stability, responsibility, happiness and peacefulness.

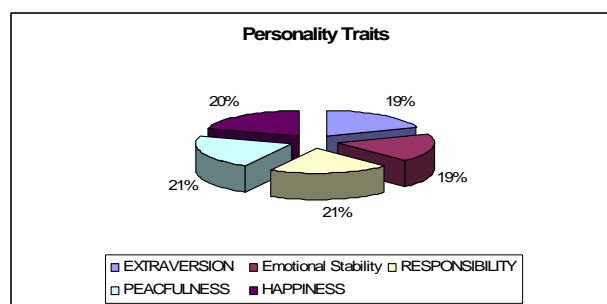


Fig. 1. Personality Traits of the Subjects

After analyzing test results we have found that the *extraverted* personality factor have correlation with *symbol perception rate* ( $Rho=0.31$   $p<0.05$ ) and *SMS sending frequency* ( $Rho=0.35$   $p<0.05$ ).

There have been founded a meaningful correlation between *responsibility* and first *symbol perception* test ( $Rho=0.44$   $p<0.05$ ) and ( $Rho=0.32$   $p<0.05$ ) second *symbol perception* test.

Also we found that symbol perception test can give same results at same conditions. Because there is a significant correlation ( $Rho=0.49$ ,  $p<0.01$ ) between two symbol perception test results for subjects who had attended to both tests.

Furthermore we found that there is a inverse relation between *usability* factors (which used in ISO 9421-1) and *responsibility* personality trait ( $Rho=-0.40$ ,  $p<0.05$ )

When person have peacefulness trait, his SMS sending error count is get lower according to correlation ( $Rho=0.38$ ,  $p<0.05$ ). Because SMS sending frequency ( $0.35$   $p<0.05$ ) is high for this type of person and the SMS sending time period is shorter than the other personality types.

#### **4.2 The Relation of Frequency of SMS Sending and SMS sending Time Period**

According to the ANOVA and Chi-Square tests results, the SMS sending will be time shorten when the frequency of SMS sending increases. ( $F_{(3-28)}=2,35$ ,  $p<0.05$  and Chi-Square=130.5,  $sd=95$ ,  $p=0.009$ ,  $P<0.01$ )

Also in second study we have gained an inverse correlation between *SMS sending time period* and *SMS sending frequency* ( $Rho=0.35$ ,  $p<0.05$ ). In the occurrence of these tests results we can conclude that the users who use SMS message sending functions frequently can also complete the SMS sending tasks more quickly too.

#### **4.3 The Relation of SMS Sending Time Periods and Error Counts**

The SMS sending frequency correlated with symbol perception test 1 and test 2 respectively have ( $Rho= 0.36$  and  $Rho=0.39$ ,  $p<0.05$ ). SMS sending frequency have inverse correlation between SMS sending period of time 1 and SMS sending period of time 2 ( $Rho=-0.35$  and  $Rho=0.31$ ,  $p<0.05$ ) for both tests. When we analyzed the per SMS error count for participants of both two test studies we have seen that error counts increased between two tests ( $Rho=0.60$ ,  $Rho=0.79$ ,  $p<0.01$ ).

#### **4.4 The Relation of Frequency of SMS Sending and Encountered Count of Errors**

In second study we have gained a correlation between SMS sending time period and SMS error counts as ( $Rho=0.85$ ,  $p<0,05$ ). It means that in the SMS sending action, when subjects made errors so much, SMS sending time is increase as well.

#### **4.5 The Relation of Technological Skill with the Task Completion Time and Error Count**

The correlation we found between technological skills and prior NOKIA branded cell phone is meaningful ( $Rho=0.31$   $p<0,05$ ).

There is a positive directional and strong relation between the user's technological skills and the speed of inputting letters per minutes ( $Rho=0.48$ ,  $p<0.05$ ).

There is an inverse and correlation between users technological skill and users all task completion time ( $Rho=-0.30$ ,  $p<0.05$ ).

Also SMS sending times is reducing while technological skills are at a high rate ( $-0.35$ ,  $p<0.05$ ).

Although there is a meaningful correlation between users technological skill and users task completion time of SMS sending times. (Two directional ANOVA  $F_{(7-26)}=4.35$  ,  $p<0.05$ )

According to the results above having some prior technological skill and experiences help users to use cell phone more easily then a novice user. But having such skill is not a necessity to use them

Also having a prior technological skill can not avoid making mistakes while using cell phone SMS sending function. Because we had seen that the period of time spending on SMS functions also increases error counts. This skill can only help users to operate faster.

### **5 Conclusions:**

According to results we reached the following conclusions:

- The time period of SMS sending directly depends on users' technological skills with the frequency of users timely SMS sending.
- When the subjects personality type have high responsibility rates and when the symbol perception rate is also high; the total error counts in SMS sending decreases.

- When a person uses the same type of device or same brands of cell phone the learnability is high and the rate of error occurrences is lower.
- When learnability factor is formed in SMS sending, the total the total error counts in SMS sending decreases. This is related with responsibility and extroverted personality types.
- Some prior technological skill and experiences help users to use cell phone more easily than a novice user

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