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SYMPOSIUM B

Electrical & Computer Engineering

The Effect of Mobile phone's User Interface Configurations on User Comfort

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ABSTRACT

Mobile phone consists of some input elements as its user interfaces for example keypad and navigator. Shape, layout, and dimension of the input elements determine the user interface configuration of mobile phone. The configuration of user interface may influence user comfort in using mobile phone. For that reason, it is important to understand the effect of various mobile phone's user interface configurations to user comfort. This research investigates the effect of mobile phone's user interface configurations on user comfort. First, this research collects some data related to shape, layout, and dimension of keypad and navigator of available mobile phones. Then, the data are synthesized to develop various alternatives of user interface configurations. Finally, a survey is conducted to investigate the effect of the developed configurations on user comfort. A questionnaire is spread among the user of QWERTY mobile phone as a survey. The result of the survey shows that some configurations are not preferred by the users because it is not comfortable according to them. However, the configurations that accommodate tight distance and square keypad with trackpad navigator provide the highest level of user comfort.

Keywords

Mobile phone, user interface, configuration, user comfort

1. INTRODUCTION

Some types of mobile phone, which have been launched, could not attract user to buy them. The important reason of the fact is because user does not feel comfortable in using those mobile phones. Hence, user comfort should be considered in developing a mobile phone. User comfort in this case is a pleasant feeling of being relaxed and free from pain in using a mobile phone.

To increase user comfort level in using a mobile phone, usability aspect of the mobile phone should be investigated. The usability aspect is related to user interface of the mobile phone. User interface of a mobile phone is divided to three types, which are physical user interface, logical user interface, and graphic user interface [1]. The physical user interface can be divided into seven user interface elements in example input, display, audio and voices, ergonomics, detachable parts, communication method, and applications [2].

Some researches have been done in evaluating elements of physical user interface, in specific input element. Mittal A. and Sengupta A., propose keypad layout of non-QWERTY mobile phone to increase the speed in entering text [3]. They also evaluate the proposed keypad layout by asking six subject to type text using the keypad. However, this research evaluates only the typing speed of each subject and does not evaluate user comfort level.

Jin, B.S. and Ji, Y.G., propose an evaluation framework to quantitatively measure the usability risk in the mobile phone user interface. Related to the input element of user interface, they evaluate the controllability and usability of the key types of mobile phones [4]. However, this research describes only the controllability and usability of the key types of some non-QWERTY mobile phones.

Meanwhile, Park, Y. S., and Han, S. H., investigate the effect of touch key sizes and locations on a mobile phone [5]. In the research, they evaluate the first transition time, task completion time, number of errors, and the pressing convenience of the subject in using the touch key. The result related to the pressing convenience shows that the region in the middle centre of mobile phone provides higher satisfactory score for the user compare to the other regions. In this research, the evaluation is performed to the subject in using the touch key with one hand thumb.

None of the previous researches give information about the relation between physical user interface configuration of QWERTY mobile phone and user comfort. Based on the preliminary observation, the configuration of the physical user

interface may influence user comfort in using the mobile phone. For that reason, it is important to understand the effect of various QWERTY mobile phone's physical user interface configurations to user comfort.

2. RESEARCH METHODOLOGY

This research investigates the effect of QWERTY mobile phone's physical user interface configurations on user comfort. In this research, the physical user interface configuration is limited to the configuration of input elements of the physical user interface. In general, the configuration of input elements is determined by their shape, their layout, and their dimension. This research is performed in two stages. First, some alternatives of mobile phone's input element configurations are developed based on available mobile phone's models. At the second stage, a survey is conducted to investigate the effect of the developed mobile phone's input element configurations in user comfort.

At the first stage, data collection is conducted to get information related to various input elements of mobile phone. The QWERTY mobile phone's models, which are released in 2010 and before, are used in this stage. Then, the input elements of the mobile phone's model are classified. Not all input elements are investigated. Keypad and navigator are the input elements of mobile phone, which are investigated. Finally, various types of keypad and navigator are analyzed and synthesized to develop various alternatives of mobile phone's user interface input element configuration.

At the second stage, a questionnaire is spread to 30 users of QWERTY mobile phone as respondent. The age of the respondents is between 18 years old to 25 years old. Before that, some mobile phone prototypes, which describe all alternatives of mobile phone's input element configurations, are made. Then, the respondents are asked to pretend using each prototype to make a phone call. In using the prototype, the respondents are asked to use both of their hand thumbs. Next, the respondents are asked to assign a score between 1 and 5 in scale of likert for each of configurations. The assigned scores represent the comfort level related to each alternative of configurations. In this research, a score of 5 points means the alternative of configuration provides the highest level of comfort. Meanwhile, a score of 1 point means the alternative of configuration provides the lowest level of comfort.

3. RESULT AND DISCUSSION

Based on the available mobile phone's models, the keypads of mobile phone are classified according to their shape, their layout, the distance between them, and their numeric area location. The shapes of keypad are divided into two categories, which are round and square. The two types of layout are straight and curve. And, the distances between keypad are loose and tight. Meanwhile, the mobile phone navigation elements are classified according to their types of navigation and the shapes of the navigation element. Three types of navigator are dome key, trackball, and trackpad. Each of types is divided into three shapes, which are round, square and oval.

However, based on a preliminary survey, keypad layout and numeric area location do not give a significant influence into user comfort. For that reason, the alternatives of mobile phone's input element configurations are developed based on keypad shape, keypad distance, and navigation type and shape. Morphological chart to develop various alternatives of mobile phone's input element configuration is shown in figure 1.

	Solution 1	Solution 2	Solution 3	Solution 4	Solution 5
Keypad distance	 Tight	 Loose			
Keypad shape	 Round	 Square			
Navigation	 Round Dome Key	 Square Dome Key	 Trackball	 Trackpad	 Oval Dome Key

Figure 1: Morphological Chart

Based on the morphological chart, 20 alternatives of mobile phone's input element configuration are developed. The alternatives of mobile phone's input element configuration are shown in figure 2. Then, 20 prototypes of mobile phone, which represent each configuration alternative, are made from Styrofoam. Some examples of the prototypes are shown in figure 3.

ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5
Tight Keypad distance Round Shape Keypad Round Dome Key	Tight Keypad distance Round Shape Keypad Square Dome Key	Tight Keypad distance Round Shape Keypad Oval Dome Key	Tight Keypad distance Round Shape Keypad Trackball	Tight Keypad distance Round Shape Keypad Trackpad
ALTERNATIVE 6	ALTERNATIVE 7	ALTERNATIVE 8	ALTERNATIVE 9	ALTERNATIVE 10
Tight Keypad distance Square Shape Keypad Round Dome Key	Tight Keypad distance Square Shape Keypad Square Dome Key	Tight Keypad distance Square Shape Keypad Oval Dome Key	Tight Keypad distance Square Shape Keypad Trackball	Tight Keypad distance Square Shape Keypad Trackpad
ALTERNATIVE 11	ALTERNATIVE 12	ALTERNATIVE 13	ALTERNATIVE 14	ALTERNATIVE 15
Loose Keypad distance Round Shape Keypad Round Dome Key	Loose Keypad distance Round Shape Keypad Square Dome Key	Loose Keypad distance Round Shape Keypad Oval Dome Key	Loose Keypad distance Round Shape Keypad Trackball	Loose Keypad distance Round Shape Keypad Trackpad
ALTERNATIVE 16	ALTERNATIVE 17	ALTERNATIVE 18	ALTERNATIVE 19	ALTERNATIVE 20
Loose Keypad distance Square Shape Keypad Round Dome Key	Loose Keypad distance Square Shape Keypad Square Dome Key	Loose Keypad distance Square Shape Keypad Oval Dome Key	Loose Keypad distance Square Shape Keypad Trackball	Loose Keypad distance Square Shape Keypad Trackpad

Figure 2: Various Alternatives of Mobile Phone's Input Element Configuration

After the respondents are asked to pretend using each prototype to make a phone call, the respondents are asked to assign a score between 1 and 5 in scale of likert for each of configurations. A score of 5 points means the alternative of configuration provides the highest level of comfort. Meanwhile, a score of 1 point means the alternative of configuration provides the lowest level of comfort. Table 1 shows the percentage represents the comfort level related to each alternative of configurations.

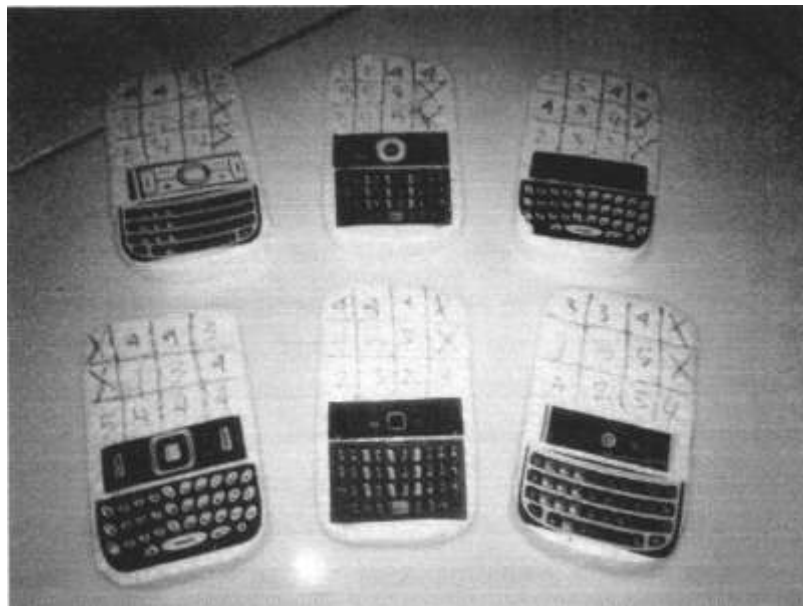


Figure 3: The examples of Some Prototypes

Table 1: Percentage of User Comfort Level

Alternative		Percentage					
		1	2	3	4	5	
1		27	53	20	0	0	
2		17	30	30	23	0	
3		20	47	33	0	0	
4		37	50	13	0	0	
5		11	29	32	29	0	
6		20	57	23	0	0	
7		3	7	10	37	43	
8		7	33	47	10	3	
9		20	17	50	13	0	
10	Uncomfortable	3	14	24	31	28	Comfortable
11		10	23	57	10	0	
12		27	50	23	0	0	
13		13	57	23	7	0	
14		32	58	11	0	0	
15		13	30	30	20	7	
16		23	40	37	0	0	
17		20	53	23	3	0	
18		10	50	20	20	0	
19		70	23	7	0	0	
20		3	10	30	27	30	

As shown in table 1, type 7 of mobile phone’s configuration provides the highest level of user comfort. It means that mobile phone’s configurations with tight keypad distance, square shape keypad, and square dome key provide the highest level of user comfort. Meanwhile, type 19 of mobile phone’s configuration, which consists of loose keypad distance, square shape keypad, and trackball, provides the lowest level of user comfort.

Related to the keypad distance, the highest level of user comfort has been provided by mobile phone’s configurations, which consist of tight keypad distance, as shown by type 1 to type 10. Mobile phone’s configurations, which consist of square shape keypad, provide higher level of user comfort compare to round shape keypad. Meanwhile mobile phone configurations with trackpad provide the highest level of user comfort compare to other types of navigation.

Based on the research, the configurations that accommodate tight distance and square keypad with trackpad navigator have the highest level of user comfort. The highest level of user comfort has been provided by mobile phones, which have tight keypad distance. In addition, the square shape keypad of mobile phones provides higher level of user comfort. Moreover, mobile phones with trackpad provide the highest level of user comfort.

4. CONCLUSION

Based on the research, the configurations that accommodate tight distance and square keypad with trackpad navigator have the highest level of user comfort. The highest level of user comfort has been provided by mobile phones, which have tight keypad distance. In addition, the square shape keypad of mobile phones provides higher level of user comfort. Moreover, mobile phones with trackpad provide the highest level of

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