Assignment M5:

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***Abstract*—Keyboards are currently the most common electronic input device people use when typing text on a computer. Despite the large number of users worldwide, the keyboard designs only target the English proficient speakers. Although it is possible to change the language of typing on a computer, the keys on the keyboard only show the English letters. This poses a huge burden on people who desire to type letters of a different language. The current project aims to investigate this issue, find the needs of the user, propose new ideas to efficiently re-design the keyboard layout, and finally evaluate them systematically.**

1 QUALITATIVE EVALUATION

As explained in my M4 assignment, I performed qualitative evaluation on the first prototypr design explained in my M3 assignment.

1.1 Pragmatics

The qualitative evaluation was taken place in a room in a quiet environment. Two participants were surveyed in my work office and three were surveyed in a room booked at my school.

The sessions were different between participants since each of them varied in the level of consciousness and concentration on the task. This affected the time it took for the participants to first understand the prototype and then answer the questions. As a results, after two sessions, I tried to eliminate the environmental noise and distractions more than before. I mostly tried to hold the sessions in a quieter place.

For the next time, if I plan to recruit more participants, I will choose a very quiet setting and run the evaluation experiment in the first place (predictor view of the participant). Then, I will run the experiment in a noisy environment (participant view of the user) to study the difference between these two conditions. I believe

this will give me a better idea for better designing the prototype or the final model.

1.2 Raw results

Details of the raw results are provided in Appendix 1.

In summary, higher satisfaction rates were reported for the way the design handles typing the special characters. Results also shows that participants were not generally happy with the comfortableness and easiness of the use of this prototype. Participants raised their opinions about the design being time consuming and not easy to work with.

1.3 Analysis

The main takeaways from the results are listed below:

- The current design with visualizations seem to satisfy the participants.
- The design needs to be revisited to make it more comfortable to use.
- There is need to revisit the needfinding process in order to identify the needs of the users with easiness of use.

Surprising feedback received in the results are listed below.

- Although the shape of the design in the prototype was very similar to the current typical keyboard design, the participants expressed the design being not comfortable. There is room to explore and re-design the shape of the keyboard in another study with a different design life cycle.
- One participant pointed out to a feature, embedded in another prototype designed in M3 assignment, being more practical to use. It would be beneficial to evaluate that prototype in the second round of evaluation.

Expected feedback received in the results are listed below.

- The participants were generally satisfied with the design for the visualizations.
- The participants were generally happy with the way typing special characters is handled in the new design.

1.4 Prototype changes

As the results of the analysis revealed, there is need to revisit the needfinding process. The following are the main changes that the results of the qualitative evaluation suggests.

- The participants expressed difficulty with replacing the keys. They also mentioned this being a time-consuming process. Therefore, it is important to revisit the design and eliminate the need to add or remove keys.
- The participants expressed that the design is not comfortable to use. It is important for the new design to be comfortable. I can get more idea about this through another needfinding process.

2 PREDICTIVE EVALUATION

As explained in my M4 assignment, I performed predictive evaluation for the third prototype design in my M3 assignment. Therefore, the prototype being assessed here is different from the one assessed in the previous section of this assignment.

2.1 Walkthrough

This prototype's design is very similar to the design of the typical mechanical keyboard, currently being used everywhere. The major novel design is to replace the face of the keys with small LED screens. This enables displaying language-specific letters immediately after the user changes the language of typing on a computer. There are additional keys embedded in order to type special characters without the need to hold multiple keys at once. Details are provided in M3 assignment.

In this prototype, the user sits at a desk in front of the computer's monitor and a keyboard with a physical shape similar to that of the current design of mechanical keyboard. They first change the language of typing exactly the same way as they did before (i.e., by means of pressing Alt and Shift at the same time or change the language from Control Panel). When they change the language, the small LED screens provided on the keys immediately display the language-specific letters (e.g., if the language is changed to Farsi, Farsi letters appear on the

keys, including the additional keys provided). This is clearly shown in Figure 1 adopted from my M3 assignment.

Figure 1- Wireframe prototype of the keyboard with current language set to Farsi

2.2 User knowledge

Since the design of the prototype keyboard is very similar to the current mechanical keyboard design, the users already have a knowledge about how to use the keyboard (i.e., by pressing the keys). Also, the label for some of the keys are static and are not subject to change upon changing the language (e.g., Alt, Shift, Caps). Additional keys demonstrated in Figure 1 on the right also show the specific letters that users previously typed by holding multiple keys. These keys are also embedded with LED displays and users employ their knowledge of language to press them in the correct order to type text into the computer.

The users can use their memory to remember what the function for each of these keys were or even to change the language of the system. The only thing that is subject to change are the keys used to type language-specific letters.

In addition, the nature of the LED displays on the keys distinguishes them from the keys with static labels. This helps the user to bring their attention to these keys easier. Therefore, it would be easier for the user to find the keys and eventually become faster when writing.

2.3 Design principles

As mentioned previously, since the prototype is similar to the current design of the mechanical keyboard, it enables the user to use the previous affordances such as keys that require pressing.

Also, with the labels being changes with changing the language of the system, a direct mapping is provided. This means that the user immediately knows that

each key is associated with the letter being shown on the small LED display provided as the face of the key.

All other keys with static labels are consistent with the current design of a typical mechanical keyboard. This means that the label for the keys such as Alt, Shift, and Caps stay consistent with the previous design that the user is already familiar with. This helps the user to immediately understand the function of these keys.

3 EVALUATION SUMMARY

3.1 Additional needfinding

Two different prototypes were evaluated in the previous two sections.

In the next needfinding phase, I will start with the prototype with LED display on the keys since it not only addresses the requirements identified in the previous stage, but also is easy to use. For this prototype, adopting from the results of the qualitative evaluations, I will explore the user's comfort with the design. The comfort with visualizations in different settings and times of the day is of great importance. For example, the users might have some difficulties when working with LED display-based keys at night for a long time. Therefore, there is need to perform another round of need finding and get user's feedback to make revisions to the prototype. Also, the comfort of the user with the physical shape of the keyboard matters to a great extent. The requirement of the users for physical comfort needs to be identified in the second round of needfinding.

3.2 Design alternatives

In both qualitative evaluation and predictive evaluation processes, two design alternatives came to my mind that require more investigation and getting feedback from the user.

The first one comes from the qualitative evaluation in which the users mentioned that they are experiencing difficulty with comfort using the physical shape of the keyboard. I was focusing on the language-specific needs in the first needfinding phase and did not notice it in the previous design life cycle. However, I will explore different physical shapes in my second round of need finding. One of the

design alternatives can be making the keyboard more ergonomic with different designs.

The second one comes from the predictive evaluation. For this evaluation, I printed out the wireframe prototype I have on a piece of paper to better visualize and evaluate the design. Immediately after printing, I noticed that I am not able to visualize the letters on the blue LED screens on the keys. This notified me that I need to explore the user's needs with the LED display to make it more usable (e.g., it is possible that the font of the letters being shown on the display matters to the users to a great extent). I then thought maybe there is a difference between the user's sight in the night when it is dark. Therefore, I believe it is definitely to explore the user's needs in this field as well. One of the design alternatives can be using LED displays that change background color or font compatible with user's needs and preferences.

3.3 Prototypes

The qualitative evaluation process results revealed that the use of the first prototype with replaceable keys did not satisfy the user's needs with ease of use, time to complete the gulf of execution, and comfort. However, my predictive evaluation results seemed to be generally positive with regards to the ease of use and time to complete the task (i.e., type a letter using the keyboard).

I am planning to incorporate the feedback I received from the users about comfort of use in the design of the prototype with LED screens on the keys. This means making the prototype more ergonomic to incorporate for the physical needs as well as making it flexible with background color to incorporate for visualization requirements.

3.4 New evaluations

Assuming the aforementioned changes are applied, I will do another round of qualitative evaluation through interview sessions. I will then try to make changes according to the feedback. Then, in the next round of evaluation, I will perform empirical evaluation on a larger number of user participants and finally analyze the results statistically to revisit the design.

4 APPENDIX 1

Below are the questions asked from the participants and a statistical visualization of their answers.

How satisfied are you with the visualizations that this design provides?

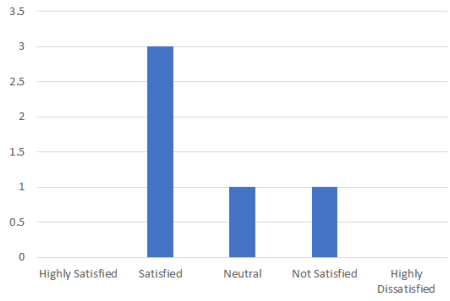

Figure 1- Number of participants versus satisfaction rate with visualizations

How satisfied are you with the current design for typing special characters?

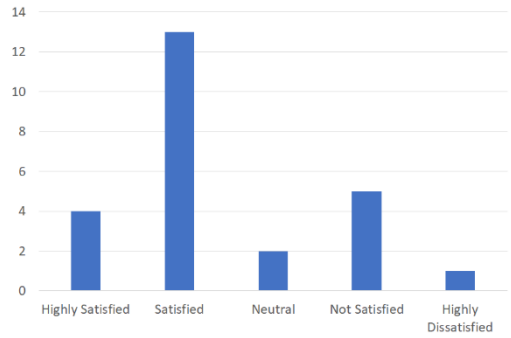

Figure 2- Number of participants versus satisfaction rate with typing special characters

How comfortable is it physically to use this keyboard design?

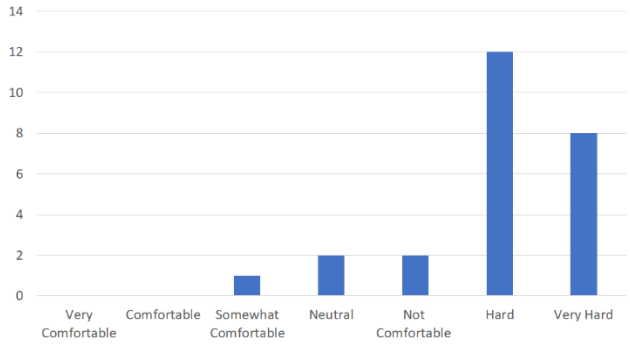

Figure 3- Number of participants versus physical comfort of the design

How easy it is to switch between languages with this design?

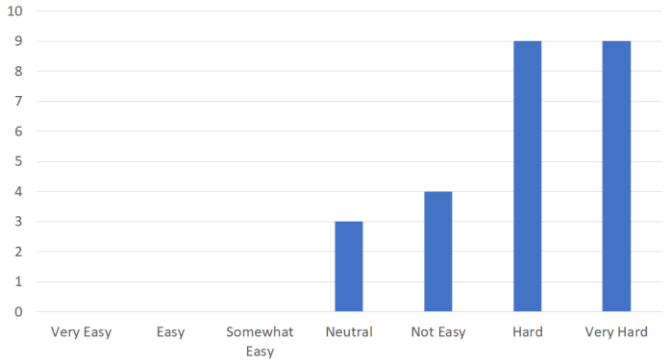

Figure 4- Number of participants versus easiness in switching between languages

What is your overall satisfaction rate with this design?

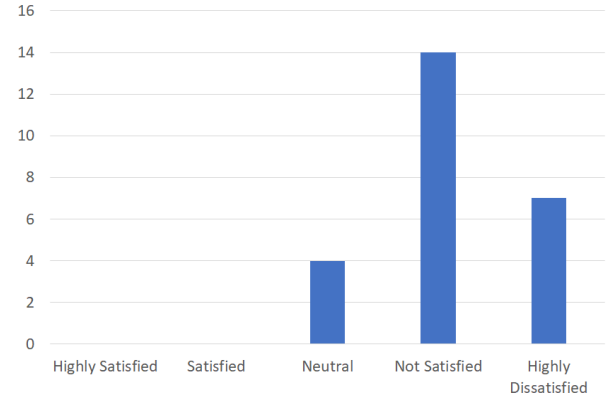

Figure 5- Number of participants versus overall satisfaction with this design

If you have any additional comments and suggestions, please provide them below.

- “Replacing the keys on the keyboard is not trivial. It would take a lot of time for me”.
- “I do not like this design because it is hard to match the elements correctly”.
- “This design works only if you would like to change the keys for a long amount of time. Otherwise, it does not worth it”.