

Analysis

Primary Hypothesis: Participants using the Citrus Keyboard to input text will recommend it to their friends more often than when using the PlayStation 3 keyboard to input text.

Participants were asked their likeliness to recommend each interface to a friend, and responded on a scale of 1-5, 1 being very negative and 5 being very positive. The average responses for Citrus Keyboard and the PS3 keyboard were as follows:

	Citrus	PS3
Mean	2.82	1.95
Standard Deviation	1.07	1.57

With 16 participants in each condition. Performing a two-tailed t-test to determine if users were more or less likely to recommend the Citrus Keyboard than the PS3 keyboard resulted in a t-value of 1.8316, which in turn represents a p-value of 0.0770. From this result, we are able to conclude that we may not reject the null hypothesis.

Secondary Hypothesis: Participants using Citrus Keyboard will input text faster than using the PlayStation 3 keyboard.

Our study consisted of 16 participants, all who were able to complete the study successfully. Each user was given 10 minutes to use the Playstation 3's keyboard and our Citrus keyboard while we tracked the words per minute (WPM). The average WPM for the Playstation 3 was 9.18 WPM and 6.2 for the Citrus Keyboard. Each user's individual WPM is shown in figure 1 of the appendix. Clearly, with an average WPM 32% faster than Citrus Keyboard, the Playstation 3 allows participants to input text the fastest. Now, let's observe the standard deviation: 2.55 for Citrus Keyboard and 3.65 for the Playstation 3 (Appendix, Figure 2). This result is interesting as you would expect the more established interface to have a lower standard deviation than one that no one has ever used before. With a P-value of 0.37 it is safe to say that we cannot reject the secondary null hypothesis as it is much greater than 0.05. That is to say that we cannot conclude that Citrus keyboard is faster. This P-value was calculated using a statistical regression analysis

Discussion

The primary hypothesis stated that users would enjoy using Citrus Keyboard more, and be more likely to recommend it to a friend. Although we were unable to reject the null hypothesis, the results were promising. The p-value was quite close to being statistically significant. In addition to the recommendation question, we asked participants other questions such as "Do you feel that you could type faster with this keyboard after more practice?" The average response for the question was an *overwhelmingly positive* 4.53. This indicates that the primary shortcoming for Citrus Keyboard was the learning curve. If we can address that design problem, it would be worthwhile to administer the study once again in the future.

The secondary hypothesis stated that Citrus Keyboard would be faster than the current standard game console keyboard. The study showed that we were unable to reject the null hypothesis, meaning that citrus keyboard is as slow or slower than the current keyboard. Essentially what this means is that citrus keyboard doesn't work as anticipated. It is not quicker, or easier to use. In order to make citrus keyboard faster, a lot of improvements need to go into it. From the study we were able to identify where the users struggled, and what needs to be fixed.

Most of these issues need to be fixed back in the design. The layout of the keyboard should work, however the selection process is awkward. It is confusing for users to point in the direction of a section, and not highlight all those characters. Some users also had trouble with the input mapping. Some of this was issues with how the input was designed to be, and some were actual implementation issues.

From a developer standpoint, there were issues with the implementation. The joysticks were not as responsive as they could have been, and there were issues with jumpiness and dead zones. These caused the users to run into more issues, and ultimately slow them down. All of these issues may be minor on their own, however when combined they make for a slow typist.

A slow keyboard is a useless keyboard to a user. The primary purpose of a keyboard is to type, and if the users can't type with it, then it is useless. This keyboard has a lot of potential, but is currently not ready for production level. Hopefully with time, we can design the keyboard to be much faster than any of the existing solutions.

Anticipations

From the very start, our team realized that the interface would require practice in order for users to adjust. It was a system very different from any other keyboard input device currently existing and we anticipated that most users would start off typing slowly and progressively pick up more speed with practice. This was reflected during the studies as most participants had a tough time typing initially but began to be relatively quick as they gained confidence with the interface.

One of the major expectations we had that turned into a huge disappointment however, was the speed of the keyboard. We expected citrus keyboard to be very fast. During development and early testing it looked like it had a lot of potential, but once we started the preliminary testing phase we found it to be incredibly slow. There are a number of different issues that caused this, which are further described in the discussion section above.

We also expected that users would enjoy using the keyboard more than they did. We anticipated it being very easy to use, and very natural, but instead it was unnatural for users, and it required a lot of effort to get use to it.

HCI Guidelines

Output should always be clearly visible, preferably as close to the input as possible. One of the issues we had was a lack of confirmation for character selection. Although we had an

output text box, it was too far away from the center of the keyboard for users to be able to clearly see it without glancing away from the keys.

Objects of similar groupings should be placed together. We had two types of groupings in our keyboard. The left selection wheel, and right selection wheel each chose a subsection of characters. Although we had the right idea, the left thumbstick selected letters around the entire keyboard wheel, which made it hard for users to easily be able to see where they needed to point to select a character.

Haptic feedback is very important to give confirmation of the user's actions. One of the biggest issues we had was participants tend to over rotate and skip the desired sector. Though they can visually see what they wanted on the screen, they couldn't feel when the joystick entered a new sector. Adding in a click, or even having the controller vibrate to signal to the participant that they have entered a new sector would be immensely helpful.

Appendix

Figure 1:

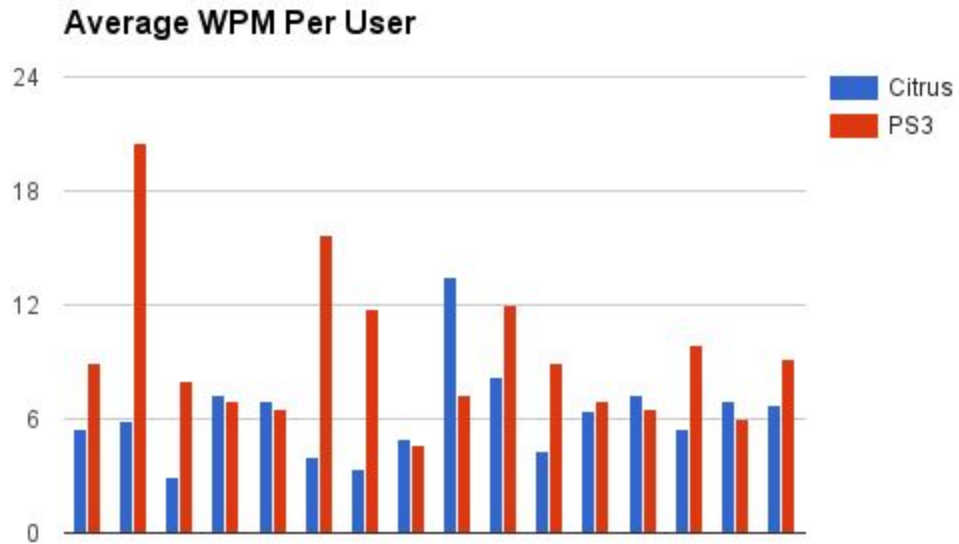


Figure 2:

Interface	Mean (WPM)	Standard Deviation (WPM)
Citrus Keyboard	6.2	2.55
Playstation 3	9.18	3.66

Figure 3:

