# Heuristic Evaluation

Purpose: The purpose of the heuristic evaluations is identify usability issues with our new keyboard design to improve in later iterations.

Method: We started the heuristic evaluation by demoing our product to the usability expert. The demo showcased how a potential user would interact with our paper prototype and accomplish multiple subgoals. While we demoed our product, the usability expert identified and rated the usability issues using the 10 nielsen's usability heuristics:

(1) Visibility of system status

(2) Match between system and the real word

(3) User Control and freedom

(4) Consistency and standard

(5) Error prevention

(6) Recognition rather than recall

(7) Flexibility and efficiency of use

(8) Aesthetic and minimalist design

(9) Help users recognize, diagnose, and recover from errors

(10) Help and documentation

The rating is scaled from 0 - 4 where 0 is there is no usability problem and 4 is there is a usability catastrophe.

Tasks and procedure:

Each interview was held in-person with the usability expert for about 30 - 45 minutes.

During the interview, the interviewer demonstrated the paper prototype by completing these

subgoal to the usability expert:

1. Switch to one-handed keyboard & adjust keyboard width
2. Enter text “Cool, good”
3. Enter “luck”
4. Assume the user accidentally made a typo (i.e., entered “lyck”), fix the typo
   1. (Tell the user that they accidentally made a typo)
5. You changed your mind and wanted to enter “kick” instead, replace luck with kick
6. Enter “!”
7. Enter 😂 emoji
   1. U+1F602
   2. HTML &#128514
8. Send message

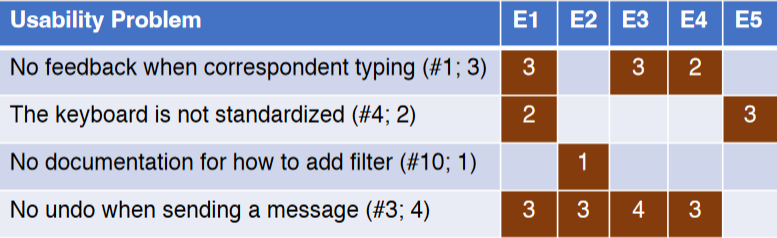
We asked the usability expert to identify specific issues, the severity of those issues on a scale from 0 to 4, as well as what usability heuristics did these issues break.

Participants:

The usability experts were 5 random master students currently taking Human Computer Interaction at the University of Michigan. Despite the short timespan, we believe the knowledge the students gained over the course of the semester is enough to perform the heuristic evaluation.

Results: Does the assignment contain notes on all usability issues that the experts found with corresponding usability heuristic and severity score?

Listed below are the design issues and the respective scores noted by the usability experts. As mentioned previously, the design issues are based on Nielson’s Usability Heuristics, and the scores range from 0, not an issue, to 4, a usability catastrophe.

* + - 

| Usability problem | E1  Daniel | E2  Franklin | E3  Isaac | E4  Jerry | E5  Yichen |
| --- | --- | --- | --- | --- | --- |
| Switching to the one-handed keyboard (our new design) has low discoverability.  (#10, #6, #1, #7; 4) | 2 | 3 |  | 4 | 3 |
| No indication of the extended delete word feature (#1, #10; 2) | 1 |  | 4 |  |  |
| The user still needs to touch the very left of the screen to fix the beginning words (#3; 1) | 2 |  |  |  |  |
| Need to allow users to delete characters, not just words (#7; 1) | 1 |  |  |  |  |
| Deviates from the standard keyboard layout  (#4; 1) |  | 3 |  |  |  |
| No indication users can tap the typo word to be taken to the word candidate table. (#1, #6, #7; 2) |  | 3 |  | 2 |  |
| The user cannot return to the ‘ABC’ keyboard from the emoji and number/punctuation keyboard. (#4, #3; 2) |  | 3 |  |  | 3 |
| The user is locked to comma, and question mark as default for the bottom right keys (#3; 1) |  | 2 |  |  |  |
| The user cannot toggle the keyboard cosmetics/typo lists off. (#3, #5, #9; 4) |  | 1 | 3 | 3 | 3 |
| The user cannot continuously delete words with the new delete feature. (#3; 1) |  | 1 |  |  |  |
| The user can mistakenly minimize the keyboard for one handed use by accidentally dragging the keyboard. (#5; 1) |  |  | 1 |  |  |
| The user does not know you can swipe up to type an exclamation mark. (#10; 1) |  |  | 4 |  |  |
| No maximum limit to the keyboard minimization feature. (#3; 1) |  |  | 2 |  |  |
| Every time the user presses the delete key, the new animation (elongated delete key) is triggered. This not only is initially confusing to new users, but it may also annoy experienced users. (#1, #7; 1) |  |  |  | 2 |  |

1. **The** design has no indication of the yellow backspace feature.
   1. Usability Principle: Visibility of system status (1)
   2. Score: 1
2. **If the** user wants to correct the word at the very beginning, the user needs to touch the very left of the screen to select it.
   1. Usability Principle: User Control and freedom (3)
   2. Score: 2
3. **What if** the user only wants to delete the last character, not the last word? Can be more flexible.
   1. Usability Principle: Flexibility and efficiency of use (7)
   2. Score: 1
4. **How do** users know they can narrow the keyboard? No such indication.
   1. Usability Principle: Help and documentation (10)
   2. Score: 2
5. **The use**r would not be able to discover this one-hand keyboard feature. This feature isn't visible to the user.
   1. Usability Principle: Recognition rather than recall (6)
   2. Score: 3
6. **The lack** of the return key on the one-hand keyboard goes against convention and standard.
   1. Usability Principle: Consistency and standard (4)
   2. Score: 3
7. **The user** doesn't know that they can tap the typo word to be taken to the word candidate table.
   1. Usability Principle: Recognition rather than recall (6)
   2. Score: 3
8. **The use**r cannot return to the keyboard keyboard from the emoji and number/punctuation keyboard. No ‘ABC’ key to go back.
   1. Usability Principle: Consistency and standard (4), User Control and freedom (3)
   2. Score: 3
9. **The use**r is locked to comma, and question mark as default for the bottom right keys.
   1. Usability Principle: User Control and freedom (3)
   2. Score: 2
10. **The user** cannot toggle the keyboard cosmetics off.
    1. Usability Principle: User Control and freedom (3)
    2. Score: 1
11. **The user** cannot continuously delete words with the new delete feature.
    1. Usability Principle: User Control and freedom (3)
    2. Score: 1
12. **The user** can mistakenly minimize the keyboard for one handed use by accidentally dragging the keyboard.
    1. Usability Principle: Error prevention (5)
    2. Score: 1
13. **The user has** no way to return back from the typo correction menu.
    1. Usability Principle: User Control and freedom (3)
    2. Score: 3
14. **The user** does not know you can swipe delete entire words.
    1. Usability Principle: Help and documentation (10)
    2. Score: 4
15. **The user d**oes not know you can swipe up to type an exclamation mark.
    1. Usability Principle: Help and documentation (10)
    2. Score: 4
16. **No maximum l**imit to the keyboard minimization feature.
    1. Usability Principle: User Control and freedom (3)
    2. Score: 2
17. **It is diffic**ult for the user to discover/find (for the first time) how to switch between a two-handed keyboard and one-handed keyboard.
    1. Usability Principle: Visibility of system status (1) Recognition rather than recall (6) Flexibility and efficiency of use (7)
    2. Score: 4
18. E**very time the u**ser presses the delete key, the new animation (elongated delete key) is triggered. This not only is initially confusing to new users, but it may also annoy experienced users.
    1. Usability Principle: Visibility of system status (1) Flexibility and efficiency of

use (7)

* 1. Score: 2

1. **It is difficult for** new users to discover/find the autocorrect feature that displays a list of words.
   1. Usability Principle: Visibility of system status (1) Recognition rather than recall (6) Flexibility and efficiency of use (7)
   2. Score: 2
2. **If the user a**ccidentally clicks on the typo, which results in the keyboard displaying a list of words for the user to select from, there is no way for the user to go from the current state back to the keyboard.
   1. Usability Principle: User Control and freedom (3) Error prevention (5) Help users recognize, diagnose, and recover from errors (9)
   2. Score: 3
3. **Users woul**d have a hard time figuring out how to shrink the keyboard using space unless given clear instructions or hints.
   1. Usability Principle: Visibility of system status (1) Recognition rather than recall (6)
   2. Score: 3
4. **Users can't g**o back to the keyboard panel if they wrongly enter the error fixing mode. They have to choose a word to proceed.
   1. Usability Principle: Visibility of system status (1) User Control and freedom (3)
   2. Score: 3

# Simplified User Testing

Purpose:

The purpose of simplified user testing is to test the usability and the features of our mobile device text entry prototype against our designated user requirements.

Methods:

We started the interview by disclosing the purpose to the participants. We made sure participants were aware that participation is completely voluntary. Additionally, we stated that any information about the participants will be either confidential or declassified. We told participants they will perform a think aloud and explained how a think aloud works. During the interview, the interviewer placed the paper prototype against a portable surface and changed the IPhone interface based on user input. The participants were given users tasks to perform with the paper prototype. These tasks test our user requirements, stated below:

* User Requirement 2: User should not need to manually fix any mistakes produced by the system’s keyboard assistive features (e.g., autocorrect) when entering text on their mobile device with one hand
* User Requirement 3: User should be able to remove any text entered on their mobile device using one hand without accidentally removing any other characters or words the user did not intend
* User Requirement 4: User should be able to navigate, communicate and interact with different keyboard elements using one hand without introducing slips and without straining (overextending) their thumb (hand) or repositioning the mobile device
* User Requirement 5: User should be able to locate and enter emojis, punctuations, and numbers on the mobile device with one hand more efficiently (faster) than their default (i.e., current or existing) method of entry

The interviewer took notes of any breakdowns user experiences to discuss later to the group.

Tasks and Procedure:

We started the interview by showing the participant the video on think-aloud. This helps the participant understand what they are expected to do. Then, we gave participants a set of goals to accomplish with our paper prototype. The tasks the participant performed are listed below:

1. Switch to one-handed keyboard & adjust keyboard width
2. Enter text “Cool, good”
3. Enter “luck”
4. Assume the user accidentally made a typo (i.e., entered “lyck”), fix the typo
   1. (Tell the user that they accidentally made a typo)
5. You changed your mind and wanted to enter “kick” instead, replace luck with kick
6. Enter “!”
7. Enter 😂 emoji
   1. U+1F602
   2. HTML &#128514
8. Send message

The interviewer would wizard-of-oz the functionalities of the paper prototype based on the user’s input. While the user is talking and interacting with our product, the interviewer will take notes on any difficulties the user faces and any mistakes they make due to our design. If the user stops verbalizing their thoughts, the interviewer will ask to keep talking. Otherwise, the interviewer will stay silent.

Participants:

Results: Does the assignment contain quality interpretations of the participant actions and utterances during the think-aloud, and notes on when and how the design fails to meet the user requirements?

Need to summarize what we found, specifically regarding the breakdowns in our prototype.

**Piazza Instructor Answer**: You don't need to list all individual results. The results should be summarized based on individual results, but you should include some details from your individual results (e.g., with reference to which participant said/did what during your study) to support your findings.

Explain which user requirements were met and why (use user testing results to support our conclusions)

**Task 1: Switch to one-handed keyboard & adjust keyboard width**

* U1 (Daniel)
  + Participant doesn’t know how to get into the one handed keyboard
  + Participant wants to turn phone to the side to adjust the width (not desired)
  + Participant is unable to figure out how to make into one handed keyboard for a while
  + Participant tried random motions
  + Participant reaches the other side of the keyboard to adjust width instead of anywhere on keyboard
* U2 (Franklin)
  + Can’t tell the difference between this and the default keyboard.
  + He can’t seem to find the way to trigger the one hand mode.
* U3 (Isaac)
* U4 (Jerry)
  + Switching from the two-handed keyboard to the one-handed keyboard had low discoverability (i.e., the participant could not complete Task #1).
  + The participant mentioned during think-aloud that they had no idea how to switch by looking at just the keyboard alone.
    - They mentioned that there was no indication on the keyboard for how to switch.
  + They attempted the following interactions but none of them were the desired interaction we designed.
    - dragging the keyboard from left to right
    - go to settings
    - press the dictation button (the microphone icon)
    - press language switch key (the globe icon)
  + Although this result does not make the design fail to meet any specific user requirements, not being able to switch to the one-handed keyboard (our design) in the first place would prevent the user from using any of its features.
* U5 (Yichen)
  + The user got confused about how to change to one-handed keyboard. She tried several things, including tabing the ‘space’ key, tabing and dragging the white space on the keyboard, click on the emoji, and click on the language switching key. She thought those ‘special’ keys might trigger the one-handed typing mode, but neither worked. At this time, she got focused and had long stalls.
  + The user noticed that there was a triangle button that represents ‘sliding’. So she tried to drag that button and finally she could adjust the keyboard width.

**Task 2: Enter text “Cool, good”**

* U1 (Daniel)
  + Participant is able to write out the text
  + Participant used the new comma key instead of going into the numbers key to find the comma (desired)
  + Participant had no difficulty doing this task
* U2 (Franklin)
* U3 (Isaac)
* U4 (Jerry)
  + The participant easily spotted the newly added punctuation keys on the keyboard.
  + They were able to successfully use them to enter a comma.
  + The participant also mentioned during think-aloud that usually they had to switch to another keyboard to enter punctuation but the new punctuation keys really made the process easier.
* U5 (Yichen)
  + Since the ‘shrink’ keyboard had smaller keys, she had to slow down to prevent mistouch.
  + To type ‘,’, she got accustomed to click on the ‘123’ key to change to punctuation/number keyboard, as she did previously. And then she could finally find the ‘,’. After typing ‘,’, she switched to the one-handed alphabet keyboard.
  + At this time, she noticed there is a shortcut for the ‘,’ key, which is one of our prototype feature. She stalked for a second, and said that she would try to use this shortcut next time.
  + She also thought that because of the small key size, she could not easily notice the ‘,’ shortcut.

**Task 3: Enter “luck” (but accidentally typed “lyck”)**

* U1 (Daniel)
  + Participant is able to write out the text
  + Participant used the new comma key instead of going into the numbers key to find the comma (desired)
  + Participant had no difficulty doing this task
* U2 (Franklin)
* U3 (Isaac)
* U4 (Jerry)
* U5 (Yichen)
  + Great! The user completed the task without any difficulties.

**Task 4: User realized that they made a typo (i.e., entered “lyck”), fix the typo**

* U1 (Daniel)
  + Participant double taps the typo
  + Participant taps “Luck”
  + Participant is a bit hesitant to tap “Luck” because of the capital L in the beginning instead of lowercase
    - May need to allow different cases
* U2 (Franklin)
  + Wants the long-press the typo word to highlight it and delete it
* U3 (Isaac)
* U4 (Jerry)
  + To fix the typo, the participant went straight to delete.
  + When given the task to fix the typo, the participant first mentioned that they looked at the 3 suggested words at the top of the keyboard but they did not give the right suggestions.
  + Therefore, the participant went straight to just delete it and re-enter the correct word.
  + After all tasks were finished and I asked the participant to try to use another method to fix the typo, the participant then tried to further explore the autocorrect feature.
  + When using autocorrect, it took the participant some time to figure out that tapping on the typo would give a list of suggested words.
    - They eventually figured it out because they mentioned that Apple had the same feature that tapping on the typo would give 3 suggested words at the top of the keyboard.
  + Although this result does not make the design prototype fail to meet user requirement 2, it does show that the new autocorrect feature has low discoverability and that users may not really wish to rely on autocorrect as their first instinct.
* U5 (Yichen)
  + When fixing the typo, the user found that there were some red dots underline with the wrong word. She thought maybe she need to tape on that word. After typing on that word, the 3x3 suggestion autocorrect words appeared. She tried looking the word line by line, from left to right, and finally picked up the correct word. In short, she completed the task without any mistakes.

**Task 5: User wanted to enter “kick” instead, replace “luck” with “kick”**

* U1 (Daniel)
  + Participant would double tap the word then backspace
  + Participant is unaware of the new delete feature
    - May need to put a better indicator of new functionality of backspace
* U2 (Franklin)
  + When he deletes he deletes it character by character
  + When he hold down the delete button, he doesn’t know what the blank keyboard means
  + Thinks there should be a way to delete multiple words conveniently
* U3 (Isaac)
* U4 (Jerry)
  + When pressing down the delete key to delete the word “luck” (Task #5) and the frame with the delete key feature was shown to the participant, the participant thought that it was a “glitch”.
  + The participant deleted the word by repeatedly pressing down the delete key, rather than trying to swipe on the screen to delete the entire word, which was the new delete feature we designed.
  + The participant was not able to figure out the interaction that needed to trigger the new feature and thought that this feature (shown on the new interface) was strange.
  + When asked whether the elongated delete key meant anything to them after all tasks were finished, the participant said that they could not think of anything that this new interface could do.
    - The participant also added that if they just wanted to delete one or two letters, showing this new interface (i.e., having the delete key elongated while the rest of the keys grayed out) every time they click on the key would be annoying and not helpful.
  + This result would give us inconclusive evidence on whether our design prototype meets user requirement 3 because the participant did not use the new delete feature to delete any words.
* U5 (Yichen)
  + The user noticed that she need to delete the whole word, so she quickly found the delete button.
  + She clicked the ‘delete’ button four times to delete every character of the word.
  + She didn’t notice that the revised ‘delete’ button could easily delete the whole word by swiping on the screen.

**Task 6: Enter “!”**

* U1 (Daniel)
  + Participant opts to click the number key over the mini ! key on the bottom right
  + Participant thinks it’s more time consuming to hold the bottom right key and swipe up
    - Prefers manual click than swipe
* U2 (Franklin)
  + First reaction is to find the exclamation mark key on the default keyboard layer.
  + Assumed that it may be on the default keyboard because he is using the keyboard in one-hand mode
  + Wasn’t able to find the exclamation mark key at first glance
  + Not sure if he needs to long press the key to enter the exclamation mark
  + The regular iphone keyboard doesn’t show alternate symbols on the keys
* U3 (Isaac)
* U4 (Jerry)
  + They were also able to enter an exclamation mark, which was the alternative value of the key.
    - However, they initially had some confusion about it as they mentioned that they wanted to somehow hit the “shift” key (like the physical keyboard for a computer), to enter the exclamation mark.
    - But then they realized that holding down the punctuation key and sliding it up would give them the exclamation mark.
  + The participant also mentioned during think-aloud that usually they had to switch to another keyboard to enter punctuation but the new punctuation keys really made the process easier.
* U5 (Yichen)
  + The participant noticed that she could use the shortcut for ‘!’ based on the cognition of task #2. And she also noticed that the ‘!’ is on the upper corner for that key.
  + So she firstly clicked on the upper arrow on the left and then successfully clicked the ‘!’ key without any mistake

**Task 7: Enter** 😂 **emoji**

* U1 (Daniel)
  + Participant clicks the emoji button and gets the emoji with ease
  + Participant experienced no confusion and confident in his action
* U2 (Franklin)
  + Wanted to long press the emoji key to go into emoji keyboard
  + Confused by the emoji search bar
  + Thinks people usually don’t know the name of a specific emoji
  + Thinks search bar may be useless
  + Does not mind locating the emoji by manually looking it up
  + Remarks that the most common emoji is at top
* U3 (Isaac)
* U4 (Jerry)
  + Entering emojis was easier for the participant compared to before
  + The participant mentioned during the think-aloud that because the emojis key was more shifted towards the right, they could easily reach it and switch to a different keyboard to enter the emoji.
  + The participant was able to quickly locate the emoji because it was listed under the frequently-used emojis, thus further contributing to the easier entry of emojis.
* U5 (Yichen)
  + She noticed that she needed to switch to the emoji keyboard. Her finger could easily touch the emoji switch button, and then went inside the emoji keyboard. And then she clicked on the emoji without any difficulties.

**Task 8: Send the message**

* U1 (Daniel)
  + Participant clicks the correct button (send button)
  + Participant does task with ease
* U2 (Franklin)
* U3 (Isaac)
* U4 (Jerry)
  + Removing the return key from the keyboard did not interfere with the participant’s ability to accomplish their goal of sending the message to a friend.
  + The participant was still able to recognize that there was a “send” key located in the messaging app and was able to click on it to send the message.
  + The participant also did not mention anything wrong about the missing return key.
* U5 (Yichen)
  + She completed the task without any difficulties.

**Additional Notes**

* Jerry (not sure where to put them yet, we can collectively discuss on this later)
  + The autocorrect was no longer counterproductive.
    - As the participant (pretended that they) made a typo, they mentioned that usually when they made a typo and did not realize it immediately, the autocorrect would automatically change the word to something they did not want.
    - Because the word simply just got underlined and the participant could manually fix it themselves, they thought it was helpful.
  + All keys on the keyboard were easily reachable.
    - The participants mentioned that they could easily reach all keys on the keyboard when entering the words.
    - The participants also did not mention any difficulties with the keys being too narrow.

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