Instructions (from Canvas): Does the User Requirements section contain a comprehensive list of objective and testable user requirements properly grounded in the context of use? Is each requirement properly explained and justified?

For the user requirements, we realized that there would always be a tradeoff between the four rules/principles that a requirement must satisfy, especially between the requirement’s objectivity and whether the requirement implies a solution. Being more specific would increase objectivity, but would also increase the likelihood of implying a solution. On the other hand, being more abstract would less likely imply a solution, but would also be less objective. Thus, we tried our best to balance these two rules, and occasionally had to prefer one over the other if the requirement made more sense in one way.

**User Requirement [?]**: When entering text on mobile devices, user should not make more typos (slips) when operating with one hand compared to operating with both hands (U05-07, U5-08, U05-13, U05-23, U05-27, U05-29, U05-35, U01-14, U01-15, U03-04). \*\*\*

Explanation/Justification

* The user frequently made typos, almost every other word, while typing on the phone with one hand (U05-07 to 08, U05-23, U05-35). They expressed frustration and annoyance towards making these slips (U05-13) and switched to typing with both hands when they became too irritated with making typos, even if that meant putting down the artifact that originally occupied their other hand to focus on typing (U05-27). This truly shows the level of frustration of the user with making typos. Moreover, when typing with both hands, the user experienced fewer typos compared to typing with one hand (U05-29). Taken all together, it is clear that there is a salient breakdown in the existing method of one-handed text entry on mobile devices, hence this user requirement.

Does this requirement meet the 4 rules?

* This requirement is grounded in the context of use, because it references interpretation notes.
* This requirement is testable, because we can ask the user to enter one short paragraph with two hands, and then enter another paragraph with similar complexity and length with one hand.
* This user requirement is fairly objective, since it is clear whether the requirement is met or not by measuring the number of typos when entering text with both hands vs. one hand, and then comparing the two.
* This user requirement does not imply an obvious solution that can easily address this.

**User Requirement [?]**: 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 (U05-09, U05-10, U05-11, U05-12, U05-13, U05-25, U05-27, U05-30).

Does this requirement meet the 4 rules?

Explanation/Justification

* The autocorrect feature appears to be ineffective and even counterproductive when the user is using one hand to enter text on the phone while multitasking (U05-09 to 13, U05-25). The default autocorrect feature on the iPhone (which was what the user was using) would automatically change the typo word to a word that the algorithm believes is what the user intended to type, unless the user manually select a suggested word displayed at top of the keyboard (U05-09, U05-11). However, more often than not, the autocorrect feature got it wrong (U05-09), and the resulting word would sometimes be completely different from what the user intended, especially when it was an acronym (U05-10). Moreover, the user could not use the autocorrect feature on this word anymore because the word was now considered as “correct” by autocorrect; consequently, the user had to manually delete and retype the entire word (U05-12). Forgetting to manually select from the suggested words was especially common when the user was using one hand and distracted by the surroundings (U05-11), causing the autocorrect to be in fact counterproductive and making the user very annoyed and frustrated (U05-13). In contrast, the user was able to use the autocorrect feature much more effectively and efficiently when typing with both hands (U05-30). Thus, it is clear that there is a breakdown in the existing autocorrect feature when entering text on the phone with one hand and multitasking.

Does this requirement meet the 4 rules?

* This requirement is grounded in the context of use.
* This requirement is testable, because we can ask the user to enter a short paragraph with one hand, and record whether they needed to fix any mistakes that were not caused by an unintentional slip of the user.
* This user requirement is fairly objective, since one can clearly tell which mistake is caused by an unintentional slip of the user (e.g., mis-pressing keys) and which ones are caused by the system’s keyboard assistive features (e.g., autocorrect). Consequently, it is clear whether this requirement is met or not.
* We tried our best to make this user requirement not imply an obvious solution, by changing it to be more abstract rather than just specifically for autocorrect features.

**User Requirement [?]**: User should be able to fix a typo (mistakenly-spelled word) using one hand independently of keyboard assistive features and without accidentally modifying any other (correctly-spelled) characters or words (U05-25, U05-26, U05-27, U02-06, U04-17).

Explanation/Justification:

* Despite being helpful, autocorrect could only take the user so far: It was difficult for autocorrect to produce the right suggested words every single time, and when it did not, the user struggled to fix typos with just one hand (U05-25, U05-26, U05-27, U02-06, U04-17). In the case when the user’s other hand was occupied, they had no choice but to manually fix the typo with just one hand by first holding down the delete key, which frequently ended up over-deleting the entire current word and the word before it, rather than just up to and including the letter that differed from the right word (U02-06, U04-17, U05-26). As a result, the participant had to spend more time retyping more letters than necessary. Moreover, the fact that the user would use both hands to fix the typos when the other hand was not occupied (U05-12) and even when the other hand was occupied if they became so frustrated with fixing typos (U05-27) truly indicate the difficulty of fixing typos with just one hand. Therefore, this user requirement was created.

Does this requirement meet the 4 rules?

* This user requirement is grounded in context of use.
* This user requirement is testable, since we can ask the user to type a difficult/complex paragraph which likely induces many typos/slips, then we can record whether the user modified any word other than the typo when fixing them.
* This user requirement is fairly objective, because it is clear whether the user modified any word that was not a typo.
* This user requirement does not imply an obvious solution.

**User Requirement [?]**: User should be able to locate and enter emojis, punctuations, and numerics on the mobile device with one hand more efficiently (faster) than their default (i.e., current or existing) method of entry (U05-15, U05-16, U05-17, U05-37, U04-09, U04-18, U02-08, U03-06, U03-18, U03-19).

Explanation/Justification:

There appears to be a breakdown in entering non-letters with one hand, such as emojis (U05-15, U05-16, U05-17, U04-09, U04-18), punctuations, and numbers (U02-08, U03-06, U03-18, U03-19, U05-37). To enter these characters, the user had to first switch the keyboard (e.g., switching from the default letters keyboard to the emojis keyboard) by locating and pressing the keyboard-switch key, which the user struggled on since this key is located at the edge of the keyboard (U05-15, U05-37, U03-18, U03-19). Then, the user had to find the desired characters on the new keyboard, which was also hard to do: For example, to select to desired emoji, the user had to consciously look at the keyboard rather than relying on muscle memory because the emojis keyboard has way more keys (i.e., emojis to choose from) compared to the letters keyboard and it also dynamically changes based on the frequently used emoji of the user (U05-16). Similar experience applies to the punctuations and numbers keyboard (U03-18, U05-37). Furthermore, because the user had to frequently enter these characters, almost in every message they sent, this process drastically slowed down the overall text entry speed (U05-17) and the user eventually stopped entering these characters due to its complexity (U05-37).

Does this requirement meet the 4 rules?

* This user requirement is grounded in context of use.
* This user requirement is testable, since we can ask the user to first find an emoji, punctuation, and number using their current method, and use the new prototype we build to find a different emoji, punctuation, and number, recording the time for both and comparing them.
* This user requirement is fairly objective because it is clear to determine whether the time is faster using one method or the other.
* This user requirement does not imply an obvious solution.

# Hi Daniel, please Start Here [3 more to do]

**User Requirement [?]**: When engaging with social media on mobile devices in a relaxed posture (e.g. lying on the side), the user should be able to comfortably navigate, comment, and interact using one hand without straining or repositioning the device frequently (U04-02, U04-03, U04-05, U04-06, U04-12). \*\*\*

When using mobile devices in various relaxed postures, users should be able to navigate, comment and interact with the phone comfortably with one hand without straining or repositioning the device.

Does this requirement meet the 4 rules?

- User requirements must be grounded in context of use: Yes, references interpretation notes.

- User requirements must be testable: Yes, observe the user navigating TikTok and noting instances of strain or discomfort.

- User requirements must be objective: Yes, we can measure the frequency and ease of interaction.

- User requirements must not imply a solution: Yes, no specific solution is implied.

Explanation/Justification:

The user prefers a relaxed posture like lying on the side when engaging with TikTok (U04-02, U04-03). They often found it difficult to navigate, especially when the interactive elements are not within easy reach of their thumb (U04-05, U04-06). This led to discomfort and the need to frequently reposition the device (U04-12). Thus, ensuring a comfortable one-handed interaction is essential for user satisfaction.

Merge next 3

**User Requirement [?]**: The user should be able to easily reach and interact with key elements, (e.g. comment button, emoji switch, and send button) without the need to excessively stretch their thumb or switch to using both hands (U04-06, U04-07, U04-09, U04-10, U04-11).

Does this requirement meet the 4 rules? \*\*\*

Users should be able to access all elements (keys) on the keyboard without discomforting their hand by stretching their thumb or needing to use both hands.

(U01-05, U01-07, U01-13, U02-02, U02-03, U02-08, U02-17, U03-06, U03-08, U03-12, U04-06, U04-07, U04-09, U04-10, U04-11, U05-37)

**When typing**, the user should be able to reach keys on the opposite side of the keyboard 9 out of 10 times without readjusting the phone(U01-07, U03-06, U04-10, U01-13).

The user should not have to extend their thumb to the opposite third of the screen to reach any keys.

The user must be able to switch keyboard capitalization without needing to reach the opposite edge of the phone across from the user's hand (U05-37, etc..)

- User requirements must be grounded in context of use: Yes.

- User requirements must be testable: Yes, measure the ease of reaching and interacting with key elements.

- User requirements must be objective: Yes, we can observe the user's ease of interaction and thumb stretch.

- User requirements must not imply a solution: Yes.

Does this requirement meet the 4 rules?

TBD

Explanation/Justification:

The user often switches between one-handed and two-handed typing depending on the context, such as the language used or the need for error correction (U04-13, U04-14, U04-17). The positioning of certain keys, like the delete key, makes it challenging for one-handed use (U04-16, U04-17). The keyboard should adapt to the user's needs, ensuring comfort and accuracy in all scenarios.

Franklin

1. The user must be able to switch keyboard capitalization without needing to reach the opposite edge of the phone across from the user's hand (U05-37, etc..)

Isaac

The phone should fit comfortably and held securely within the user’s hand, ensuring a secure grip while minimizing hand strain.

The user should be able to hold the mobile device one-handed in a secure manner without inflicting physical discomfort.

The mobile device should be designed to allow for a secure one-handed grip, with users reporting no hand fatigue after a long time of use.

Users should have the flexibility to move the keyboard to a comfortable position on the screen, whether it's to the left, right, or center.