Just Ask Me: Comparing Older and Younger Individuals' Knowledge of Their Optimal Touchscreen Target Sizes

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ABSTRACT

To understand whether people can identify their optimal touchscreen target sizes, we asked older and younger adults to identify optimal target sizes on a questionnaire and compared these chosen sizes to performance on a target acquisition task. We found that older individuals (60+) were better than younger adults at choosing their optimal target sizes. In fact, younger adults underestimated the smallest target size they could accurately touch by almost 6mm. This study suggests that older adults may be able to better configure target size settings than younger adults.

Author Keywords

Older adults; Questionnaire; Accessibility settings

ACM Classification Keywords

• Human-centered computing~Accessibility systems and tools

INTRODUCTION

Approaches to achieve optimal accessibility settings, particularly for target size (e.g., mouse or touchscreen button size), typically rely on performance-based tests (*e.g.*, [2,3,5]). However, the number of taps, swipes, or mouse clicks required to reliably model the user's ability in this way is time consuming and potentially fatiguing.

In this work, we explore whether performance testing is necessary for optimization, by measuring the extent to which users can simply *identify* their individually optimal touchscreen target size. Because age can impact touchscreen input performance [1], we also explicitly recruit participants who span a wide range of ages. If participants can identify their optimal target size reasonably well, self-report questionnaires may be sufficient for optimizing a variety of accessibility settings. Alternatively, showing that users are not able to do so provides further motivation that performance-based optimization is worth the effort.

Our study contributes empirical results suggesting that older adults achieved better performance than younger adults on target sizes they chose on a questionnaire. This finding suggests that older adults may be able to identify their optimal target sizes more accurately than younger adults.

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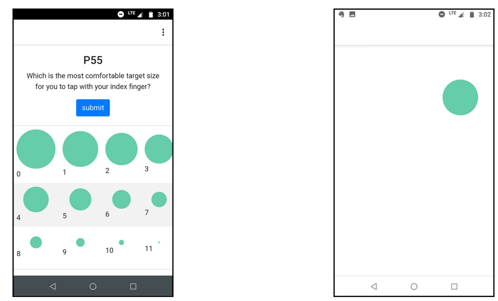

Figure 1. Questionnaire (left) and performance test (right).

STUDY 1: METHOD

We recruited 19 participants for this controlled lab study. Participants first identified preferred target sizes on a questionnaire, them completed a tapping performance test.

Participants

We divided participants into two groups for analysis: older adults (*N*=7, aged 60+) and younger adults (*N*=12, aged < 60); 60 years is a typical age cut-off for older adults [6]. The older adults were on average 67.4 years old (*SD*=4.1) and included four women and three men. The younger adults were on average 39.2 years old (*SD*=12.1) and included nine women and three men. The older adults had on average 6.9 years (*SD*=3.8) of touchscreen experience, while the younger adults had on average 10.0 years (*SD*=1.8).

Apparatus

The apparatus consisted of a questionnaire and a performance test (Figure 1), both implemented in JavaScript and displayed in a Chrome browser window on a Moto G5S+ (Android v.8.1.0). The questionnaire presented 12 target sizes ranging from 1mm to 23mm and incrementing in size by 2mm. These targets were arranged in one of four layouts, where for each layout, the largest target appeared in cell 0, 3, 8, or 11, and the rest of the targets were ordered by size. Above the grid of targets, one of two questions was displayed depending on the condition: (1) "Which is the *smallest* target size that you could tap with your <index finger or thumb> without missing most of the time?", and (2) "Which is the *most comfortable* target size for you to tap with your <index finger or thumb>?".

Procedure

Participants first completed a questionnaire with a verbal phase followed by an interactive phase, then completed an input performance test. For the verbal questionnaire phase, the participant selected an optimal target 32 times, one for each of the following variations: 2 *questions* (smallest, most comfortable target) × 2 input *fingers* (index, thumb) × 2 device *orientations* (landscape, portrait) × 4 target *layouts* (described above). The four layouts were used to avoid introducing target ordering as a confound. For each of the 32 combinations, participants visually inspected the grid of numbered targets (Figure 1) and verbally indicated the target they felt was optimal, after which the researcher selected the target. The participant then moved to the interactive phase, where they again identified optimal targets for the 32 combinations, but this time by interactively tapping on the screen. Tapping within the grid cell for a given target highlighted the cell, after which the participant tapped "submit" to confirm the selection. We used verbal and interactive presentation types to see if participants would correct their verbal target selection during the interactive phase.

The performance test followed. Here, the participant was presented with each of the 12 same target sizes as before for three *finger* × *device* orientation conditions: (1) index × landscape, (2) index × portrait, (3) thumb × portrait. Conditions were counterbalanced. The thumb × landscape condition was excluded because reaching across the length of the screen with the thumb is difficult and potentially error-prone. For each condition, the participant was prompted to use their index finger or thumb in landscape or portrait mode. The participant held the device in their non-dominant hand while tapping with their dominant hand. The 12 targets were presented one at a time in randomized order. After the participant attempted to tap a given target, the system advanced to the next target regardless of whether the tap was accurate. The participant tapped a total of 36 targets.

RESULTS

We report the average target sizes that younger and older adults chose on the questionnaire across *presentation type*, *finger*, *orientation*, and *layout* combinations. We also report how each age group performed on target sizes chosen on the questionnaire.

Questionnaire Results

Older people tended to identify larger target sizes on the questionnaire than younger people.

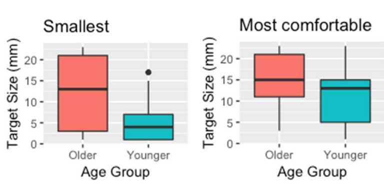

Figure 2. Boxplots of "smallest" (left) and "most comfortable" (right) target sizes by age group across *presentation type*, *finger*, *orientation*, and *layout* combinations.

There was a significant positive correlation between age and selected target size, for both "smallest" (Spearman's ρ=0.24, p<.001) and "most comfortable" (ρ=0.21, p<.001) target sizes. In line with these results, younger adults consistently chose smaller target sizes for both "smallest" (younger: *Median*=4mm, *IQR*=6mm; older: *Median*=13mm, *IQR*=18mm) and "most comfortable" (younger: *Median*=13mm, *IQR*=10mm; older: *Median*=15mm, *IQR*=10mm) questions across variables (e.g. *finger*, *orientation*, *presentation type, and layout*) compared to older adults (Figure 2).

Performance Test Results

To understand how each target size identified by participants mapped to their *actual* performance, we computed how accurately the participant tapped on targets of the given size and larger. For example, P16 (age 38) identified 3mm as her "smallest" target size when using the index finger in portrait mode. Her mean accuracy for target sizes ≥ 3mm in this condition (index × portrait) on the performance test was 91%.

For "smallest" target sizes, older adults had higher accuracy on target sizes they chose on the questionnaire compared to younger adults (older: *Median*=100%, *IQR*=10%; younger: *Median*=83%, *IQR*=25%) across the three *finger* × *orientation* combinations (Figure 3, left). Older and younger adults had the same median accuracy for the "most comfortable" target sizes (older: *Median*=100%, *IQR*=0%; younger: *Median*=100%, *IQR*=12%) (Figure 3, right).

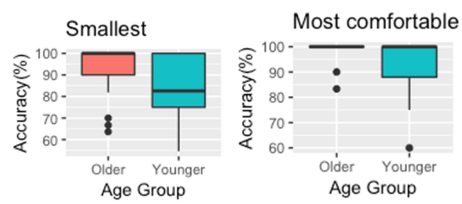

Figure 3. Mean accuracy on the "smallest" (left) and "most comfortable" (right) target sizes by age group.

DISCUSSION AND CONCLUSION

Older adults performed better than younger adults on target sizes that they had chosen on the questionnaire, particularly for the "smallest" target sizes. Younger adults were overly confident in their ability to accurately tap, choosing a median "smallest" target size of 4mm, compared to older adults who chose a median of 13mm. Parhi *et al.* [4] found that error rates on small touchscreen devices could not be discriminated statistically with target sizes ≥ 9.6mm with participants whose mean age was 25.7 years. Thus, younger adults in our experiment chose an average "smallest" target size that was almost 6mm smaller than Parhi *et al.*'s recommended target size. However, this finding may be explained in part by experience with touchscreens, of which older adults had less (7 years compared to 10 years for younger adults). Future work can explore how age and years of touchscreen use relate to identification of optimal target sizes. In sum, older adults might not need performance assessments for determining their optimal target sizes, while younger adults might.

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