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Barbara S. Chaparro, Editor

Can Expanding Targets Make Object Selection Easier for Older Adults?

By Michael Bohan & Deborah Scarlett

Given the proliferation of computers and rapidly aging demographic trends, there is a critical need for user interface designs that accommodate older adults. It is known that many adults in this age group experience declines in cognitive, sensory, and/or motor capacities that may interfere with their ability to interact effectively with current user interfaces.

Motor behavior slows with age. Compared to younger adults, older adults take longer to complete the same movement, and their movements are more variable, less smooth, and less coordinated (Seidler & Stelmach, 1996). The loss of fine motor skills makes it difficult for older adults to position cursors on computer screens, particularly when interacting with small objects (Chaparro, et al., 1999; Walker et al., 1996). This can lead to greater frustration and possibly increased risk of cumulative trauma due to prolonged periods of time in awkward postures. This article describes one of a series of studies designed to explore alternative interaction techniques to make object selection easier for older mouse users.

When searching for ways to make object selection easier, consideration must be given to the trade-off between screen space and object accessibility. Increasing the size of objects makes their selection easier by virtue of Fitts� law (1954), but it also reduces the amount of screen space available for displaying other objects and information. Alternative solutions have been suggested which make use of a larger cursor activation area (Kabbash & Buxton, 1995) or a dynamic control-display gain (Keyson, 1997) to enable faster selection of targets without increasing their size. These interaction techniques have been shown to be successful in improving the performance of older adults in basic object-selection tasks (Worden, Walker, Bharat, & Hudson, 1997).

Another promising interaction technique involves dynamically expanding objects on the screen as the cursor approaches them (McGuffin & Balakrishnan, 2002). This technique was found to significantly improve target selection time in younger adults, suggesting that subjects were able to modify their initial motor response (i.e., to a small initial target) to take advantage of the final expanded target size. However, it is unclear whether this same capability would be shared by older adults. Some research suggests that older adults are unable to adjust a motor response based on new visual information once the movement has been initiated (Heath, et. al., 1999). An additional concern is that a target which suddenly changes size could be distracting for older adults.

A preliminary experiment was conducted to assess the potential usefulness of expanding targets as a means to improve object selection for older computer users. Specifically, we investigated: (a) whether older adults could adjust their initial motor response to take advantage of the larger final target size and (b) whether performance is affected by the point at which the target begins to expand.

METHOD

Participants

Eight young (M age = 20 yrs) and eight older (M age = 81 yrs) participated in the study. All participants reported to be daily computer users.

Materials

A Pentium II based personal computer, with a 60 Hz, 96dpi 17" monitor with a resolution setting of 1024 x 768 pixels was used. A Java program[1] was modified to display two static targets (small � 5mm x 5mm square, large � 25mm x 25mm square) and three expanding targets (from an initial size of 5mm to a final size of 25mm). The expansion point occurred at 10%, 50%, or 90% of movement completion (see Figure 1). Participants completed a total of 20 trials per each condition for a total of 100 trials.

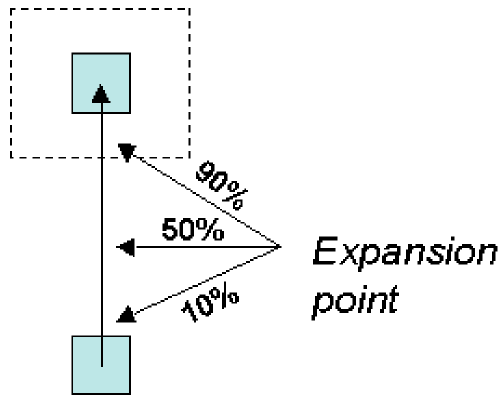


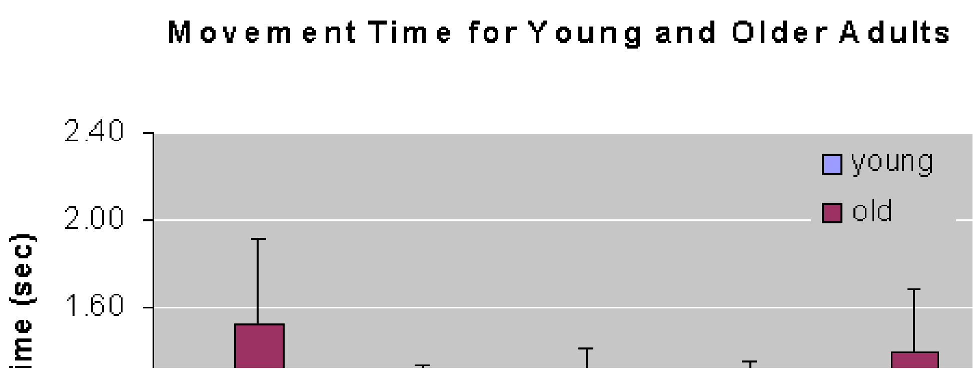
Figure 1. The three points of target expansions.

Procedure

Participants were introduced to the target acquisition task and allowed to practice each of the five conditions prior to beginning the experiment. Participants then completed the trials for each condition in random order and were encouraged to take rest breaks between conditions.

RESULTS AND DISCUSSION

Figure 2 shows the movement times for younger and older adults for the static and dynamic target conditions. A 2 x 5 split-plot ANOVA showed a main effect of age and a main effect of target condition [$F(1,14) = 28.26$, $p < .001$; $F(4,56) = 38.83$, $p < .001$ respectively). The older adults took significantly longer to acquire the targets than did the younger adults across all conditions. Post-hoc analyses showed that movement times for the 10% and 50% expanding target conditions were equivalent to those of the large static target for both age groups. However, in the case of the 90% expanding target condition, movement times were no different than that for the small static target for both age groups. Thus it would appear that all participants were able to adjust their initial motor response to take advantage of the final target size when expansion occurred early enough in the course of the movement. However, when expansion occurred late in the movement, neither group was able to adjust their movement accordingly.



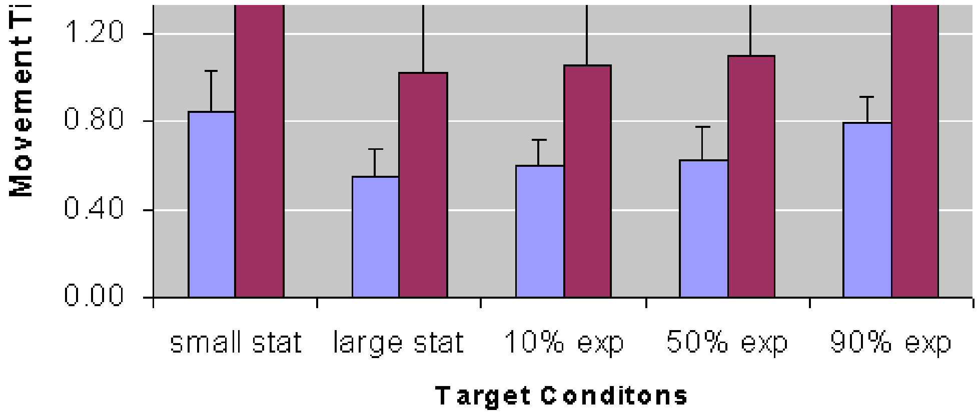


Figure 2. Movement time for young and older adults. Early expansion of the target resulted in better performance than late or no expansion.

This finding was inconsistent with McGuffin & Balakrishnan�s (2002) study in which they reported significant gains in performance for younger adults even when expansion began after 90% of movement completion. However, the discrepancy may be a result of an important difference between the expansion-algorithms used in the two studies. In the algorithm used by McGuffin and Balakrishnan, target expansion occurred at a set rate once the expansion point was crossed. The expansion would occur regardless of the cursor�s position relative to the target once beyond the expansion point. In our experiment, the size of the target was yoked to the cursor�s position relative to the target�s center. Thus, once the expansion point was crossed, the target size increased or decreased as the subject moved the cursor toward or away from the target�s center. One consequence was that the rate of expansion (and contraction) varied with the expansion point. That is, in the 90% condition, the target had to reach its maximum size (or minimum size) within a much shorter movement distance than that for the 50% and 10% conditions, and therefore expand at a much faster rate. The expansion rate may have been too fast to allow subjects to update their movement plan based on the new visual information about the target�s size. We are currently investigating this issue.

CONCLUSION

The results of this study, together with those of McGuffin and Balakrishan (2002), demonstrate that expanding targets are a promising interaction technique for improving target selection for older adults. Future studies will investigate how expansion rate impacts target acquisition and how it may be optimized for older adults. In addition, we are comparing this technique to other methods of optimizing target selection (such as "sticky" icons and area cursors).

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[1]Code was obtained from McGuffin, & Balakrishnan (2002) and modified for purposes of this study.

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