

ACCESS TO AAC: ARRANGING THE INTERFACE

Denis Anson, MS, OTR; Erin McGreel, OTS; Erin Baker, OTS; Jenna Reel, OTS
and Julie Mikolaichik
Misericordia University, Dallas, PA

INTRODUCTION

Augmentative and Alternative Communications consists of two components: the selection set and the selection method. The selection set is the message components (words, phrases, concepts) that the user of an AAC device can choose to include in a message (utterance). It is generally accepted that a user requires a large vocabulary to express nuanced ideas in a range of topics and environments (Weitz, Dexter, & Moore, 1997; Zangari, 2013). A number of studies have been conducted to identify the core vocabulary that would allow communication parity for the user of an AAC system (Balandin & Iacono, 1999; Banajee, Dicarolo, & Stricklin, 2003; Hill, 2001; Marvin, Beukelman, & Bilyeu, 1994; Stuart, Beukelman, & King, 1997). Various strategies have been developed to manage large vocabularies for a person with limited movement skills, including semantic compaction, word and phrase prediction, and communication macros.

The selection method of an AAC device or system encompasses the behaviors of the user must produce to generate the message to be communicated to the communication partner. The selection method includes both the motor demands of making selections and the cognitive and perceptual processes of identifying the appropriate selection. This area appears to have been less well studied. For example, the Dynavox Dynamic AAC Goal Grid offers only a single strategy for improving communication speed: increasing the number of buttons. It does not address the relative advantages of scanning, switch encoding, or direct selection with finger or eye-gaze that might be available to the user. Even within any of the selection methods, physical layout of the choices may have a significant impact of performance.

With the ubiquitous availability of dynamic displays, one unexplored issue of AAC device layout is the relative effects of paging of the selection set (displaying a subset of the choices at a time) versus displaying all of the choices on a single page. Displaying the entire core vocabulary at once, if the user is able to perceive the display, reduces the demand of remembering the location of undisplayed choices, but increases the cognitive and perceptual load of the single display. On the other hand, using multiple pages of choices requires the user to remember the location of desired targets, but provides, for a given display, larger targets. Fitt's Law tells us that larger targets are easier to select than smaller ones. However, it is also known, though not as well quantified, that complex visual fields are more difficult to process than simple ones.

This leads to the following research questions:

1. How do the selection rates differ between a single display of the entire selection set and a paged display of the same selection set when display size is constant?
2. How does the accuracy of selection differ between a single display of the entire selection set and a paged display of the same selection set when display size is constant?

In order to examine the effect of layout on selection speed and accuracy, this study strove to remove the effects of language interpretation from the selection process.

Go!" At the word Go, the participant began copying the message. When the timer rang, the subject was instructed to stop.

At each session, the participant was allowed to complete no more than three trials, to control for possible fatigue effects.

Data Analysis

After all of the data was collected, each participant message was compared with the source material for length using Word's Word Count feature, and for accuracy by comparing the content with the text version of the source message using Word's Compare Documents feature. Each block of difference between the original and participant message counted as a single error, whether this was a single wrong symbol or a skipped line. The speed and accuracy were compared between the two keyboard layouts.

RESULTS

How do the selection rates differ between a single display of the entire selection set and a paged display of the same selection set when display size is constant?

Using the single-page layout, participants were able to enter an average of 193 symbols in 20 minutes on the first trial, and 216 symbols on the third. This difference was statistically significant ($p < .05$). Similarly, with the multipage layout, participants were able to enter 133 symbols on the first trial, and 180 symbols on the last trial. This difference was also significant ($p < .05$) indicating that subjects were faster as they learned the layouts. However, participants started faster, and ended faster on the single page layout than they were on the multipage layout ($p < .05$), with a difference in of communication rate of approximately 20%.

This would appear to be a clear win for the single page input.

How does the accuracy of selection differ between a single display of the entire selection set and a paged display of the same selection set when display size is constant?

Using the single-page layout, participants averaged, on their first trial, 23 errors, and 20 errors on their final trial. This difference was not statistically significant ($p > .05$), indicating that accuracy was not improved over time. However, on the paged layout, participants showed an average of 18 errors on their first trial, and only 13 errors on their final trial. This difference was significant ($p < .05$), indicating that with practice, participants improved on the paged layout.

Further, the difference in errors between the two layouts, on the final trial, was also significant ($p < .05$), with the subjects averaging 35% fewer errors on the paged layout.

This would appear to be a clear win for the paged layout.

DISCUSSION

The results of this study would appear to be ambiguous, with the single page layout being preferred for speed (a major limitation of AAC), and the paged layout being preferred for accuracy (a major desire for communication). However, the magnitude of the difference would seem to indicate a preferred approach. The gain in accuracy obtained by using paged layout was nearly double the cost in speed, indicating that paged layouts with larger targets are generally superior for communication.

The current study was crafted to remove the effects of language from the results. The icons had no labels, so that the participant could mentally name them freely, but no series of icons conveyed any meaning, so it was not possible to predict the next icon from the current selection. In AAC, the inclusion of language may affect the outcome in any number of ways.

Because language has a high level of redundancy, the inclusion of a small number of errors might not hinder the conveyance of meaning to the communication partner. This may be particularly true when the communication partner is familiar with the speech patterns of the user and can recognize an utterance that is unlikely to be what the individual was meaning to say. ("I want more fish," when it is known that the speaker abhors fish.) In this case, the difference in accuracy would be less important.

Because language has internal structure, communication systems can be created that incorporate that structure. One page might contain people and favorite things; another might contain actions; while a third might include modifiers. With such a structure, the user would be able to predict the likely location of a symbol to convey specific meanings. This might allow for faster message generation.

Because language might provide improved performance for both types of keyboards, future research should be conducted using meaningful messages, to evaluate how language changes the performance of single-page versus multipage communication layouts.

CONCLUSIONS

This study was designed to assess the impact of physical targeting and cognitive/perceptual processing on performance using single and multi-paged communication layouts. It was designed to, as far as possible, remove the impact of language from the performance.

The participants in this study were all typically developing individuals. The benefits of larger targets would likely be greater for individuals with motor control limitations or perceptual difficulties, while the benefits of a single screen would likely be greater for a person with learning or memory deficits.

Because different individuals bring different skill levels to the use of AAC devices, there is no ideal solution. This study does not identify a magical solution for everyone. It does, however, provide some evidence basis to guide the selection of the layout of communication systems.

REFERENCES

- Balandin, S., & Iacono, T. (1999). Crews, wusses, and whoppas: Core and fringe vocabularies of Australian meal-break conversations in the workplace. *Augmentative and Alternative Communication, 15*, 95-109.
- Banajee, M., Dicarlo, C., & Stricklin, S. B. (2003). Core vocabulary determination for toddlers. *Augmentative and Alternative Communication, 19*, 67-73.
- Hill, K. (2001). The development of a model for automated performance measurement and the establishment of performance indices for augmented communicators under two sampling conditions. *Dissertation Abstracts International, 62*(05), 2293.
- Marvin, C. A., Beukelman, D. R., & Bilyeu, D. (1994). Vocabulary-use patterns in preschool children: Effects of context and time sampling. *Augmentative and Alternative Communication, 10*, 224-236.
- Stuart, S., Beukelman, D. R., & King, J. (1997). Vocabulary use during extended conversations by two cohorts of older adults. *Augmentative and Alternative Communication, 13*, 40-47.
- Weitz, C., Dexter, M., & Moore, J. (1997). AAC and Children with developmental disabilities. In S. L. Glennen & D. C. DeCoste (Eds.), *The Handbook of Augmentative and Alternative Communication* (pp. 395-444). San Diego, CA: Singular Publishing Group.

Zangari, C. (2013). Teaching Core Vocabulary. Retrieved from <http://praacticalaac.org/strategy/teaching-core-vocabulary/>

Alt-text for Figure 1

The single-page layout is grid of 60 symbols ranging from a mail-box to a kangaroo. The grid is 10 cells wide by six cells tall. There is no pattern to the order of the symbols, so that they do not convey meaning.

Alt-text for Figure 2:

This image shows the first page of the paged layout. The top row of the layout includes the numbers from 1 to 4, allowing the participant to jump directly to any desired page. The next three contain five symbols each. The arrangement of these symbols is exactly the same as the upper-left corner of the single page layout.