Exploring Multimodal Alternative AAC Access for Adults With Cerebral Palsy

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Introduction

- Despite the significant advances in AAC access technologies, there are many individuals with complex communication needs (CCN) and severe motor impairments who find it challenging to access their AAC systems.
- Functional use of an AAC system requires individuals to accurately and efficiently access their systems (Beukelman & Mirenda, 2013). For individuals with severe speech and motor impairments, alternative access methods (i.e., rather than touch of a finger or hand) are often required in order to achieve accurate and efficient access (Fager, Beukelman, Fried-Oken, Jakobs, & Baker, 2012).

Alternative Access Methods

- Alternative access methods may use a combination of control sites (e.g., eyes, knee, head, etc.) and any number of interfaces (e.g., touch screen, switches, etc.); and these combinations can be used to directly or indirectly select items on the system.

Challenges

- Limited flexibility in how individuals access their systems

Current technologies → Individuals use ONE access modality at a time

OR

Only eye-gaze — *Only* switch access

Although single-modality access may suffice for some, it can lead to →
- extreme fatigue
- over-use injuries
- inefficiency

- There is an urgent need to identify more effective and efficient ways for individuals to access their AAC technologies.

Solution

- An alternative to single-modality access is multimodal access.
- Multimodal access combines two access modalities (e.g., eye-gaze and switch access) in order to reduce demands placed on the individual.

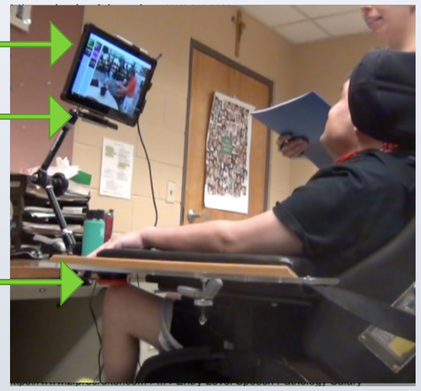
This study investigated a new multimodal access technology developed by Jakobs and colleagues (2014) which integrates eye gaze and switch scanning selection techniques to operate an AAC system.

Multimodal Access Technology

Microsoft Surface tablet with personalized visual scene display (VSD)

Tobii-Dynavox infrared eye tracker

Jelly bean switch



The multimodal access technology was investigated as individuals made selections on visual scene displays (VSDs). VSDs are photographs displayed on a screen with programmed "hot spots" that when selected, produce a pre-recorded word or phrase.

Personalized VSD showing all hotspots activated

The participants used eye-gaze to highlight an approximate area of the VSD.

Participants then used switch scanning to scan through the hot spots most adjacent to the highlighted area.

Design

- Single subject alternating treatment experimental design

Independent variable
- access technique – eye-gaze, scanning, or multimodal

Dependent variable
- **accuracy** and **latency** of target selection

Participants

- Two adults with Cerebral palsy who used eye-gaze alone to access their AAC systems
- Participant 1
  - 42-yo male
- Participant 1
  - 52-yo male

Procedures

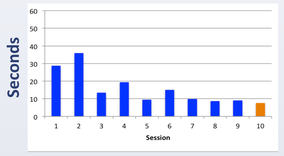
- **Collection of "Learning Curve" data**
  - Before the alternating treatment sessions began, the participants engaged in practice sessions using the new access technique.
- **Alternating Treatment**
  - Once the "learning curve" data were collected, the participants engaged in **15 counterbalanced** alternating treatment conditions across 5 individual sessions
    - 5 eye-tracking
    - 5 scanning
    - 5 multimodal access
  - In each session, the participants completed a target acquisition task.
    - "Find the bed."
  - Specifically, they selected targets across various screen locations on their individual VSDs.
  - Each participant was prompted to find 12 targets during each of the 3 conditions.

Results

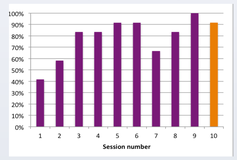
Participant 1

Learning Curve

Median latency to select target

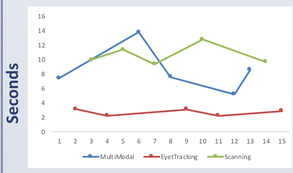


% accuracy of selecting target

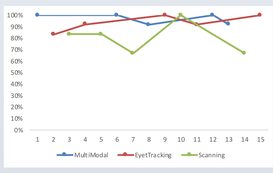


Alternating Treatment

Median latency to select target



% accuracy of selecting target



FASTEST
1) Eye-gaze (*Mdn* = 3.15 s)
2) Multimodal (*Mdn* = 7.45 s)
3) Scanning (*Mdn* = 9.95 s)

SLOWEST

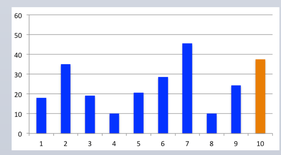
MOST accurate
1) Multimodal (100%)
2) Eye-gaze (92%)
3) Scanning (83%)

LEAST accurate

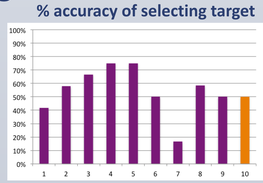
Participant 2

Learning Curve

Median latency to select target

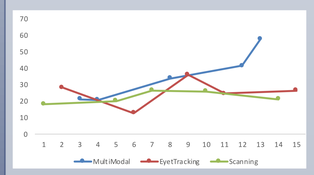


% accuracy of selecting target

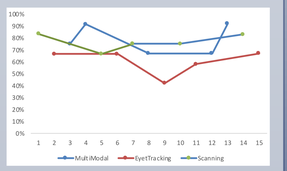


Alternating Treatment

Median latency to select target



% accuracy of selecting target



FASTEST
1) Scanning (*Mdn* = 21.3 s)
2) Eye-gaze (*Mdn* = 28.3 s)
3) Multimodal (*Mdn* = 33.75 s)

SLOWEST

MOST accurate
1) multimodal (75%) & Scanning (75%)
2) Eye-gaze (67%)

LEAST accurate

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