Visual Attention: How Motion May Impact AAC Users' Learning of Novel Symbols

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Introduction

- The design of AAC displays is a critical component to support successful understanding, learning, uptake, and use of AAC for communication (Light et al., 2019; Johnson et al., 2006; Wilkinson et al., 2012).
- Aided AAC modeling is a key intervention strategy to support positive outcomes in AAC. For modeling to be effective, the AAC user needs to visually attend to the AAC display as it is modeled.
- To date, limited research has investigated the design of effective AAC system displays. Consequently, AAC displays may impose burdens on the users' visual and cognitive processing systems (Light & McNaughton, 2013).
- Visual crowding may impact an individual's ability to assign meaning to a symbol, whether novel or known (Whitney & Levi, 2011). Decluttering as a means to support learning needs to be investigated.
- Motion is a powerful tool that may attract visual attention (Jagaroo & Wilkinson, 2008) and can support learning in individuals with developmental disabilities (e.g., Boyle et al., 2017).
- This study investigated the impact of motion on visual attention and learning of picture symbols **over time**. This may be the first study to look at attention over time using eyetracking.

Research Design & Materials

Research Design

- Three within subject group design studies, 1)college students, 2) people on the autism spectrum, 3) people with Down syndrome
- College students were included to inform study design and understand potential patterns of attention

Materials

- Tobii Pro Spectrum Eye Tracker with Tobii ProLab Analysis Software
- Stimuli presented through Tobii ProLab for (1) static and (2) motion condition across three sessions over time

Methods

Procedures

The procedures were similar across all three studies

- Participants completed three sessions over time of a visual search task requiring them to locate a target "pocket monster" within a grid display created to represent novel AAC symbols.

- Each trial started by displaying the target symbol in isolation.
- The participant selected the target from the array.
- Once selected, the display either remained constant (static condition) or the target symbol was isolated and *traveled* to the center of the screen (motion condition) and the label was spoken like a standard AAC system (Video example available).

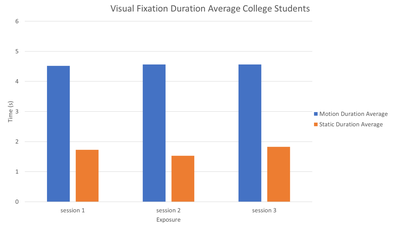
Data Collection and Analysis

Visual Fixation Duration (a measure of visual attention) to the target symbol was averaged within the static and motion condition for each participant for each session over time (as recorded by Tobii Pro Lab)

Results: College Students

Visual Fixation Duration

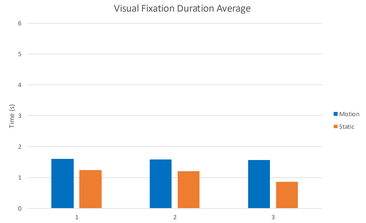
- On average, the college students attended in the motion condition more than twice as long as the static condition, which is statistically significant ($F1,9=218.456$, $p=<.001$, $r2=.960$).
- This pattern was consistent across time.



Results: Individuals on the Autism Spectrum

Visual Fixation Duration

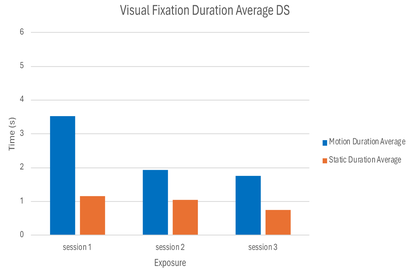
- These results are **preliminary** based on 7 school aged individuals on the autism spectrum.
- On average, these individuals attended to the motion condition more than the static condition with relatively consistent attention across time in the three sessions
- Note the relatively low levels of attention overall (stimulus was available for 4 seconds)



Results: Individuals with Down Syndrome

Visual Fixation Duration

- These results are **preliminary** based on 5 adolescent and adult individuals with Down syndrome
- On average, the 5 individuals with Down syndrome attended to the motion condition more than the static condition across each session. This is similar to the individuals on the autism spectrum.
- Overall, the individuals with Down syndrome showed decreased attention across time with each session
- Notable is the consistent low attention to the target symbol in the static condition, < 1 sec



Accuracy

- Learning was assessed after each session with probes using PowerPoint.
- Audio of the target symbol names were provided, and the participants selected the named symbol from a randomized field of 8 for each trial
- The accuracy analysis is in progress
- The accuracy data is very difficult to interpret secondary to ceiling effects and variability.

Limitations

- All of the symbols and concepts were novel to the individual by design. Typically, an AAC user would have some level of familiarity with at least some of symbols or concepts on the display.
- This task did not use a communicative context.
- Data Collection is still underway

Implications

Clinical Implications

- AAC system display design may influence learning of picture symbols.
- When using aided modeling, visual engagement is an important indicator of learning. The use of motion appears to attract visual attention and should be considered when implementing aided modeling in AAC intervention.

Research Implications

- Further investigation is needed as to the individual effects of the movement and the decluttering of the display.

Technological Implications

- Manufacturers and developers should consider incorporating linear motion as an option on displays to facilitate visual attention to specific vocabulary as a means to support aided modeling and learning.

Conclusion

- Systematic research into AAC display design is of critical importance to move the field forward with innovative approaches given the breadth of technology advancements in recent years.
- Utilizing eye tracking research to understand visual attention patterns is a key piece of this foundational research into AAC display design.
- The use of linear motion should be considered as a tool to increase attention, and potentially learning for individuals who may benefit from AAC

Future Directions

- Investigate whether a similar use of motion will influence the learning of the written label.

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