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Integrating Speech Recognition into AAC Technology

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Background/Rationale

- Desire to use natural speech is innate
 - Automatic
 - Source of identity
 - Allow for more natural timing in interaction
 - Able to “hold the floor” compared to device-mediated interactions
- AAC technology tends to serve as a “replacement” for speech



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Prototype description

- Speech recognition based on models of dysarthric speech
 - SSR (Supplemented Speech Recognition)
 - Incorporates speech, first letters of spoken words are typed, word prediction
- Fager, S., Beukelman, D., Jakobs, T., & Hosom, J.P. (2010). Evaluation of a Speech Recognition Prototype for Speakers with Moderate and Severe Dysarthria: A Preliminary Report. *Augmentative and Alternative Communication*, 18, 48-55.

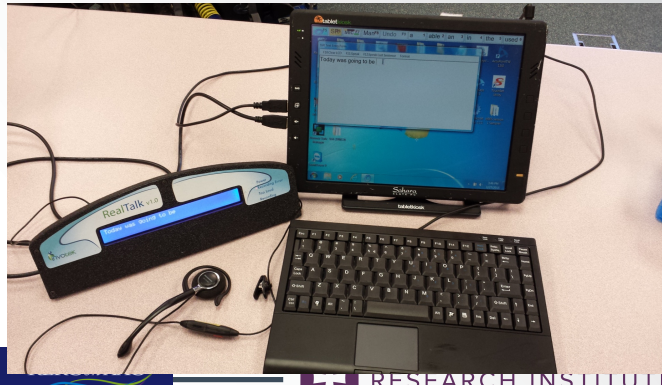


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- Forward facing monitor
 - User essentially has subtitles, can turn on or off
- Synthesized speech output if desired/needed



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How the prototype works

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- User types the first letter of the target word
- They speak the word
- The SSR attempts to recognize the word
 - If recognized it is inserted in the line of text
 - If not, the word may appear in the word prediction list and the user can select it from there
 - Or user can spell the word out letter-by-letter
- What is written is displayed on the forward-facing monitor to the listener

RERC on AAC

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Supplemented Speech Recognition

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1. Automatic speech recognition based on models of dysarthric speech
 - System is further customized by individual user
2. First letter identification (alphabet supplementation)
3. Word prediction



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How SSR functions

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- User types the first letter of the target word
- User says the word
- Word shows up in line of text (most probable) OR
- Word is available on one of 6 word prediction buttons (next 6 probable word options) OR
- User has to type the word

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SSR video

- <http://www.invotek.org/products/speech-recognition/>



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Evaluation

- The goal of the evaluation is to assess how this new method of supporting an AAC interaction impacts the listeners behavior.
- Hypotheses:
 - Listeners engagement as measured by on-task behavior and eye-gaze will increase during the RealTalk condition compared to traditional AAC condition



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Conditions

- Traditional AAC (no speech, just text to speech with word prediction)
- RealTalk (prototype AAC system that incorporates supplemented speech recognition)



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Participant

- Speaker with dysarthria
 - Female with CP, 74% sentence intelligibility, research assistant
- 5 listeners
 - 1 male, 4 females
 - 2 students in speech pathology, 1 accounting professional at rehab hospital, 1 IT manager at rehab hospital, 1 administrative assistant at rehab hospital



Tasks

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- Unstructured conversation (introduction, hobbies, pets/vacations)
- Structured barrier tasks
- Tasks randomized per condition, per listener



Analysis

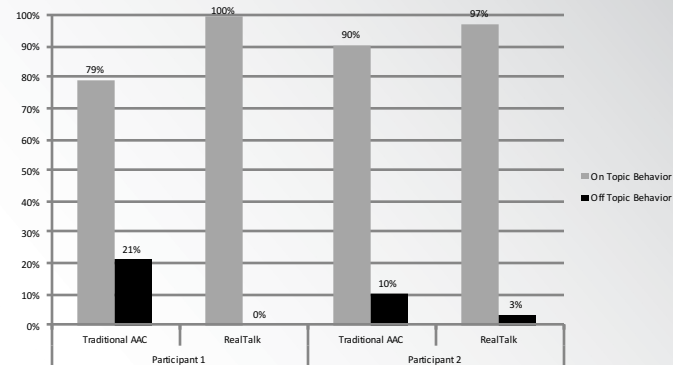
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- Qualitative analysis of gaze behavior of listener
 - All interactions video-recorded, transcribed, timed and coded for gaze behavior (on topic vs. off topic)
 - On topic- focused on speaker or task
 - Off topic- looking around room, focusing gaze on other objects in environment, engaging in conversation with 3rd party
- Proportion of words per participant (unstructured conversation)
- Qualitative feedback on comfort and preference of technology being used in a communicative interaction with the speaker



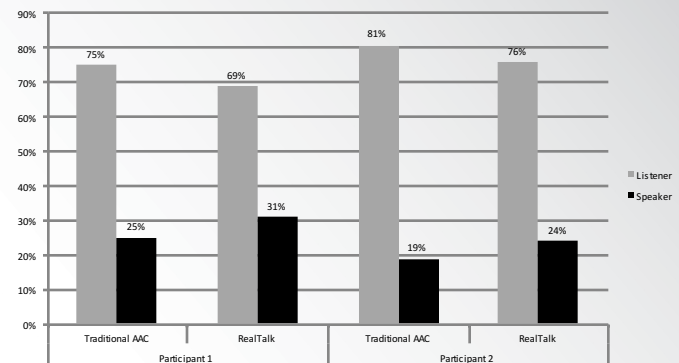
Results- Listener on-topic vs. off-topic

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Proportion of words used in unstructured conversation

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Preference and qualitative comments

- All listeners preferred RealTalk to the traditional AAC condition for day-to-day communication with a communication partner
- Comments from listeners of Participant 1:
 - When she was talking it seemed more helpful during the conversation.
 - I didn't know what to do or look at during the [traditional AAC] part. I felt uncomfortable.
 - I was able to focus and pay attention when she was talking.
 - I felt like I knew more what was going on when I could hear her talk.
 - The time delay in the traditional AAC condition felt unnatural. It felt more natural to be able to listen to her speech during the interaction.



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- Comments from listeners of Participant 2:
 - Felt uncomfortable in Traditional AAC condition
 - Didn't know how to react (where to look or attend while waiting)
 - Liked being able to look at monitor during RealTalk to stay focused on conversation
 - Felt as though the speaker had to work harder in the AAC only condition
 - Felt as though the AAC only condition took more time



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3rd Party Listener of Interactions

- Asked typical individuals to view video-taped interactions of an individual with complex communication needs using traditional AAC and then using RealTalk prototype
- Mixed quantitative/qualitative design
 - Viewers completing ratings
 - Discussed why they rated the interactions the way they did



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Preliminary data from 3 listeners

	Traditional AAC	RealTalk
How enjoyable did the conversation appear to be for the AAC user?	4	3
How enjoyable did the conversation appear to be for the non-AAC user?	6	4
How well did the AAC user seem able to say what she wanted to say?	3	4
How well did she seem able to say things in good time?	7	6
How well did she seem able to share in control of the conversation?	4	3
How confident did she seem?	3	3
How relaxed did she seem?	3	3
How lively did she seem?	3	3
How well did the conversation flow?	6	5
How "natural" did the conversation seem?	5	3
Overall, how satisfactory was the conversation?	5	3



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Qualitative themes/supporting comments

- All 3 listeners chose RealTalk over Traditional AAC condition
 - Interactions appeared more comfortable for the listener
 - Less wait time
 - Listeners appeared more engaged



Theme 1: Listener comfort

- All 3rd party listeners felt that the listener (non-AAC user) in the interactions appeared to be more comfortable during the RealTalk condition compared to the Traditional AAC condition:
 - “She seemed less tense..more natural listening to the person using AAC”
 - “He seemed more at ease and focused on the conversation.”
 - “In the (Traditional AAC condition) she didn’t seem to know where to look...”



Theme 2: Flow of conversation

- All 3rd party listeners felt that the “flow” of the conversation was better during the RealTalk compared to the Traditional AAC condition:
 - “Both were slow...but the (RealTalk condition) appeared to flow more naturally.”
 - “There appeared to be more back and forth during the interaction.”



Theme 3: Enjoyment of interaction by the AAC user

- Many of the 3rd party listeners commented that the AAC user appeared to enjoy the interaction more when using RealTalk compared to the Traditional AAC condition:
 - “She was more animated...laughed more.”
 - “She seemed like she was more interested in the interaction...”



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