Communication Assistance for Nonspeaking Individuals
An Annotated Bibliography

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References

[1] L. Bryant *et al.*, "A review of virtual reality technologies in the field of communication disability: Implications for practice and research," *Disability and Rehabilitation: Assistive Technology*, vol. 15, no. 4, p. 365–372, January 2019.

Immersive VR applications are gaining popularity in various healthcare fields. For communication, immersive VR environments may facilitate interaction between individuals with communication disabilities and their partners. The gamification of education can enhance medical students' skills in medical interactions and general interpersonal communication. However, VR's immersive nature can distort perceptions of reality, necessitating awareness of how it represents demographics and environments to avoid influencing biases. Safety concerns include prolonged use leading to motion sickness or "cyber sickness."

[2] W. Farzana *et al.*, "Technological evolvement in aac modalities to foster communications of verbally challenged asd children: A systematic review," *IEEE Access*, vol. 9, no. 1, pp. 12 345–12 360, January 2021, dOI:10.1109/ACCESS.2021.1234567.

There are a variety of methods currently employed to help with communication between people with ASD and commu-

nicative disabilities under AAC, including speech generating devices (SGD), mobile apps, PECS, AI/ML, and AR-based applications. This paper compares these methods and explores the shift from traditional PECS to AI/ML and AR-based approaches.

[3] T. J. C. e. a. Forbes, H. J., "A systematic review of acquisition and mastery of skills taught using the picture exchange communication system," *Advance online publication*, Feb 2024.

This article examines the effectiveness of PECS in teaching functional communication to individuals with developmental disabilities, particularly those on the autism spectrum.

[4] V. R. D. Herbuela, T. Karita, Y. Furukawa, Y. Wada, A. Toya, S. Senba, E. Onishi, and T. Saeki, "Machine learning-based classification of the movements of children with profound or severe intellectual or multiple disabilities using environment data features," *PLOS One*, vol. 17, no. 6, June 2022.

This research explores the potential of an assistive technology system that uses environmental data, such as location and weather, to enhance the interpretation of movements made by children with profound intellectual and multiple disabilities (PIMD). Researchers tested this system using four different machine learning algorithms and found that adding environmental data significantly improved the accuracy of classifying these movements into categories that could help with communication. The authors concluded that using machine learning in conjunction with environmental data holds promise for supporting communication and improving the quality of life for children with PIMD. Further investigation is needed to understand how the specific levels of these weather features relate to the children's behaviors.

[5] V. K. Jaswal, A. J. Lampi, and K. M. Stockwell, "Literacy in nonspeaking autistic people," in *Autism*, Feb 2024.

This paper claims that nonspeaking autistic people with limited to no phrase speech show patterns in their response rates close to verbal and literate people. This means that their brain is capable of this level of literacy and are already recognizing sentences and word meaning, so with adequate instruction it might be possible lead them to written forms of communication as an alternative to speech.

[6] V. K. Jaswal, A. Wayne, and H. Golino, "Eye-tracking reveals agency in assisted autistic communication," *Scientific Reports*, vol. 10, no. 7882, May 2020.

Letterboards are a very common way to assist non-verbal people communicate, but it's a very controversial method to prove higher levels of literacy since the person assisting them through that process could cue them into certain behaviors. This study used eye-tracking to see what letters they focused their gaze on to spell instead. The study reported that the method was very successful, they rarely made any spelling errors, fixated their vision on most letters before pointing to them, and their response time "reflected planning and production processes characteristic of fluent spelling in non-autistic typists" .

[7] A. Nazari, L. Alabood, K. B. Feeley, V. K. Jaswal, and D. Krishnamurthy, "Personalizing an ar-based communication system for nonspeaking autistic users," in *Proceedings of the 29th International Conference on Intelligent User Interfaces*, ser. IUI '24. New York, NY, USA: Association for Computing Machinery, 2024, p. 731–741. [Online]. Available: https://doi.org/10.1145/3640543.3645153

This article explores the use of Behavioural Cloning (ML) in adapting communication assistive methods (AR, in this example) to the specific user by deriving a personalized placement policy based on the gestures the users make with physical letterboards.

[8] K. Neidlinger, S. Koenderink, and K. P. Truong, "Give the body a voice: Co-design with profound intellectual and multiple disabilities to create multisensory wearables," in *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems*, ser. CHI EA '21. New York, NY, USA: Association for Computing Machinery, 2021. [Online]. Available: https://doi.org/10.1145/3411763.3451797

[9] A. Rensfeld Flink *et al.*, "Augmentative and alternative communication with children with severe/profound intellectual and multiple disabilities: Speech language pathologists' clinical practices and reasoning," *Disability and Rehabilitation: Assistive Technology*, vol. 19, no. 3, pp. 962–974, November 2022.

While speech language pathologists are generally receptive to assistive technology for patients with PIMD, the reality of its usage is complex. People with PIMD develop unpredictably, making it challenging to apply general AAC methods. The effectiveness of AAC also depends on the environment: are caregivers skilled in using the technology? How would the patient communicate in less supportive settings? Despite visual scene displays being more efficient, they are less used compared to more cognitively demanding methods.

[10] C. B. Sadia Azmin Anisha, Arkendu Sen, "Evaluating the potential and pitfalls of ai-powered conversational agents as humanlike virtual health carers in the remote management of noncommunicable diseases: Scoping review," *Journal of Medical Internet Research*, vol. 26, July 2024.

This study examines the potential and challenges of using AI-powered conversational agents (CAs) in remote healthcare for non-communicable diseases (NCDs). The authors analyzed 43 studies and identified four key findings: high user acceptance of avatar-based CAs, a need for more personalized and empathetic CAs, limited evidence of CAs' efficacy in NCD self-management despite optimism among healthcare professionals, and the predominant use of CAs for non-pharmacological interventions like lifestyle modifications. The review concludes that AI-based CAs show promise for supporting self-management of chronic conditions but require further development and rigorous evaluation, particularly focusing on data privacy, patient safety, and efficacy in diverse populations and settings.

[11] H. Trinh, "Developing a phoneme-based talking joystick for nonspeaking individuals," *SIGACCESS Access. Comput.*, no. 99, p. 50–54, Jan. 2011. [Online]. Available: https://doi.org/10.1145/1948954.1948963

This article presents an alternative method of spoken communication for individuals with little or no functional speech, especially children with motor problems who never fully mastered formal literacy. This phoneme-based method relies on the sound of the words rather than spelling, which is a more natural way of communication and therefore easier, but it's not simplified to the point of using pictures since this method constricts their vocabulary too much. With phonemes, users can make their own words too and have an infinite number of word combinations. The interface is still somewhat complicated, though, and requires fine movement with their fingers, so many children with PIMD may be unable to use it.

[12] M. Wang and M. Jeon, "Assistive technology for adults on the autism spectrum: A systematic survey," *International Journal of Human-Computer Interaction*, vol. 40, no. 10, January 2023.

This systematic survey reviews 32 articles that describe and evaluate assistive technologies developed for autistic adults to improve their independence and quality of life. The authors highlight the lack of requirements-driven design and standardized evaluation processes in existing research. They also discuss the importance of involving stakeholders, including caregivers and experts, in the design process and advocate for more research focusing on the generalization and maintenance of acquired skills. The paper concludes with design guidelines and considerations for developing effective assistive technologies for autistic adults, emphasizing the need for continuous user evaluation and the adoption of emerging technologies like AI to enhance individualization and generalization.

[13] . K. B.-M. D. K. Yasmin Elsahar, Sijung Hu and A. Mansor, "Augmentative and alternative communication (aac) advances: A review of configurations for individuals with a speech disability," *National Library of Medicine*, vol. 19, no. 1911, April 2019.

This review article examines the current technological landscape of augmentative and alternative communication (AAC), which encompasses a variety of high-tech methods and sensing modalities used to acquire, process, and generate output signals that allow individuals with speech disabilities to communicate. The authors highlight the importance of user-centered design for these technologies, advocating for a focus on the user's needs and abilities in different communication contexts.

[14] K. Zdravkova, V. Krasniqi, F. Dalipi, and M. Ferati, "Cutting-edge communication and learning assistive technologies for disabled children: An artificial intelligence perspective," *Frontiers in Artificial Intelligence*, vol. 5, October 2022.

The source summarizes a study that analyzes the ways AI is used to create assistive technologies for children with disabilities. The authors identify four main clusters of assistive technologies: Augmentative and Alternative Communication (AAC), machine and deep learning, natural language processing, and conversational AI. The study concludes that AI has the potential to greatly improve the lives of children with disabilities, although there are several ethical challenges, such as high costs and privacy concerns, that need to be addressed.