Language Alignment in Older Adults with Socially Assistive Robots: Implications for Aphasia Rehabilitation

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Introduction

Many persons with aphasia (PWA) experience barriers to sustainable speech therapy services such as limited insurance coverage, geographical distance, and a shortage of speech-language pathologists. Social assistive robots (SARs) are a type of robot that "provide assistance to human users through … social interactions" (Feil-Seifer 2005). SARs can close this gap by delivering easily accessible in-home speech therapy for PWA and providing social support and companionship for PWA who suffer from social isolation. We investigated clinical potential of SARs, by examining if and how older adults align their linguistic expressions with robot partners in an interactive language task. Communication partners echo each other's linguistic expressions, including use of same sentence types, and those alignment behaviors support implicit language learning in both typical speakers and PWA (Branigan & McLean, 2016; Lee et al., 2023). However, it remains unknown if such alignment effects can also occur when people interact with robots.

Methods

Twelve healthy older adults (age *M*=73, *range* 67-93; 3 Female, 9 Male) completed a collaborative language game with a human partner and two robots, a machine-like NAO and a human-like Furhat that differ in their levels of anthropomorphism (Figure 1). With each partner, the participants took turns describing transitive action scenes in sentences, with the goal of finding matching pictures. During their turn, the human or robot partners described their pictures in either a passive or active sentence. We measured if the participants would produce a passive sentence more frequently after their partner said a passive rather than an active sentence to evaluate the degrees of linguistic alignment across partner conditions. After interacting with all three interlocutors, we administered the Technology Acceptance Model questionnaire (King 2006) to assess participants' attitude, usefulness, ease of use, and appearance for each SAR and gained qualitative feedback about their experience via a semi-structured interview.

Results

A repeated-measure ANOVA test revealed that the type of interlocutors did not have a statistically significant effect on participants' levels of linguistic alignment ($F(2, 22)=0.93$, $p=0.41$). The participants produced passives more frequently after hearing their partner produce passives with all three partner types (human M=0.75, SD=0.25; NAO M=0.81,

SD=0.22; Furhat M=0.77, SD=0.33). Paired t-tests showed that there is no statistically significant difference in how participants perceive the usefulness (NAO M=3.69, SD=0.97; Furhat M=3.63, SD=1.04; t(11)=0.22, p=0.83), ease of use (NAO M=2.86, SD=1.36; Furhat M=3.22, SD=1.15; t(11)=-1.65, p=0.13), or appearance (NAO M=3.73, SD=1.20; Furhat M=3.79, SD=1.03; t(11)=-0.51, p=0.62) between the two robots. From the semi-structured interview, seven of the twelve participants shared that NAO felt like a cartoon-like child, while Furhat felt more reactive and comfortable.

Conclusions

The results suggest that both SARs can be as effective in eliciting linguistic alignment effects as a human interlocutor and the older adults had positive experience interacting with each of the robots. SARs have potential to deliver interventions to improve communication abilities of older adults and persons with aphasia and mitigate some of the barriers to sustainable aphasia rehabilitation.

References

Branigan, H. P., & McLean, J. F. (2016). What children learn from adults' utterances: An ephemeral lexical boost and persistent syntactic priming in adult-child dialogue. Journal of Memory and Language, Volume 91, 141-157.

Feil-Seifer, D., & Mataric, M. J. (2005, June). Defining Socially Assistive Robotics. In 9th International Conference on Rehabilitation Robotics, 2005. ICORR 2005. (pp. 465-468). IEEE.

King, W. R., & He, J. (2006). A Meta-analysis of the Technology Acceptance Model. Information & Management, Volume 43, 740-755.

Lee, J., Keen, A. D., Farr, E. & Christ, S. (2023). TelePriming Sentence Production in Aphasia. Frontiers in Human Neuroscience, Volume 17.

Lindsay, M. P., Norrving, B., Sacco, R. L., Brainin, M., Hacke, W., Martins, S., ... & Feigin, V. (2019). World Stroke Organization (WSO): Global Stroke Fact Sheet 2019.

Platz, T. (Ed.). (2015). Therapeutic rTMS in Neurology: Principles, evidence, and practice recommendations. Springer.

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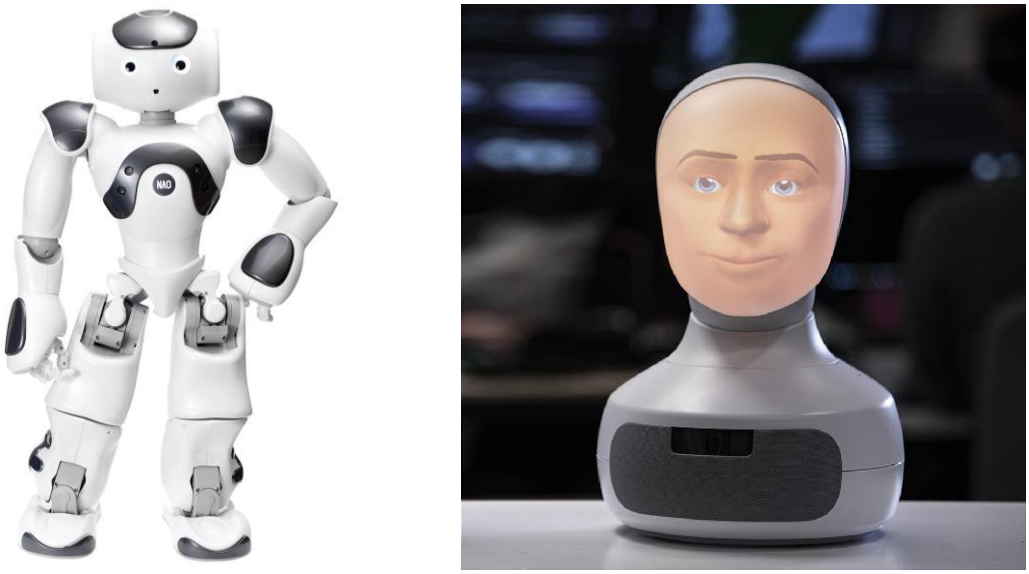

Figure 1. NAO, on the left, is a full-body humanoid robot that interacts using vocal utterances and body gestures. In contrast, Furhat, on the right, is a tabletop robot with a human-like face features.