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Individuals with neurodegenerative disease discuss values about the speed-accuracy trade-off in communication BCIs (Brain Computer Interfaces)

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Keywords

Brain computer interface, user preferences, speed versus accuracy

Abstract

Introduction: Communication BCIs are not as accurate or fast as spoken language. The slow rate or inaccurate word choices might be a barrier to adoption Understanding how potential end-users conceptualize this trade-off, is critical for designing devices. This study, examined the values that potential end-users ascribed to the speed-accuracy trade-off.

Methods and Results: Sixty-six individuals with neurodegenerative disease responded to prompts about six hypothetical ethical vignettes. Participants either responded to questions in semi-structured interviews or through online surveys. All responses were analyzed using a consensus coding and modified grounded theory approach [1], supplemented by a directed content analysis [2]. Four themes emerged. (1) Disease progression may contribute to the trade-off between speed and accuracy. (2) Individual experiences with technology use inform their views. (3) There is a range of views about how slow or inaccurate communication may impact their quality of life. (4) Design solutions are proposed to address trade-offs.

Discussion: Engineers, developers and researchers often consider speed to be the gold standard for communication BCIs. Respondents told us that speed may not always be the most critical value. The context, partner, message, and environment affect the prioritization of speed or accuracy. Developers and researchers need to measure more than speed. Communication plays a critical role in many aspects of life that users value. These values need to be integrated into the design and evaluation of communication BCIs.

Significance: This research emphasized exploring preferences and values for the speed-accuracy trade-off with individuals already using AAC (Augmentative and Alternative Communication) and those anticipating future use of BCI technologies. Often, input for BCI design does not include individuals who experience disability [3]. The

potential end-users in this research should shape the design, training, and implementation of communication BCIs.

References: [1] Charmaz, K. (2006). Constructing grounded theory: A practical guide through qualitative analysis. Los Angeles, CA: Sage. [2] Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. Journal of advanced nursing, 62(1), 107-115. [3] Peters, B., Eddy, B., Galvin-McLaughlin, D., Betz, G., Oken, B., & Fried-Oken, M. (2022). A systematic review of research on augmentative and alternative communication brain-computer interface systems for individuals with disabilities. Frontiers in human neuroscience, 16.