

Individuals with neurodegenerative disease discuss values about the speed-accuracy trade-off in communication BCIs

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Introduction: Messaging with communication BCIs is not as accurate or fast as spoken language. The slow rate or inaccurate word choices might be a barrier to adoption, especially by potential end-users with neurodegenerative disease who have been competent communicators their entire lives. Understanding how potential end-users conceptualize this trade-off, what they would accept, why, and in what contexts, is critical for designing devices that meet end-users' needs and preferences. This study, which is part of a larger research agenda on ethics and BCI communication [1], examined the values that potential end-users ascribed to the speed-accuracy trade-off that must be considered during device development, training, and usage.

Methods and Results: Sixty-six individuals with neurodegenerative disease responded to prompts about six hypothetical ethical vignettes. Eight participants used augmentative and alternative communication devices for expression, and the remaining 58 were natural speakers, experiencing different degrees of communication impairments. Participants either responded to questions in semi-structured interviews that were audio-recorded or through online free response surveys. All transcripts and online free responses were analyzed using a consensus coding and modified grounded theory approach [2], supplemented by a directed content analysis [3]. Four themes emerged. (1) Disease progression may contribute to the trade-off between speed and accuracy with communication BCIs. (2) Individual experiences with technology use inform views about the speed-accuracy trade-off. (3) There is a range of views about how slow or inaccurate communication may impact relationships, the integrity of a message, and quality of life. (4) Design solutions are proposed by participants to address trade-offs in communication BCIs. Pertinent quotes will be shared.

Discussion: Engineers, developers and researchers often consider speed the gold standard for communication BCIs. Respondents told us that speed may not always be the most critical value in all situations. The context, partner, message and environment affect whether augmented and natural speakers prioritize speed or prioritize accuracy in any communication exchange. Developers and researchers need to measure more than information transfer rate or words per minute. Communication plays a critical role in many aspects of life that users value, their relationships, self-concept, and connections to the world. These values need to be integrated into the design and evaluation of communication BCIs.

Significance: This research emphasized the importance of exploring preferences and values for the speed-accuracy trade-off with individuals who experience the full range of communication impairment, those already using AAC and those who are anticipating future use of BCI technologies. Often, input for BCI design does not include individuals who experience disability [4]. The potential end-users in this research should shape the design, training and implementation of communication BCIs.

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