

## 2D Control of Speech Synthesis via Surface Electromyography M. Cler, A. Nieto-Castanon, F. Guenther, S. Fager, C. Stepp

Individuals who use augmentative and alternative communication (AAC) devices due to impairment of their speech motor control require two complementary systems to communicate: an interface that produces speech (e.g. a grid of letters on a computer screen) and an input modality with which to select targets (e.g. a head-tracker or sip-and-puff system). Innovations are needed in both areas, particularly for users with minimal movement capabilities. Here we present an evaluation of a cursor control system leveraging spared facial muscle control via surface electromyography (sEMG), used to control a phonemic interface and synthesizer. The cursor control system translated sEMG of spared musculature into cursor movements, and was designed for individuals with spared facial muscle control as in users with high spinal cord injuries. The phonemic interface gave users direct control over their synthesized speech by enabling them to select phonemes rather than letters. These systems were evaluated in ten adults without motor impairment who used both a typical mouse and the facial sEMG-controlled cursor to produce speech over eight sessions in order to assess motor learning of the expected function. Users received both visual and auditory feedback for motor learning. Results showed that the communication rates achieved with a typical mouse stabilized after five sessions, while users continued to improve with the facial sEMG cursor control system throughout all eight sessions, suggesting the motor learning continued only with the sEMG-controlled system and not the typical mouse. Both the phonemic interface and the sEMG-controlled cursor show promise for future communication applications.