Individuals with complex communications needs are often limited in their ability to control their environment, communicate with others, and use a computer. Some with limited motor control are able to access augmentative and alternative communication (AAC) devices with mechanical switches, infrared sensors, or computer vision systems (Schlosser & Sigafoos, 2006, Tai et al., 2008). For individuals with severe motor disabilities, however, such solutions may be difficult, if not impossible to operate (Man & Wong, 2007). This session will introduce an innovative new switch, nicknamed "The Hummer". Results of a research study will be shared along with video and live demonstration of the proposed device.

Amongst the population of individuals with difficulties accessing AAC technologies are those who are able to vocalize. Due to dysarthria, however, the produced vocalizations are often unintelligible to the general population or are highly variable and inconsistent, thus preclude the use of automatic speech recognizers (Noyes & Frankish, 1992). To overcome this limitation, sound-based access solutions have been used and proven to be effective (Lancioni & Lems, 2001; Lancioni et al., 2005). Existing sound-based solutions, however, suffer from problems associated with unintended sounds (e.g., coughs) (Lancioni et al., 2005), ambient noise (Noyes & Frankish, 1992), and user fatigue (Chang & Karnell, 2004). To overcome these shortcomings, an access solution based on periodic vocal cord vibration has been recently proposed (Falk et al., 2009). The device is housed within a comfortable fabric neckband, fitted with a safety quick -release and customized to suit the wearers' individual preferences e.g. colour, pattern, and fabric. In this study, we extend the functionality of the device to allow for multiple output control signals to be generated, thus giving individuals greater control of their environment and communication. Multiple output signals are generated based on discriminating between vocal cord vibrations of different temporal durations or pitch frequencies. A threshold dial is incorporated to allow for threshold levels to be adjusted for each participant.

Three children between the ages of 9.2 and 14.5 with differing levels of dysarthria were recruited and the performance of the developed multi-output device was evaluated. Participants were also given a modified five-point Borg scale [1=not tired at all, 5=very tired] to measure their perceived exertion levels before and after an approximate 30-minute experimental session. At the beginning of the session, participants were asked to utter two vocalizations, one of longer duration (e.g. 'aaahhh') and another of shorter duration (e.g. 'ah' or 'go'), to determine an appropriate temporal duration threshold value. Similarly, participants were also asked to utter vocalizations of different pitch frequencies (e.g., 'wee-woo-wee-woo') to determine an appropriate pitch frequency threshold. Of the three participants, only the oldest was able to produce at least two distinguishable pitch frequencies, a finding that resonates with those reported by Patel (2002).

Participants were asked to perform various computer-based activities using available two-switch step scanning software. The device was programmed to output a 'space' keyboard output for detected short-duration or low-pitch vocalizations and an 'enter' for long-duration or high-pitch vocalizations. Sessions were videotaped for retrospective switch activation analysis. The performance of the proposed device was quantified in terms of switch sensitivity and specificity. The latter relates to the percentage of correctly identified vocalizations, whereas the former relates to the percentage of correctly rejected user-generated artefacts. It was observed that the device, operating as a single-output solution (either short/long duration of high/low pitch frequency would generate a switch activation), achieved 96.4% sensitivity and 99.6% specificity. As a dual-output device, in turn, an average sensitivity of 72% and specificity of 76.5% were obtained. Moreover, all participants reported no increase in perceived exertion levels after the completion of the task. The results of this study show that the proposed access solution

provides a promising new access option for individuals with severe and multiple disabilities that are able to hum or produce vocalizations.

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