Preliminary Evaluation of a Wearable Multichannel Electrotactile Speech Processor.

R.S.C. Cowan, P.L. Blamey, J.I. Alcantara, L.W. Whitford and G.M. Clark,
Department of Otolaryngology,
University of Melbourne.

Speech discrimination testing, using both open- and closed-set materials was carried out with four severely-to-profoundly hearing impaired adults, and seven normally hearing subjects, to assess performance of a wearable eight-channel electrotactile aid (Tickle Talker). The device consisted of a handset composed of nine electrodes, a stimulator unit, and a speech processor and input microphone. Eight small electrodes were located over the digital nerve bundles on each side of the four fingers of one hand, and a larger common electrode was placed on the wrist. Subjects perceived eight separate channels of information, each corresponding to a stimulus on one side of one finger. The speech processor provided estimates of second formant frequency, fundamental frequency and amplitude of the speech waveform. These features were coded as electrode position, pulse rate and pulse width respectively. This processing strategy (FOF2AO) is similar to that used in an earlier model of the Cochlear Pty. Ltd. cochlear implant.

Significant increases in speech tracking rates were noted for all subjects when using the electrotactile aid. After 70 hours of training, mean tracking rate for the normally hearing group increased from 36 words-per-minute (wpm) lipreading alone (L) to 55 wpm in the tactile plus lipreading condition (TL). Similarly, for the hearing impaired group, mean tracking rate increased from 24 wpm lipreading alone to 37 wpm in the aided condition, after 35 hours of training. Small but significant increases in scores on both groups in the TL condition. Aided scores, for the normally hearing group, were 67% on CNC words (13% better than L) and 68% on CID sentences (14% better than L). Similarly, mean TL scores for the hearing impaired group were 73% (13% better than L) for CNC words and 70% (21% better than L) for CID sentences.

All eleven subjects showed a significant increase in identification scores for /I/ vowels and /2/ consonants when using the aid with lipreading. In addition, scores were significantly above chance when the tactile aid was used without lipreading. Mean percent correct scores for the normally hearing group were: 99% TL, 90% L, 75% T for vowels and 95% TL, 69% L and 47% T for consonants. Scores for the hearing impaired group were: 98% TL, 87% L, 43% T for vowels and 86% TL, 53% L and 34% T for consonants. The results for the Tickle Talker on closed-set tests using trained materials were equivalent of better than results for implant patients using the same speech coding strategy. This indicates that similar segmental and suprasegmental information was provided by the two devices. Implant patients scored higher on open-set word and sentence tests an on speech tracking rates, possibly due to auditory language experience prior to their hearing impairment. The Tickle Talker may be a viable alternative to the implant for prelinguistically hearing impaired people and for those with some residual hearing. Currently, three hearing impaired adults and seven children are using prototype devices at home and at school.


A.M. Crittenden, D.E. Broomham and M.P. Jones,
Concord Hospital, N.S.W.

The A.B.R. traces of over 100 patients under oto-audiological investigation were separately analysed by the hospital's staff neurologist and an audiologist, with access to the available clinical data. Traces were classified as (a) normal (b) abnormal and (c) uninterpretable.

Generally, there was a high level of agreement between the two, but disagreement occurred in c. 5% of cases. Here, the neurologist passed as normal traces that the audiologist reported as either outside normal limits or uninterpretable.

Differences in cursor placement and the use of different 'normal' values by the two interpreters were among the factors to account for this disagreement. Possible reasons for the audiologist's tighter definition of 'within normal limits' are discussed, together with suggestions for improved quality control in A.B.R. interpretation and strategies for handling differences in interdisciplinary viewpoints.
Author/s:
Cowan, R. S. C.; Blamey, P. J.; Alcantara, J. I.; Whitford, L. W.; Clark, Graeme M.

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