Critical Review:

[illegible]ar old participants with severe hearing impairments who [illegible] participated in the Bernhardt et al. (2003) study [illegible] and were therefore familiar with the technology. Intervention took place over [illegible] weeks [illegible]. Each session [illegible] -23i(g)[(i)(pul)16(a)-7(t)1(a)-711(o)25(e)17 Tm[(w)32(e)15(d.)12( )] TJET32412 began with an awareness component, followed by [illegible] images with either ultrasound or EPG separately. [illegible] some measures were: phonetic transcription, acoustic analysis of vowel formant values [illegible] EPG tongue-palate contact patterns. Authors conclude [illegible] vowels [illegible] all the speakers, most notably /i/, reported by [illegible] to be difficult for this population due to high second and third formants . Subject 1 showed change on all vowels in some dimension, Subject 2 showed [illegible] some dimension with /i/ showing improvement on all measures, and Subject 3 [illegible] positive change across all vowels. In general, authors conclude 8 of the 15 vowels showed gains, but it is unclear under which of the three measures these gains are reported.

A strength of this study was using several measures to determine accuracy of target production: transcription, acoustic analysis, and EPG contact patterns, an improvement over the 2003 study which looked solely at transcription. In addition, raters outside of the study conducted both the Praat acoustic analysis as well as the EPG analysis. Authors of the study performed the transcription. However, it was rare that all three measures agreed with one another for each vowel. Some vowels showed improvement on transcription, but no change or unfavourable change on another measure. It is difficult, therefore, to determine whether or not these changes were significant. One reason for this inconsistency may relate to the data from the age-matched controls. The hearing impaired subjects were compared to hearing speakers from the area, but data from only one male and one female were used. It is possible that a data set averaged from a large collection of control speakers would have been more valid 5(d)24( )-11(f)23a1 202.6642.19 Tm1rmaeatetrar(i)-7(o)48(n)] TJETBT896642.19 Tm15 573.05

were administered the *Computerized Articulation and*

Delattre, P., & Freeman, D. (1968). A dialect study of American r's by x-ray motion picture. *Linguistics: An InternationalReview*, 44, 29–68.

Ertmer, D.J., Stark, R.E. & Karlan, G.R. (1996). Real- time spectrographic displays in vowel production training with children who have profound hearing loss. *American Journal of Speech-Language Pathology*, 5(4), 4-16.

Foss, M., Whitehead, B., Paterson, M. & Whitehead, R. (1990). Ultrasound as a visual feedback aid for the hearing-impaired. *Journal of Diagnostic Medical Sonography*, 2, 80-86.

Guenther, F., Espy-Wilson, C., Boyce, S., Matthies, M., Ruffin-Simon,C. (1983). Relationship between production and perception of speech: Some developmental issues. In I. Hochberg, H. Levitt & M.J. Osberger (Eds.). *Speech of the Hearing Impaired: Research, Training, and Personnel Preparation*. (pp.233-250). Baltimore: University Park Press

Smith, C., (1975). Residual hearing and speech production in deaf children. *Journal of Speech and Hearing Research*, 18, 795-811.

Stone, M. (2005). A guide to analyzing tongue motion from ultrasound images. *Clinical Linguistics and Phonetics*. 19(6-7), 455-502.

Tye-Murray, N., Spencer, L. & Woodworth, G. (1995). Acquisition of speech by children who have prolonged cochlear implant experience. *Journal of Speech and Hearing Research, 38, 327-337*.

Westbury, J., Hashi, M., & Lindstrom, M. (1998). Differences among speakers in lingual articulation for American English /r/. *Speech Communication*, 26, 203–226.

Zandipour, M., & Perkell, J. (1999). Articulatory tradeoffs reduce acoustic variability during American English /r/ production. *Journal of the Acoustical Society of America*, 105, 2854–2865.