

Intelligibility and Production in Greek Hearing-Impaired Speech

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Abstract

Talkers with prelingual profound hearing impairment (PHI) develop speech without adequate auditory feedback. Consistent with the DIVA model of speech motor planning, auditory feedback plays a key role in the development and continual tuning of the speech production mechanism [1], [2]. The purpose of the present study was to examine the speech intelligibility of Greek adults with PHI in relation to vowel system characteristics, such as duration, position in the acoustic space and token-to-token variability.

Index Terms: hearing-impaired talker, normal-hearing listener, speech intelligibility, vowel space, Greek

1. Introduction

Speech intelligibility refers to the degree to which listeners receive the talker's intended verbal message. Intelligibility levels of talkers with PHI are characterized by great variability [3], [4]. Intelligibility level is a useful indicator of oral communication abilities, but its relation to speech production characteristics needs to be explored as well, so as to design effective remediation for individuals with hearing loss [5]. This study investigates (a) selected acoustic properties of the vowel system of Greek adult talkers with PHI using conventional hearing aids and (b) the relationship between vocalic acoustic characteristics and PHI speech intelligibility level as judged by naïve listeners with normal hearing.

2. Method

Two experiments were carried out, one measuring speech intelligibility and the other looking into selected acoustic characteristics of vowels.

For the intelligibility experiment, 101 words and 25 sentences were recorded by five men and five women with prelingual profound hearing loss ranging from 91 to 105 dB HL, who had not received cochlear implants but made continuous use of hearing aids since the diagnosis (before the age of 4). The material was judged by 60 naïve listeners with normal hearing, and scored according to [6].

For the production experiment, symmetrical disyllables of the form /pVpV/ (V= [i, a, u]) with stress placed on the first or second syllable, embedded in a carrier phrase, were uttered by the nine talkers with intelligible PHI speech and by five talkers with normal hearing, two men and three women, serving as a control group. Formants F₁ and F₂ at vowel midpoint as well as vowel duration were measured in both syllable positions.

3. Results

The results of the intelligibility experiment showed that intelligibility level ranged from medium to very high, with the exception of one talker with unintelligible speech.

Additionally, the higher identification rate of words in sentences vs. in isolation indicates that context is an important factor in successful communication, in agreement with [7]. The acoustic analysis revealed reduced vocalic contrast, higher acoustic variability and longer vowel durations than normal. The combined results of the two experiments suggest an inverse relationship between overall speech intelligibility and acoustic space mainly due to a more anterior production of [u]. However, acoustic variability and duration did not seem to correlate with intelligibility level.

4. Conclusions

Talkers with PHI are seriously disadvantaged listeners. Their speech production mechanism matures under severe restrictions due to limited ability to monitor their own speech as well as inadequate opportunity for adaptation to external conditions during verbal communication. The results of the present study provide evidence for the detrimental effect of reduced vocalic contrast on speech intelligibility and hold the premise that the exploration of perceptuo-production links underlying the communication of hearing-impaired talkers and normally-hearing listeners is necessary in order to develop improved technological and remedial strategies for successful communication.

5. References

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