

Duration - An Important Acoustic Property in Hearing Impaired Children's Word Prosody

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Introduction

Word prosody, a product of the acoustic properties duration, intensity, and fundamental frequency (Dogil, 1999), has been shown to play a crucial role in language acquisition (Jusczyk, et al., 1999, Morgan, 1996). In order to produce it correctly two prerequisites must be met: i) the stressed syllable must be perceived as stressed and ii) the phonological system according to which stress is distributed within words must be learned.

This paper focuses on the word prosody of German hearing impaired children and explores the question whether their reduced acoustic input harms their acquisition of word prosody. The study hypothesizes that since hearing impaired children perceive a reduced and/or deviant language input they cannot pick up the acoustic cues from the language input which are necessary for the acquisition of word stress. The study further presupposes that since word prosody is marked by three acoustic properties the acoustic signal may contain redundant information. Should this be the case, then not all three acoustic properties would be necessary to perceive/produce word prosody.

Method

15 monolingual German children (age 3 – 6) with prelingual bilateral sensorineural hearing impairment of varying degree and no additional impairments and a control group of 6 normally developing children matching in age named 20 illustrations in isolation. The words pictured on the illustration were selected so as to include words varying in i) syllable number (bi- & trisyllabic), ii) word structures (four types) and iii) stress placements (antepenult, penult, final). The recorded data was first analyzed auditorily to check if all syllable constituents are produced and if stress is produced on the correct syllable. The data was subsequently analyzed acoustically by means of the software packages Praat 4.0.1 and Speech Analyzer 2.4. to check the acoustic properties duration, intensity, and fundamental frequency F0.

Results & Interpretation

The results of the auditory analysis show that hearing impaired children's word productions do not sound as incorrect as expected. In most cases all syllable constituents were produced and word stress was predominantly placed on the correct syllable. However, a comparison of the acoustic analysis of the impaired children with that of the normal children yielded a surprising effect. While the normal children employed all acoustic properties to mark word prosody, the impaired children only applied syllable duration using neither intensity nor fundamental frequency to mark word stress.

The fact that hearing impaired children place word stress correctly but solely mark it via one acoustic property implies i) syllable duration is sufficient to detect stress, and ii) intensity and fundamental frequency contain redundant information. This explains why the impaired children can acquire the stress system and why their acquisition is delayed. Since they only receive one third of the acoustic information they need more time to arrive at the result.

References

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