

# Word Recognition Scores by Native and Non-native Speakers of Modern Greek Language

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## INTRODUCTION

Previous work has shown that non-native adult listeners often experience greater speech perception difficulties than native speakers especially in adverse listening environments. Best (1995) showed when people perceive a second language sound, it will be perceived according to its similarity to, and its discrepancy from the closest counterpart sound in the native language.

Bergman (1980) examined the speech perception of adult native-Hebraic listeners for whom English is a second language (ESL) under various conditions of signal-to-noise ratio (SNR). Results indicated that the ESL subjects obtained significantly poorer perception scores than the native English speakers across all listening conditions. Crandell and Self (1994) investigated the effects of noise (SNR = +6, +3, 0, -3, and -6 dB) on the speech perception of adult ESL (Chinese, Spanish, and Japanese) listeners. Results indicated that the ESL group performed significantly more poorly than the native English speakers at SNRs ranging from 0 to -6 dB. Cutler et al (2004) did an experiment to examine whether the different levels of noise can lead to any change of the phoneme identification difference between native and non-native listeners. The experiment's result clearly showed that both native and non-native listeners suffered more by increased noise, and the performance of the non-native English group are worse than the native English group in all SNR conditions. However, the experiment result also showed a very interesting thing that the non-native and native difference remained as a constant at all noise levels. Lecumberri and Cooke (2006) examined the effect of different kinds of noise maskers on native and non-native English speech perception. These different kinds of maskers included 8-talker babble, speech-shaped noise, competing English and Spanish speech and the clean speech. The experiment results showed that both native's and non-native's speech perception ability adversely affected by the 4 types of noise maskers while natives' performances were better than non-natives in all conditions.

An additional factor that plays an important role in non-native speech perception is age. Mayo et al. (1997) examined whether the age of second-language acquisition will influence the speech perception in noise. They used a SPIN test which consists of sentences presented in a competing babble-type noise. Their results showed that although the non-native listeners could perform at a very high level in the quiet condition, they performed significantly worse in the noise condition. The earlier they began to learn English, the better they performed in the test in noise condition.

Previous researches (Best, 1995; Mayo et al. 1997; Cutler et al., 2004; Lecumberri and Cooke, 2006) showed that the first language strongly influence the second language perception, the age also plays an important role.

The present study was designed to examine performance on a word recognition score (WRS) test between native and non-native adult speakers of Modern Greek language in quiet and under 5 different listening conditions (SNR = +12, +9, +6, +3, and 0 dBHL).

## METHODS AND MATERIALS

### Subjects

The individuals who participated in this investigation included twenty native Modern Greek adult listeners (Mean age 26.35 years; SD=2.80) and twenty adult listeners for whom Modern Greek is a second language (GSL) (Mean age 27.30 years; SD=3.50). All GSL subjects were Albanian natives who learned Albanian as a first language and Modern Greek as a second language after puberty and lived for a minimum of five years in Greece. All subjects had pure tone thresholds of  $\leq 15$  dB HL at all octave frequencies ranging from 250 Hz to 8000 Hz with no known history of auditory dysfunction or neurological disorder.

### Speech Stimuli

The speech stimuli used in this experiment were the four lists for assessing WRS performance, each of which contains 50 open-set phonemically balanced (PB) bisyllabic words, developed by Trimmis and colleagues (2006). These lists are intended for people older than 12 years of age.

### Competing Noise

Speech-shaped noise was used as the noise competition.

### Procedure

Testing was conducted in a sound isolated booth (Industrial Acoustics Company - Model 402/A) with all stimuli presented monaurally (right ear), via a Madsen-Orbiter 922 clinical audiometer, to the subjects wearing TDH-49 earphones.

Word recognition scores were assessed:

1. In quiet at 10 hearing levels ranging from 0 dBHL to 45 dBHL in 5-dBHL increments, and
2. Under 5 different SNRs (SNR= +12, +9, +6, +3, 0) at 45dB HL.

## RESULTS

The mean WRS results in percentage correct and standard deviations, for the native Modern Greek speaking and GSL adults in quiet and at various SNRs are presented in Figures I through IV.

## DISCUSSION

The results of this study indicate that the masking of speech by noise has a substantially greater effect on the word recognition ability of non-native speakers of Modern Greek than the native speakers of Modern Greek.

First, it is interesting to note that the performance of the native group was better even in quiet (Figure I).

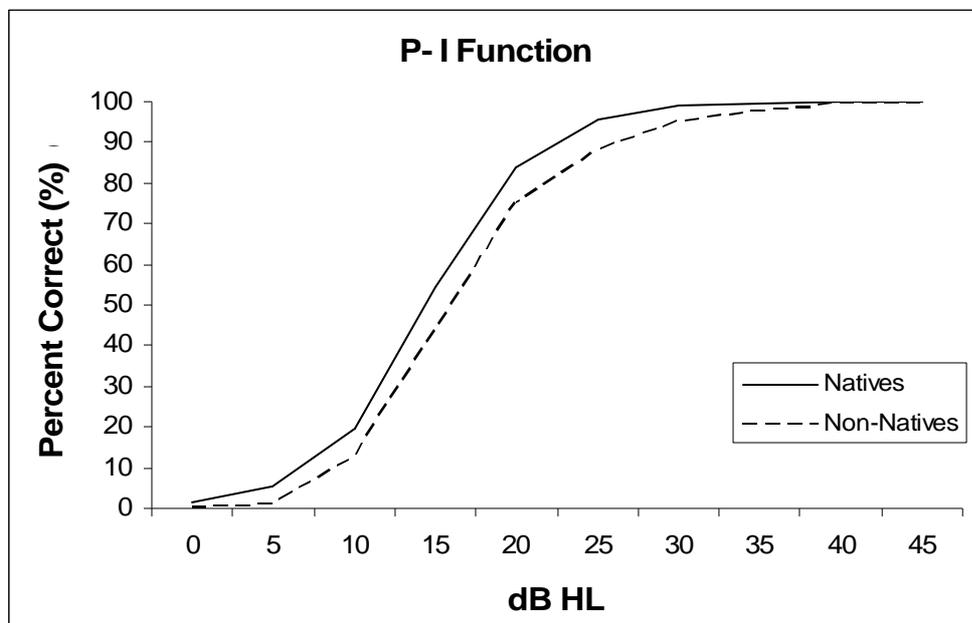


Figure I. Mean percent of the monaural (right ear) correct scores of native and non-native Greek speakers for the four WRS lists in quiet.

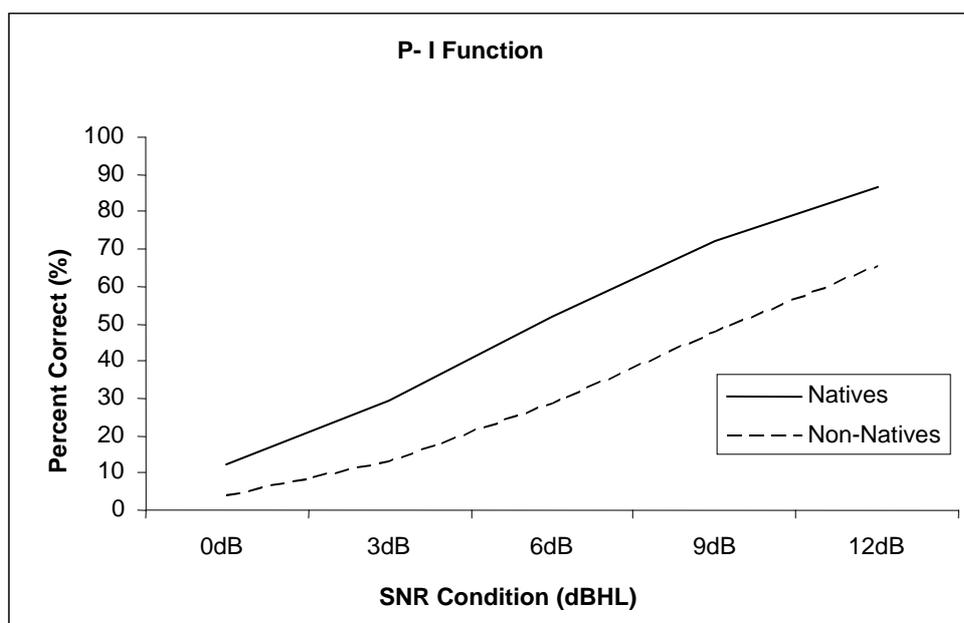


Figure II. Mean percent of the monaural (right ear) correct scores of native and non-native Greek speakers for the four WRS lists at various signal-to-noise ratios.

Second, GSL subjects obtained poorer perception scores than the native subjects across all of the SNRs (Figure II). Moreover, the performance decrement between the two groups remained almost constant at the various SNRs.

Also, the GSL subjects exhibited marked variability in performance, compared to the native Modern Greek

listeners, particularly in quiet and at more favourable SNRs (Figures III and IV). The source(s) of this variability is uncertain at this time; however, similar results are commonly noted in the performance of listeners with hearing loss (Crandell, 1991b).

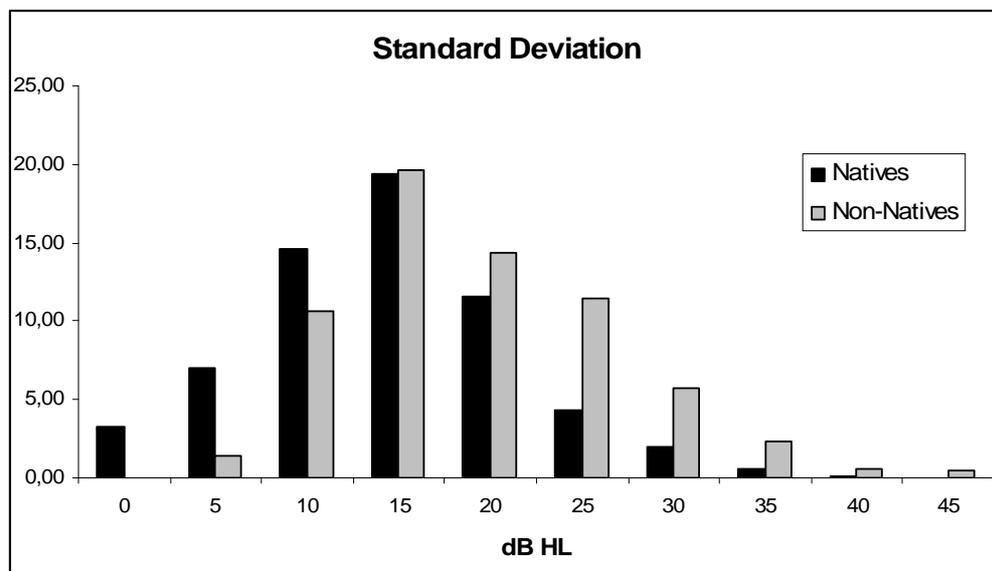


Figure III. Mean Standard deviations for the 4 WRS lists of the two groups in quiet.

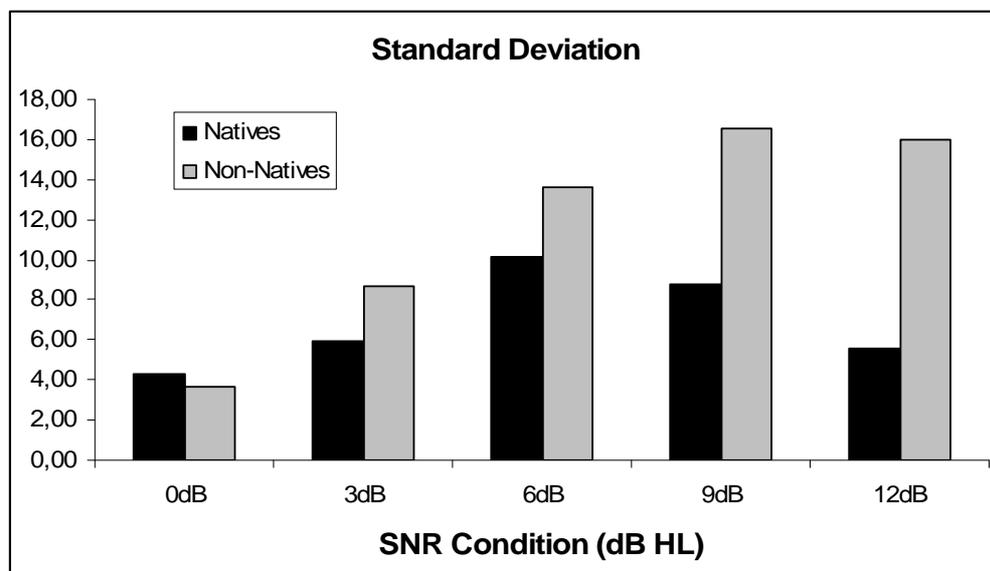


Figure IV. Mean standard deviations for the 4 WRS lists of the two groups at various signal-to-noise ratios.

These findings are consistent with previous research suggesting that bilingual listeners will exhibit decreased perceptual performance in the second language in degraded listening environments.

To date, the acoustic and/or linguistic mechanism(s) for diminished speech perception in non-native listeners remain uncertain. According to Bradlow & Pisoni (1999), spoken word recognition accuracy depends on a combination of at least three types of factors:

1. Signal-related characteristics.
2. Lexical factors.
3. Instance specific factors.

However, it is well known that language proficiency in a second language rarely matches that of the native language. Therefore, redundancy of the speech signal caused by the masking noise will be less tolerated in the second language.

In summary, the findings from this study have important implications for the more than one million non-native Modern Greek-speaking adults in Greece who may be exposed to unfavourable listening conditions.

Further research is recommended especially for GSL children since recent estimates from the 'Ministry of National Education and Religious Affairs' suggest that approximately 10% of all children in the public school system in Greece (Primary and secondary education) speak Modern Greek as a second language. Appropriate classroom acoustics (i.e., noise and reverberation levels) should be maximized for increased speech perception by GSL children in educational settings. Additionally, appropriate intervention strategies for GSL populations such as personal or sound-field FM amplification systems, need to be identified.

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