

Hearing impaired speakers of tonal languages may be more affected by noise than speakers of non-tonal languages

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Cross-language comparison is necessary to investigate whether tonal-language hearing-impaired speakers are more challenged when listening in noise



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Presented at the 7th Speech in Noise (SpiN) Workshop, Copenhagen, Denmark, January 8-9, 2015

Background

In tonal languages (TL), each monosyllable is pronounced with a distinctive tone, denoting a specific lexical meaning. Tones correspond to variations in pitch. They are produced directly by the vocal folds and do not affect lip movement. Thus, tone recognition relies exclusively on the ability to perceive pitch variations.

Hearing Impaired (HI) listeners are often less sensitive to changes in pitch. Therefore, in TL difficulties in tone perception are likely to have more serious effects on communication, as they can directly affect listeners' speech intelligibility.

Furthermore, research indicates that accurate tone recognition is important for understanding speech in noisy environments. In this study, it is suggested that noise may affect differently TL speakers with hearing loss (HL) and proposed that the Hearing In Noise Test (HINT) be used to compare TL versus non-TL performance.

Aim of the study

To encourage research that addresses the following questions:

- Does noise affect differently TL and non-TL listeners with similar HL?
- Does HL affect performance in noise the same way for both TL and non-TL listeners?

Language categories based on tonal content

Non tonal

Pitch is used at sentence level for intonation (emphasis, emotions, questions, statements)

Word contrast occurs to a greater extent with means other than pitch.

e.g. European languages

Simple tonal

Pitch is important for conveying meaning at a word level

Limited combinations of pitch patterns within a single word

This category comprises languages that possess characteristics of both tonal and non tonal prosodic systems.

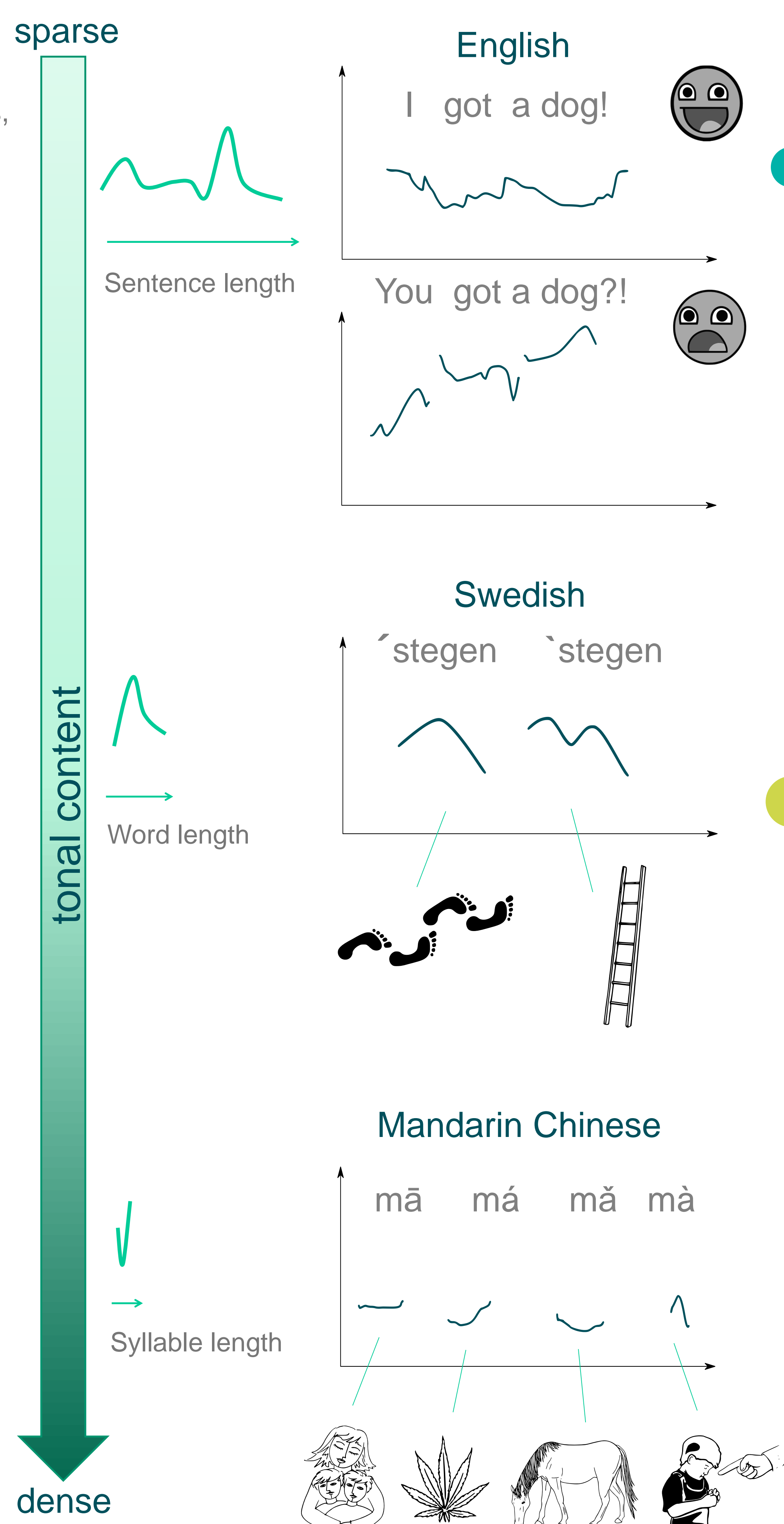
e.g. Swedish, Japanese

Complex tonal

Pitch is used to transfer meaning

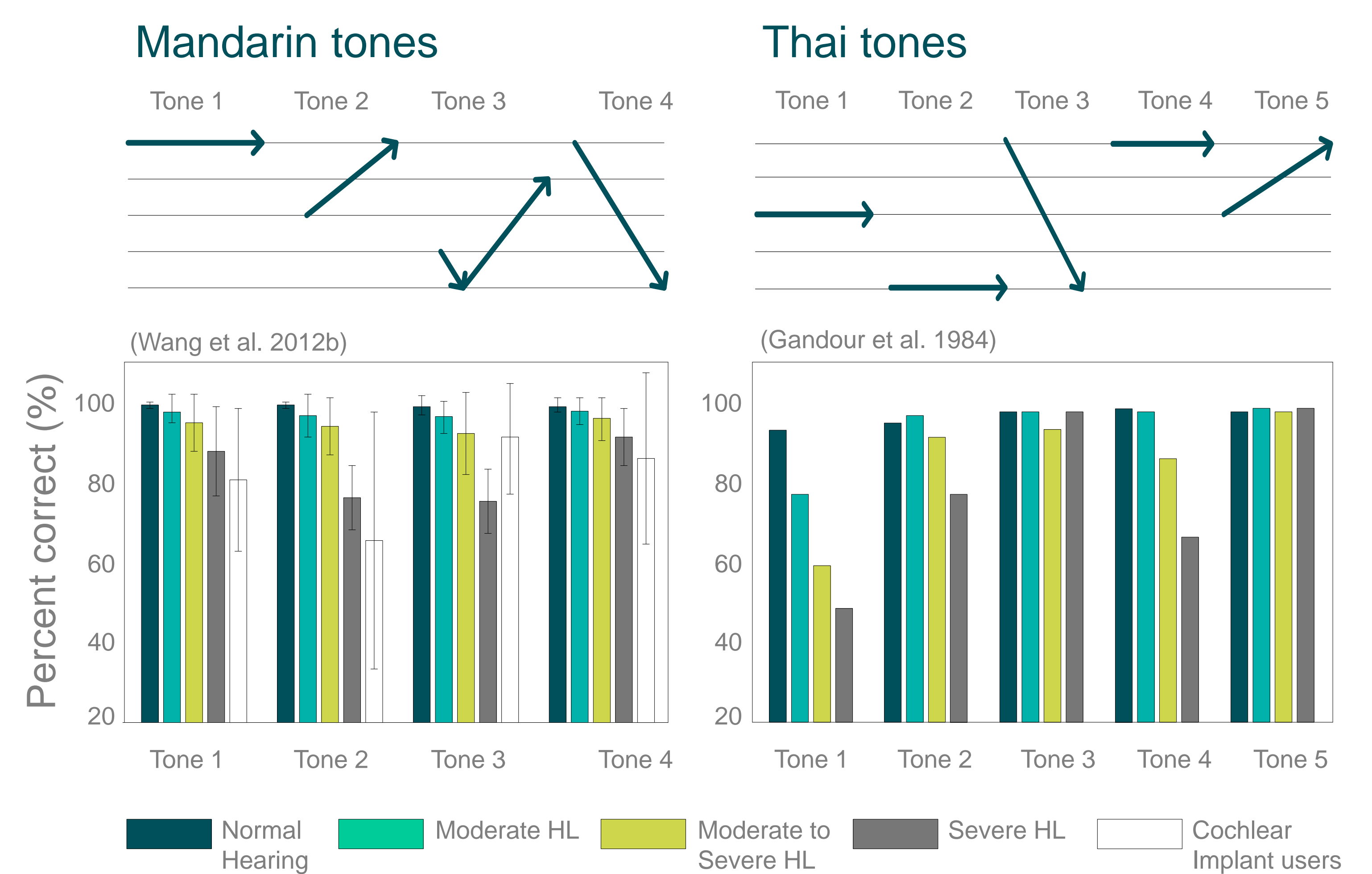
Pitch varies independently in each syllable

e.g. Mandarin Chinese, Cantonese Chinese, Thai



HI and tone identification

Experiments conducted *in quiet* show that HL may prevent access to the most crucial characteristic of tonal languages, i.e. the tone, even when compensating for audibility. Examples are shown below from studies in Mandarin Chinese and Thai. *In noise*, accurate pitch perception becomes even more important as shown by previous research (Chen et al. 2014). It is therefore possible that HI TL listeners find listening in complex situations more challenging than non-TL listeners.



Use of HINT for cross-language comparisons

We propose using the HINT to measure and compare performance in noise between TL and non-TL listeners. To our knowledge such data has not been published to date. The HINT is an appealing tool as it offers the following main advantages:

- It is developed in more than 20 languages including TLs such as Mandarin and Cantonese Chinese.
- Speech materials for all languages have been developed under the same considerations.
- It allows direct comparison across languages by means of the H-scores, which express HINT performance as the deviation from performance of normal hearing individuals.

Conclusions

The present work aims in highlighting the need for comparative studies in order to quantify the differences in noise performance between TL and non-TL HI speakers. The findings of such studies would strengthen or weaken the assertion that TL speakers may benefit from a specially-designed fitting rationale.

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