

Abstract

Project Code : MRG5480272

Project Title : Subjective Intelligibility Testing of Thai Speech

Investigator : Assoc. Prof. Dr. Charturong Tantibundhit

E-mail Address : tchartur@engr.tu.ac.th

Project Period : 3 years

Abstract: We methodically designed and developed a subjective intelligibility testing of Thai speech for initial and final consonants based on the diagnostic rhyme test (DRT). The Thai DRT (TDRT) consists of 2 test sets, one for initials (TDRT-I) and the other final consonants (TDRT-F). The test for initials is designed to equally compare 21 phonemes pairwise, which results in 210 stimulus pairs. The TDRT-F compares 8 final phonemes, yielding 84 stimulus pairs. The tests are well-constructed using real monosyllabic words. TDRT-I and TDRT-F have main advantages in that percent intelligibility scores in each stimulus pair as well as confusion patterns across all phonemes can be evaluated and compared. To confirm its validity, we carried out a series of experiments. The subjective intelligibility tests were conducted on 28 Thai normal hearing listeners in four SNR levels (-6, -12, -18, and -24 dB for TDRT-I and TDRT-F) and subsequently on eight sensorineural hearing loss patients (with and without hearing aids) using clean stimuli (for TDRT-I). Average intelligibility scores, percent correct responses, and confusion matrices were obtained. Comparisons of confusion patterns in both subject groups showed that for both initial and final consonants, voicing was the most robust contrast while place-of-articulation was the least. Specifically, for initials, /r/ is the most confusable phoneme, while /w/, /j/, and /p/ are among the least. Perceptual representation spaces, derived from confusion matrices, yielded five non-overlapping groupings: glide, glottal constriction, nasality, aspirated obstruent, and a combination of liquid and unaspirated obstruent. The results suggested that patients' perceptual difficulty could be attributed to the nasality grouping, normally well separated for normal hearing listeners, shifting close to the glottals and aspirated obstruents. Hearing aids seemed to improve perception of all phonemes by 10%, with /tç^h/, /k^h/, /s/, and /h/ (all unvoiced) showing significant improvement rate. Lastly, the signal detection theory (SDT) bias values of *c* among all possible 108 pairs of unvoiced vs. voiced phonemes revealed that normal hearing subjects are in favour of unvoiced phonemes. The hearing loss patients (with and without hearing aids) showed the same bias pattern. Interestingly, the hearing aids seem to substantially increase more biases for the unvoiced category.

Keywords : Thai diagnostic rhyme test, subjective intelligibility, confusion matrix, similarity score, perceptual representation space, *c*-value