



Categorization of Native and Non-Native Speech by Native Malayali Children, Young Adults, and Older Adults

Satheesh M¹, Asna P¹, Afra A¹, Safwana A¹, Girish KS² and Abhishek BP^{3*}

¹Under-Graduate Students, AIISH, India

²Assistant Professor in Speech Language Pathology, JSS Institute of Speech and Hearing, India

³Assistant Professor in Speech Language Pathology, All India Institute of Speech and Hearing, India

***Corresponding author:** Abhishek Budiguppe Panachakshari, Assistant Professor in Speech Language Pathology, All India Institute of Speech and Hearing, Mysore, Tel: 8073534767; Email: abhiraajaradhya@gmail.com

Received Date: April 22, 2024; **Published Date:** May 22, 2024

Abstract

Native and non-native identification is challenging but is very important in speech and speaker recognition. The current study was carried out with the aim of testing the categorization ability across three group of non-native listeners of Malayalam (children, young adults and older adults). Stimulus was presented in phonemes, words and sentence levels. It was found that there was significant difference across the three groups. The non-native listeners found it difficult to discriminate the native and non-native listeners at the phoneme level. At sentence level, the participants found it easier to differentiate the native and non-native listeners.

Keywords: Native; Non-Native; Discrimination; Complexity Levels

Introduction

Communication is the active exchange of ideas and information about one's desires, needs, knowledge and perception through comprehension and expression [1,2]. Verbal communication is accomplished through spoken words and language, which may be accompanied by culturally appropriate normal gestures and facial expression. The speaker must communicate the information in an acoustic signal/sound generated by the human vocal tract, which is referred to as speech production. While the process by which listeners perceive, interpret, and comprehend the sounds of language is known as speech perception.

The accuracy of speech perception and recognition depends on a wide range of talker-, listener-, and utterance-related

characteristics, all of which can vary across communicative situations [3]. Both the speaker and the listener must put efforts to reach mutual understanding for communication to be successful, if not, the burden of communication will fall on one of them or may result in communication breakdown. For listeners to successfully decode an utterance, they must be able to reliably discriminate the speech sounds of a particular language. The speech signal presents listeners with a multitude of acoustic information, along different auditory dimensions, that lies within the limits of human hearing [4].

Perceiving speech is not simply a task of attending to these auditory dimensions equally, but it is a critical task on how listeners integrate the multiple dimensions to successfully map them onto speech sound categories. It is commonly

known that non-native speech typically contains acoustic-phonetic properties that deviate from average native speech properties [5,6]. In intercultural interactions where native speakers converse with non-native speakers or when non-native speakers speak with native speakers, there are asymmetries of power that result in inequalities [7]. To distinguish between native and non-native speech, which is a key skill, the listener must use auditory qualities of native speech that are distinct from non-native languages.

However, several factors influence the speech perception by native listeners. The first is the level of variability, where listeners are given spoken word lists with a high level of stimulus variability, word recognition accuracy declines and reaction times rise [8]. Second, familiarity with the talker's voice and articulatory features by the listener increases word recognition accuracy in difficult listening situations. Third, the lexical properties of the specific words in a stimulus set have a significant impact on overall intelligibility. That is, words that are lexically easy and have few phonetically similar neighbors are recognized more readily than words that are lexically hard and have a lot of these neighbors. Finally, talkers with high levels of articulatory precision often had more understandable speech than talkers with low levels of articulatory precision [8]. Along with linguistic factors, the listener may also rely on non-linguistic factors to discriminate between native and non-native speakers.

Considering the aforementioned factors that affect speech perception, adults can accurately differentiate speech and group them according to their labels provided by the experimenters when compared to children [9]. On the one hand, children's sensitivity to acoustic phonetic variations in the speech signal is less well understood. Researchers opine that 4- to 5-year-old children and adolescents often struggle with activities requiring explicit labelling or discrimination judgements [10]. Native and non-native discrimination research is an important and integral area in speech perception. However, there aren't enough studies on listeners' capacity to distinguish between native and non-native speech. It is important to conduct this research as now a days, non-native speakers are substantially outnumbering native speakers of many languages [11,12]. Hence the present study aimed at investigating the native listener perception of native and non-native speech. In the current study, listeners' explicit awareness of the speech variation was tested across three age groups at the phoneme, word, and sentence levels. The results advance the understanding of individual's developing representations of this source of social-indexical variability.

Methods

Aim of the Study

To investigate the native listener's perception of native and non-native speech.

Objectives

- To compare the scores of categorizations of native and non-native speech by native Malayali children, young adults and older adults across sounds, words, and sentences.
- To compare the scores of categorizations of native and non-native speech across native Malayali children, young adults and older adults within sounds, words, and sentences.

Participants

The present study involved 60 native Malayali speakers who were divided into three groups based on their ages. The first group included 20 children between the ages of 10 and 12 years; the second group included 20 young adults between the ages of 18 and 25 years; and the third group included 20 older adults between the ages of 55 and 70 years. All the participants had Malayalam as their first language. All the participants had normal hearing sensitivity with no history of sensory or motor problems. This was informally tested by a speech language pathologist (SLP).

Materials

The stimuli included 10 phonemes, 10 words and 10 sentences from Malayalam language. Each of these stimuli were recorded from 5 native and 5 non-native Malayalam speakers in the age range of 21 to 24 years. After randomizing the order of these stimuli, the final stimuli track was created.

Procedure

Participants were comfortably seated in a quiet environment, and the final stimuli track was presented through circum-aural headphones. Before playing the stimuli to the participants, the operational definition of native and non-native speakers was explained to them. The participants were made to wear circum-aural headphones and the final randomized stimuli track was played at moderate intensity level corresponding to 60 dB roughly. Each stimulus was presented for a maximum of two times only. Participants were asked to identify whether the stimuli presented was spoken by a native or a non-native speaker. They were instructed to provide scores of 1 and 0 for samples they thought came from native speakers and non-native speakers, respectively. The responses from the participants were analyzed for accuracy. The response was

considered correct when the judgment was correct while the response was considered incorrect when there was a wrong judgment. The maximum score for the three set of stimuli (sounds, words, and sentences) was 30.

Results and Discussion

The mean scores on the speaker judgment task was computed for the phonemes, words and sentences in the three group of participants. Group 1 (younger participants) secured a score for 4.3 for phonemes, 6.34 for words and 7.2 for sentences. Group 2 participants secured a score of 5.2 for phonemes, 7.76 for words and 8.2 for sentences. Group 3 participants secured a score 4.4 for phonemes, 6.2 for words and 7.78 for sentences. The first objective was to verify if there was any difference between phonemes, words and sentences. As the data did not abide by the properties of normal distribution, Friedman's test was used and the X^2 values obtained was 2.34, 2.14 and 1.98 and the corresponding p values showed significant difference between the three groups. The second objective was an extension of the first objective where the accuracy on judgment task was compared for the three groups. Kruskal-Wallis test was used to verify if there was any significant difference and the X^2 value obtained was 2.33 (group 1 vs group 2), 2.33 (group 1 vs group 3) and 1.8 (group 1 vs group 2) for words and the corresponding p values showed significant difference between the three groups. For phonemes there was no significant difference between the three groups. For sentences there was significant difference between group 1 and group 2, group 1 and group 3 ($p < 0.05$). There was no significant difference between group 2 and group 3 ($p > 0.05$).

The mean values suggested that the group 2 participants over performed the two groups for all the three linguistic units. Group 3 performed better than group 2 for all the linguistic units. Discriminating native and non-native speakers was difficult at the level of phonemes for all the three groups followed by words and sentences. Group 2 (younger participants) were able to differentiate native and non-native speakers even at the level of words. While group 1 and group 3 participants exhibited difficulty in differentiating between native and non-native speakers even at the level of words. The current study is an exploratory study as the basic linguistic level at which the native speakers were able to differentiate between native and non-native speakers was not explored in the previous studies to the best of our knowledge. It was clear and evident that listeners regardless of their age found it difficult to differentiate between native and non-native speakers at sound (phoneme) level. At sentence level, participants of second and third group were comfortably able to differentiate between native and non-native speakers. However, group 1 participants found it difficult to differentiate native and non-native speakers even

at the level of sentences and this can be probably attributed to the limited exposure to non-native participants in this group. At word level younger participants performed well compared to the other two groups showing that native and non-native speaker discrimination is possible even at the word level.

Conclusion

The current study was carried with the aim of investigating native listener perception of native and non-native speech. Listeners (participants) were divided into three groups based on their age. Younger participants (group 2) over performed the other two groups for phonemes, words as well as sentences. Sentences were identified better compared to words and sentences.

References

1. Bradlow AR, Pisoni DB (1999) Recognition of Spoken Words by Native and Non-native Listeners: Talker, Listener, and Item-Related Factors. *J Acoust Soc Am* 106(4): 2074-2085.
2. Williams D, Escudero P (2014) Native and Non-native Speech Perception. *Acoustics Australia* 42(2): 79-83.
3. Simon E, Lybaert C, Plevoets K (2022) Social Attitudes, Intelligibility and Comprehensibility: The Role of the Listener in the Perception of Non-native Speech. *Vigo International Journal of Applied Linguistics* (19): 177-222.
4. Sommers MS, Nygaard LC, Pisoni DB (1994) Stimulus Variability and Spoken Word Recognition. I. Effects of Variability in Speaking Rate and Overall Amplitude. *J Acoust Soc Am* 96(3): 1314-1324.
5. Luce PA, Pisoni DB (1999) Recognizing Spoken Words: The Neighborhood Activation Model. *Ear Hear* 19(1): 1-36.
6. Clopper CG, Pisoni DB (2004) Homebodies and Army Brats: Some Effects of Early Linguistic Experience and Residential History on Dialect Categorization. *Lang Var Change* 16(1): 31-48.
7. Van Bezooijen R, Gooskens C (1999) Identification of Language Varieties: The Contribution of Different Linguistic Levels. *Journal of Language and Social Psychology* 18(1): 31-48.
8. Ptacek PH, Sander EK (1996) Age Recognition from Voice. *Journal of Speech and Hearing Research* 9(2): 273-277.

9. Floccia C, Butler J, Girard F, Goslin J (2009) Categorization of Regional and Foreign Accent in 5-to 7-year-old British Children. *International Journal of Behavioral Development* 33(4): 366-375.
10. Roth KC, Clayton KRH, Reynolds GD (2022) Infant Selective Attention to Native and Non-native Audiovisual Speech. *Scientific Reports* 12: 15781.
11. Wagner L, Clopper CG, Pate JK (2014) Children's Perception of Dialect Variation. *Journal of Child Language* 41(5): 1062-1084.
12. Fuhrmeister P, Phillips MC, McCoach DB, Myers EB (2023) Relationships between Native and Non-native Speech Perception. *Journal of Experimental Psychology* 49(7): 1161-1175.