Perception of a non-salient place contrast in Tshivenda by Xitsonga speakers

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1. Introduction

Tshivenda is a southern Bantu language spoken in South Africa and Zimbabwe by about 1.3 million speakers.



a. Tshivenda speaking towns



Figure 1: A map of Limpopo

Tshivenda is unique because it marks a place contrast between dentals and alveolars across various manners in the orthography using a carat sign underneath symbols for alveolars. Lee et al. (2018) reports acoustic characteristics of the place contrast and focuses on nasals due to qualitative differences found in the realization of plosives and laterals; for example, the orthographic 't' is produced as a palatal affricate and the orthographic 't' is produced as an alveolar. In Suzuki and Lee (2019), we report that the contrast between dentals and alveolars is retained in the production test, but the difference is not robustly perceived by native speakers of Tshivenda. This finding was interpreted as perceptual merger in the non-salient coronal place contrast, also known as near merger (Yu 2007).

In this study, we address the issue of perception of non-salient contrast by looking into perception data from Xitsonga speakers who don't have the nasal place contrast, but nonetheless share the linguistic sphere with Tshivenda speakers. Informal inquiries to Xitsonga speakers yielded responses that they can distinguish the place contrast, presumably because sharing the linguistic sphere allowed them to observe the production of the sounds. Even so, an experimental study was necessary to verify these impressionistic claims to understand non-native speakers' perception of the non-salient contrast.

Xitsonga speakers are selected for this study due to various reasons. Xitsonga speakers share the geographical area with Tshivenda speakers. During the apartheid period, the homeland for Tsonga people and the homeland for Venda people were next to each other. In remote rural areas, intermarriage between these two groups is common. In modern day Thohoyandou, Limpopo, contacts between these two groups are frequent so that many speakers can understand the basic of each other's language. This geographical proximity and close social structure make a perception study of these two languages worthwhile because other external factors can be excluded in understanding the perception of non-salient contrast by speakers of other languages.

Perception results reveal that Xitsonga speakers do not perceive the difference between dental and alveolar place contrast (even though some informally claimed that they can do so). The findings suggest that geographical proximity as well as familiarity with a language do not result in a perception of a non-salient contrast. Furthermore, the findings imply that non-salient phonological contrast may only be perceivable only if the grammar encodes the contrast.

2. Experiment

2.1. Participants and Procedure

A perception task was conducted in Thohoyandou, Limpopo, South Africa in November 2018. Xitsonga speakers who were familiar with the orthographic representation of the dental and alveolar contrast were recruited. Eleven native speakers of Xitsonga were asked to identify whether a token in a frame sentence begins with a dental or an alveolar. Two forced choices were presented using standard Tshivenda orthography using Superlab version 5.0 (Abboud 2013). Participants made decisions using two keys on a keypad that was directly connected to a MacBook Air using a USB connection. After a short practice session, participants made judgements for 120 items selected from the production data by four speakers.

2.2. Stimuli

Stimuli for the perception test were 3 pairs of minimal pairs with the dental versus alveolar contrast in (1). Recordings of the 6 items from 6 previously recorded participants were selected for the perception test. At the time of the recording, a post-test confirmed that all the speakers who produce the stimuli were using these words in their everyday life.

(1) Stimuli

- a. nínga 'punch' nínga 'hit sideways'
- b. nànga 'flute' nánga 'choose'
- c. nènga 'sneak away' nènga 'sneak'

2.3. Analysis

Results from the psychological software Superlab 5 were analyzed using a d-prime value. Perception tests yield four types of responses that need to be considered. For example, when a participant responds with 'dental', the response may come from a dental stimulus (called 'hit) or from an alveolar stimulus (called 'false alarm'). In that same scenario, when a participant responds with 'alveolar', the response may come from an alveolar stimulus (called 'correct rejection') or from a dental stimulus (called 'miss'). The d-prime value is calculated by subtracting the z-score of 'false alarm' responses from the z-score of 'hit' items. When two sounds are categorically distinguished by participants, the d-prime value reaches around 3.

One participant only provided alveolar responses. We deemed that this participant did not understand the purpose of the experiment, and the responses were excluded from further data analysis.

3. Results

The results show that Xitsonga listeners do not distinguish dentals from alveolars based solely on acoustic recordings. Although the higher the d-prime is, the more discernability of two items, d-prime values by Xitsonga listeners were rather low as shown in table 1. The lowest d-prime value is -0.17, and the highest value is 0.45. The overall distribution of d-prime value suggests that Xitsonga speakers cannot distinguish the nasal place contrast between dentals and alveolars. The c-value shows a tendency in their responses. Higher c-values indicate that a participant tends to offer alveolar responses. Given the low c-value, Xitsonga speakers have tendencies to respond most items as dentals.

Listeners	D-prime	С
1	-0.179555829	-0.163569188
2	0.125355438	0.147750675
3	-0.030370821	-0.216648952
4	0.178345967	0.036488363

Table 1: D-prime and C values

5	-0.115820944	0.037020384
6	-0.011685931	0.131504312
7	0.05268462	-0.02634231
8	0.326541345	0.047157722
9	0.458182462	-0.103429884
10	-0.074980604	-0.347830164

4. Discussion

It is well known that perceiving contrasts that are not present in one's dominant or native language is not an easy task. However, it is not always obvious whether speakers of languages that share the same linguistic sphere will share the same difficulty. Xitsonga speakers and Tshivenda speakers not only live in a nearby area, but also share various aspects of their life suggesting a closer than usual relationship both linguistically or non-linguistically. Such a close relationship would predict that non-native contrast in Tshivenda may not be difficult to perceive by speakers of Xitsonga.

The findings in this study, however, show that non-salient contrast in Tshivenda that is not present in Xitsonga is not perceivable. D-prime results by Xitsonga speakers show that many listeners were guessing rather than discriminating any differences between dental and alveolars. Moreover, when they have to make a judgment, Xitsonga speakers displayed inclination to judge a stimulus as a dental sound rather than an alveolar sound; possibly due to the marked status of the dental nasal sound. In other words, when Xitsonga speakers face a difficult task of mapping an audio stimulus to a category of sound, they opted for the marked dental rather than the unmarked alveolar.

In Suzuki and Lee (2019), Tshivenda speakers display rather low d-prime values for an alleged native contrast (ranging from -0.34 to 1.62), which suggests that near merger (Yu 2007) is an ongoing process in the phonology of Tshivenda. This finding shows that Tshivenda speakers already have difficulty perceiving the nasal place contrast even though they could produce the difference by advancing the tongue and producing an interdental nasal. The results in this paper show that a contrast that is experiencing near merger is also nearly impossible to be perceived by speakers of other languages when the contrast is not present in those languages.

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