A Perceptual Experiment on Thai Consonant Types and Tones

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Abstract: Monogenesis in Thai arose historically from neutralization of a voice contrast in prevocalic consonants: new higher tonal variants after what had been voiceless consonants and new lower variants after the earlier voiced consonants. Today, Thai has again acquired a series of voiced stops and the same allophonic variation in F0 may be observed on the tones following voiced and voiceless stops. How important are these F0 cues to Thai listeners? Can one stage of the tonal multiplication process that shaped Thai tone system be demonstrated in the lab? To answer these questions, a perceptual experiment was conducted. The result showed that listeners were able to differentiate voiced and voiceless stops even though the information before, at burst, and after burst (30-120 ms) was gated out. There must be other cues for voicing besides F0. However, if F0 plays a role, this result mirrors the rise of distinctive tones in Thai history.

INTRODUCTION

The reconstruction of Thai phonology showed that monogenesis in Thai arose from the merger of Proto voiceless aspirated and Proto voiced stops (2). Those two groups are pronounced as voiceless aspirated stops in Standard Thai. The cue to differentiate the two Proto voiceless and Proto voiced stops is no longer voicing but the F0 variations of vowels following those consonants. Vowels after original voiced consonants have a lower tone; whereas, vowels after original voiceless consonants have a higher tone (1). The development of these F0 distinctions lead to the split of Thai tones from three tones in Proto Thai to five tones in Standard Thai.

Today, Standard Thai has three sets of stops: voiceless aspirated stops (from Proto voiceless aspirated and Proto voiced stops), voiceless unaspirated stops (from Proto voiceless unaspirated stops), and voiced stops (from Proto glottalized voiced stops). F0 variations can be observed on the tones following voiced and voiceless stops. There may be additional cues, too, other than voicing itself. A perceptual experiment was conducted to see if Thai listeners could differentiate voiceless-voiceless stop minimal pairs without the main cue for voicing itself. If so, this experiment in the lab would duplicate one stage of the monogenesis process in Thai.

PROCEDURE

Six minimal pairs of Thai words were chosen for this experiment. These six pairs were 1) paan 'as if'-baan 'to bloom' [mid], 2) paa 'forests' - baa 'shoulders' [low], 3) paa 'aunt' - baa 'crazy' [rising-falling], 4) taen 'melon' - duen 'red' [mid], 5) tap 'liver' - dap 'to extinguish' [low], and 6) taan 'to resist' - daan 'sides' [rising-falling]. Each pair contained a word with a voiceless unaspirated stop and the other with a voiced stop. The first three pairs had initial labial stops and the other three pairs had initial dental stops. The pairs 1 and 4 had a mid tone, the pairs 2 and 5 had a low tone, and the pairs 3 and 6 had a rising-falling tone. All the words were put into a context "nii +word". This is "nii +word". Then, the tokens were read and recorded on an analog tape recorder. The tokens were randomized and gated at six points of time: 30 ms before burst, at burst, 30 ms, 60 ms, 90 ms, and 120 ms after burst. These tokens were prepared in two main contexts: with an onset word /nii/ + silence + word or with onset white noise (in lieu of an onset / nii / + word). Voicing of stops was replaced by these onsets. There were a total of 156 tokens (12 words (6 pairs) * 6 points gating * 2 contexts + a set of 12 unprocessed tokens [ 'nii' + word ]). Eleven adult native-Thai subjects (six males and five females) listened to these tokens and judged whether each token had a voiceless or voiced initial stop.

RESULTS AND DISCUSSIONS

The results of this experiment are shown in Figs. 1 and 2 which present a percentage of voiceless (solid line) and voiced (dashed line) responses over different gating points with onset of white noise (figure 1) and with the onset word / nii / (figure 2). From the two figures, it can be seen that listeners heard voiceless tokens as voiceless

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FIGURE 1. Correct responses in context: white noise onset

FIGURE 2. Correct responses in context: the onset word / nil /

more often than they heard voiced tokens as voiced. However, when the gates were greater than 30 ms after burst, listeners were still able to distinguish between voiceless and voiced tokens at a higher rate than would be possible if only voicing in stop closure were the cue. That is, if voicing in closure were the only cue, all the judgments for voiceless stops should have been 'voiceless' at gates of +30ms or more.

An analysis of variance was used to analyze the interactions between voicing, places of articulation and tonal effects. First, voicing had a significant effect on the responses at every point of time: F(1,10)=495.87, p<0.07. Listeners heard voiceless tokens as voiceless and voiced as voiced. It was interesting that listeners were able to differentiate between voiceless and voiced tokens although the cues for voicing past 30 ms after burst were gated out. Second, places of articulation had a significant effect on responses at burst, 30 ms, 60 ms, and 90 ms after burst: F(1,10)=32.03, p<0.07. We found that listeners heard voicing differently for more alveolars than for labials at those points of time. Third, tones had a significant effect on responses at burst and 120 ms after burst: F(1,10)=24.94, p<0.07. We found that listeners heard voicing differently for all tones (mid, low, rising-falling) at burst but only for contour tone at time 120 ms after burst.

CONCLUSIONS

This experiment showed that listeners heard voiceless tokens as voiceless more than voiced tokens as voiced. We can see the differences in responses starting from 30 ms after burst. This means that Fo, a cue for voicing, which usually lasts until 30 ms after burst is still a major cue for voicing contrast. Furthermore, it can be concluded that Fo played a significant role in the process of tonogenesis in Thai. However, the fact that listeners were still able to differentiate voicing although the voicing-caused Fo perturbation were absent after +30 ms from burst implies that there are other cues for voicing besides Fo. Further analysis is in process to identify such cues.

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REFERENCES


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