Trading Relation between Spectral and Temporal Cues for the Perception of Stop Consonant in Kannada

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Stop consonants have several spectral and temporal cues. It has been well-known for many years that several cues may signal a single phonetic contrast (Denes, 1955), Thus it is possible to demonstrate that when the perceptual utility of one cue is attenuated, another cue may take on primary effectiveness in signaling the contrast under scrutiny because both cues, it is assured, are equivalent. This is called phonetic trading relationship (Repp, 1983).

This study was conducted with an interest to see that whether the spectral (burst) and the temporal (closure duration) cues are equivalent and trade each other or not in Kannada stop consonant perception. Two experiments were conducted to find out the trading relation between silence and burst. Two synthesized words, one where only temporal cue for the plosive as in (s-silence-uta) and the other where both temporal and spectral cues as in /s-silence-puta/ were taken. In both the stimuli /s/ was of 200 msec, and the silence was introduced in 10msec. steps till 140 msec. Thus, 30 stimuli (15 from s-silence-uta and 15 from s-silence-puta) were prepared and presented to ten native Kannada speakers (who had normal hearing according to IS-Standards) through the earphone (UHER-w-770). They were instructed to identify /sputa/, among the 30 stimuli. Each stimulus was presented six times with an interval of 3 msec, and the percent identification score was calculated for each stimulus. The average score of ten subjects showed that at a particular silence duration more than 50% of the stimuli were perceived as /sputa/. It was also observed that the stimuli with only Temporal cue took longer silence of 50 msec, to be perceived as /sputa/ and stimuli with both temporal and spectral cues took 30 msec, of silence duration to perceive it as /sputa/. Thus, in the absence of the spectral cue, the temporal cue compensated for stop perception.

The second experiment was designed to find out whether the above mentioned two cues (closure duration and burst) were equivalent or not, to neutralise and discriminate each other. Three types of test stimuli being presented were as -

1. One cue condition - The member of each pair "to be discriminated" stimuli differed by only one cue of the two cues ie. spectral cue.
2. Two cue co-operating condition - one member of each pair had both cues biased toward /sputa/, the other had both cues biased toward suta.
3. Two cue conflicting condition - one member of each pair had one cue biased toward sputa, the other toward suta, in the other member of the pair the cues (and their biases) were reversed.

Totally 150 synthetic stimuli were presented. They were in triplets and were iterated six times.

An auditory test was administered on ten subjects of native Kannada normal speakers where they were instructed to listen to the triplets and indicate the odd one in the response sheetprovided to them. All the data were tabulated and analyzed for percent response.

Further, the identification and discrimination scores were plotted. The results indicated that the discrimination was high at shorter duration and decreased as the length of silence increased. And also of the three conditions, two cue co-operating condition received the highest percent discrimination.

In the two cue conflicting condition, in contrary to the expectation both the cues did not neutralize each other. But to some extent they neutralize each other as the over all response decreased.

Thus, it appears that the burst and the silence trade with each other. However, the experience of the experimenter with other pairs of words in Kannada indicated that it may not be so. It could be concluded that this trading may be specific to some word pairs and cannot be generalized.