

# **Closure Duration As A Cue To Stop Consonant Voicing A Developmental Study In 3-6 Year Old Kannada Speaking Children**

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One of the basic unresolved issues in the study of speech and language is the complex relationship between production and perception. Applied to children, it is important to understand the modification process that the child undergoes to document the status of phoneme perception during the years the child is acquiring the phonology in production. Studies have suggested that a developmental or maturational differences in the closure duration phoneme boundary width in children (Simon 1974, Zlatin & Koenigsnecht 1975) are present. Several investigators have also obtained results in support of relation between perception and production of speech (Simon 1974, Eilers & Oiler 1975). Other researchers claim that such a relation does not exist between perception and production (Bailey & Haggard 1972 Smith 1981). Amidst these paradoxical results, there is a pressing need for experimental evidence on the development of perception in various languages to allow for preliminary generalisation about normal perceptual development. In this context, the present study was planned to investigate closure duration as a cue to voicing contrast of stop consonants in 3-6 years old Kannada speaking children. Specifically the study aimed at determining:

1. The developmental trend in the perception of closure duration as a cue to voicing of stop consonants (p,t,k) in 3-6 year old Kannada speaking children.
2. The effect of linguistic syllabic boundaries i.e. whether bisyllabic and trisyllabic boundaries influence the percept of voicing of stop consonants in medial position in 3-6 years old Kannada speaking children.
3. The change across the place of articulation in closure duration needed for change in percept for 3-6 year old Kannada speaking children, and
4. The concurrence of perception data with production data on closure duration for stop consonants.

Four plosives - Voiceless velar /k/, Voiceless retroflex /t/, Voiceless dental /t/ and Voiceless bilabial /p/ were selected for the study as in four meaningful bisyllabic Kannada words (baka, tuti, titi & wope) and four meaningful trisyllabic Kannada words (Pakoda, Karati, Itara & Talapu). These words formed a minimal pair with a change from voiceless plosive to voiced plosive. These eight words with voiceless plosives in the medial position were uttered by a seven year old normal Kannada speaking male child and digitally recorded on a computer with 12 bit ADC at a sampling frequency of 20KHz. From the digitized waveform of each word, closure duration was measured and using the waveform editor DWSSLC, closure duration was cut in 10msec steps from the burst end until the closure duration was almost removed.

Each word with its synthetic tokens was considered as a test and within each of the eight tests the tokens were randomized and iterated twice and

recorded on a metallic cassette with an inter stimulus interval of one second. Totally eight tests consisting of 81 synthetic stimuli were formed.

Ten normal Kannada speaking children (5 males and 5 females) each in the age range of 3-4 years, 4-5 years 6 5-6 years served as subjects. Pictures representing the test words and minimal pairs (representing an alternate forced choice) were selected. Each child was tested individually after being initially conditioned to the pictures. The experimenter recorded the child's response on a response sheet immediately after the child's response.

The data thus obtained was tabulated and percent response for the stimulus was calculated. Identification and discrimination functions were drawn for each test word and four measurements viz. 50% crossover, lower limit of phoneme boundary width, upper limit of phoneme boundary width and phoneme boundary width were calculated from the identification functions.

The results obtained revealed the following points:

1. At short closure duration, voiced percept was identified and at longer closure duration, voiceless percept was identified.
2. As the age increased the 50% crossover value reduced i.e. longer closure duration were required at younger age group to identify voiced plosive than the older age group.
3. Within the various places of articulation retroflex required shortest closure duration and the closure duration increased in the order of retroflex, velar, labial and dental. This was found only in the context of bisyllabic word. In trisyllabic context, no consistent trend was noticed.
4. The lower limit decreased in retroflexes and bilabials as the age increased and increased in dental as function of age.
5. The upper limit decreased for the retroflexes and bilabials in the trisyllabic context and for retroflexes in the trisyllabic context. Upper limit increased in dentals and bilabials in the trisyllabic context and was inconsistent in velars.
6. No consistent trend in the phoneme boundary width was noticed in the bisyllabic context. However, in the trisyllabic context the boundary width decreased for retroflexes and dentals as a function of age and in bilabials it increased.

7. For retroflexes and bilabials, the 50% crossover value was always shorter in the Disyllabic context than in the trisyllabic context.

The results of the study revealed that closure duration operates as a cue for voicing of stop consonants in children 3-6 years old. It is interesting to note that in Kannada, the closure duration ratio between voiced and voiceless varies from 1.5 to 2.42 (Savithri 1992) and that of preceding vowel duration varies from 1: 1.02 to 1: 1.21. The perception data is in consonance with the production data in Kannada in that in production data

- closure duration readily distinguished voiced from voiceless stops whereas preceding vowel duration does not (Sujatha 1992).

A definite developmental trend in perception is evident. While at younger age groups (3-4 years), the closure duration required for the perception of voiced stop is longer, in the older age group (5-6 years), voiced stops are perceived only at very short closure duration. This is in consonance with the results of the study by Wolf (1973), Simon (1974) & Zlatin & Koegnigsknecht (1975, 1976). Also there is an influence of the linguistic boundary, in that bisyllabic and trisyllabic words differed in the four functions across the places of articulation.

Thus, the results of the study indicate that closure duration acts as a cue to perception of voicing contrast in 3-6 year old Kannada speaking children. Also, the production data and perception data for closure duration in Kannada correlate well. There is a definite developmental trend in closure duration as a voicing contrast and development of perception is not yet complete by 6 years of age.

Further developmental research directed specifically to cover multiple acoustic parameters will be enlightening with respect to possible changes in the relative or combined strength of acoustic parameters as perceptual cues for voicing in Kannada. Applied to communication disordered population, the controversial issue whether or not speech perception deficits exist in individuals who have no known organic disorders, but who exhibit deviant production skills could probably get an answer. Furthermore, attempts could be made to define the nature of perceptual deficit in relation to production deficits in the communication disordered children.