

The establishment of contrast between /t/ and /k/ in Brazilian Portuguese children.

This study examines the establishment of contrast between /t/ and /k/ in terms of production and perception of the acoustic phonetic characteristics of voiceless dental and velar stops in Brazilian Portuguese-speaking children. Two experiments were conducted: acoustic analysis of the production and an identification experiment of the contrast investigated with 03 young BP learners (mean age 35 months).

The stimuli used in production experiment consisted of familiar disyllabic words with penultimate stress combining initial /t/ and /k/ with /a, u/ in stressed position: /'taku/ (baseball bat); /'kaku/ (shard); /'kuba/ (sink) and /'tuba/ (tuba). These words were represented with correspondent pictures. The context vowel /i/ was excluded because the precedent /t/ in that context is palatalized, being produced as the affricate /tʃ/.

The production experiment consisted of the randomized repetition of the target word in a carrier sentence after the experimenter said the target word as a prompt when presenting the correspondent picture. There were five repetitions of each word, computing a total of 60 tokens (2 vowels x 3 children x 5 repetitions x 2 consonants = 60). The data were recorded with a digital tape recorder and analyzed with a sampling rate of 44 kHz using the PRAAT software (Boersma & Weenink, 2008).

The acoustic parameters analyzed were: 1) acoustic characteristics of the noise burst; 2) acoustic characteristics of formant transitions; 3) acoustic parameters related to the time pattern of closure and burst production (Forrest et. al., 2000). Duration parameters were analyzed by Friedman ANOVA, while other parameters were analyzed using two-way ANOVA and Hierarchical Linear Modeling (Raudenbush et al., 2004), to determine which acoustic parameters are needed to categorize the two stops. Statistical significance was set at 0,05 ($p < 0,05$). A previous study based on the speech of a typical-adult speaker of PB was conducted to determine which acoustic parameters were primary or secondary cues.

Acoustic analysis revealed the following characteristics: (i) presence of double bursts, in both typical production of /t/ and /k/ (18,9%) and deviant production of this contrast (substitution of /t/ for /k/ and vice versa – 26%); and (ii) presence of covert contrast (Scobbie, 1998; Scobbie et. al., 2000; Li et. al., 2009) in 57,14% of the substitutions. In addition, in productions presenting double bursts the acoustic analysis of each burst revealed similar spectral characteristics, suggesting the use of the same articulator in the production of the two explosions. Concerning others parameters, younger children generally used primary phonetic cues in order to begin to establish the contrast between the two stops: F2 onset (CV transition), spectral peak and durational parameters.

The second experiment, perceptual identification, investigated the perceptual consequences of the presence of overt contrast and covert contrast in the children's production, using PERCEVAL software (André, et. al, 2003, 2009). Specifically, the stimuli used were the children's own productions, divided in two groups: categorical stimuli (45 tokens) and gradient stimuli (15 tokens). Furthermore, each child identified only categorical and gradient stimuli they had produced..

A one-way ANOVA and a post-hoc Scheffé test were run. Statistical significance was set at 0,05 ($p < 0,05$). Younger children showed a trend toward the identification of overt contrast over covert contrast (60% and 40%, respectively – Figure 1), but the reaction time in the identification of these stimuli didn't show statistical significance ($p=0,70$ – Figure 2).

These results call for future research to continue investigating both speech production and speech perception of contrast and covert contrast in younger children.

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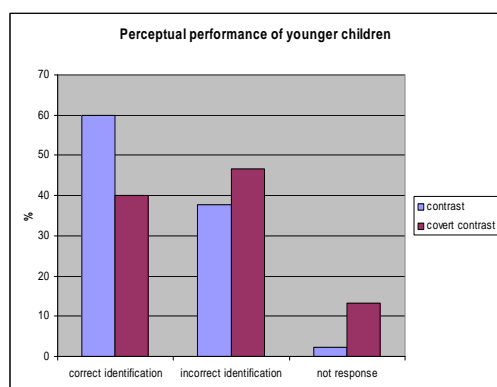


Figure 1: Perceptual performance of younger children.

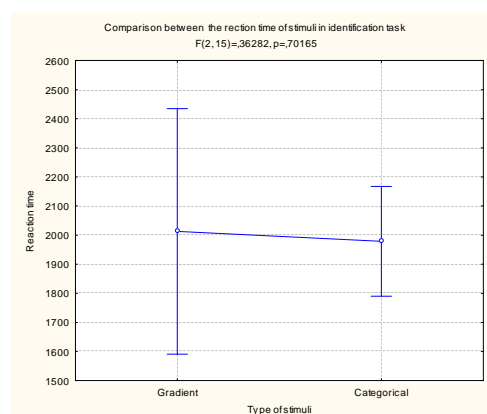


Figure 2: Comparison between the reaction time of stimuli in identification task.