**A comparison of the production of phonetic variants of /t/ in child-directed speech versus adult-directed speech**

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The surface phonetic details of an utterance affect how 'native' a speaker sounds, even though they do not create changes in meaning. However, previous studies have shown that children's acquisition of adultlike context-appropriate phonetic variation (sometimes referred to as allophones) is late in their native language (Klein & Altman, 2002; Rimac & Smith, 1984). For example, they begin by producing a canonical /t/ sound (with a clear closure and release) before they start producing context-appropriate variants of that phoneme (Song, Shattuck-Hufnagel, & Demuth, 2015). Because children's primary input comes from their caregivers, many studies have aimed to describe the characteristics of child-directed speech (CDS). However, while many researchers have focused upon CDS at the phonemic level, CDS has been understudied on the level of context-appropriate phonetic variation. To fill in this gap, the present study compared mothers' production of four types of phonetic variants of alveolar stop /t/: flapped (as in *but<u>t</u>er*), glottalized (as in *but<u>t</u>on*), unreleased (as in *go<u>t</u>*), and unaspirated (as in *s<u>t</u>op)*. In light of previous findings on CDS, it was hypothesized that mothers would tailor their input to their children in order to produce fewer variants of /t/ in CDS than in adult-directed speech (ADS), to potentially assist children in the development of a firm representation of the category.

Eight native American English-speaking mothers of children under the age of 2 years were recorded in two sessions on the same day, one with their child (CDS condition) and one with an adult researcher (ADS condition). Participants were asked to use two specially-prepared storybooks to tell stories in a paraphrased manner, in order to elicit more spontaneous speech. Tokens were divided by utterance position: medial or final. We used both acoustical measurements and perceptual judgments to detect whether the target variant was produced. Mixed effects regression models were used for analysis, with one fixed factor, listener (ADS vs. CDS), and two random effects, participants and words.

Results showed that while there is little difference between ADS and CDS in the use of the flap variant of /t/ (Figure 1a), there were significant differences for other variants. As expected, mothers released word-final /t/ (therefore not producing an unreleased variant) more often in CDS than in ADS, though only in utterance-final position ($p < .001$) (Figure 1b). Concerning word-medial glottalized /t/, mothers produced significantly more glottalization in ADS than in CDS, in both utterance-medial ($p < .001$) and utterance-final positions ($p < .001$) (Figure 1c). Finally, the average difference between the VOT of aspirated /t/ and unaspirated /t/ was found to be significantly larger in CDS than in ADS in utterance-medial position ($p < .01$), and also nearly significantly larger in CDS in utterance-final position ($p = .057$) (Figure 1d).

Results obtained for the unreleased and glottalized variants show that mothers do indeed produce fewer phonetic variants in CDS than they do in ADS. Also, while the results for the unaspirated variant do not show that mothers are producing longer VOTs for /t/ following /s/ (indicating less use of the unaspirated variant), it is interesting that mothers did increase the VOT for canonical (aspirated) /t/, resulting in a larger difference between the two variants. This might allow children to more easily distinguish between them. Overall, these results show that while mothers produce variants some of the time, their production is indeed lesser in CDS when compared to ADS. Mothers could be providing input in both canonical and allophonic form, as a

way of providing scaffolding to help children make a connection between underlying forms and their variants. Our results could help explain why children are learning underlying forms (phonemes) before surface forms (context-appropriate phonetic variation).

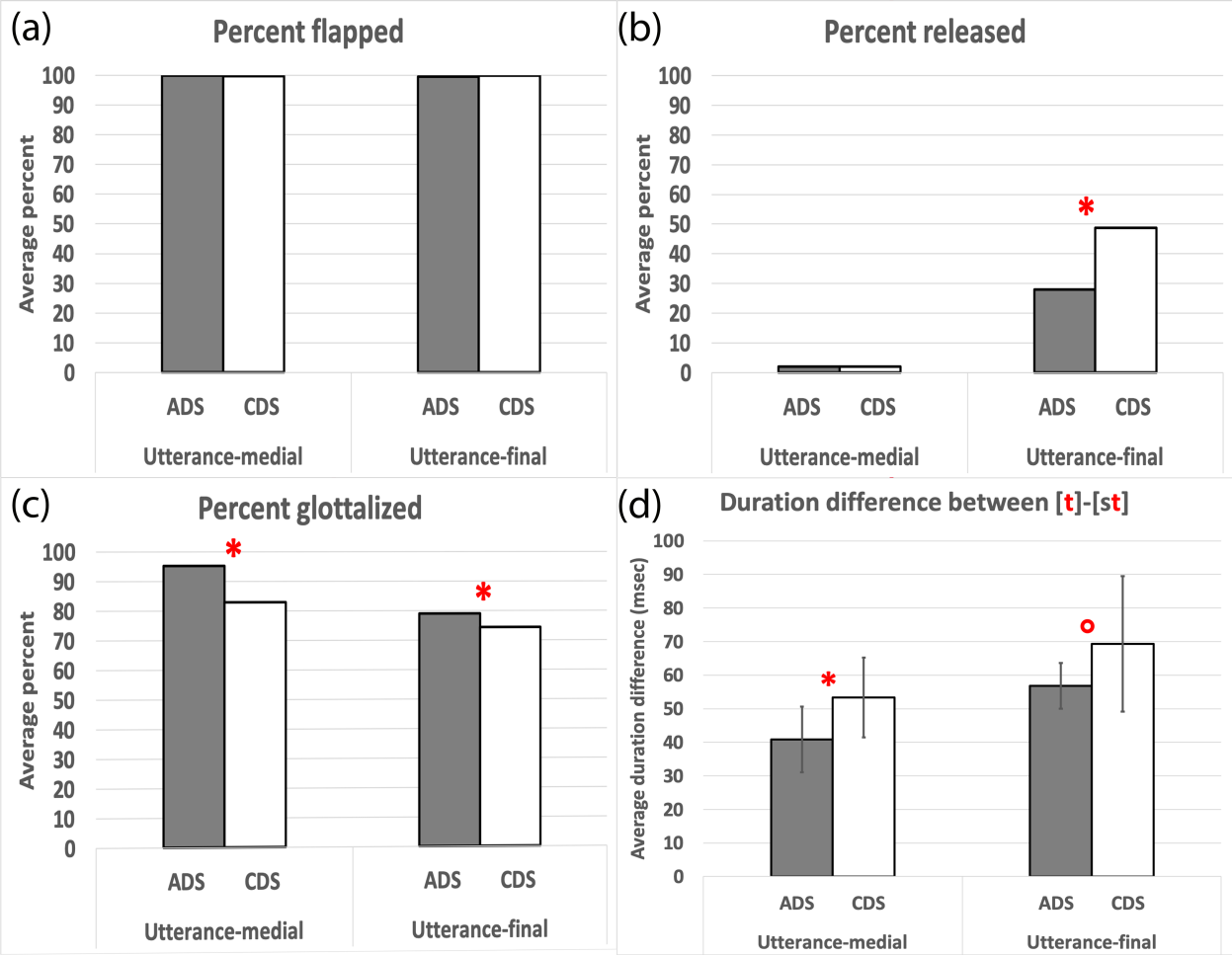


*Figure 1. Results for flapped, released, and glottalized /t/ (graphs a-c, respectively), and duration difference between [t] and [st] (graph d). Asterisks indicate a statistically significant difference, and the degree symbol indicates a nearly statistically significant trend.*

**Bibliography**

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