

# Phonetic variation in coronals in English infant-directed speech: A large-scale corpus analysis

## BACKGROUND

- Infants must extract the canonical form of a segment from a set of surface variants in their input, infant-directed speech (IDS)
- Infants must also learn the rules that govern the variants, e.g. positional allophony, such as:
  - intervocalic tapping: /bʌtɛɹ/ → [bʌɾɛɹ]
  - syllable initial aspiration: /pɪt/ → [pʰɪt]
- Previous work largely focused on canonical IDS
  - Comparing naturalistic IDS to adult-directed speech [1-5]
  - Computationally modelling phonemically-transcribed IDS [6-7]

## OUR OBJECTIVES

- 1) Phonetically transcribe a corpus of naturalistic IDS
- 2) Quantify the extent of phonetic variation in the corpus
- 3) Determine how much of this variation is explained by position-sensitive allophonic rules

## METHOD

- Phonetically annotated ~7,000 utterances from IDS recordings from the Providence Corpus [8]
  - Utterances force-aligned [9] by orthographic transcript, boundaries hand-checked by 3 phonetically-trained native speakers of English and phonetic realizations transcribed
  - 31,245 coronal segments analyzed: /t, d, s, z, n/ (excluded: 2,006)
  - Inter-rater reliability: 74.13%

## RESULTS

### Canonical forms are most frequent for all segments

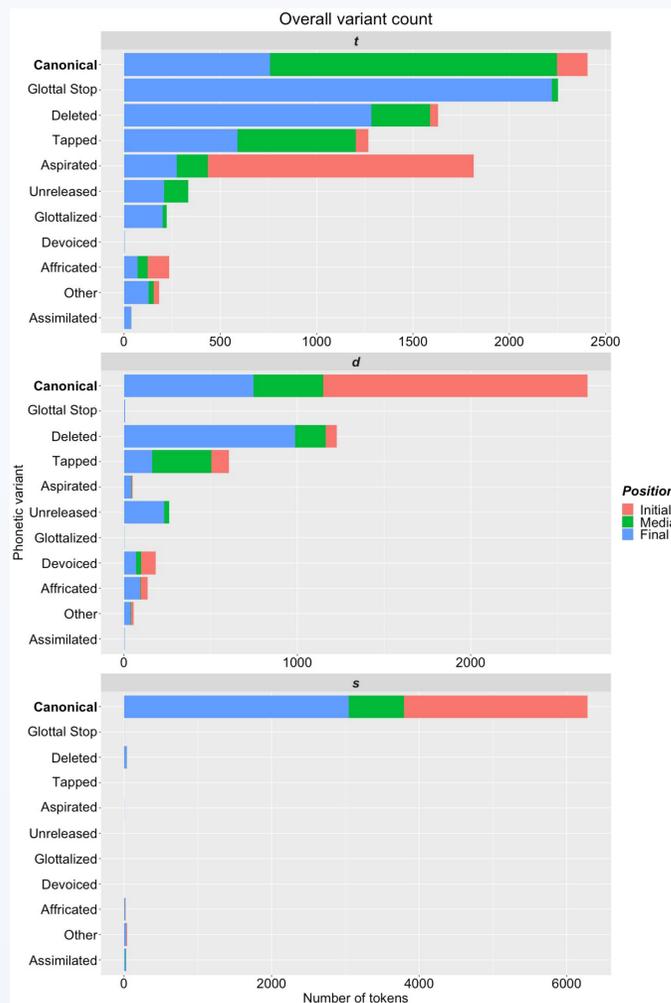


Figure 1: Phonetic variants for /t/, /d/, and /s/

### Word-final -t and -d are largely non-canonical

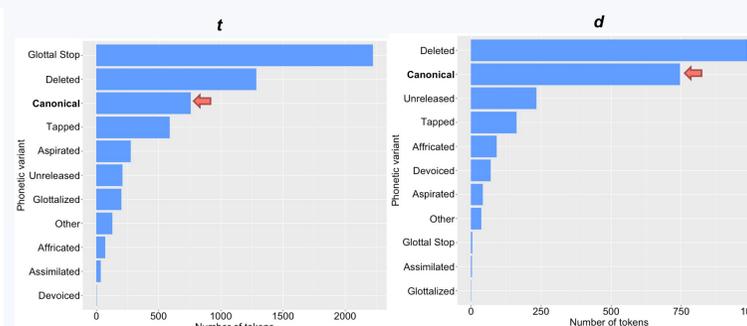


Figure 2: Phonetic variation in word-final /t/ and /d/

- Word-final /t/ is most likely to be a glottal stop, whereas word-final /d/ is most likely to be deleted

### Morphemic word-final -t and -d are more canonical

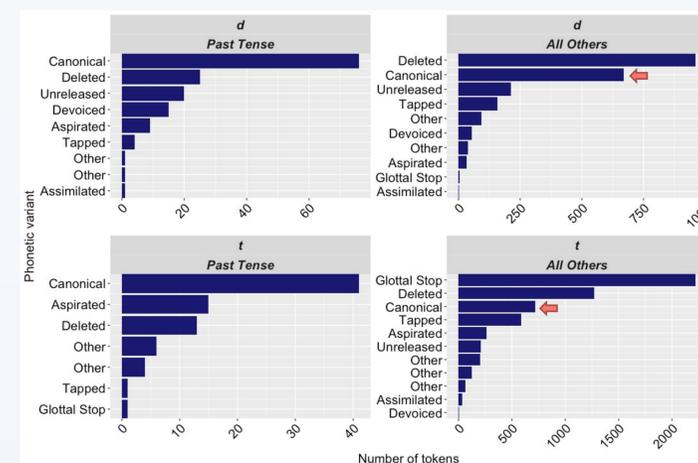


Figure 3: Phonetic variation in word-final /t/ and /d/ as a function of morphology

- Regular past tense -t and -d overwhelmingly canonical

### Variants are often not rule-governed

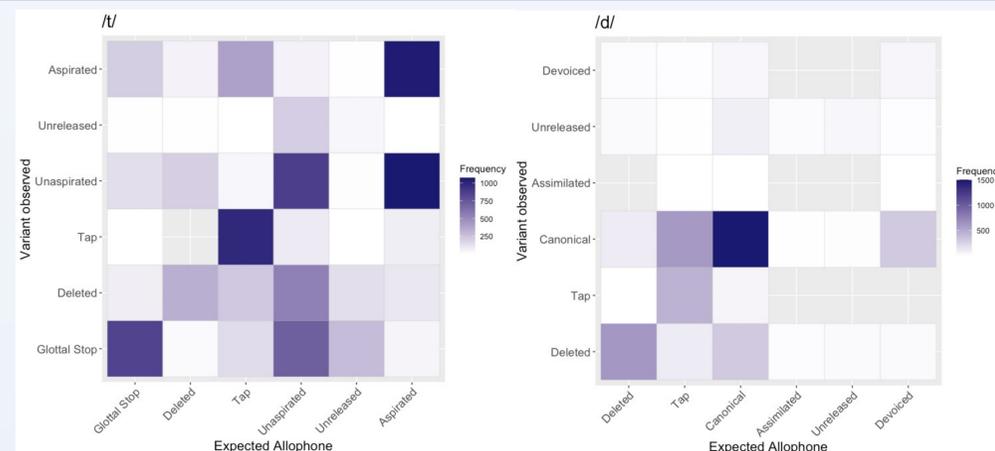


Figure 4: Expected vs. realized variants for /t/ (left) and /d/ (right). Expected allophones are generated based on Ladefoged & Johnson (2014).

- If phonetic variation is as expected based on positional allophony (Ladefoged & Johnson 2014), dark cells should only occur on the diagonal
- Instead, unexpected variants are common in IDS
  - Occasionally equally frequent as expected variant (unaspirated and aspirated /t/)

## CONCLUSIONS

- We generated one of the first phonetically transcribed naturalistic IDS corpora and quantified the frequency of phonetic variants in coronal segments
- We found that:
  - 1) the canonical form is the most frequent form for each segment
  - 2) morphologically-conditioned t and d are overwhelmingly canonical
  - 3) variant forms are not predictable solely from basic positional allophony rules

## FUTURE DIRECTIONS

- Comparing distribution of phonetic variants to that of naturalistic ADS
- Phonetically annotating and analyzing the remaining consonants (and vowels) in English
- Infant perception experiment on sensitivity to canonical vs. variant forms

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