A reanalysis of glottal stops and glottalization in English
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Background
- Glottal stops in North American English occur in 3 environments:
  1. As an allophone of /l/, e.g. ‘button’ [baʔn].
  2. With simultaneous coda stop closure, e.g. ‘cat’ [kʰæʔt].
  3. Optionally before vowel-initial words, e.g. ‘apple’ [ʔæpl].
  - This is the only position studied here.
- Many factors influence the occurrence of glottal stops:
  - Prosodic, lexical, segmental, sociolinguistic factors.
  - It is still unclear which factors are most important in predicting where glottal stops occur.
- Most studies on glottal stop distribution rely on visual inspection of voicing:
  - Irregularity = ‘glottalization’.
    - The irregularity is often assumed to be a lenited glottal stop.
  - But is every case of irregularity a glottal stop?

Research Goals
- To determine which factors are most important in predicting glottal stop occurrence.
- To test which cases of voicing irregularity are in fact due to glottal stops.

Method
- Word-initial vowels and sonorants [m, n, ñ, l, w, j] were extracted from Boston University Radio News Corpus.
  - For sonorant-initial words, the following vowel was also extracted (Massachusetts).
  - Analyzed 2658 tokens from 2 female and 2 male newscasters.
  - Two transcribers coded for presence of a full glottal stop [ʔ]:
    - [ʔ] = period of silence followed by a burst and onset of phonation.
    - Disagreements between transcribers were resolved by the author.
  - Transcribers also coded for a variety of factors:
    - Segment type, vowel height, vowel backness, vowel tenseness.
    - Lexical frequency, content vs. function word, previous and following words.
    - Whether target segment was prominent, preceding and following break index, preceding pause, preceding irregularity.
      - Break index ‘5’ = Breath group.
  - All initial vowels and sonorants were extracted and voice quality measures were obtained using VoiceSauce:
    - H1*-H2* = acoustic correlate of glottal constriction.
      - Lower values for increased constriction.
    - CPP = noise measure.
      - Lower values when signal is noisier and/or less periodic.

Results
- The most important predictors of [ʔ] are preceding break index and prominence.
  - Prominence alone accounts for 75% of instances of full glottal stops.

What about incomplete glottal stops?
- In the same contexts, prominent initial vowels also have lower H1*-H2*:
  - Acoustic support for glottal constriction, consistent with the presence of an incomplete glottal stop.

But for all segments, phrase-initial voicing is less periodic.
- Even for those that are never be preceded by [ʔ]: inconsistent with presence of a glottal stop.

Discussion
- Glottal stops in English are dependent on prosody.
  - Prominence is responsible for most glottal stop gestures.
  - Higher domains mostly ensure that the gesture is fully realized.
- Higher prosodic domains are also responsible for irregular voicing that is inconsistent with a glottal stop gesture.
  - Decrease in periodicity.
  - Ongoing study shows decrease in vocal fold contact using electroglottography.

Voicing irregularity at phrase onsets looks similar to phrase-final creak:
- Phrase-final creak also shows decrease in periodicity and vocal fold contact.
- So phrase-initial voicing irregularity might be another type of creak.

Conclusions
- Glottal stops before vowel-initial words are mostly predicted by prosody.
- Not all irregular voicing during word-initial vowels should be treated as a realization of a glottal stop.

References