The phonetics of resyllabification in English and Arabic speech.

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## 1) Stetson's Motor Phonetics. Quote from Stetson (1945. p.78):

1. The possible movements and movement combinations of the speech apparatus for any and all languages are limited and the movements are cross-connected and reciprocal.

2. From the range of these possible movements and combinations, each language has come to select its own type of syllable movement and to differentiate the syllables by a group of phonetic signals.

2) Summary of claims:

- Universal inventory is articulatorily determined. Speakers in experiments which manipulate production factors can be induced to shift from one structure to another.

- Specific languages choose combinations for phonemic signalling.

3) Observations about syllable affiliation.

A) Rate-induced resyllabification (Stetson, 1951, etc.; Tuller & Kelso, 1991; de Jong et al, 2002a) VC syllables repeated at fast rates become perceived as CV's. Data from de Jong et al. 2002a.
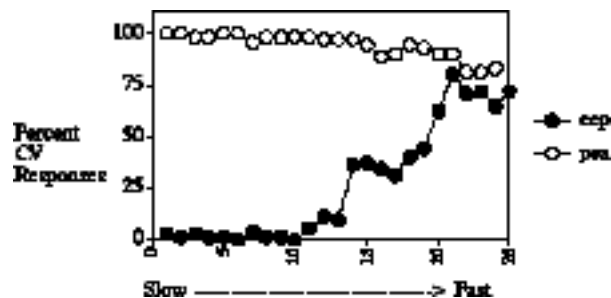
B) Glottal-to-oral (GtO) timing (Tuller & Kelso, 1991; de Jong et al, 2002b)

The GtO timing in VC's shifts to an earlier phase at fast rates to match CV's. Following data from de Jong et al. 2002b.

O - CV's   ■ - VC's
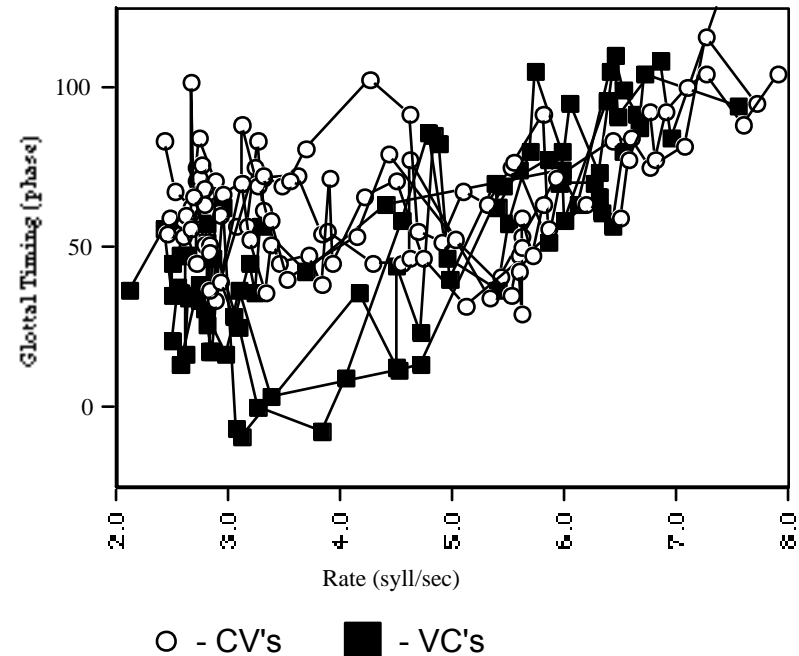
C) Perceptual Sensitivity (Tuller & Kelso, 1991)

Tokens with different GtO phase are perceived w/ different affiliations

4) Tuller & Kelso (1991): Conclusions.

1) GtO timing = collective variable indicating syllable affiliation. Claim similar to Keating's (1984) use of Voice Onset Time (VOT).

2) Modes in Timing. Speakers cluster around certain values. These clusters indicate preferred modes of coordination.

3) Motoric Influence. Modes are observed in both production and perception, but GtO phase shifts are driven by production factors.

4) Cont'd

4) Stability. Some modes are more stable than others, reflected in fast rate shifts from one mode to a more stable mode.

5) Cross-language Markedness. Relative stability of CV and VC coordinations partially accounts for prevalence of CV structures cross-linguistically.

5) Us: Model Sketch.

-> Motor Phonetics: Coordinations give inventory of phonological structures

-> Historical Pressures: language groups are more likely to settle on structures with motoric preferences.

6) Experimental Conditions.

METRONOME PACER: Repetition rate controlled: start slow (450 ms/syll.) and increase throughout trial (to 200 ms/syll.)

TEXT PROMPTS: Simple bisegmental forms:

VC & CV, where C = {b, p, k, t} & V = {i, œ}

TOTAL CORPUS: 30 syllables/utterance * 74 utt. = 2220 syllables

SPEAKERS:

- native American English speaking male in 30's (first author)

- native Arabic-speaking female from Amman in 20's

7) Recordings. Recorded at Haskins Laboratories:

- Acoustic traces digitized at 20 kHz
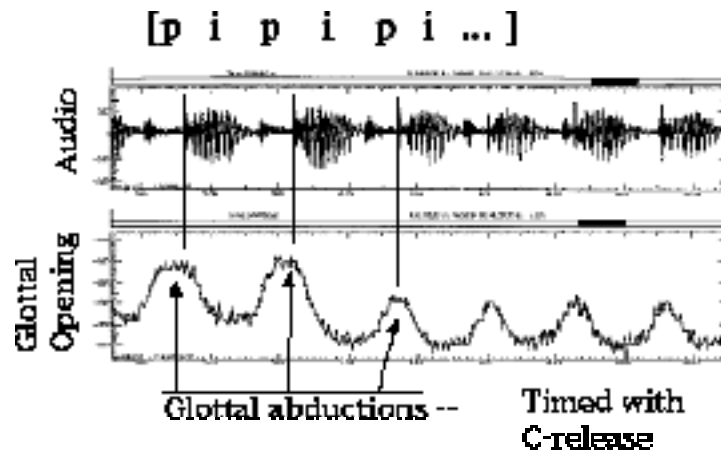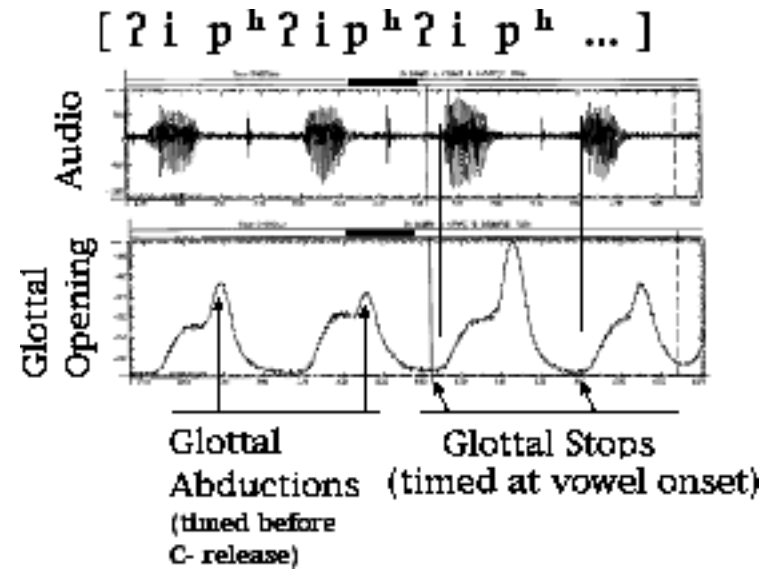
- Glottal transillumination traces at 635 Hz

Glottal transillumination traces = output of a photo-transducer placed externally on the anterior surface of the trachea. Transducer detects a light source in the upper pharynx, modulated by the size of the glottis (Baer, et al., 1983).

- EMA trajectories of tongue, jaw, and lips

- Pharyngeal pressure traces

8) English Observations.

A) Fast speech rate changes are more than just re-timing
  i) Loss: Slow rate CV's have a glottal stop which is eliminated at fast rates.

[ʔ i pʰ ʔ i pʰ ʔ i pʰ ...]

Glottal Abductions (timed before C- release)

Glottal Stops (timed at vowel onset)

[p i p i p i ...]

Glottal abductions -- Timed with C-release

8A) Cont'd.

ii) Addition: Speakers add voiceless gestures to voiced VC's at fast rates. This new gesture is coordinated with a fast rate timing.

SO -> there are fast rate modes, but they involve both timing and composition of glottal behavior

B) Perceptual shifts synchronize with timing shift, but rather with the loss of glottal stop.

SO -> Gestural composition (junctural ///) has prosodic parsing function which is heavily reflected in listener perceptions
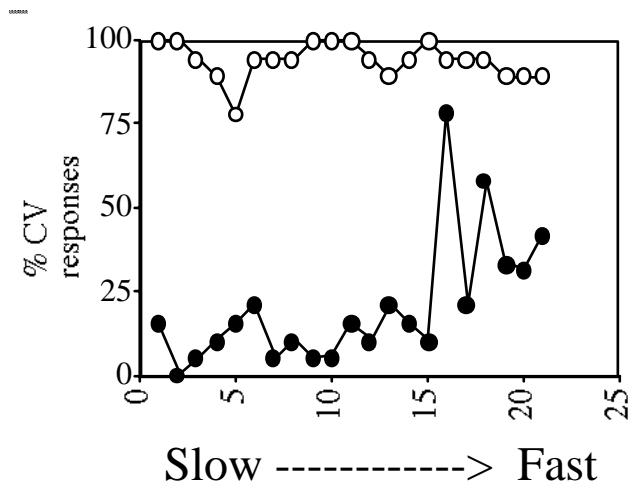
9) Arabic Observation 1.

Arabic speaker avoids the removal of glottal stops

English

Arabic

6.5   Time from beginning   10.5
of utterance (s)
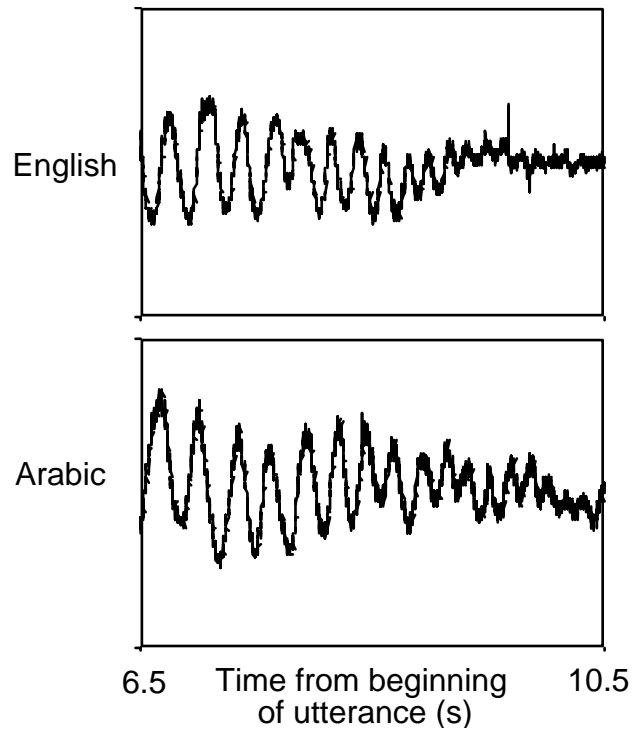
-> Suggests Arabic paradigmatic use of /ʔ/ as a consonant (Figures to be added)

10) Response Functions for similar utterance

Resists Resyllabification:

Slow ------------> Fast

12) Arabic Observation 2.

Arabic speaker tends to insert /h/ in the coda of CV's
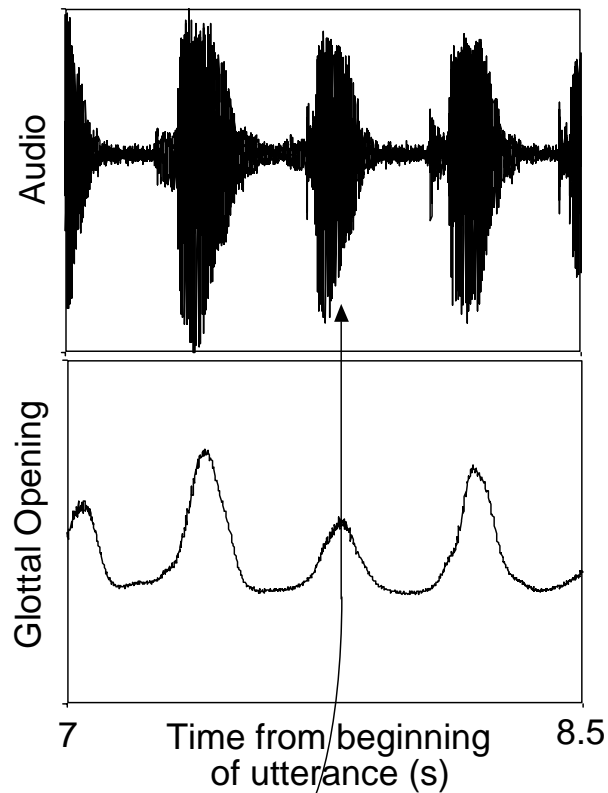
Glottal Peaks
align with end
of vowel

13)

ENGLISH	ARABIC
/ʔ/ = juncture marker at suprasyllabic level. Multiple syllables, e.g. at fast rates, get grouped into higher level unit.	/ʔ/ = consonant introduced into empty onset position. Implicit in both slow and fast rates.
VC's and CV's are both likely syllables within larger grouping.	CVC predominates, even inside of larger groupings C.f. Broselow, 1992; Davis & Zawyadeh, 200

14) General Conclusions.

1) Speaker's gestural activity in speech experiments is determined partially by production factors.
- Speakers can be induced to change both coordination and composition of the gestural regime.
- There is good evidence for speech modes.

2) BUT, linguistic function also determines behavior in production experiments. Gestures have linguistic function which is embodied in speaker's behavior. This function affects how speakers cope with production factors in the experiments.

15) Us: Model Recapitulation.

-> Motor Phonetics: Not all gestural coordinations and compositions are motorically equal. Motorically preferred structures appear as modes in speech behavior and can be induced in speech experiments.
-> The appearance of these speech modes in numerous languages suggests motor factors act as background pressures in the historical determination of linguistic systems.
-> Motor structures, however, may get integrated into different languages for different linguistic functions. These functions, in turn, determine what speakers will do in speech experiments.

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