

Glottalization of non-initial vowels in marking prosodic structure in American and Australian Englishes

Jiyoung Jang¹, Sahyang Kim², and Taehong Cho¹

¹*Hanyang Institute for Phonetics & Cognitive Sciences of Language, Hanyang University (Korea),*

²*Hongik University (Korea)*

Voice quality is a controllable phonetic parameter, allowing speakers to convey linguistic and paralinguistic information as well as to demonstrate variation in its use from language to language [1,2]. Vowel glottalization is one such quality that may be used for prosodic purposes, marking prominence and/or boundaries [1-7] while its use may differ cross-linguistically [2,5]. Many previous studies, however, have primarily focused on vowel-initial words, presumably because they facilitate observing glottalization, particularly in vowel hiatus contexts. This can possibly enhance the percept of the vowel under prominence and demarcate a prosodic juncture [2,5,6]. Nonetheless, if voice quality is modulated for these prosodic purposes, its application may extend beyond initial vowels to vowels in non-initial contexts within the language, while languages, and even varieties within a language, may still exhibit variations in its application (cf. [8]). The present study investigates these possibilities by examining how vowel glottalization is utilized in non-initial vowel contexts for prosodic purposes, such as marking prominence and boundaries, in two varieties of English: American (AmE) and Australian (AusE). This language context will further illuminate the extent to which speakers can control voice quality differentially at a fine-phonetic level across varieties of the same language.

Acoustic data from 15 AmE speakers (8F,7M) used in [9], and additional 14 AusE speakers (10F,2M) used in [10] were analyzed. Eight test words, from a part of a larger research project, were available for analysis in two contexts: NVC (*mop, mob, net, Ned*) in *phrase-initial* and medial positions and CVN (*palm, bomb, ten, den*) in *phrase-medial* and *phrase-final* positions. Boundary (IP/Wd) and focus-induced prominence (focused/unfocused) conditions are manipulated as shown in Table 1. Various spectral measures (H1*-H2*, H1*-A3*, and HNR) were examined as the indexes of glottalization at three relative time points during the vowel (25, 50, 75%) using VoiceSauce [11]. For the sake of simplicity, only H1*-A3* results are reported here. The measured vowel glottalization data (H1*-A3*) were fitted to linear mixed-effects models with fixed effects: Dialect, Focus, Boundary, and Timepoint with random intercepts (subject/item).

Results indicate significant effects of Focus and Boundary on vowel glottalization: vowels are more glottalized in focused conditions than in unfocused ones (Fig. 1a,a'), and more in the IP-initial (left edge) than in the IP-medial positions in NVC contexts (Fig. 1b). Conversely, phrase-finally in CVN contexts (Fig. 1b'), vowels tend to be less glottalized IP-finally than IP-medially, but only at a later point in the vowel (75%). However, this phrase-final weakening is evident only in AmE (Fig. 1e'). Results also show other notable differences between the varieties. Vowels are *more* glottalized in AusE than AmE in NVC (Fig. 1c). In this context, the cross-dialectal difference is crystallized in the degree of V-glottalization due to focus and boundary: It is much *larger* in AusE than AmE (Fig. 1d,e). In CVN, no such robust cross-dialectal differences are observed, except for some tendency for the focus effect being larger in AusE than in AmE (Fig. 1d') and the observed phrase-final glottal weakening in AmE. No further interactions are found.

The results indicate that speakers of both English varieties utilize V-glottalization in non-initial vowel contexts for the prosodic purposes of marking prominence and boundary, indicating a more general use of voice quality in marking the prosodic structure across these varieties. However, the precise modulation of V-glottalization differs between the varieties. While AusE speakers tend to glottalize vowels more than AmE speakers, they notably do so to signal prominence and boundary (left edge) more than AmE speakers. In contrast, the use of glottal weakening may signal boundary (right edge) only in AmE. The observed cross-dialectal variation in the use (and magnitude) of V-glottalization suggests that voice quality is controlled by speakers in reference to prosodic structure, yet it results in different phonetic forms across dialects. Such differences, arising at the phonetics-prosody interface, must be internalized in the phonetic component of a given language, varying even across dialects of the same language.

Table 1. Example sentences with each condition of boundary and focus. Targets are underlined and focused words are in bold. NVC contexts provide *phrase-initial* versus phrase-medial conditions, while CVN provide *phrase-final* versus phrase-medial conditions.

Boundary	Focus	Phrase-initial context (NVC)	Phrase-final context (CVN)
IP	Focused	A: Did you write " <u>bob</u> fast again"?	A: Were you supposed to write " <u>bob</u> "?
	Unfocused	B: Not exactly. " <u>Mop</u> fast again" was what I wrote.	B: No. I was supposed to write " <u>bomb</u> ", wasn't I?
Wd	Focused	A: Did you write "say <u>bob</u> fast again"?	A: Did you write "say <u>bob</u> fast again"?
	Unfocused	B: Not exactly. I wrote, "say <u>mop</u> fast again."	B: No. I wrote, "say <u>bomb</u> fast again."

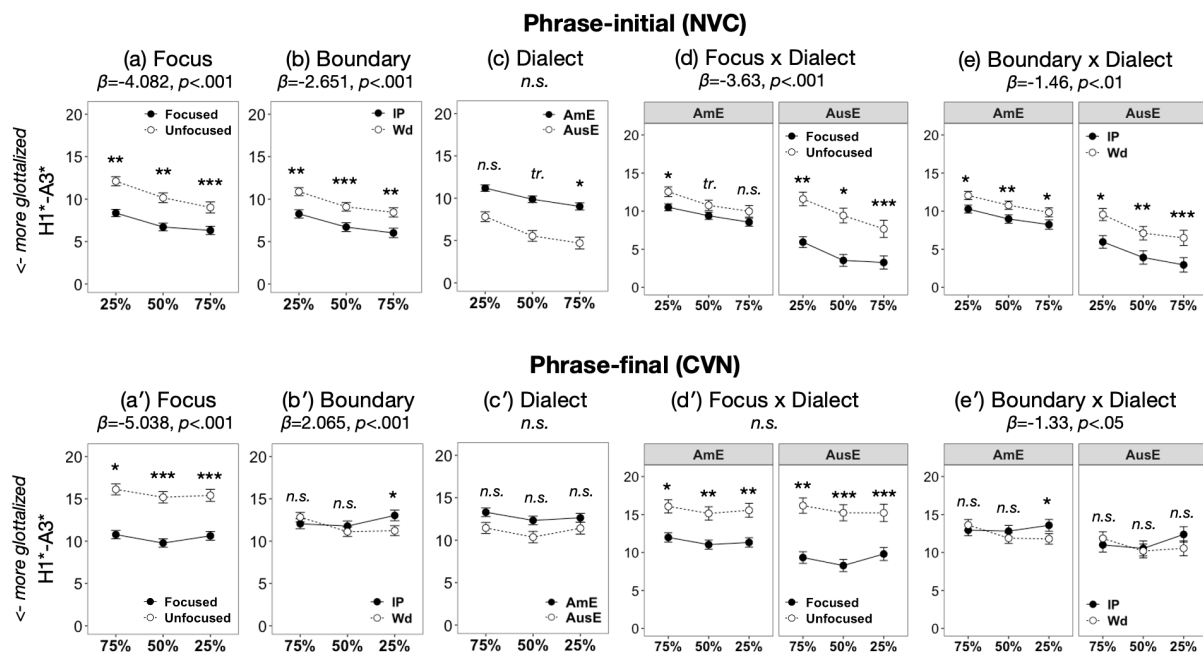


Figure 1. Results on vowel glottalization ($H1^*-A3^*$) in NVC (a-e) and CVN (a'-e'). (***: $p < 0.001$, **: $p < 0.01$, * : $p < 0.05$, *tr.*: $0.05 < p < 0.08$, *n.s.*: $p > 0.08$).

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