"Tense" /æ/ is still lax: A phonotactics study

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Introduction: The vowel /æ/ is widely studied as a sociolinguistic variable in American English (AmE). Several dialects have both the lax [æ] allophone and an allophone [ɛə] that is described as raised and tensed, even though the vowel is historically lax. This is noteworthy because phonotactic restrictions in English apply to the classes of tense and lax vowels; for example, only lax vowels are found preceding coda clusters /sk, sp/, e.g., [lɪsp], but *[lisp]. In this paper, I ask whether the /æ/ used by Northern Cities Shift (NCS) speakers, which is realized as tense [ɛə] in all environments, still patterns as a lax vowel. I test the NCS specification through a forced-choice well-formedness judgment task, in which I look for evidence of a phonotactic restriction on the appearance of /æ/ in a lax-only /Vsk, Vsp/ environment. I compare the performances by speakers of California English (CalE) and NCS speakers. As I will show, NCS speakers treat /æ/ as a lax vowel, preferring it over tense vowels in this environment, just like CalE speakers.

AmE /æ/ systems: CalE is representative of the most common AmE /æ/ system, in which the tense allophone only occurs pre-nasally (*cat* [kæt], but *hand* [hɛənd]). The NCS system, on the other hand, tenses /æ/ in all environments (*cat* [kɛət], *hand* [hɛənd], etc.). These are two examples of several different systems attested for the vowel among American English dialects (Labov et al. 2006). In most, the tense allophone is distinguished as raised and lengthened, often diphthongized. Both the lengthening and offglide of a diphthong give the acoustic impression of tenseness.

Tense/Lax distinction: Tense (/i,e,u,o,ɔ,ɔɪ,aɪ,aʊ/) and lax (/ɪ,ɛ,ʊ,ʌ,ɑ,æ/) vowel classes are phonologically active in English. This is evidenced both in morphophonological processes like trisyllabic laxing (Lee 1996) and in phonotactic distribution. Tense vowels are permitted word-finally (*she* [ʃi], *die* [daɪ], etc.), preceding word-final /ð/ (*bathe* [beð], *loathe* [loð], etc.), and preceding a vowel (*riot* [raɪ.ət], *react* [ri.ækt], etc.). Lax vowels may not occur in these environments (*[dɪ], *[bɪð], *[rɛ.ot]). On the other hand, lax vowels may occur preceding /ŋ/ (*hung* [hʌŋ], *sing* [sɪŋ], etc.), and in monomorphemes, lax vowels may precede consonant clusters containing a noncoronal (*wisp* [wɪsp], *mask* [mæsk], etc.). Tense vowels are not found in these environments (*[toŋ], *[tosp]) (Green 2001). The latter restriction, particularly /Vsk, Vsp/, is the focus of this experiment. As seen, the lack of tense/lax vowels in a given environment represents a systematic gap in the language.

Methods: This experiment relies on CalE speakers having a restriction in the phonotactic grammar on tense vowels in /Vsk, Vsp/. If this were the case, a comparison of NCS and CalE responses would indicate the tenseness of NCS /æ/. CalE speakers are expected to treat /æ/ as lax, preferring it and other lax vowels to tense vowels in the experiment; if NCS speakers treat /æ/ as lax, they should do the same. If they treat it as tense, they should instead significantly prefer other lax vowels over /æ/.

Speakers have been found to distinguish between systematic and accidental gaps in experimental conditions eliciting well-formedness judgments (Frisch and Zawaydeh 2001, Kager and Pater 2012, inter alia). In order to obtain these, a forced-choice experiment was designed using Experigen (Becker and Levine 2014), in which nonce minimal pairs (e.g., [desp] vs. [dɪsp]) were presented to participants, who were then asked to indicate which of the pair sounded more like a possible word of English. The nonce word pairs differed only in vowel, while the onset and coda were the same for each trial. Each test trial used the codas /sk, sp/, which are lax-only

environments. All front vowels /i, ɪ, e, ɛ, æ/ were used in this experiment. Only frames which yielded nonce words for each front vowel were used (i.e., /dVsp/ could be used: /dæsp, dɛsp, dɪsp, disp, desp/ are all nonce words. However, /rVsk/ could not: /ræsk, rɛsk, risk, resk/ are nonce words, but /rɪsk/ is an attested word). As test conditions, /æ/ was compared to each of /i, ɪ, e, ɛ/, while /i-e, i-ɛ, ɪ-e, ɪ-ɛ/ comparisons were used to control for the tense/lax distinction in general, as well as potential effects of height. Fillers were created using the same vowels and codas /b, g, p, k/. CalE speakers comprised a control group that did not engage in /æ/ tensing, while NCS speakers formed the test group that did. Stimuli were recorded such that participants heard their variant of /æ/. This meant CalE heard a lax [æ], while NCS speakers heard tense [ɛə]. Participants saw 120 trials in total: 80 test, 32 filler, and 8 practice. In total, 11 CalE and 9 NCS speakers comprise the data reported here, making for 1600 test items.

Results: For a given pair of vowels, if there is a phonotactic restriction, we would expect the licit one to be chosen at a rate well above chance, that is, well above 50%. Bonferroni corrected binomial tests show that this is the case for CalE speakers: in conditions that pit a tense vowel against a lax vowel, where we would expect a phonotactic restriction to be visible, we find that the lax vowel is chosen at a rate significantly above chance ($p<0.0015625$). CalE speakers do not choose a vowel significantly above chance in conditions that compare two lax or two tense vowels. NCS speakers behave similarly: /æ/ is favored over /e,i/, while /ɛ/ is favored over /i/. A logistic mixed effects regression model (Bates et al. 2014) of conditions that compare an attested vowel /æ, ɛ, ɪ/ to an unattested vowel /e, i/ shows that the attested vowel is significantly favored over the unattested vowel ($p<.001$). Additionally, /æ/ is treated no differently than /ɛ/, with both groups disfavoring /ɪ/ ($p<.05$). There was no main effect for dialect. In sum, there appears to be no phonotactic restriction on /æ/ in /Vsk, Vsp/ environments for either set of speakers.

Discussion: Both the binomial tests and logistic regression model point to CalE having a restriction on tense vowels in /Vsk, Vsp/ environments, with /æ/ patterning as lax. Because NCS speakers do not differ from CalE speakers in treatment of /æ/, the results also indicate that NCS /æ/ is phonologically lax, regardless of its phonetic characteristics. This serves to support an emergentist view of phonologically active classes (Mielke 2008). It appears NCS participants generalized their phonotactic grammar from attested lexical items, rather than from phonetic characteristics. That is, being long and a diphthong does not make /æ/ inherently tense, even though the other long vowels and diphthongs are tense. Instead, being attested in positions in which only lax vowels appear makes NCS /æ/ lax.

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