Phenomenon: Native Turkish phonology prohibits complex onsets, and onset clusters in loanwords are repaired with a vowel previously described as epenthetic (Clements & Sezer (C&S) 1982, Yıldız 2010). C&S report that the inserted vowel systematically participates in vowel harmony, taking its backness and rounding from the vowel that follows it. This suggests harmony in Turkish can act from right to left, contrary to the common claim that Turkish harmony is left to right only (e.g. Underhill 1986), and in accordance with Bakovic’s (2000) proposal that directional harmony does not exist.

However, the onset-repairing vowel offers some surprises. Turkish epenthetic vowels are present in orthography; stable across speech styles; and consistently harmonic. But the onset-repairing vowel is unwritten; absent in careful speech; and often disharmonic. The TELL\(^1\) corpus shows that [ɯ] is often inserted before /i/ and /e/, violating backness harmony, as well as before /o/, violating rounding harmony, in all cases creating vowel sequences that occur nowhere else in Turkish. I hypothesize that the onset-repairing vowel is intrusive (Hall 2006) – inserted post-phonologically, during articulation. Intrusive vowels, having no phonological presence, lack gestural targets, unlike phonologically present epenthetic vowels.

Experiment: To test this hypothesis, I conduct an ultrasound study of Turkish complex onsets – the first instrumental study of this topic. I follow the methodology of Davidson & Stone (2003; D&S). Their ultrasound study of English articulation of illicit voiced fricative-stop clusters demonstrated that the schwa in the pronunciation of zgama as [zgama] is intrusive, by comparing the gestural targets in the articulation of triplets like succumb ~ scum ~ zgama.

This study compares the gestural trajectories of minimal pairs like brifing [buɾiﬁŋ] ‘briefing’ and biripis [buɾipis] (nonce), to determine whether the [ɯ] in brifing has a gestural target like the /u/ in biripis. I investigate the strength of vowel harmony in the inserted vowel by varying the lexically present vowel, and follow up on C&S’s report that the consonants in the cluster play a role in determining the quality of the inserted vowel by using words with different initial consonants. In addition, I manipulate speech style and word familiarity to determine how these factors affect the rate of vowel insertion.

Results: Acoustic analysis revealed that vowel insertion was pervasive even in the careful speech condition (76-90% of tokens, depending on the speaker). By far the most commonly inserted vowel was [i], regardless of the dictates of vowel harmony – in accordance with findings from the initial corpus study. The weakness of the harmonic effect demonstrates that the insertion occurs late, after vowel harmony has already applied. For two speakers (S2 and S4), there was no significant difference in the formants or duration of inserted vowels compared to underlying vowels. For a third speaker (S5), however, inserted vowels were significantly shorter than underlyingly present vowels, suggesting that inserted vowels are intrusive for this speaker.

Gestural analysis confirmed these differences between speakers. S5’s ultrasound data exhibits a clear contrast between the tongue contours for inserted [i] (in brifing and brimiti) and the contour for underlyingly present [i] (in biripis). While underlyingly present [i] has a high and back gestural target, inserted [i] lacks this target – meaning that insertion for S5 is intrusion. In contrast, inserted [i] for S4 appears to follow the same gestural trajectory as underlying [i]. Since

\(^1\) Turkish Electronic Living Lexicon (Inkelas et al. 2000)
S4 exhibits neither a gestural nor an acoustic difference between underlying vs. inserted [ı], insertion for S4 (and by extension, S2) seems to be epenthesis.

**Conclusion:** This study found that the Turkish onset-cluster repairing vowel is not subject to categorical vowel harmony, contrary to previous descriptions (C&S 1982, Yıldız 2010). The phonological status of the inserted vowel apparently varies across speakers. For speakers who display no acoustic or gestural differences between inserted and underlying vowels, insertion appears to be late-occurring epenthesis. Meanwhile, for other speakers, the inserted vowel lacks a gestural target, meaning insertion is intrusion.

For speakers whose onset-repairing vowel has its own gestural target, insertion is epenthesis, and its harmonic behavior suggests that harmony either only applies from left to right, or that onset-repairing epenthesis interacts opaquely with harmony. Meanwhile, for speakers whose onset-repairing vowel lacks a gestural target, insertion is intrusive, and its harmonic behavior is due to coarticulation, not phonological harmony.

This study also contributes by providing new, reliable Turkish data, by collecting repeated productions by multiple speakers of methodically chosen minimal pairs of words. Finally, my study bears on the extensibility of the D&S methodology to other phonological problems. The use of ultrasound in addressing phonological questions is relatively new, and little work in the style of D&S has been done on any language. Methodological contributions in this area of phonetics/phonology are therefore valuable.

**References**


