Acoustic characteristics of speech error repairs

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Effects of competing lexical items

- How does lexical competition impact phonetic characteristics of words?
- Some work suggests that inhibition of lexical competitors results in words being less like those competitors
  - e.g. the VOT for the initial stop is longer in *pie* (cf. *buy*) than in *pipe* (Baese-Berk & Goldrick 2009, Wedel et al 2018)

Effects of competing lexical items

Can effects of minimal pairs be explained by ease of lexical access?

- Slower lexical access due to more competition (cf. Vitevitch & Luce 1999, Luce & Large 2001) might explain greater vowel dispersion and longer VOT in aspirated stops
  - Munson & Solomon (2004) find more vowel dispersion in words with higher ND
  - But Gahl et al (2012) find less vowel dispersion in words with higher ND
- Wedel et al (2018) also found significantly lower VOT for voiced (short-lag) stops in words with minimal pairs
- Other lexical characteristics might correlate with existence of minimal pairs

Effects of competing lexical items

- How does production of the same word differ based on salience of competitors?
- When a speaker clarifies misheard words for a listener, Schertz (2013) found decreased VOT in voiced stops and increased VOT in voiceless stops – for speakers with prevoiced stops, both effects could be caused by lengthening
- Oh & Byrd (2019) show that corrective focus lengthens both long-lag and short-lag VOT categories in Korean

Disfluencies

- Repairs of speech errors can help distinguish between potential explanations
- Cutler (1983) finds that speech error repairs are prosodically marked, but doesn't quantify the component phonetic characteristics of that marking
- Analyses of repairs are often comparisons between the repair and the preceding error (e.g. Cutler 1983, Shattuck-Hufnagel & Cutler 1999)
- The prosodic marking might depend on whether the error was lexical or phonological

This Work

- This study examines the acoustic characteristics of error repairs within natural speech in English
- Comparison to fluent utterances of the word
- Findings:
    - Repairs have higher F0 and higher intensity than fluent speech
    - Mixed evidence for duration effects

I argue that speech error repairs receive a distinctive type of emphasis, with relatively limited duration effects due to duration being associated with the disfluency

Data

- Data from the Fisher corpus of American English telephone conversations
- ~130 speech error repairs, all paired with instances of the same speaker producing the same or phonologically matched words in fluent contexts
- Items included regardless of whether the erroneous word was identifiable or not
- Repairs were identified as instances where the speaker stopped mid-word or immediately after a word and replaced that individual word
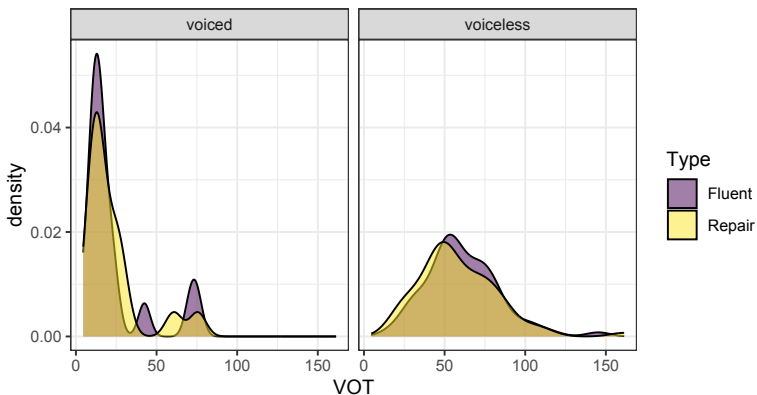
Analysis

- Statistical results come from mixed effects models with speaker and phoneme as random effects
- Several dependent variables were analyzed: VOT, onset consonant duration, vowel duration, F0, vowel intensity
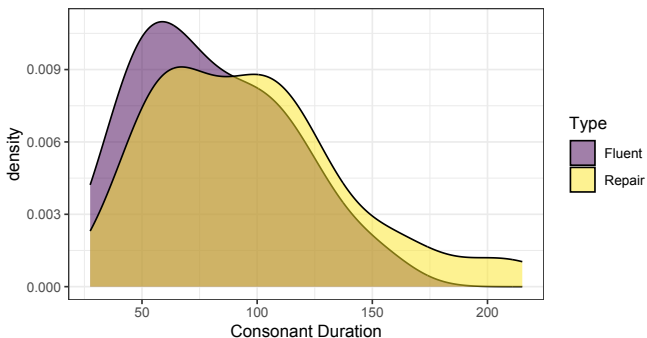
Results: VOT

No significant difference in VOT between fluent speech and repairs, either overall or split by voiceless vs voiced stops
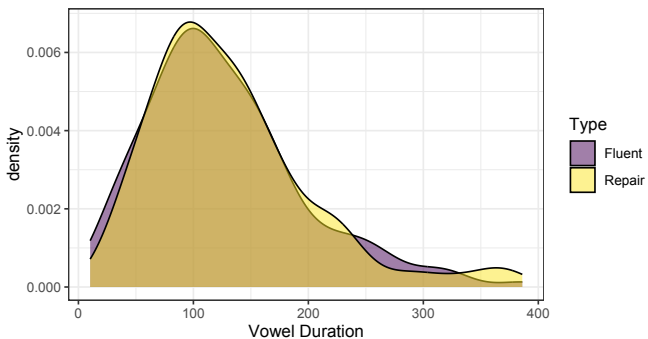
Results: Consonant duration

Word-initial non-stop consonants were longer in repairs ($\beta = 17.0$, $p = 0.0182$)
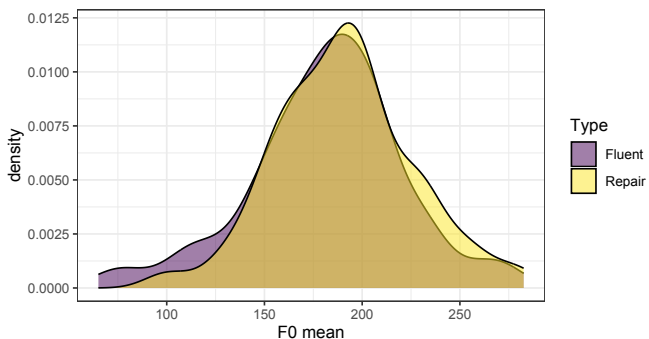
Results: Vowel duration

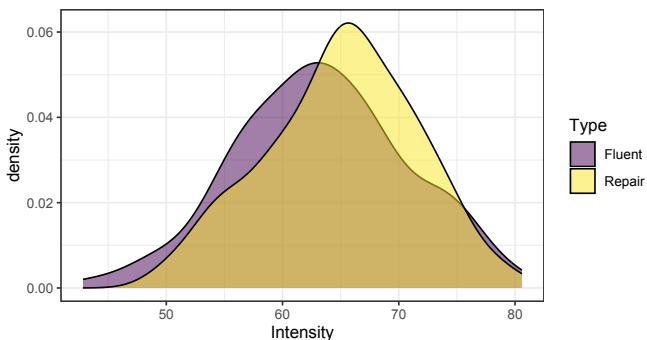No significant effect of fluent speech vs repairs on vowel duration

Results: F0

Vowels in repairs had higher mean F0 ($\beta = 8.83$, p $= 0.018$)

Results: Intensity

Vowels in repairs had higher intensity ($\beta = 1.7$, p $= 0.00121$)
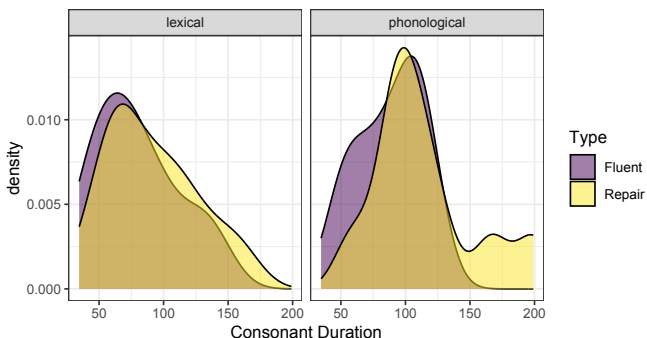
Results: Lexical vs phonological errors

Do the effects differ between lexical errors (e.g. *public* for *private*) and phonological errors (e.g. *noca(l)* for *local*)?

No interaction for VOT ($\beta = 1.09$, p $= 0.941$) – both have no effect

No interaction for Vowel Duration ($\beta = $ -1.68, p $= 0.857$) – both have no effect

Results: Lexical vs phonological errors

No significant interaction for Consonant Duration ($\beta = 14.5$, p = 0.244) – slight trend for a larger effect with phonological errors

Results: Lexical vs phonological errors

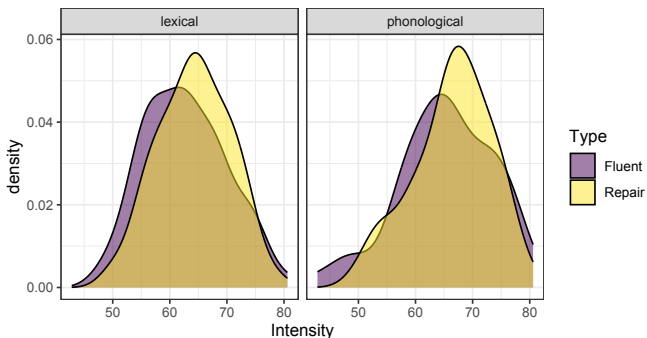No significant interaction for F0 mean (β = -13.3, p = 0.118) –
trend for a larger effect with lexical errors
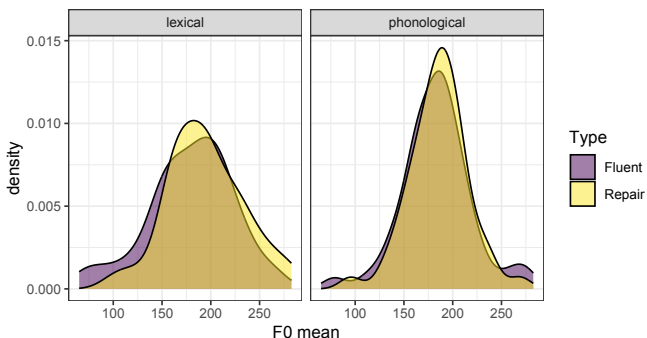
Results: Lexical vs phonological errors

No interaction for Intensity (β = -0.371, p = 0.759) – same effect for both

No evidence for hypercorrection

- The prosodic effects aren't driven by speakers increasing the phonetic differences between the target word and the error
- Most of the observed effects (consonant duration, vowel intensity, vowel F0) are not increasing distinctiveness from competing lexical items
- Restricting the data just to items where the correction was of a mispronunciation rather than a lexical error also doesn't produce an effect

Emphasis

- Repairs receive emphasis, marked by increased F0 and increased intensity
- But perhaps not duration (in contrast to e.g. focus stress)

Why is vowel duration not impacted?

- A slowdown is associated with the disfluency, which makes duration a poor cue to for emphasizing the intended word
- Faster speech rate is associated with confidence (e.g. Scherer et al 1973), which can signal that the disfluency has been resolved

Why is consonant duration impacted?

- Lengthening of initial consonants in repairs might reflect the preceding disfluency not being resolved yet
- Very local, only impacting the initial segment
- Few words in the data begin with vowels, so this lengthening is not apparent in vowels

What does this suggest about lexical access?

- Not consistent with inhibition of lexical competitors causing productions which are less like those competitors
- Consistent with lexical competition slowing down lexical access and resulting in word-initial lengthening
- Consistent with corrections eliciting focus prominence, where competing pressures due to a preceding disfluency eliminate most duration effects

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