



Perceptual similarity modulates context effects in online compensation for phonological variation



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Background

- How important is context in recognizing phonological variants in online word recognition?

Type of variant	Context matters?	Study
Canonical forms	No	e.g. Pitt et al. 2011, Ranbom & Connine, 2007
Assimilated forms	Yes	e.g. Gaskell & Marslen-Wilson, 1996
Other variants of /t/	Glottal stop [ʔ]	Yes Pitt et al. 2011
	Deletions	Yes Pitt et al. 2011
	Tap (word-medial)	Yes Pitt et al. 2011
	Tap (word-final)	No Yes

Word-final tapping in American English:

- /d/ → [r] / [-cons] __ (#)[+syll, -stress] (see Kahn, 1980; Turk, 199).

Canonical forms:

- Context does not seem to matter even though canonical forms may not be the most frequent variant in a given phonological context.
- Presumably because of perfect match to lexical representation.

But how close a perceptual match does it have to be for context to be ignored?

- Bayesian models like Shortlist B (Norris & McQueen, 2008) suggest that contextual information is less important the closer a perceptual match a surface form is compared to what is represented in the lexicon.

- [d] and [r] are perceptually very similar (de Jong, 1998; Herd et al, 2010).

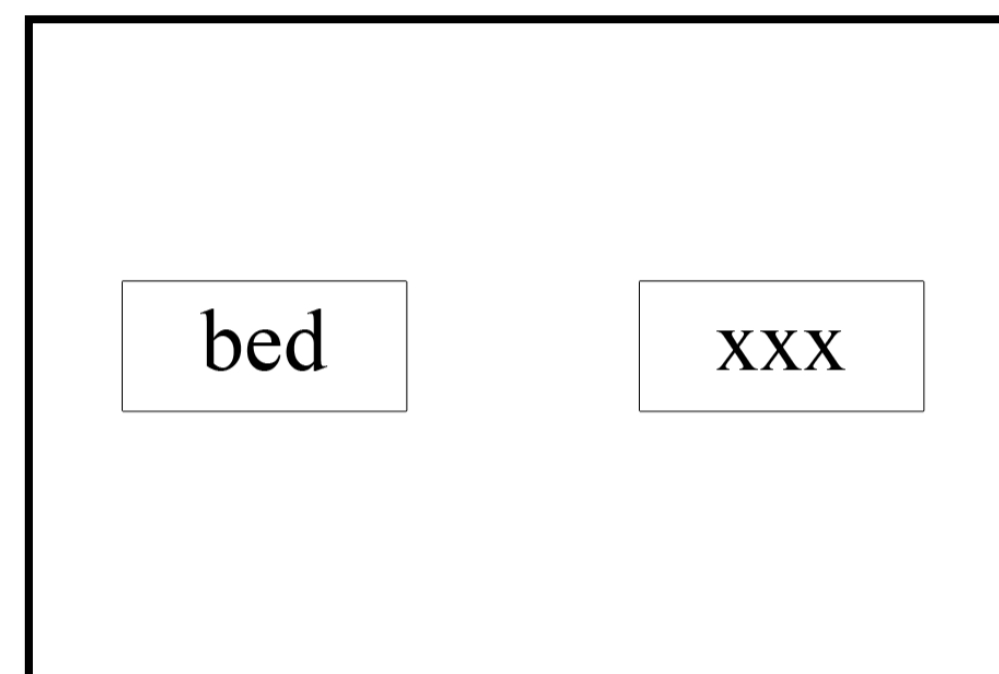
- Q: Given that [d] and [r] are perceptually very similar, do listeners ignore a mismatch context in word recognition?**

Acknowledgements

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Methods

- Two experiments (20 native English participants in each)
- Targets: 30 monosyllabic /d/-final English words, e.g. *bed* (also 30 monosyllabic /t/-final words, see Chong & Sundara, 2014; *in prep*)
- Visual Stimuli: Visual targets of *printed* words paired with distractor text of 'X's (matched for orthographic length)



- Stimuli:
 - Click on the word ___ now! (favors stop variant)
 - Click on the word ___ again! (favors tap variant)

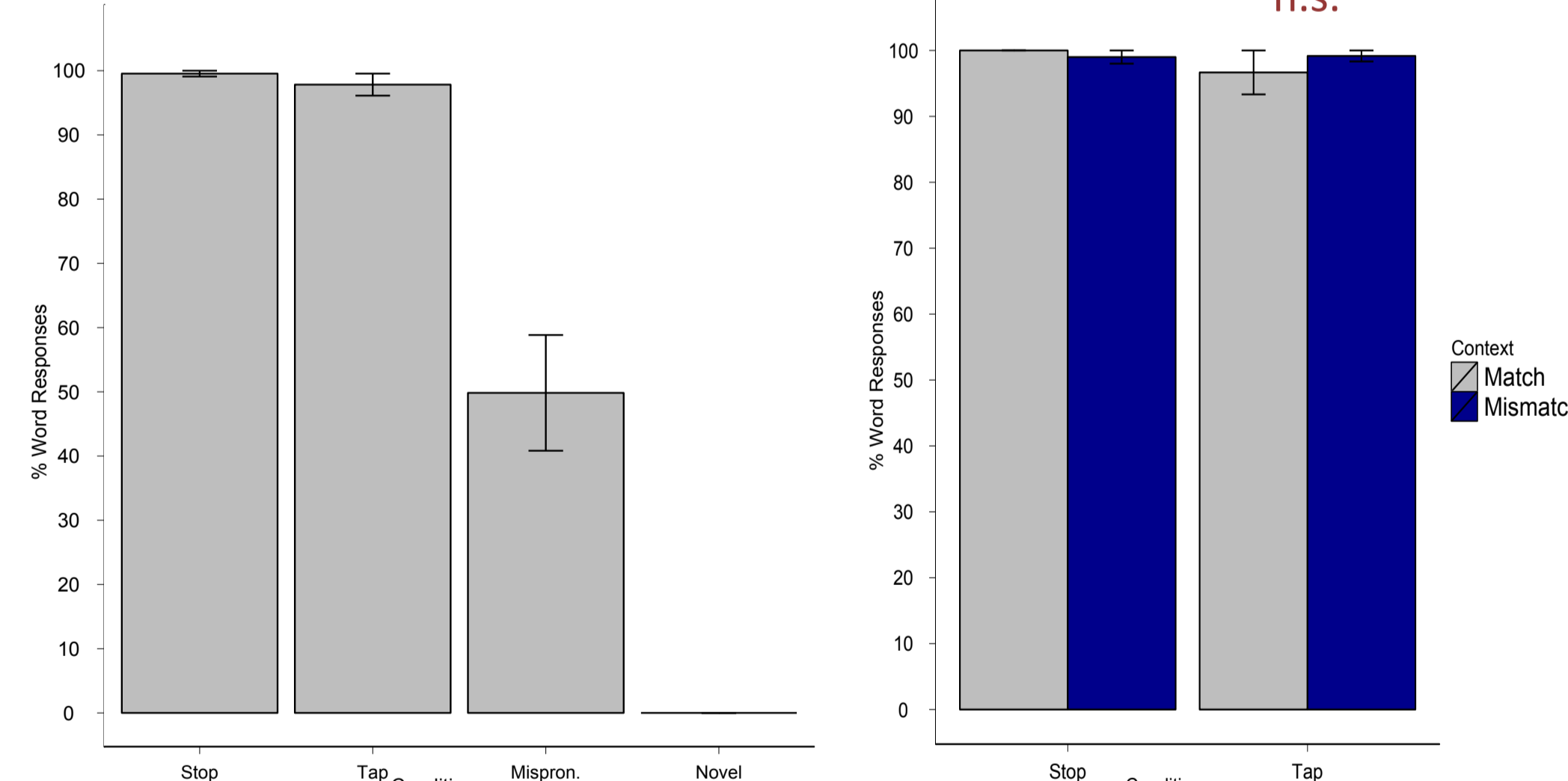
'bed' /bɛd/	Stop	Tap
Match context	[bɛd] now	[bɛr] again
Mismatch context	[bɛd] again	[bɛr] now

- Stimuli were spliced and placed in mismatch contexts
- Additional conditions (presented in both frames):
 - Mispronunciation:** One-feature place mispronunciations (e.g. *beb* for *bed*)
 - Novel:** Phonologically-dissimilar label for /d/ word (e.g. *moth* for *toad*)
 - Fillers:** Monosyllabic non-/d/-words (e.g. *bin*)
- Initial practice block of 3 trials (no feedback)

Expt. 1: Word identification

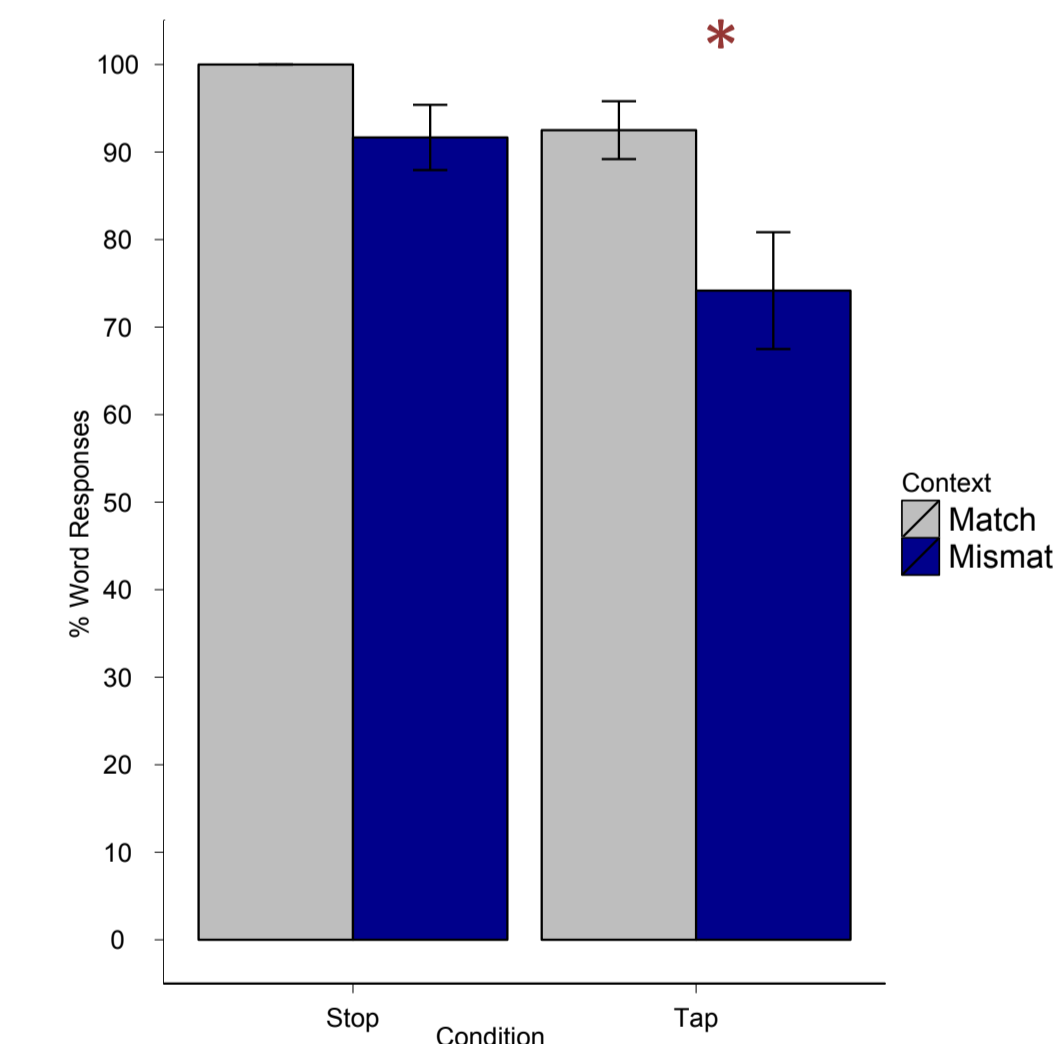
- Listeners asked to *click* on the word they heard.
- % Word responses:

- Tap condition: **Match = Mismatch**



- Compare /t/ words (Chong & Sundara, 2014; *in prep*)

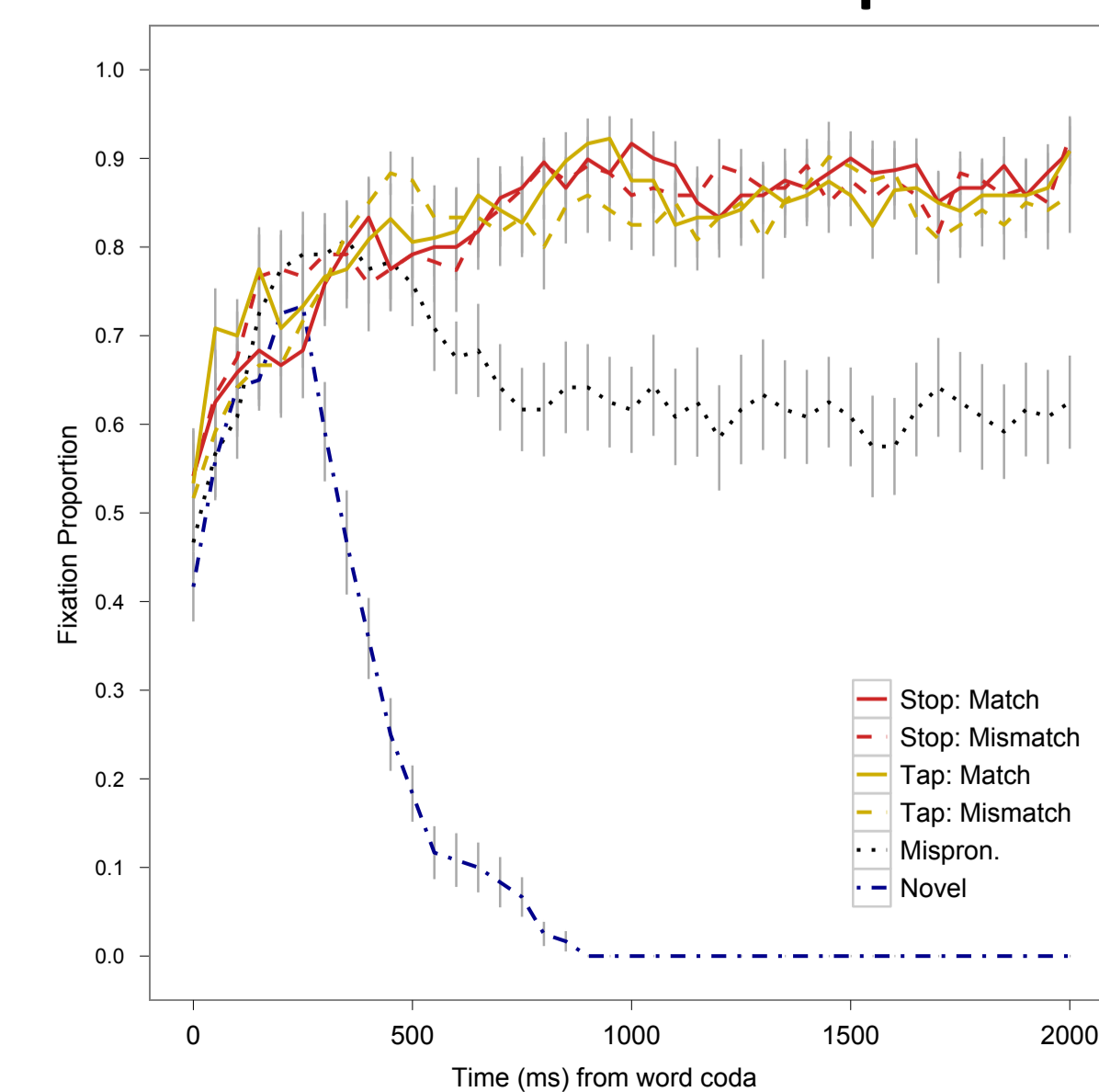
- Tap condition: **Match > Mismatch**



Expt. 2: Eye-tracking

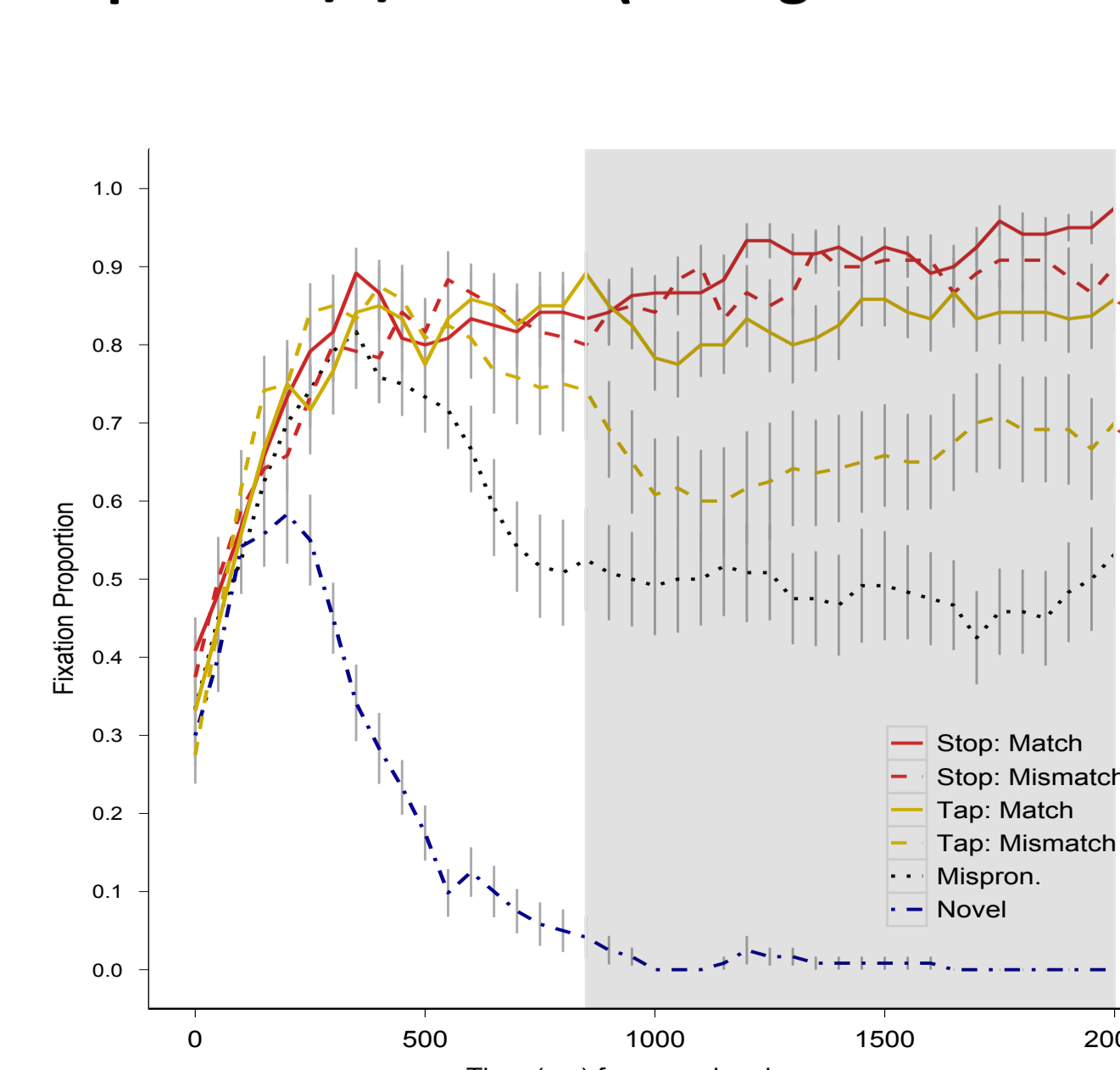
- Listeners asked to *look* at the word they heard.

NB: All stimuli was cross-spliced



- Tap condition: **Match = Mismatch**

- Compare to /t/ words (Chong & Sundara, 2014; *in prep*):



- Tap condition: **Match > Mismatch**
- Tap (mismatch) > Mispronunciation

Summary

- Context **does not matter** for canonical stop variants
- Context **does not matter** for non-canonical tap variants of /d/
 - Compare: tap variants of /t/ (Chong & Sundara 2014; *in prep*)

Discussion

Is the failure to find an effect due to inability to discriminate [d] and [r]?

- No:** Boomershine et al (2008) found that English listeners could discriminate [d] and [r] significantly above chance

What does it mean for phonological representations?

- Problematic for abstractionist accounts (e.g. inference account, e.g. Gaskell & Marslen-Wilson, 1996)
- An unviable context should have a disruptive impact on word recognition.

- Exemplar account? (Goldinger, 1996; Johnson, 1997)
- Context information would have to be stored for some variants but not others:
 - Have to explain context effect for tapped /t/ words but not tapped /d/ words
- Mismatch-tolerant representation (e.g. Connine et al. 1997)?
- Lexical access is based on the perceptual similarity of input and stored representation.
 - [d] and [r] are perceptually very similar – little cost to recognition

Future directions

- If there is a similarity bias, at what level does this operate?
- We suggest that it might be at the prelexical level.
 - Why? Infants without a lexicon also show this bias. (Sundara, Kim, White & Chong, *submitted*)
 - Planning on investigating this with auditory priming

Selected References

Boomershine, A., Currie Hall, K., Hume, E. & Johnson, K. 2008. The impact of allophony versus contrast on speech perception. In P. Avery, B. Elan Dresher & K. Rice (eds.), *Contrast in phonology: Theory, perception and acquisition* (pp. 146-172). Berlin: Mouton de Gruyter.

Chong, A.J. & Sundara, M. 2014. Compensating for tap variants in American English: The importance of context. Poster presented at LabPhon 2014, Tokyo, Japan.

Connine, C.M., Titone, D., Deelman, T. & Blasko, D.G. 1997. Similarity mapping in spoken word recognition. *J. Mem. Language* 37, 463-480.

Gaskell, G., Marslen-Wilson, W. 1996. Phonological variation and inference in lexical access. *JEP: HPP* 22, 144-158

Herd, W., Jongman, A. & Sereno, J. 2010. An acoustic and perceptual analysis of /t/ and /d/ flaps in American English. *J.Phon.*, 38, 504-516.

Kahn, D. 1980. *Syllable-based generalizations in English phonology*. Garland Press.

Pitt, M., Dilley, L. & Tat, M. 2011. Exploring the role of variant frequency in recognizing pronunciation variants. *J. Phon.* 39, 304-311.

Ranbom, L.J. & Connine, C.M. 2007. Lexical representation of phonological variation in spoken word recognition. *J. Mem. Language* 57, 273-298.

Ranbom, L.J., Connine, C.M. & Yudman, E.M. 2009. Is phonological context always used to recognize variant forms in spoken word recognition? The role of variant frequency and context distribution. *JEP: HPP* 35, 1205-1220.

Sundara, M., Kim, Y.J., White, J.C. & Chong, A.J. *submitted*. There is no pat in patting: Phonetic similarity biases infants' learning of phonological alternations.

Turk, A. 1992. The American flapping rule and the effect of stress on stop consonant durations. *Working Papers of the Cornell Phonetics Laboratory* 7, 103-133.