Reduplication and the Perception of Consonants under Repetition

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1. INTRODUCTION

- The preference for **avoiding repeated identical elements** is well-documented in phonology (e.g. the OCP: Goldsmith 1976, McCarthy 1986, Rose 2000; cf. Frisch et al. 2004, Walter 2007), and in perception more generally (see Kanwisher 1987).
- Zukoff (2015, 2017) argues that repetition avoidance is active in shaping reduplication patterns, and that (this kind of) repetition avoidance is driven by **perceptual factors relating to the presence of acoustic/auditory cues to contrast**.
- The results of an identification task support the hypothesis that accurate identification of stops is negatively impacted by repetition in a poorly-cued following context.

2. TYPOLOGICAL MOTIVATION

- Ancient Greek and other Indo-European languages (e.g. Sanskrit, Gothic), and also Klamath (Barker 1964), have prefixal reduplication as follows (see Steriade 1988, Fleischhacker 2005, Zukoff 2017):

1. Roots with initial *consonant-vowel* sequences (C_1V) copy C_1V
2. Likewise, roots with initial *obstruent-sonorant* sequences (T_1R_2V) copy C_1V (i.e. TV)
3. However, roots with initial *obstruent-obstruent* sequences (T_1T_2V) show some other pattern.

Ancient Greek	i.	TR	√klin-	→	ke-klin-	
	ii.	TT	√kten-	→	e-kton-	(*ke-kton-)
Klamath	i.	TR	√pni-	→	pi-pni-	
	ii.	TT	√ktiwcn̓a	→	kti-ktoːcn̓a	(*ki-ktoːcn̓a)

Table 1: Cluster-dependent Reduplication Patterns

- Distribution can be analyzed by positing a constraint against consonant repetitions ($C_\alpha VC_\alpha$) before an obstruent (Zukoff 2015, 2017).

⇒ This blocks the normal C_1V reduplication pattern just in case the root begins in a TT cluster (or indeed any CT cluster).

3. HYPOTHESIS

THE POORLY-CUED REPETITIONS PRINCIPLE (PCR)

In a context where robust acoustic/auditory cues to contrast are absent (e.g. before an obstruent), a consonant is identified less accurately when it is immediately preceded by an identical consonant than by a non-identical consonant:

- better identification of *p* as *p* in [...*tapt*...] than in [...*papt*...]
- better identification of *k* as *k* in [...*takt*...] than in [...*kakt*...]

At least for stops, this effect has to do with place of articulation:

- e.g., *p* becomes more confusable with *k* in such a context

4. METHODS

- Stimuli: $[C_1\varnothing\{p,k\}C_2ana]$ with $C_1 \in \{p,k\}$ and $C_2 \in \{t,l\}$.
- Read by two native French speakers (three repetitions).
- Stimuli mixed Speech-Shaped Noise with SNR = 3dB.
- Identification task run online: participants listened to the stimuli presented in random order and checked a box corresponding to the sound they heard ([p] or [k]).
- 37 native English speakers participated on a voluntary basis.

5. EXPERIMENTAL RESULTS

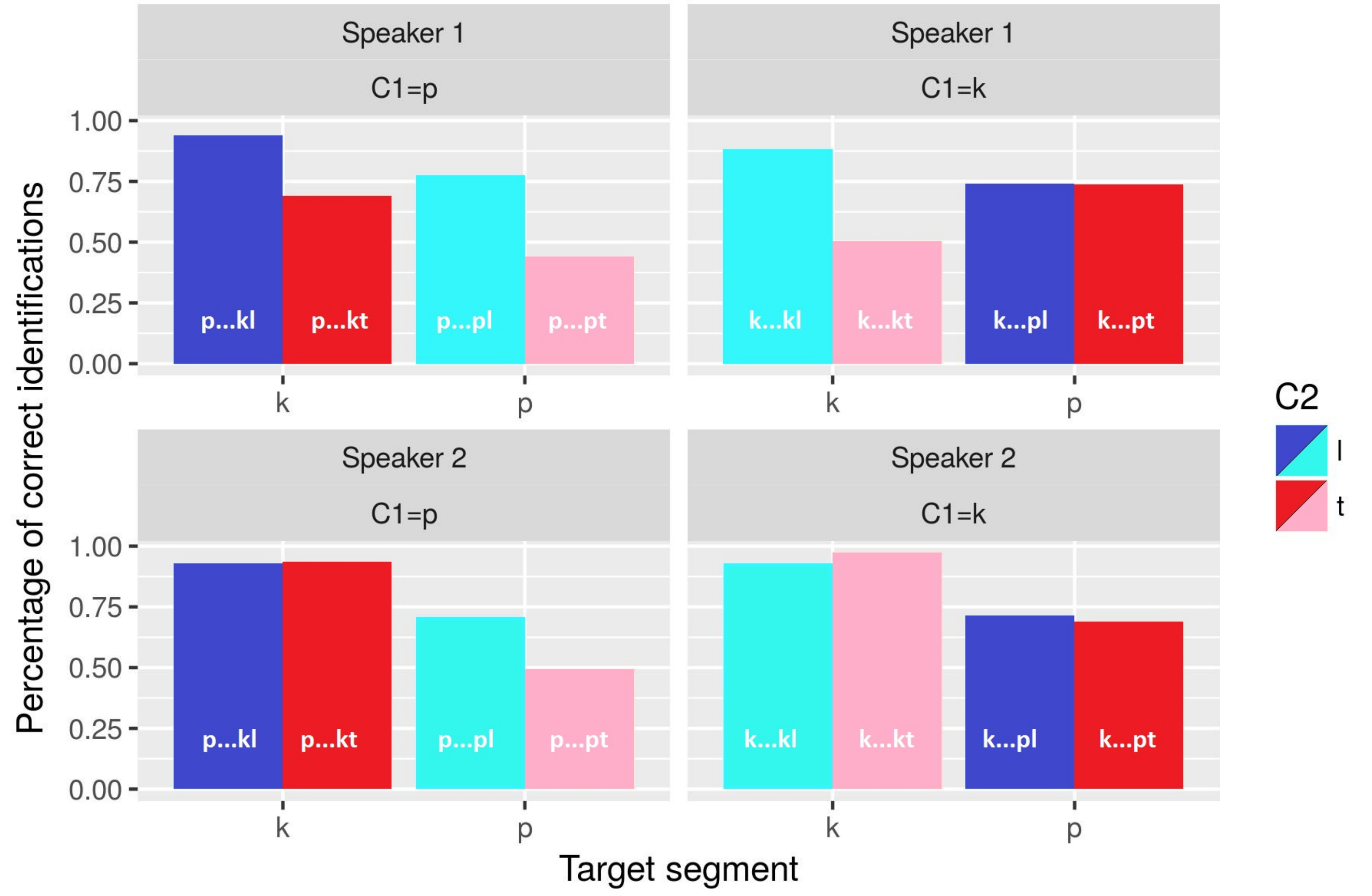

Figure 1: Percent of correct stop identification as a function of C1, C2, Target Segment, and Speaker

- Speaker 2’s results are unexpected: identification of *k* is at ceiling in all contexts.
  - This correlates with the fact that Speaker 2 strongly released *k*; Speaker 1 did not.
  - Speaker 2’s results for target *p* are in line with those for Speaker 1.
- Speaker 1’s results are exactly as expected. Our statistical analysis is based just on the results for Speaker 1.

	Estimate	Std. Error	z value	Pr(> |z|)	
Repetition, Poor Cues (baseline)	-0.11165	0.14933	-0.748	0.454645	
Repetition, Good Cues	1.76688	0.23573	7.495	6.62e-14	***
Non-repetition, Poor cues	1.03861	0.20943	4.959	7.08e-07	***
Non-repetition, Good cues	2.01379	0.26574	7.578	3.51e-14	***

Table 2: Model estimates for the logodds of correct identification for Speaker 1; main effects averaged across target segment

- The model also finds a significant interaction, which we interpret as better identification of *k* in pre-sonorant contexts. The model is not designed to adequately capture such an effect.

Main Result:

Repetition Avoidance effects in Pre-Obstruent Context (pink bars)

[except for Speaker 2 when Target = *k*]

- In pre-obstruent (poorly-cued) position, the repetition contexts show significantly worse target identification than corresponding non-repetition contexts:
  - *p...pt* < *p...kt*, *k...pt*
  - *k...kt* < *p...kt*, *k...pt*
- No additional effect by target consonant
  - *p...pt* = *k...kt*
- No equivalent effect found in pre-sonorant (well-cued) context
  - *p...pl* $\nless$ *k...pl*
  - *k...kl* $\nless$ *p...kl*

Ancillary Results

Better identification of *k* than *p* in pre-sonorant contexts

- In pre-sonorant (well-cued) position, there is better identification of *k* than *p*, regardless of whether it is part of a repetition

⇒ Likely derives from higher burst amplitude of *k*

Aberrant results for Speaker 2 w.r.t. *k*

- Speaker 2 differs from Speaker 1 in that *k* is strongly released in pre-obstruent position

⇒ This negates anti-repetition effect

- This comports with the general proposal: we predict that positions with strong cues will license repetitions

6. CONCLUSION AND DISCUSSION

- Correct identification of repeated stops (*p*,*k*) followed immediately by an obstruent (*t*) is significantly worse than in any other context (non-repetition and/or pre-sonorant).

⇒ This supports our cue-based repetition avoidance hypothesis: **THE POORLY-CUED REPETITIONS PRINCIPLE (PCR).**

- While not controlled for in the experiment, the licensing of repetitions in pre-obstruent context by Speaker 2’s stronger release burst for *k* is consistent with the hypothesis, since this turns pre-obstruent position into a well-cued context.
- **Question for future research:** What mechanism causes this effect?
  - Does repetition directly degrade perception?
  - Does prior perception bias against repetition response?

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