

Control of duration and magnitude in speech imitation

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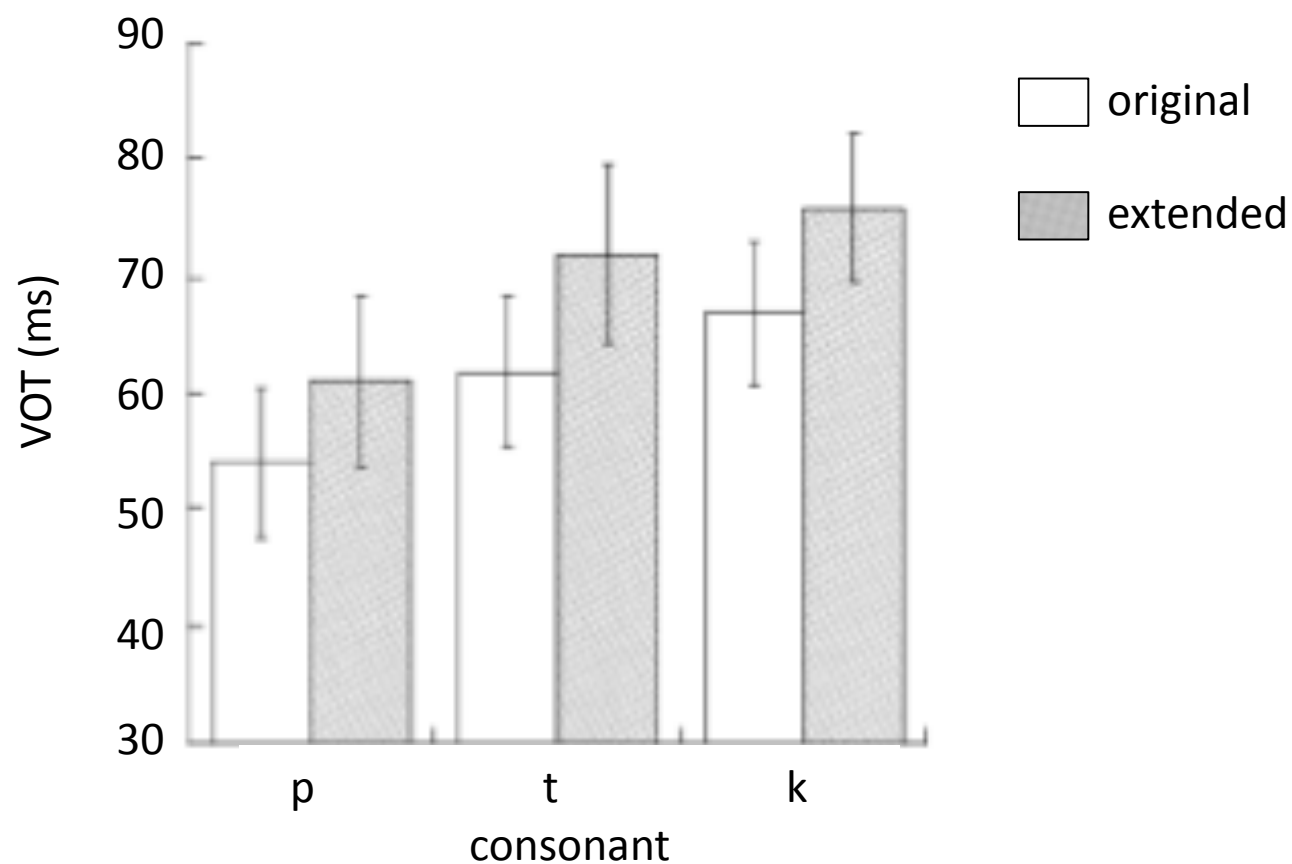
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Subphonemic detail is imitated in speech mirroring tasks



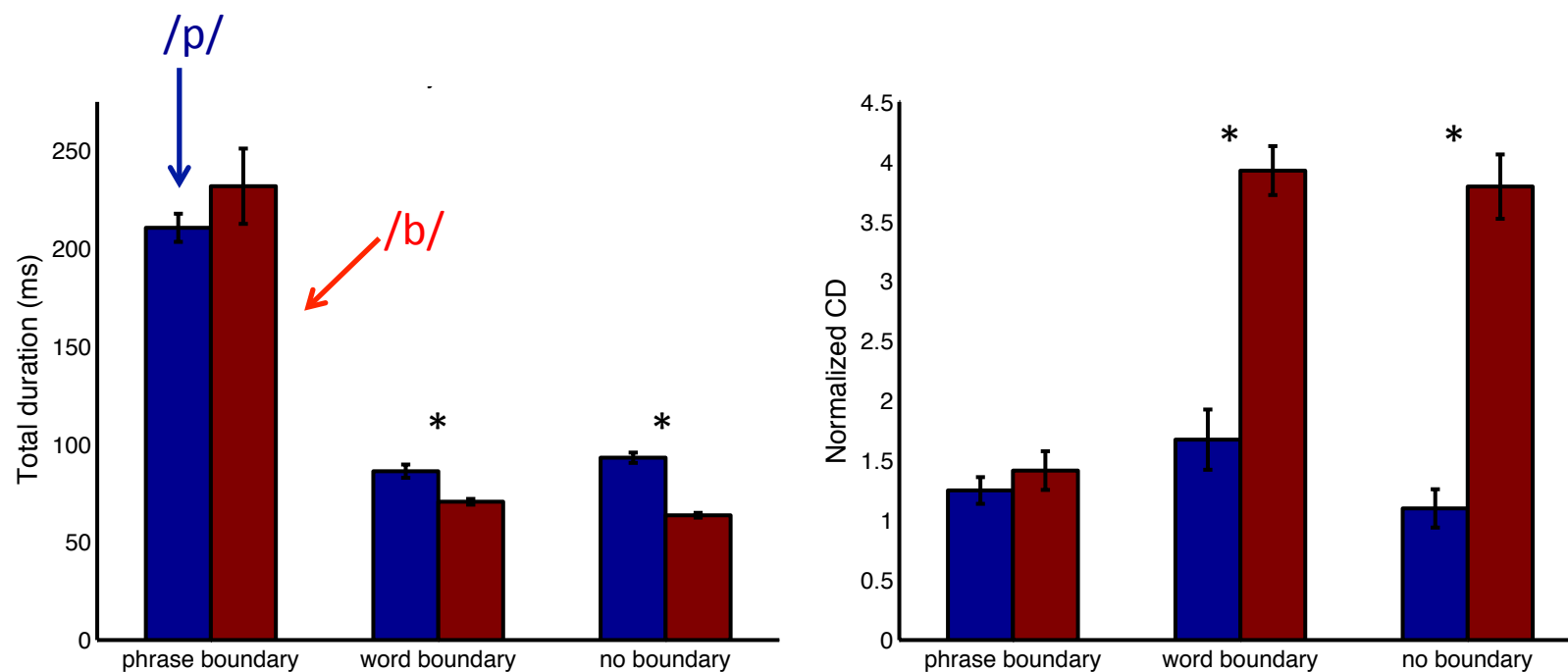
(Fowler et al. 2003)

What is imitated? What is not?

- extended VOT in English voiceless stops
- reduced VOT in English voiceless stops
- presence of prevoicing in Dutch voiced stops
- amount of prevoicing in Dutch voiced stops
- vowel formants
- vowel duration
- F0
- Syllabic liquids vs schwa in German
- Dark vs. clear /l/ in English onset

(e.g. Delvaux & Soquet 2007, Fowler et al. 2003, Honorof et al. 2011, Kappes et al. 2009, Nielsen 2011, Pardo 2006, Tilsen 2009, Vallabha & Tuller 2004)

Spanish stops vary in duration and constriction degree



Research questions:

Is articulatory movement detail in Spanish stops imitated?

Are duration and constriction degree imitated equally?

Speech imitation and control

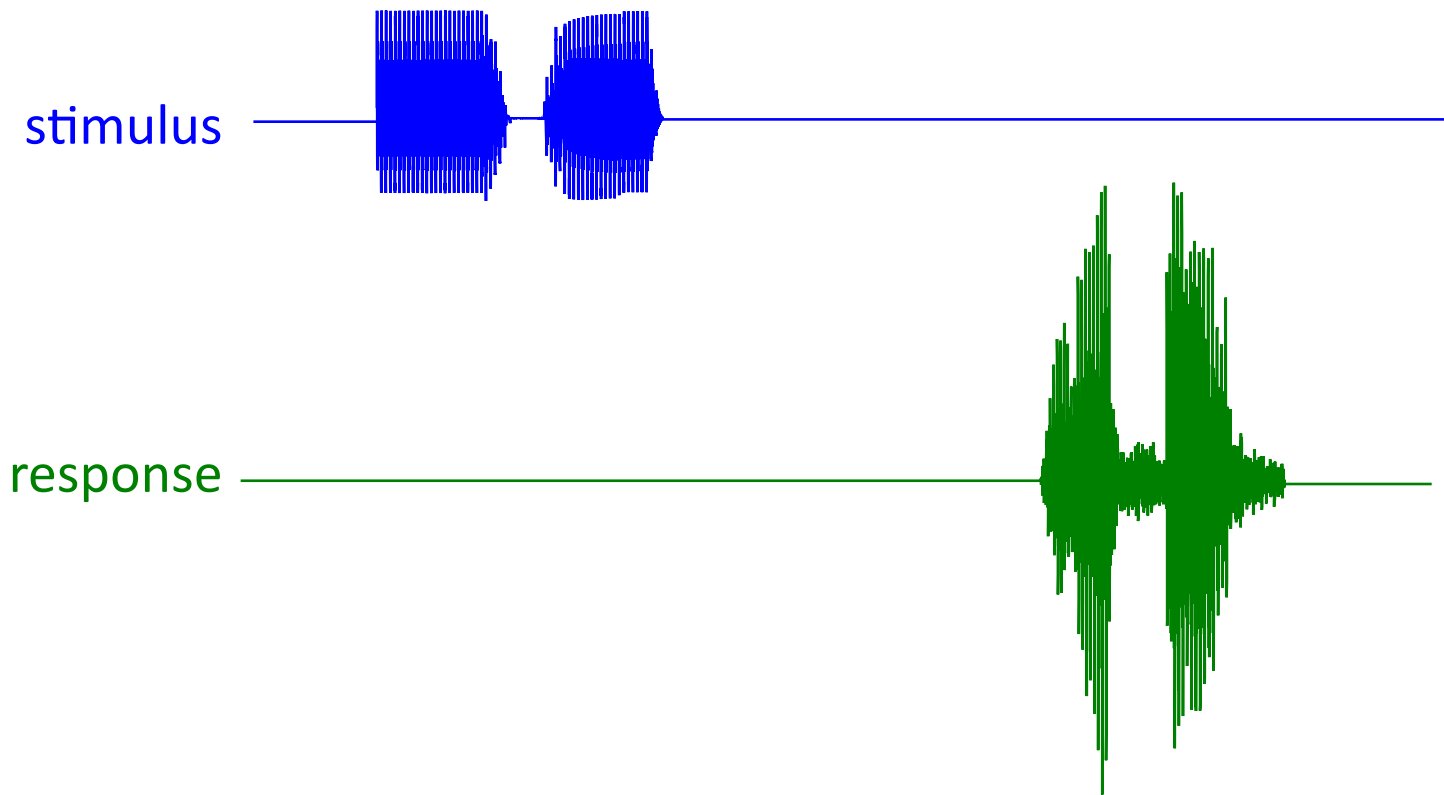


experiment design

results

analysis

Delayed repetition task



Experiment stimuli

/aba/ and /apa/

(/aga/ and /aka/ used as distractors)

duration and CD of /b/ and /p/ varied in 6 steps

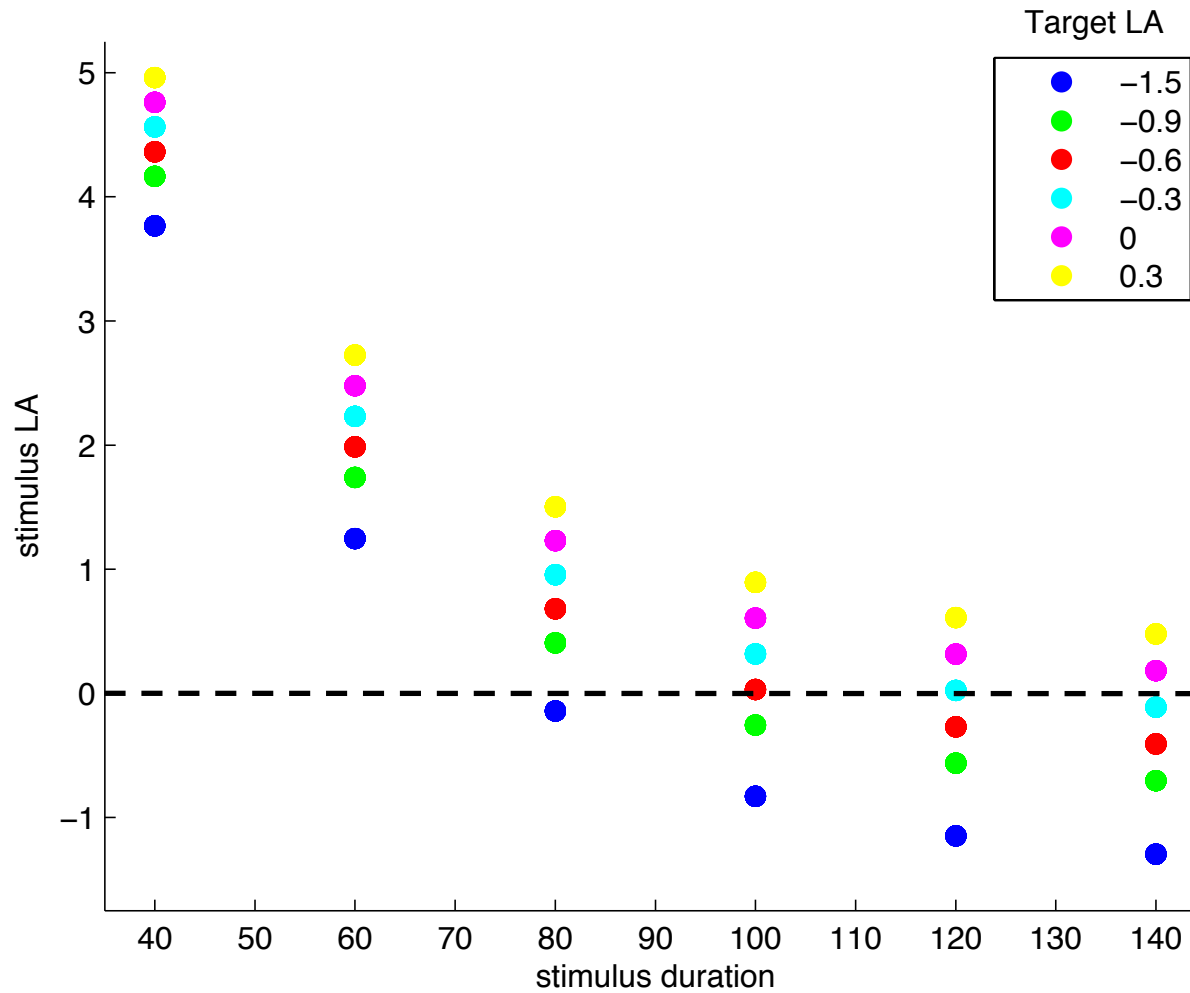
duration: 40-140 ms (20ms step)

CD target: 0.3, 0, -0.3, -0.6, -0.9, -1.5mm

vowel duration held constant:

V1: 230ms V2: 200ms

Experiment stimuli



Speech imitation and control

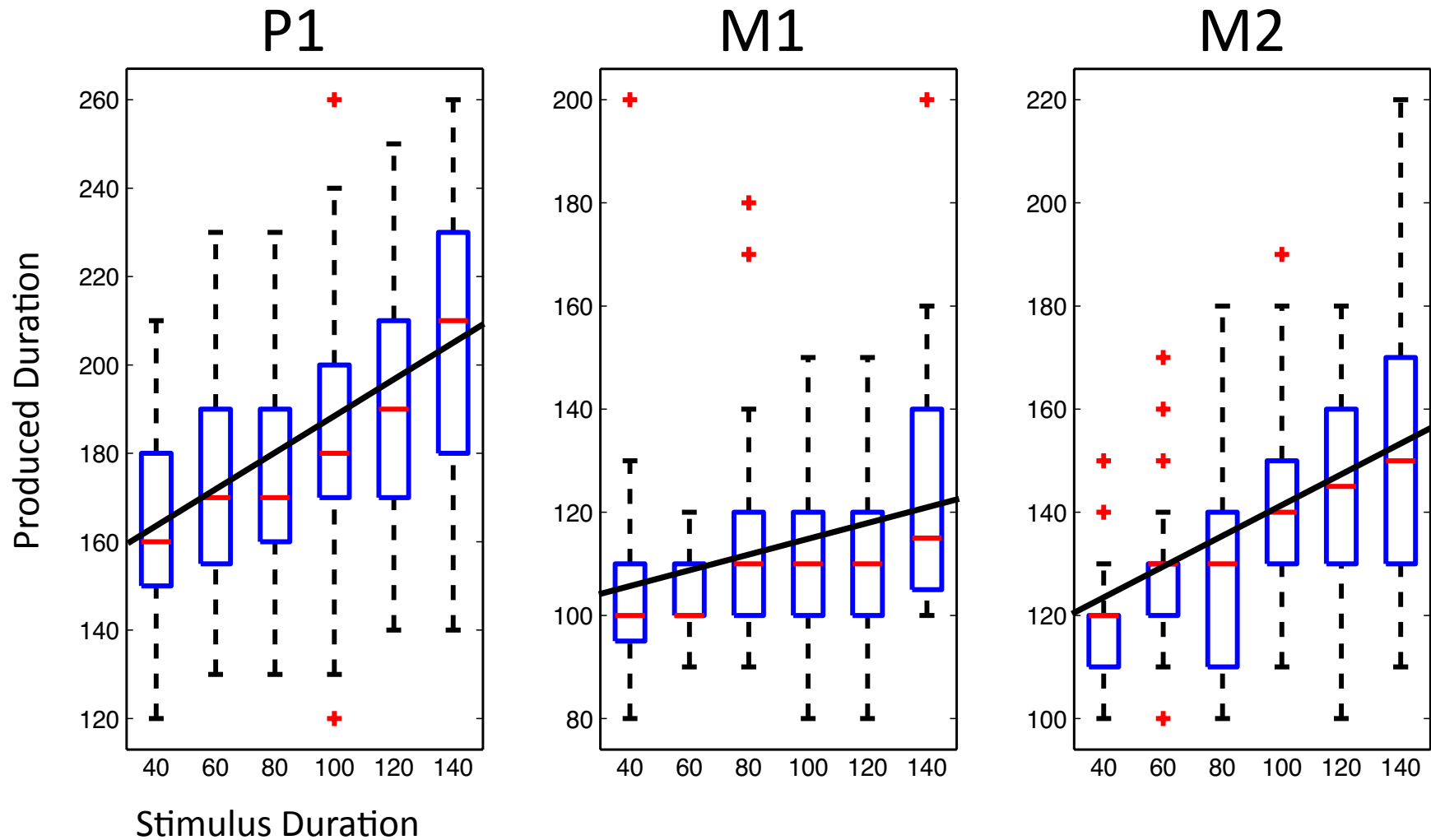


experiment design

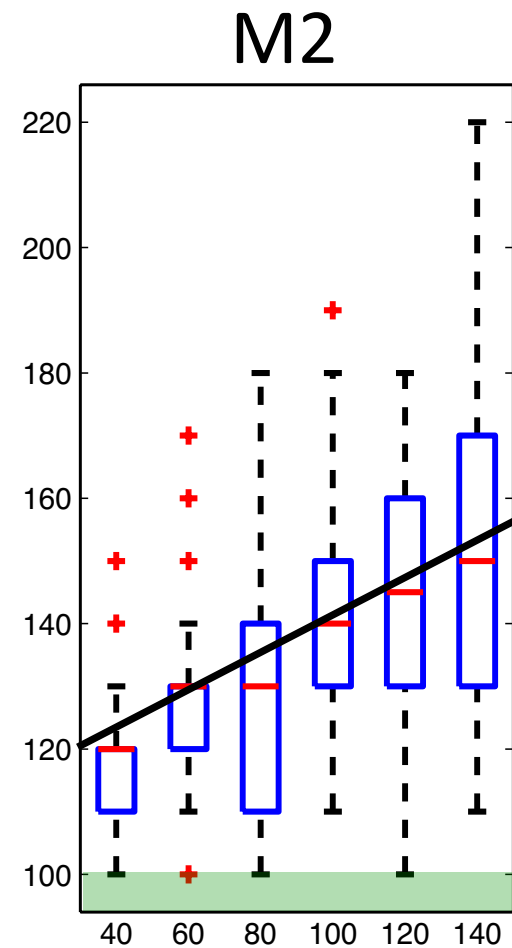
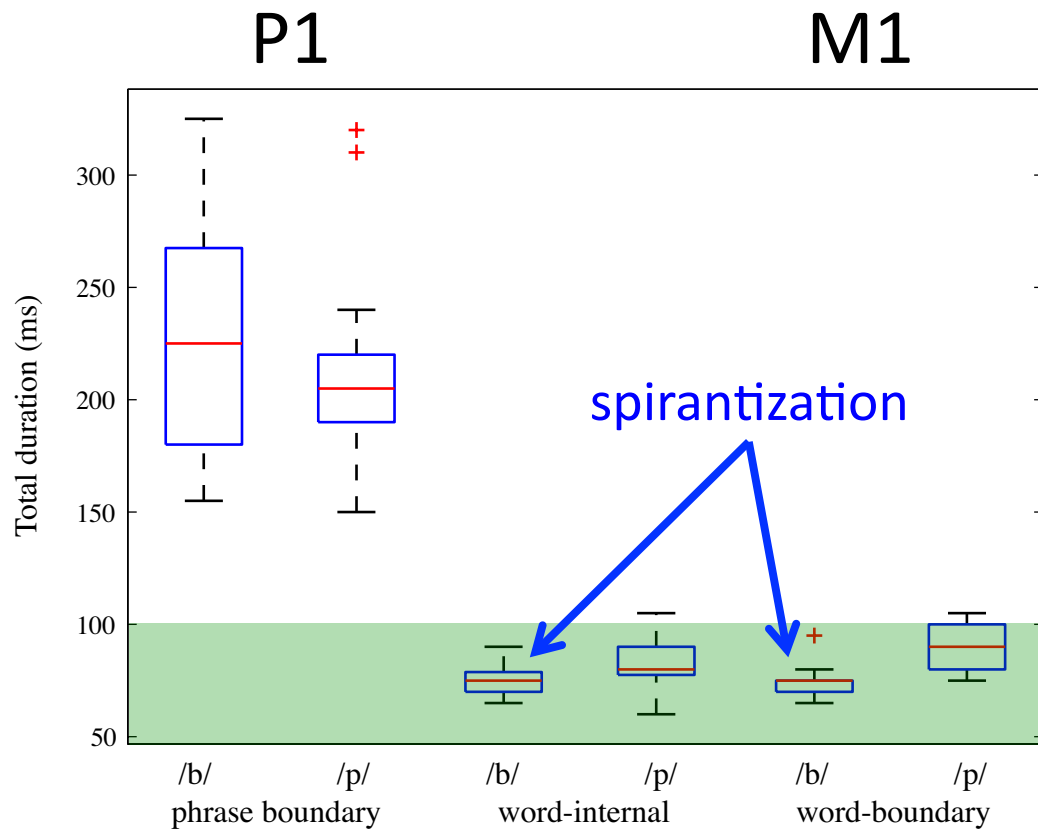
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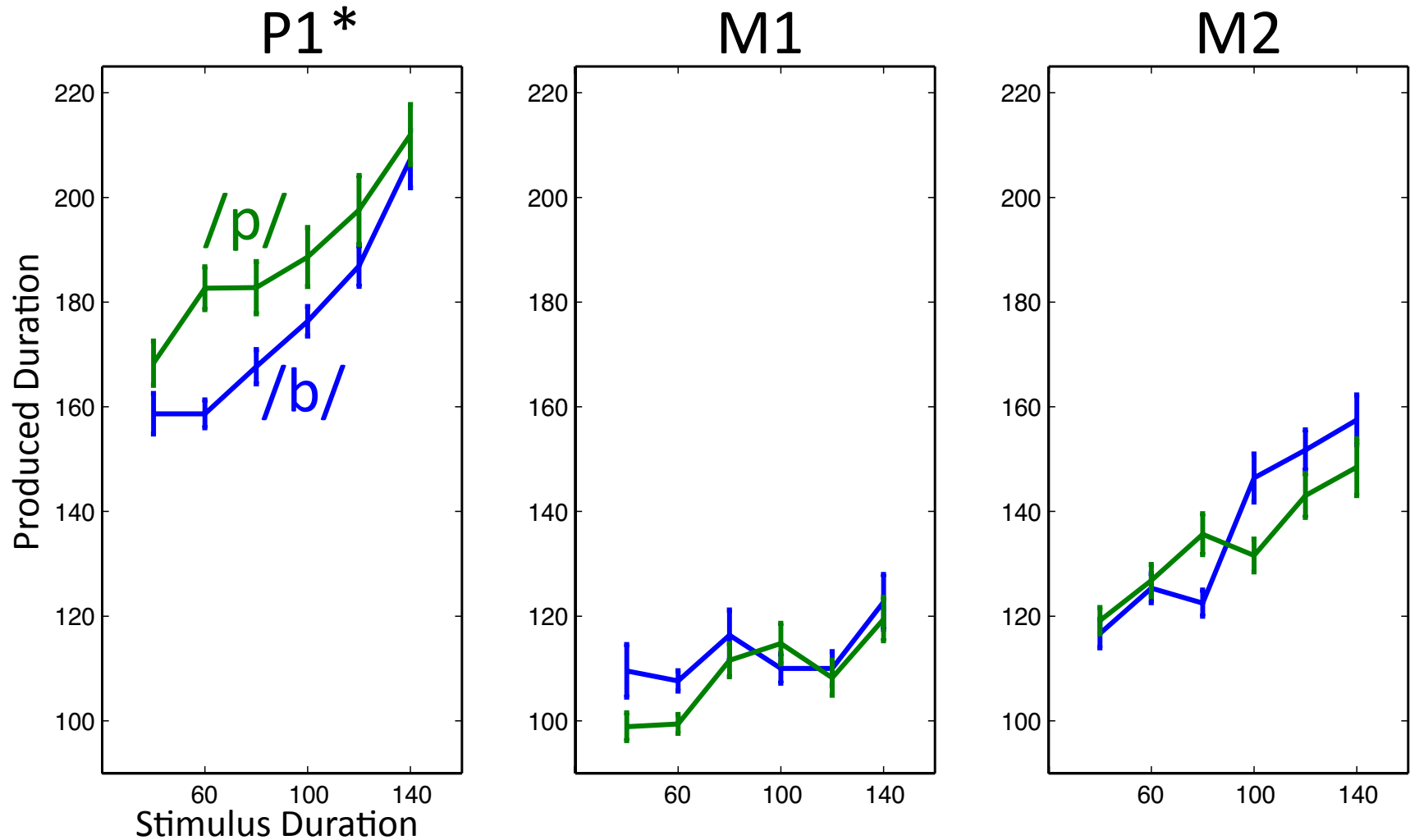
All subjects imitate duration



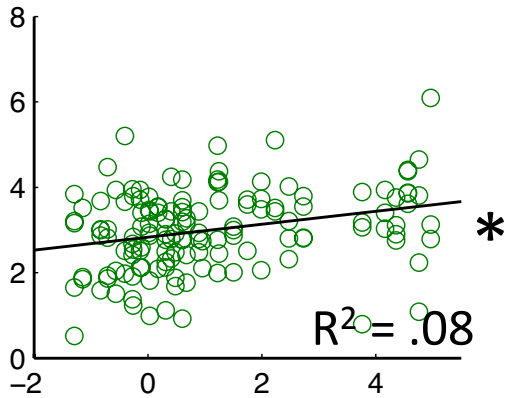
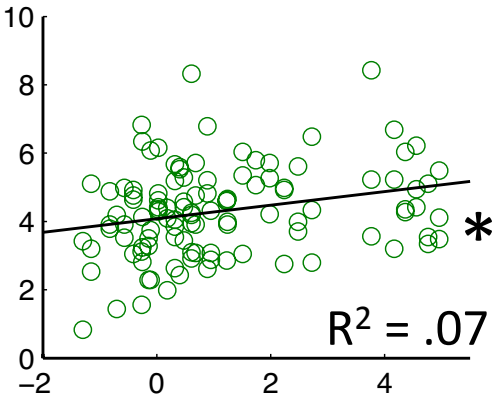
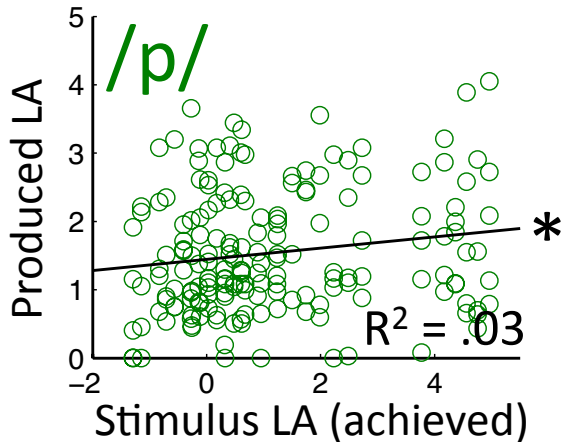
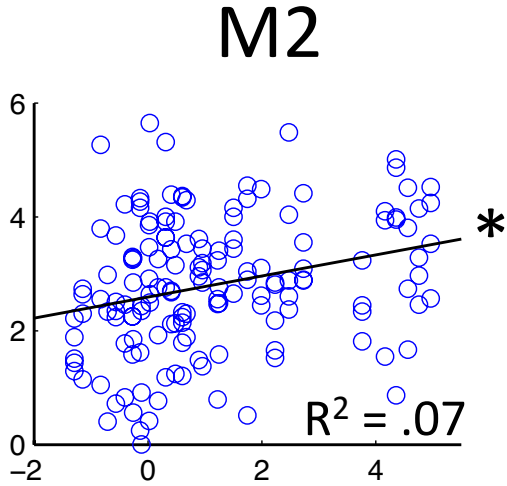
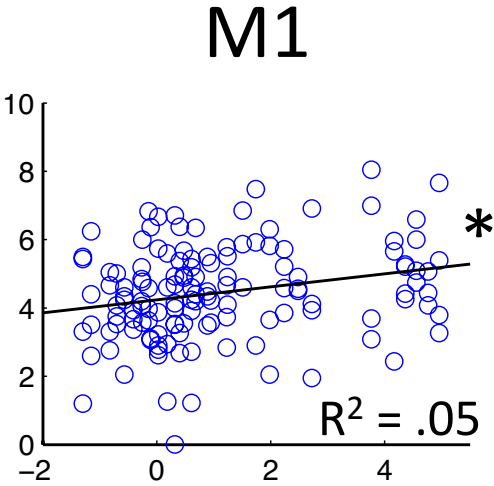
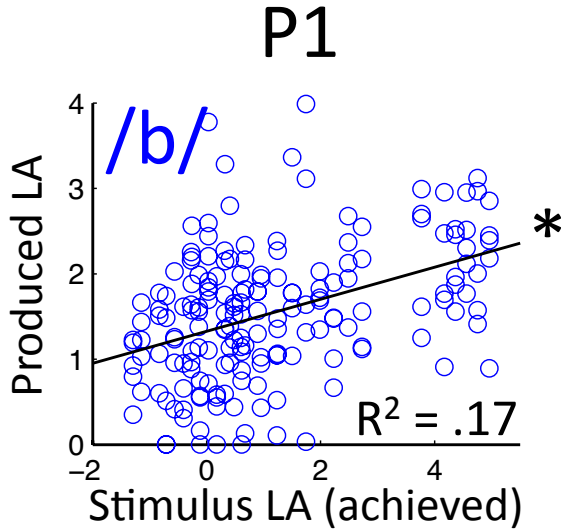
Durations much longer than in normal speech



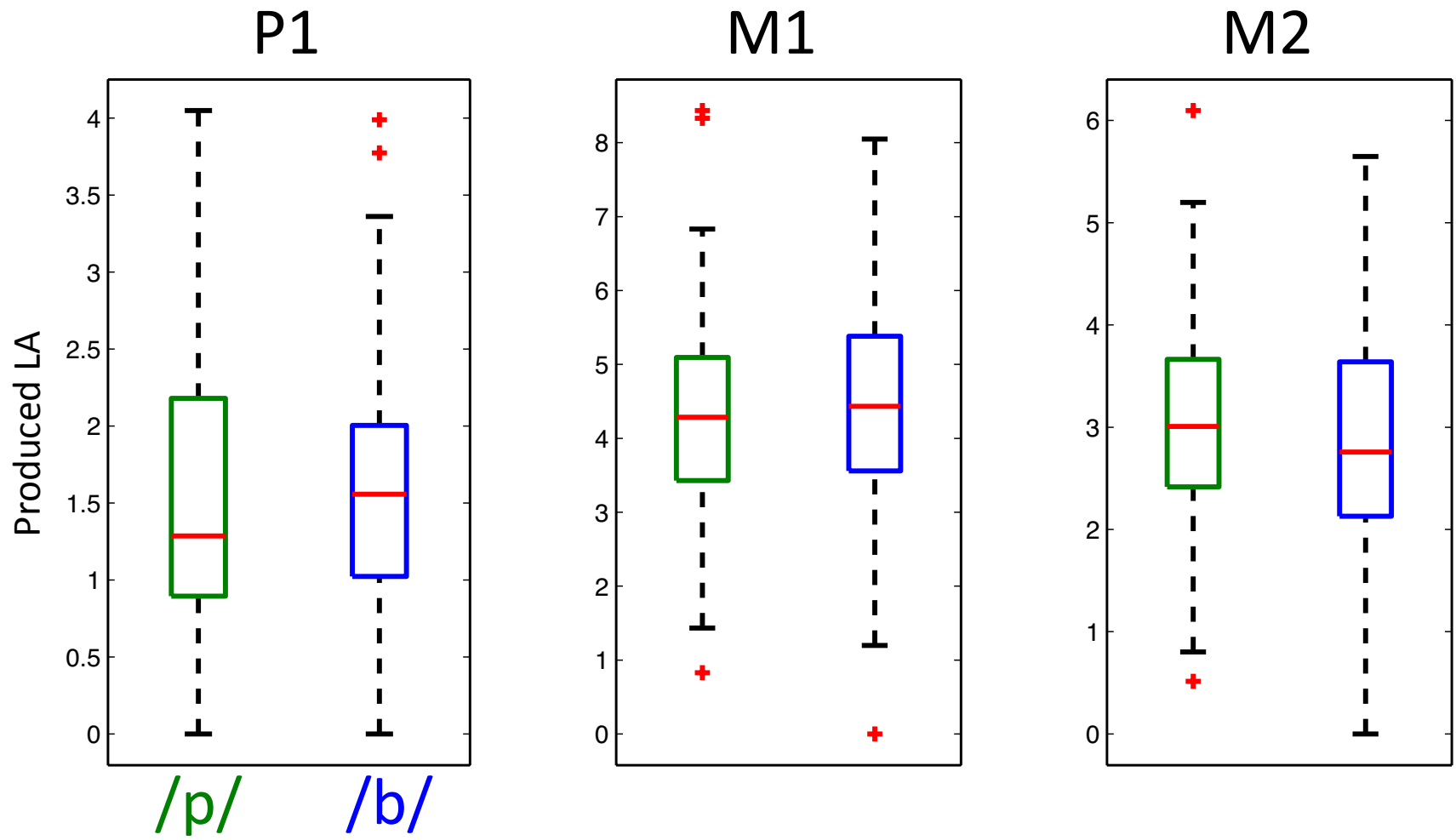
Effect of stimulus consonant differs between subjects



Subjects imitate Lip Aperture



Stimulus consonant does not affect Lip Aperture



Speech imitation and control



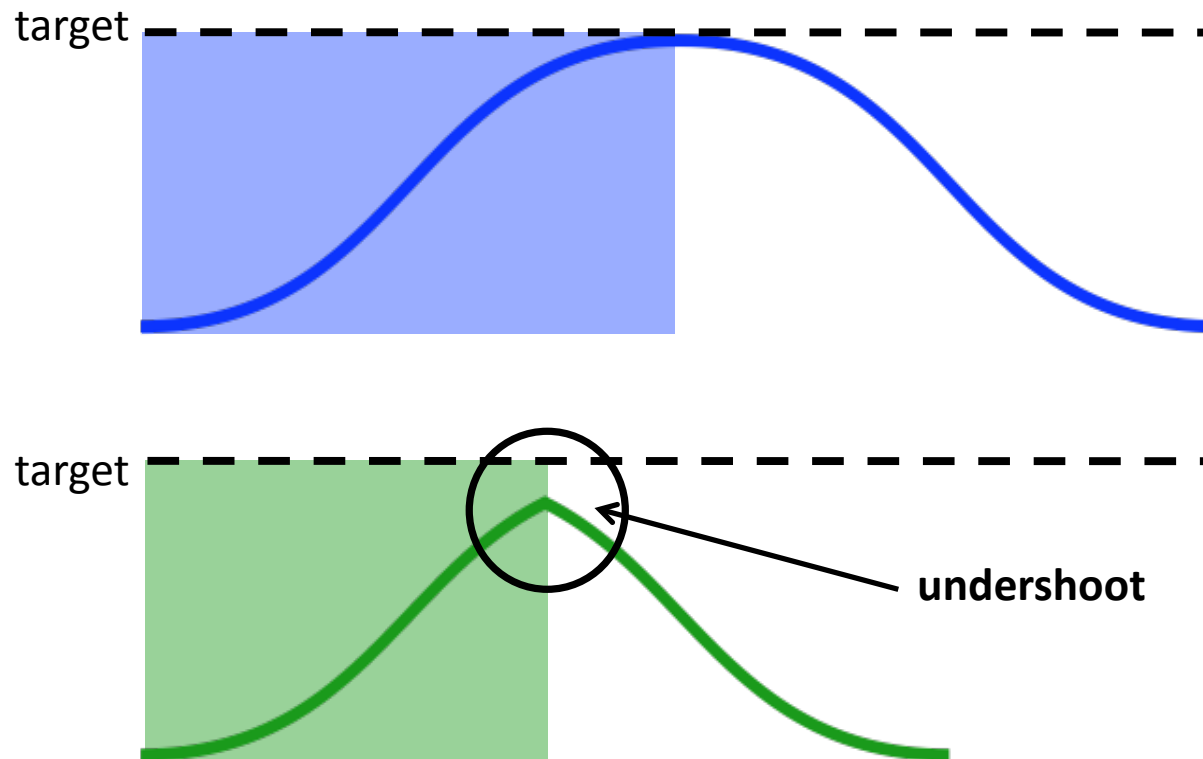
experiment design

results

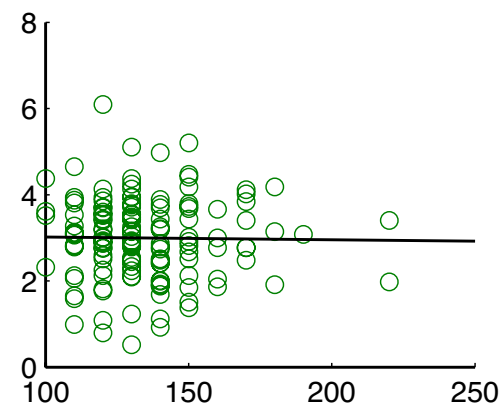
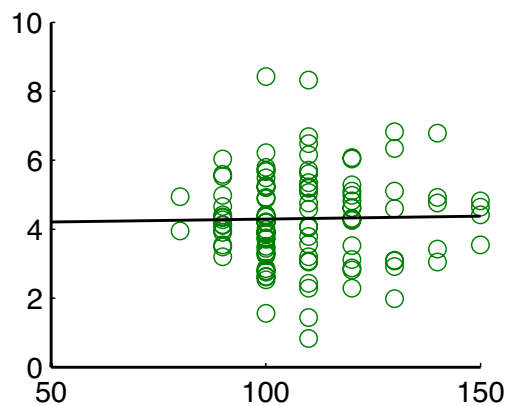
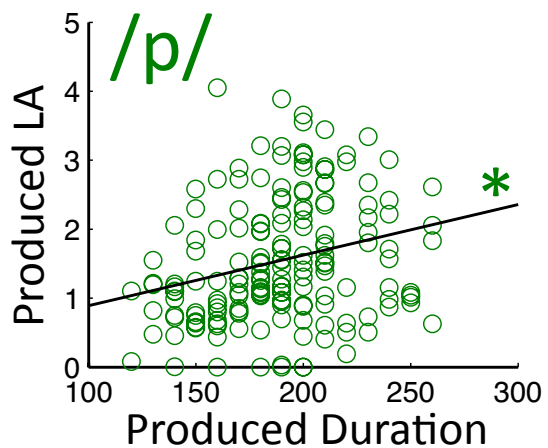
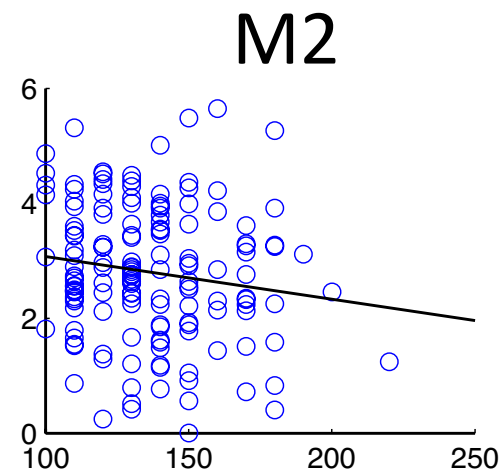
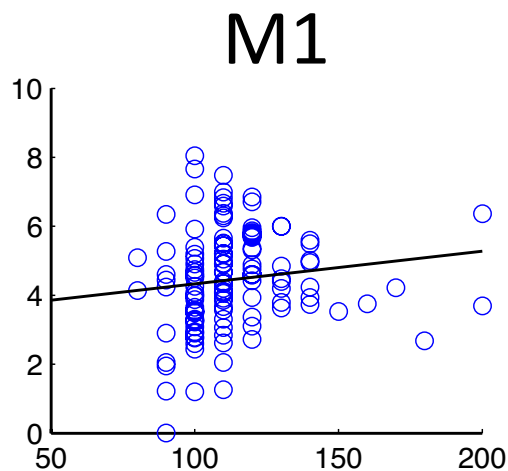
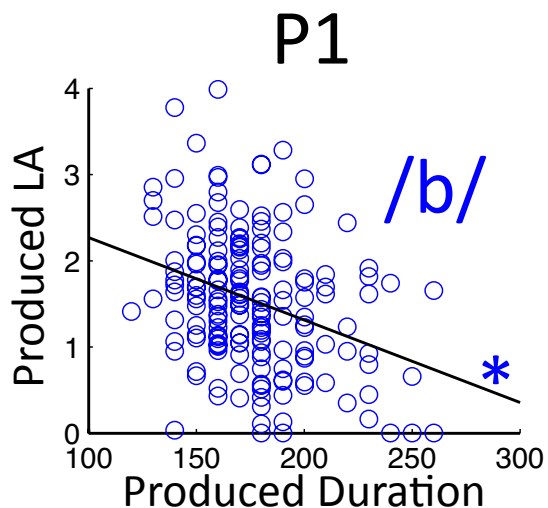
analysis

Why is imitation unequal?

Are duration and Lip Aperture independent?



No consistent correlation between produced LA and duration



Why is imitation unequal?

Are duration and Lip Aperture independent?

YES

What is special about duration?

constriction degree (LA): **phonological**

duration: (mostly) **prosodic**

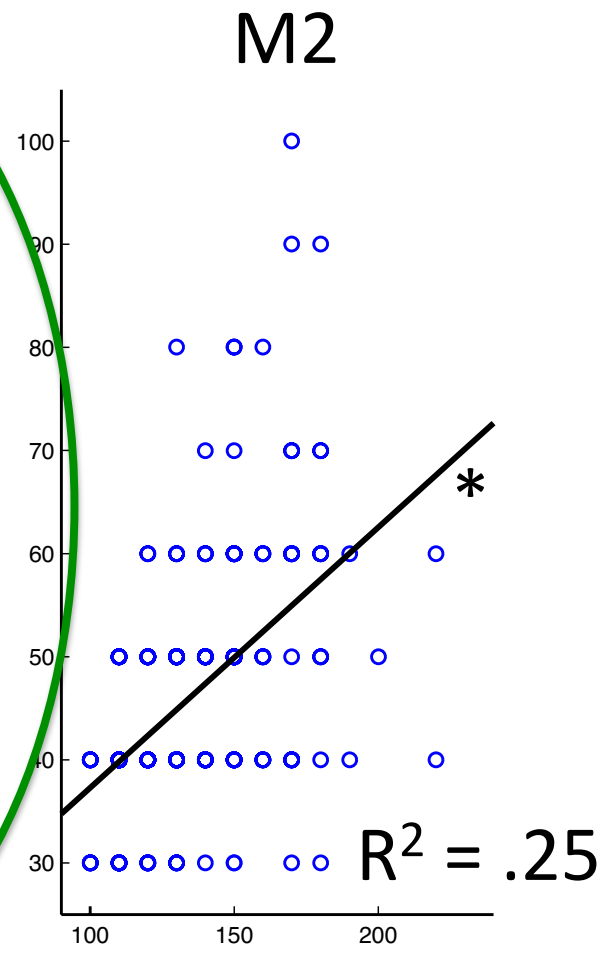
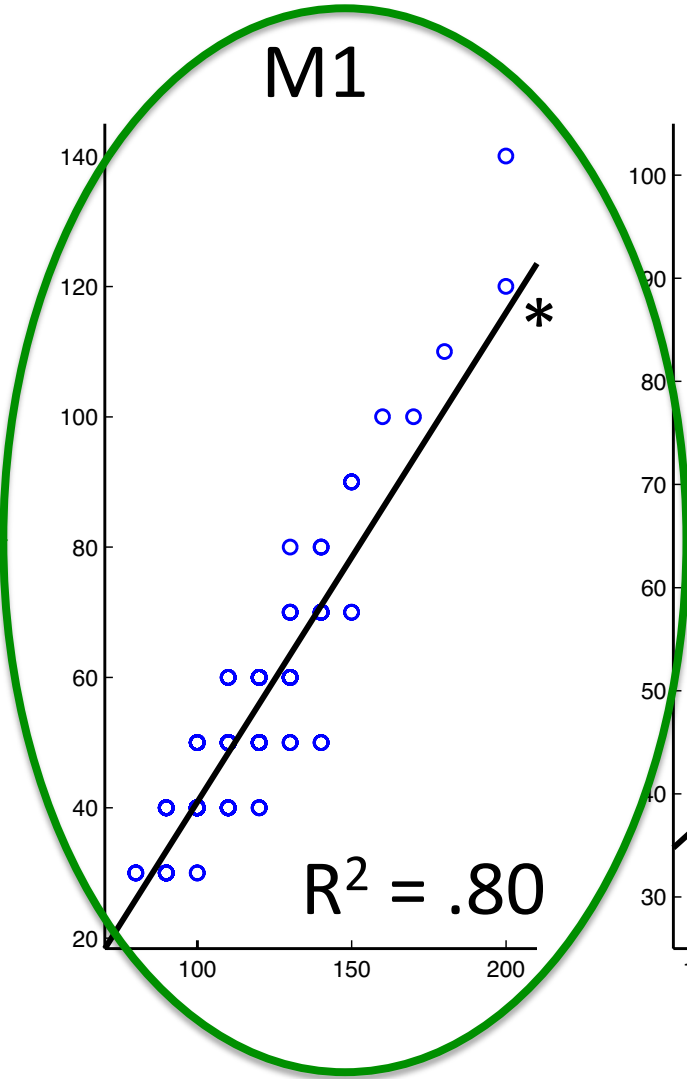
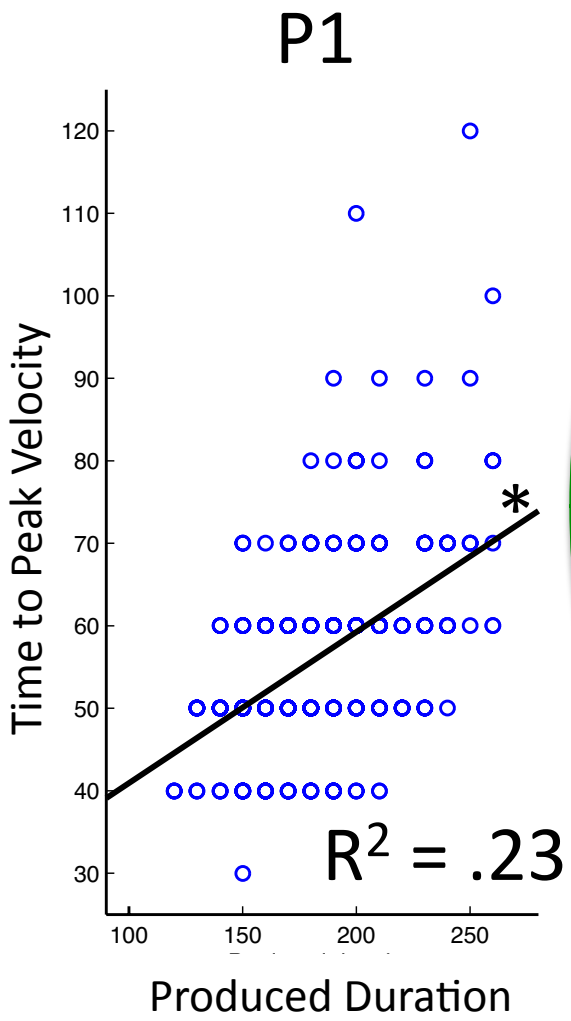
Prosodic changes in duration

Lengthening is a hallmark of prosodic boundaries

Modeled by changes in **stiffness** parameter of a mass-spring control model

Increased stiffness → longer duration, longer time from onset to peak velocity

Duration is correlated with gestural stiffness



Conclusions

Subjects show large imitation of duration, less of Lip Aperture

Imitation may be mediated by existing phonological categories

Imitation in prosodic vs phonological domains may be unequal