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**Language Brain & Behaviour**



# *The Role of Predictability and Sub-Phonemic Detail in Speech Perception: English has-Clitic [s] vs. Plural [s]*

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- morphemes are represented at the phonological level
- no phonetic difference between different English /s/ morphemes
- homophony of: plural, genitive, genitive plural, 3rd sg, clitics of *has, is, us*
- no systematic phonetic difference between different instances of one allomorph of a certain morpheme

- Does the type of morphological boundary preceding a word-final S have an effect on its duration?
- Plag et al. (2015) American English, Zimmermann (2016) New Zealand English:

house

no boundary: longest S

sits, ducks

morphological boundary: medium S

Jack's

word/clitic boundary: shortest S

- Does morphological predictability affect the phonetic realization of bound morphemes?
- Rose (2016) on NZE plurals:
  - shorter plural S duration when plural is more predictable
  - calculated plural predictability based on preceding word

three cats

more predictable plural: shorter S

handsome cats

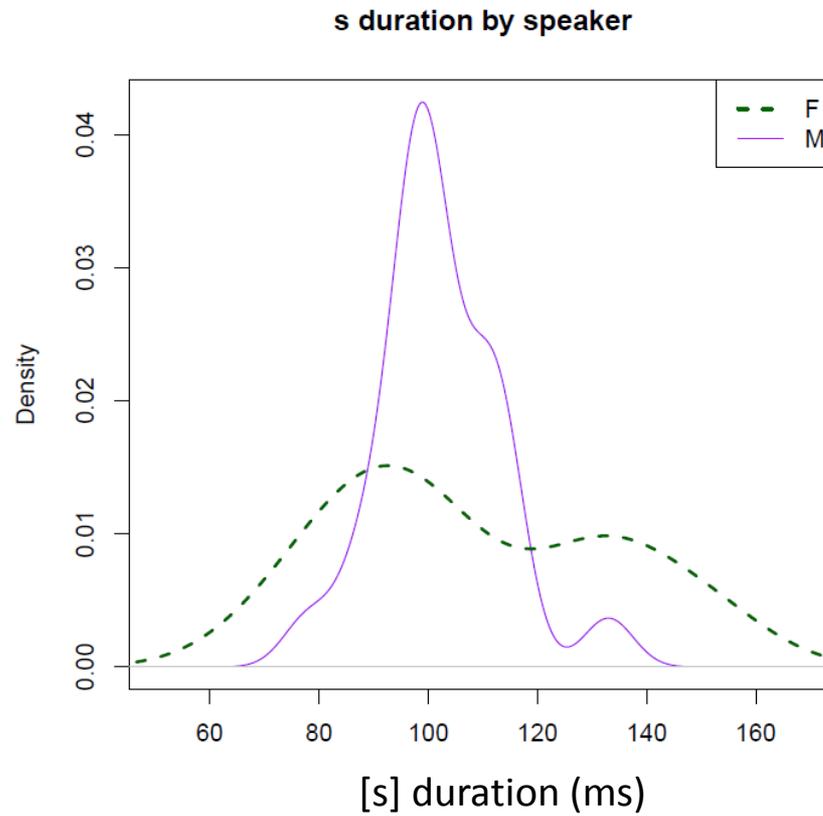
less predictable plural: longer S

- Kemps et al. (2005a, 2005b) found that listeners can distinguish free bases from bound bases followed by a suffix
- Shatzman & McQueen (2006) found that listeners can use [s] duration as a cue for word boundaries in Dutch

- Derrick & Bürkle (2016) used a visual-world eye-tracking experiment to investigate the perceptibility of acoustic correlates of anticipatory tongue movements in VrVrV-sequences like *editor* vs. *edit a*
  - participants were able to distinguish the sequences before the rhotic/non-rhotic final vowel was reached

- Does [s] duration play a role in the distinction of plural and *has-clitic* [s] in ambiguous contexts?
  - plural [s] is longer than *has-clitic* [s] in production
- Does predictability play a role in the distinction of plural and *has-clitic* [s] in ambiguous contexts?
  - plural [s] duration differs in production based on preceding context's plural predictability

- item construction
  - 2 types of [s]: *has*-clitic and plural
  - 2 target lemmas: **BOOK** and **SHIP**
  - 3 different plural predictabilities: **his**, **my**, **their**
    - ambiguous carrier sentences:
      - Reading **his book[s]** inspired them so much
      - Reading **my book[s]** inspired them so much
      - Reading **their book[s]** inspired me so much
      - **His ship[s]** appeared in numerous feature films
      - **My ship[s]** appeared in numerous feature films
      - **Their ship[s]** appeared in numerous feature films
  - 2 speakers read items for recording



- experimental setup
  - 20 participants (9 female, 11 male), native speakers of NZE, compensated with \$10 shopping voucher
  - visual-world-like eye-tracking paradigm
    - participants listen to recordings over headphones
    - two words displayed on screen, e.g. *books* and *book's*
    - instructed to look at word they think they heard in recording
    - tracking of eye-movements while participants identify words, using a Tobii X120 head-free near-infrared eyetracker
    - 48 unique test items, each played twice
    - 96 unambiguous control items
    - four blocks of 48 items each, fully randomized



books

X

book's



*“Reading my book[s] inspired them so much.”*

book's

X

books



*“Reading my book[s] inspired them so much.”*

ship's

X

ships



*“Their ship[s] appeared in numerous feature films.”*

ships

X

ship's



*“Their ship[s] appeared in numerous feature films.”*

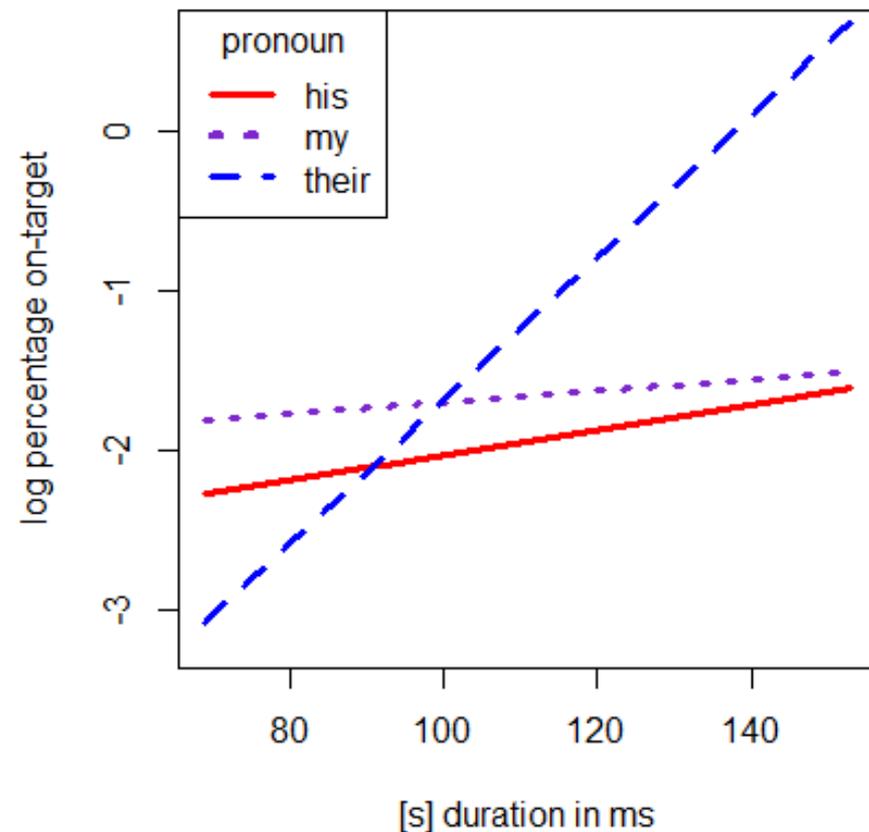
- dependent variable: percent correct gazes
  - target areas determined for each participant using control items
  - response: percentage of gazes on-target vs. off-target (vs. neutral)
  - overall observed accuracy: test items 50.5%, control items 92.9%
- explanatory variables: PL predictability, [s] duration
- covariates
  - base, speaker
  - order, target word position
  - trajectory length
    - short trajectory = direct choice, long trajectory = back-and-forth

- linear mixed effects regression modelling
  - predicting percentage of on-target gazes
  - fixed effects
    - interaction of trajectory length & type of [s]
    - interaction of base & type of [s]
    - interaction of PL predictability, type of [s] & [s] duration
  - random slope for type of [s] by participant
  - $R^2 = 0.44$

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- three-way interaction of PL predictability, type of [s] & [s] duration
  - PL predictability operationalized through pronoun preceding the item
    - their + *has*-clitic: more on-target gazes for longer [s]
    - his + plural: more on-target gazes for longer [s]

## [s] type: has



no significant effect of [s]  
duration on response  
accuracy for *his* & *my* items

*their* items with longer [s]  
reach higher accuracy than  
*their* items with shorter [s]

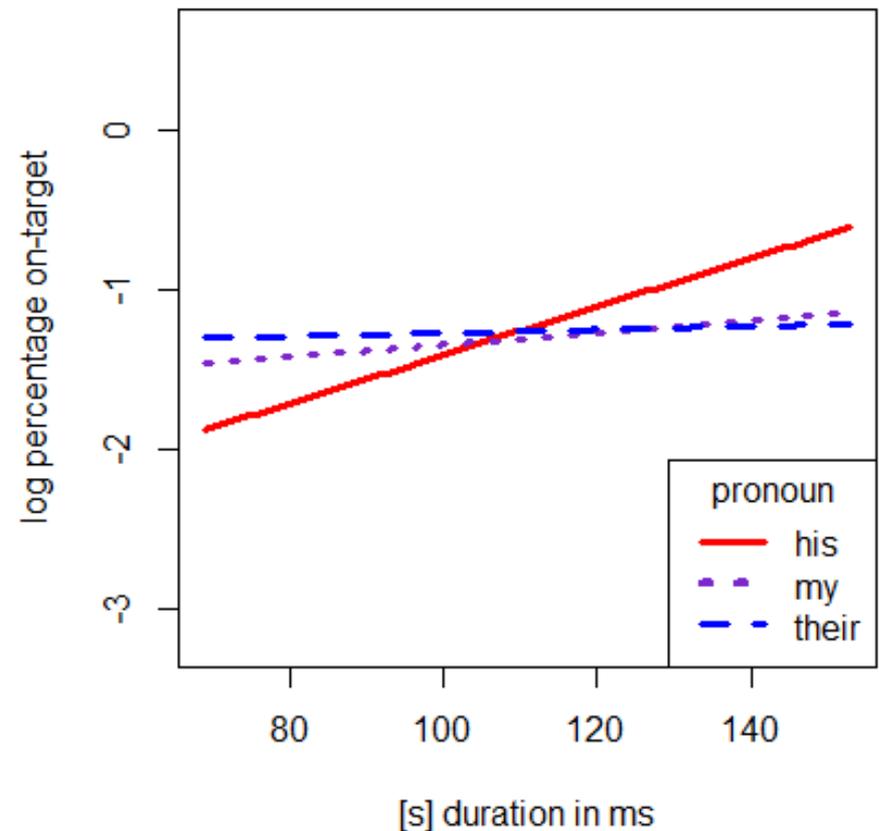
*their*: high plural predictability  
→ shorter plural [s] expected

no significant effect of [s]  
duration on response accuracy  
for *my* & *their* items

*his* items with longer [s] reach  
higher accuracy than *his* items  
with shorter [s]

*his*: low plural predictability  
→ longer plural [s] expected

[s] type: plural



- three-way interaction of PL predictability, type of [s] & [s] duration
  - PL predictability operationalized through pronoun preceding the item
    - their + *has*-clitic: more on-target gazes for longer [s]
    - his + plural: more on-target gazes for longer [s]
- random slope for type of [s] by participant
  - different sensitivities to type of [s], just like speakers

- Does predictability play a role in the distinction of plural and *has*-clitic [s] in ambiguous contexts?
  - Yes. There are effects of predictability on percent correct gazes.
- Does [s] duration play a role in the distinction of plural and *has*-clitic [s] in ambiguous contexts?
  - In certain contexts. For *his* + *has*-clitic [s] and *their* + plural [s], duration interacts with predictability in the expected way.
  - Sensitivity to sub-phonemic detail differs between listeners.



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*Thank you for your attention!*

This research was funded by a NZILBB Language Variation and Change theme Collaborative Paper Challenge grant and by the Deutsche Forschungsgemeinschaft (Forschergruppe 2373 'Spoken Morphology', TP3 VAR, PL 151/8-1 and ZP PL 151/7-1), which we gratefully acknowledge.

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