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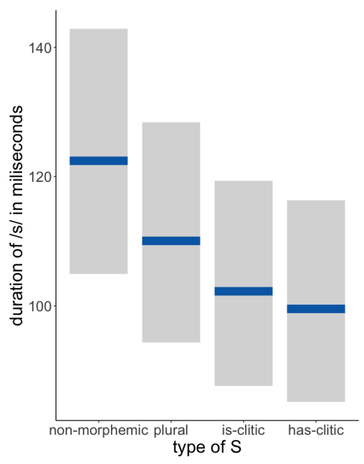
Tapping into morphology with the help of subphonemic detail?

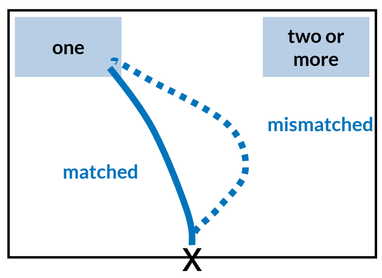
Background & Motivation

- production of homophonous suffix S in English is modulated by its morphological category [1-5]
- perception and comprehension seem affected by subphonemic detail: mismatched durations lead to detours in mouse-tracking [6]
- based on these findings we investigate the possibility of a bootstrapping mechanism between the phonetic and the morphological level [7,8]
- **Are subphonemic cues strong enough to guide morphological learning?**

Articulation



Comprehension



The Experiment

- **artificial language learning** experiment with singular and plural forms
- number decision task, measuring accuracy and mouse tracks
- **3 types of learner groups**: PHONEMIC vs. PHONETICLONG vs. PHONETICSHORT

Language design

- singular forms: $CV_1.CV_2f$ | plural forms: $CV_1.CV_2[f/p]$
- varying consonant sets: {b, n, d, k} or {l, m, g, t}
- V_1: {a, e, i, o, u}
- V_2: {ɑ, ɛ, ɪ, ɔ, ʊ}

Study design

- 60 adult L1 German speakers in three groups: singular is –/f/ (135 ms)
  - PHONEMIC group: plural is /p/
  - PHONETICSHORT group: plural is /f/ (170 ms)
  - PHONETICLONG group: plural is /f/ (210 ms)

Procedure

1) Training

- participants listen to singular and plural forms with corresponding visual stimuli

2) Test

- participants listen to new singular and plural forms and decide between morphological categories

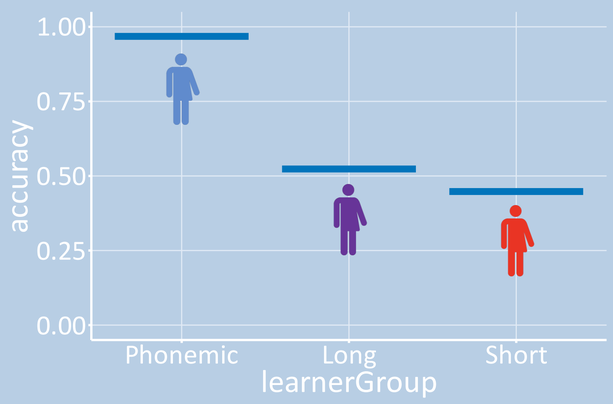
Analyses

- 60 participants x 48 target items = **2880** data points

Accuracy

- logistic regression

```
isCorrect ~ LearnerGroup
  + attestedness
  + L1likelihood
  + trialNumber
  + singularPosition
  + itemSet
  + participant
```



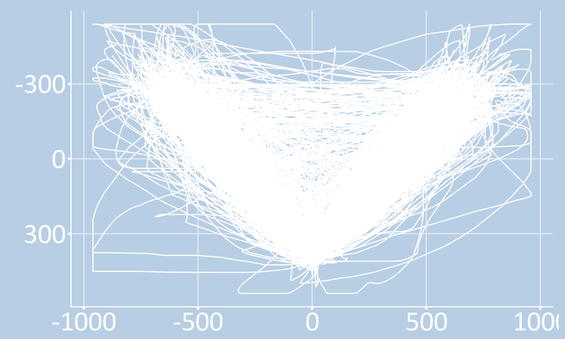
Mouse tracks

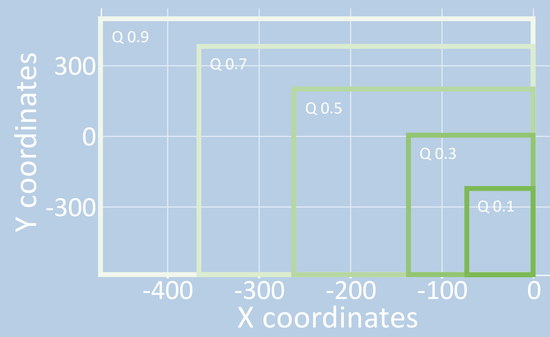
- QGAMs (quantile generalized additive mixed models)
- fitted to conditional quantiles of the dependent variables: position on X- and Y-axis

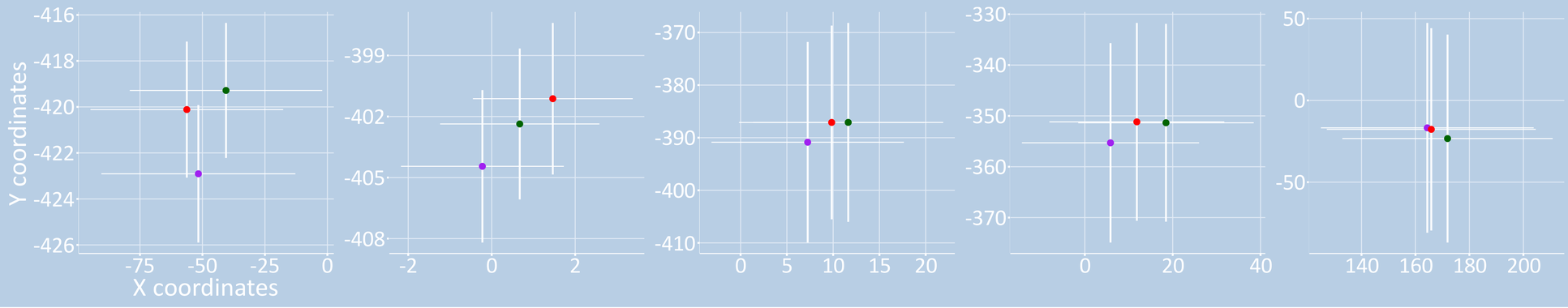
```
xCoord/yCoord ~ LearnerGroup
      + attestedness
      + L1likelihood
      + trialNumber
      + singularPosition
      + number
      + order
      + handedness
      + age
      + item
      + participant
```

Pre-Processing

- 101 data point per time normalized trial
- spatially normalized







Discussion

Learning a morphological category based on a phonemic cue is easy.
It remains unclear whether learning a morphological category based on durational cues is possible.

A new bootstrapping mechanism?

Probably not.

Cues must be present in production ✓

Cues must be perceived ✓

Cues must be made use of in learning ?

- according to **accuracy**
  - clear advantage for the PHONEMIC group and
  - clear disadvantage for the PHONETIC groups in morphological learning
- according to **mouse tracks**
  - no difference between all learner groups across all quantiles
  - trajectories of PHONETIC groups align with the trajectories of the PHONEMIC group - interpretability?
- **Are other cues necessary?**
  - coalition of cues – other additional subphonemic cues may be necessary
  - learners in natural language acquisition may rely on different cues such as context, S-V-agreement

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