Robust Acoustic Cues Indicate Upcoming Structure in Active and Passive Sentences

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Introduction

Temporary Syntactic Ambiguity
- Resolved as the sentence unfolds

The pig was kiss-ing the sheep active
The sheep was kiss-ed by the sheep passive

- Stromswold et al. (under review)
  ○ Listeners can predict syntax before hearing verbal inflection

Do naïve adult speakers also lengthen passive verb stems?
Are there other acoustic cues to active and passive structure?

Materials

Verbs
- Active: The _____ was _____-ing the _____.
- Passive: The _____ was _____-ed by the _____.

<table>
<thead>
<tr>
<th>Active</th>
<th>Passive</th>
</tr>
</thead>
<tbody>
<tr>
<td>chase</td>
<td>kick</td>
</tr>
<tr>
<td>punch</td>
<td>kiss</td>
</tr>
<tr>
<td>comb</td>
<td>shove</td>
</tr>
<tr>
<td>touch</td>
<td>pat</td>
</tr>
<tr>
<td>pinch</td>
<td>trap</td>
</tr>
<tr>
<td>poke</td>
<td>wash</td>
</tr>
</tbody>
</table>

Nouns
- bear, elephant, lion, rhino, cat, fox, monkey, sheep, cow, frog, mouse, turtle, dog, hippo, pig, zebra, duck, kangaroo, rabbit

Methods

Data Collection
- 7 adult monolingual native English speakers
  ○ Recorded audio in sound-attenuated booth
    • Sampling rate: 44.1 kHz
    • Equipment: Digital preamplifier and head-mounted condenser microphone
  ○ Read sentences once silently before reading aloud

Data Processing
- 3 coders marked morpheme boundaries using PRAAT
  ○ High inter-rater reliability (p < .001)
  ○ Calculated mean intensity, mean pitch, and duration

Results

Participant Analyses
- Significance passive verb stem lengthening effect for all participants
  ○ Significant for all 7 participants

Verb Analyses
- Phonological properties of verbs influenced verb stem lengthening
  ○ Voiced codas: comb, scrub, shave
  ○ Unvoiced codas: chase, kick, lick, pinch, poke, punch, push, touch, trap, wash

Verbs
- Active/Passive duration difference
  ○ Stop codas: kick, lick, poke, trap, scrub
  ○ Non-stop codas: chase, comb, kick, pinch, punch, push, touch, shove, wash

Auxiliary Analyses
- Auxiliary lengthening
  ○ All participants said: actives louder
  ○ Difference significant for 3 participants

Stop codas: kick, lick, poke, trap, scrub
Non-stop codas: chase, comb, kick, pinch, punch, push, touch, shove, wash

Stop/Non-stop Verb Stem Coda Effects
- Main effect: Active/Passive (p < .0005)
  ○ Passives 55 ms longer than actives

Discussion

- Passive verb stem lengthening is robust
  ○ Significant for all 7 participants

- Other acoustic cues
  ○ Some evidence of auxiliary lengthening
  ○ Some evidence of higher intensity in actives

- Why is the passive verb stem longer?
  ○ Stem longer in monosyllabic words for Germanic languages (Beckman & Edwards, 1990)
  ○ Active inflection -ing is syllabic
  ○ Passive inflection -ed is not

- Are speakers cuing upcoming syntax?
  ○ Likely not intentional
    • Participants were not speaking to someone else
    • Did not think audio would be used in a comprehension study
    • Particularly if effect is phonological

- Future work
  ○ Comprehension study using same sentences
    • In adults and in children
    • Follow-up production study
  ○ Include auxiliary has (e.g., The pig has kissed the sheep)

References


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