Introduction

- Competition: similar but not identical words are hard to say in sequence
- leads to higher error rates and longer planning and production time
- greater effects for sequences with mismatching codas (e.g. top tock) than mismatching onsets (e.g. top cop)

Explanations for higher error frequency:

1. higher activation for similar segments \( \Rightarrow \) temporal mis-selection \( \Rightarrow \) categorical substitution errors
2. frequency locking: change from 2:1 to 1:1 ratio, e.g.
   - cop: dorsal gestures are in a 1:1 ratio with labial gestures
   - top: apical and dorsal are in a 1:2 ratio with labial gestures
3. co-produced intrusion errors with continuously varying amplitudes (Goldstein et al. 2007, Poulger & Goldstein 2008)

Aims of this study:

- Connection between speech planning and speech errors: do competition and/or frequency ratio properties contribute to planning and execution?
- does the locus of equality matter, i.e. onset or coda?

Background

- Two or more different words in a row take longer to initiate than repetitions of the same word (e.g. Sternberger et al. 1988)
- similar sequences take longer to initiate than dissimilar: coda onsets: /\vot\, /\vot\, /\vot\ (Yamli et al. 1998)
- Locality: coda mismatch (top tock) vs. onset mismatch (top cop)

Materials and Methods

<table>
<thead>
<tr>
<th>Two EMA experiments:</th>
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<tbody>
<tr>
<td>- speeded repetition task for measuring error frequency:</td>
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<tr>
<td>- word repetitions at a mean rate of 200 ms, with 10-sec interstimuli periods</td>
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<tr>
<td>- delayed naming task for measuring and planning production time</td>
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- 1 speaker (Sp 1)
- 5 speakers (Sp 5)
- 20 repetitions of each word

Material:

- sequences of two words
- 7 repetitions for RT experiment
- conditions: same ("top tock"), onset different ("top cop"), coda different ("top tock")

Table: conditions with examples and number of different word sequences

<table>
<thead>
<tr>
<th>Example</th>
<th>repetition task</th>
<th>naming task</th>
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</thead>
<tbody>
<tr>
<td>same top</td>
<td>top-top</td>
<td>20</td>
</tr>
<tr>
<td>onset different</td>
<td>top-cop</td>
<td>4-12</td>
</tr>
<tr>
<td>coda different</td>
<td>top-top</td>
<td>2-7</td>
</tr>
</tbody>
</table>

Measurements: Latencies and durations for the naming task

Effects of phonological competition on speech production

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Results repetition task: error frequency

1. Defining errors (shown for codon tock)

<table>
<thead>
<tr>
<th>Levels</th>
<th>positions of primary and interposed articulator</th>
</tr>
</thead>
<tbody>
<tr>
<td>same</td>
<td>coda different</td>
</tr>
<tr>
<td>onset</td>
<td>coda</td>
</tr>
</tbody>
</table>

Types of errors:

- reductions: smaller amplitudes of intended gestures (full/partial)
- intrusions: excessive amplitudes of unconstrained articulator
- full intrusions: amplitude within the range of intended gestures
- substitutions: full intrusion of unconstrained articulator and full reduction of constrained articulator

2. Error frequency and error types for sequences with mismatching onsets or mismatching codas

- for all error categories: significantly higher rates for repetitions of words with different codas (top tock) than for different onsets (top cop)

3. Lag between medial consonants

- \( \approx \) p/t in cop top
- smaller value (more negative) \( \Rightarrow \) longer lag between constriction target regions, normalized by sequence duration
- mean for sequences of identical words is around zero \( \Rightarrow \) coda of first word is released synchronously with the onset of the constriction target region of the second word
- lag between constriction target regions is significantly shorter between identical words than for words with different onsets or codas

Results naming task: planning and execution time

1. Planning time: LatG1pv (left)

- planning time is longer for sequences of different items than of same items
- no significant difference between mismatching onset and mismatching coda: \( \approx same + OD > CD \)

2. Execution time (middle)

- the execution time was significantly longer for items with different codas (e.g. cop cop) than for same items (cop cop) and different onsets (cop top)
- no significant difference between sequences of same items and with mismatching onsets: \( \approx same + OD > CD \)

3. Lag between medial consonants

- \( \approx \) p/t in cop top
- smaller value (more negative) \( \Rightarrow \) longer lag between constriction target regions, normalized by sequence duration
- mean for sequences of identical words is around zero \( \Rightarrow \) coda of first word is released synchronously with the onset of the constriction target region of the second word
- lag between constriction target regions is significantly shorter between identical words than for words with different onsets or codas

Discussion:

Why are sequences with mismatching codas more error prone?

1. Speakers don’t care about correct production of codas
- reason: word recognition the word onset is more important
- evidence: general, assimilations and reductions are more frequent and temporal variability is lower in coda than in onset
- cannot explain longer execution time
- cannot explain the higher number of intrusions and substitutions

2. More variability causes higher error rate
- spatial variability is a precursor for frequency locking
- cannot explain longer execution time

3. Modifying/editing the motor plan takes more time for VC than for CV
- VC coupling is more frequent than CV coupling and takes longer to settle (see Nam 2007)
- Editing CV coupling (lip Sync) faster and stable
- Editing VC coupling (articulatory) slower and less stable

- spatial variability of VC
- evidence: VC universally dispreferred, later acquired
- more intrusions since higher variability reduces frequency locking
- probably longer execution times as well

Summary

Effect of similarity:

- identical words have:
  - shorter RT
  - shorter execution durations (compared to mismatch in the coda)
  - shorter lag between words

Repeating units is beneficial and speeding up performance

Locality effect: mismatch in coda vs. mismatch in onset

- no locality effect in latencies
- longer item duration for coda mismatch ("cop cop") than for onset mismatch ("cop top")

- higher intensity, reduction and substitution rates for mismatch in coda than for mismatch in onset

- for substitutions in agreement with Butterworth (1980)
- for intrusions in agreement with Tiede et al. (this meeting)

- Items sequences with different codas ("cop cop") are more error prone and take longer to produce than different onsets ("cop top") but not longer to initiate

Literature


Acknowledgments

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