Production of number agreement in adverse conditions: Speech-free noise interferes with processing at the formulation stage

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Introduction

- Under adverse, noisy conditions, speaking becomes arguably more difficult, but little is known about effects of noise on the formulation process for production
- Formulation is often considered fairly ‘automatic’ (Levelt, 1989), but might be subject to interference from concurrent processes engaging the same resources
- Babbles contains linguistic material, processing of which might create dual-task load - but is linguistic content the only source of difficulty?

Current study

- Do non-linguistic aspects of different background noise types interfere with formulation process?

Irrelevant sound effect (ISE)

- Speech-free, irrelevant sound has detrimental effect on performance in verbal serial recall tasks (e.g. Jones & Macken, 1993; Klatte & Hellbrück, 1993)
- Effect is profoundly stronger with temporally structured than with constant noise (Klatte, Kilcher et al., 1995)

Agreement attraction

- Hierarchically or linearly interpolated controller candidate can attract away verb agreement, e.g. number agreement (e.g. Bock, 1991; Eberhard, 2005):
  "The inscription on the ancient pillar was/were hard to read."
- Attraction effect has been shown to increase under other dual-task load conditions (Fayol, 1994; Hartsuiker & Barkhuysen, 2006)

Expectations

- Speech-free noise will create dual-task load
- Temporally structured noise will lead to stronger disruption than constant noise
- Under dual-task load, attraction effect will become stronger

Procedure

Stimulus sentences

- Singular head noun, match between head/local number
- Plural head noun, mismatch between head/local number
- Singular head noun, mismatch between head/local number
- Plural head noun, match between head/local number
- Singular head noun, mismatch between head/local number
- Plural head noun, match between head/local number
- Singular head noun, mismatch between head/local number
- Plural head noun, mismatch between head/local number

4 background noise conditions (blocked)

Results

<table>
<thead>
<tr>
<th>Condition</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Match</td>
<td>mismatch singular: 599 (10.1%)</td>
</tr>
<tr>
<td></td>
<td>match singular: 1048 (19.2%)</td>
</tr>
</tbody>
</table>

Error count

- silence (baseline): 1
- constant noise: 2
- multi-talker babble: 3
- single-talker babble: 4

Discussion

Number mismatch and plural markedness effect

- Results in silence replicate plural markedness effect
- Special, or ‘default’ status of singular

Noise effects

- Noise has measurable effect on error patterns
- No overall increase in attraction effect, but rather resorting to default singular marking
- Stronger effect of fluctuating noise

External monitoring effect?

- Interference with external phonological representation of head noun produced earlier by speaker, otherwise used as additional cue for verb form retrieval
- No effect of constant noise

Seriation mechanism?

- Changing state hypothesis: Competition for processing resources on seriation mechanism (Jones & Macken, 1993; Macken et al., 1999)
- Competition for processing time on seriation mechanism under fluctuating noise could increase likelihood of retrieval cue decay and ‘defaulting’ to singular verb form retrieval

Conclusion

- Speech-free, i.e. non-linguistic auditory input creates dual-task load that affects formulation process
- Acoustic characteristics of noise which yield temporally structured signal are important
- Interference between formulation and more ‘low-level’ auditory processing begs question for refined concept of domain-specificity

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References


