1. Introduction

Reference production

Referring expressions:
The monk calmed the girl. [The girl (NP) she (pronoun)] lost her mom.

Factors affecting English reference production:

**Competition effect** (e.g., Arnold & Griffin, 2007)
More pronouns in one-entity than two-entity contexts
*The monk* went for a walk. *The monk went for a walk with the girl.*

**Gender effect** (e.g., Fukumura Hyônà & Schoffield, 2013)
More pronouns in different-gender than same-gender contexts
*The monk* calmed the girl. *The nun calmed the girl.*

**Subjecthood effect** (e.g., Rohde & Kehler, 2014)
More pronouns referring to subject than non-subject entities
*The monk* calmed the girl.

The accessibility account

- Pronouns refer to highly accessible information
- NPs refer to relatively less accessible information (e.g., Ariel, 1990; Arnold, 2010)
- Limited memory and attention → different pieces of information compete for cognitive resources
- Stronger competition when there are multiple entities
- The more the entities share, the stronger the competition

**Competition effect:** (Arnold & Griffin, 2007)
The additional entity captures some attention → stronger competition in two-entity contexts → referent entity becomes less accessible → fewer pronouns

**Gender effect:** (Arnold & Griffin, 2007)
Stronger competition in same-gender contexts → referent becomes less accessible → fewer pronouns

**Subjecthood effect:**
Subject entities more accessible than non-subject (e.g., Bock & Warren, 1985) → more pronouns referring to the subject

Frequency effect

**Frequency effect on naming:**
HF representations more accessible than LF representations → HF words recognized and produced faster than LF words (e.g., Balota & Chumbley, 1984; Jescheniak & Levelt, 1994)

**Frequency effect on reference production**
*(Navarrete, Basagni, Alario & Costa, 2006)*:
“pronoun (this/that)+verb+adjective (new/old)”

Result: participants produced the given structure faster when the depicted object has a HF name rather than LF

**Limitations:** fixed structure, does not address the choice of reference form (pronoun/NP)

References:

2. Research question

Does frequency affect reference production in terms of the choice of reference form (pronoun/NP)?

3. Current study

Participants: 52 native English speakers from the U.S. (Amazon Mechanical Turk)

Task: Story continuation task

Conditions:

<table>
<thead>
<tr>
<th>Entity</th>
<th>Frequency</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>HF Subject</td>
<td>The girl (HF) ran to the pool.</td>
</tr>
<tr>
<td></td>
<td>LF Subject</td>
<td>The postman (LF) skated to the house.</td>
</tr>
<tr>
<td>Two</td>
<td>HF Subject-LF Object</td>
<td>(same gender)</td>
</tr>
<tr>
<td></td>
<td>(different gender)</td>
<td>LF Object-HF Subject</td>
</tr>
<tr>
<td></td>
<td>(same gender)</td>
<td>(different gender)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The nun (LF) forgave the boy (HF).</td>
</tr>
</tbody>
</table>

48 target items, 8 sentences per condition, constructed by 8 HF and 8 LF referent nouns, 16 equi-biased verbs used in the two-entity conditions (Hartshorne & Snedeker, 2013)

Analyses:
- Pronouns and NPs that strictly referred to the subject and object entities
- Logit mixed-effect models for competition, gender, subjecthood, and frequency in one-entity conditions (can better accommodate unbalanced data)
- Paired t-tests for frequency in two-entity conditions
- Due to the strong subject bias, we focused on the subject-object difference (% pronoun for subject-% pronoun for object) for frequency in two-entity conditions

4. Results

Replicated competition, gender, and subjecthood effects

**Frequency effect in two-entity contexts**

- One-entity: not significant
- Two-entity: significantly affected the subject-object difference in the rates of pronoun use

5. Conclusion

Frequency is a factor affecting pronoun production in the presence of multiple entities, along with gender and grammatical roles.

References:

Frequency affects pronoun production

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