Discourse behavior of possessives reflects the importance of interpersonal relationships

Jesse Storbeck & Elsi Kaiser
University of Southern California
jstorbec@usc.edu

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Who we are

Jesse Storbeck
jstorbec@usc.edu
www-scf.usc.edu/~jstorbec/

Elsi Kaiser
emkaiser@usc.edu
elsikaiser.com/
Possessives in discourse

- As people comprehend language, they keep track of relevant entities in a mental model of the discourse.
- Most of the work on how entities are represented on the discourse level has focused on simple nominal phrases (i.e. one NP → one discourse referent).
- What about complex NPs like possessive constructions?
  - Sam’s car refers to two entities → two discourse referents.
- How are possessives represented on the discourse level?
  - Does the extremely broad range of semantic relations possessives can express affect the way the two referents are represented in discourse?
Roadmap

1. Background on discourse, possessives, and interpersonal relationships
   ● Animate possession → interpersonal relationship (e.g. her brother)

2. Three competing hypotheses about discourse representations of possessions

3. A sentence-continuation experiment to assess our hypotheses
   ● We tested how animacy and being possessed affect a referent’s likelihood of re-mention in subsequent discourse
Discourse-level representation and prominence

- Entities in discourse vary in prominence (i.e. salience)
- Many factors can influence referent prominence, including:
  - **Grammatical role**
    - Subjects usually more prominent than objects (e.g. Chafe, 1976; Crawley et al., 1990)
  - **Animacy**
    - Animates usually more prominent than inanimates
    - Cross-linguistic effects on word order, choice of R-expression, etc. (e.g. Bock et al., 1992; Dahl & Fraurud, 1996)
Possessives in discourse

- **the car** → one entity explicitly mentioned  
  **simple nominal**
- **Sam’s car** → two entities explicitly mentioned  
  **possessive**

1. How are the two entities represented in discourse?
   - Simply two independent discourse referents?
   - Linked referents?

2. If linked, does the link differ across various types of possession relations?
   - e.g. *Sam’s car* [ownership], *Sam’s arm* [part-whole], *Sam’s dad* [kinship]
   - Same morphosyntactic realization in English, different semantics
Prior work: conflicting claims about prominence of possessors vs. possessions

- Little work on the discourse-level behavior of possessives
- Conflicting claims by accounts within Centering Theory (Grosz et al., 1995):
  - Possessors more prominent than possessions (Chae, 2003)
    - Sam’s car → Sam > car
  - Possessors more prominent than inanimate possessions but not animate possessions (Di Eugenio, 1998)
    - Sam’s car → Sam > car
    - Sam’s doctor → doctor > Sam
Prior work: the need for further research

- Centering Theory addresses the relative prominence of possessors and possessions (i.e. it ranks all referenced entities according to prominence)
  - Less clear how being possessed affects a referent’s discourse representation (i.e. what’s the effect of being possessed per se?)
- Possessive constructions are commonplace
  - Yet current discourse theories struggle with how to represent them
  - Thus, the lack of research on their behavior in discourse represents a significant theoretical gap
Interpersonal relationships

- With *animate* possessions, possessives denote *interpersonal relationships* (e.g. *her father, his cousin, their boss*)

- Interpersonal relationships are critical for human health and well-being (e.g. Cacioppo & Hawkley, 2009; Eisenberger & Cole, 2012)
  - Longevity (e.g. Holt-Lunstad et al., 2010)
  - Disease resistance (e.g. Miller et al., 2009)
  - Loneliness and cognitive decline (e.g. Tilvis et al., 2004)

- Interpersonal relationships are *cognitively privileged*
  - What about in discourse?
Three competing hypotheses about the discourse prominence of possessed referents:

1. The animacy hypothesis
2. The possessive hypothesis
3. The interaction hypothesis
1. The animacy hypothesis

- In general, animate referents are more prominent in discourse and memory (e.g. Bock et al., 1992; Dahl, 2008; Gelin, 2019)
- Therefore, animate possessions are more prominent than inanimate ones
  - Sam’s car → Sam > car
  - Sam’s doctor → doctor > Sam
- The animacy hypothesis predicts that this effect should be comparable in magnitude to animacy effects in simple nominals ([a] doctor > [a] car)
2. The possessive hypothesis

- Possessive NPs are referentially more complex than simple NPs
  - They refer to two entities, instead of just one
- Representational complexity promotes retrieval from memory (e.g. Hofmeister, 2011; Karimi & Ferreira, 2016; Troyer et al., 2016)
- Therefore, possessions are more prominent than simpler nominals
  - [Sam’s] car > [a] car
    - Being possessed → increased complexity → increased prominence
3. The interaction hypothesis

- If animacy hypothesis and possessive hypothesis hold →
  animate possessions should be most prominent
  - Maybe another contribution to animate possessions’ prominence?
    - **Interpersonal relationships**

- Interpersonal relationships support human health → cognitive privilege
  - Adaptive memory theories: better memory for animates arose from evolutionary importance of identifying threats, mates, and social groups (i.e. interpersonal relationships) (e.g. Nairne et al., 2013)

- Due to the physiological, cognitive, and adaptive importance of interpersonal relationships, animate possessions are exceptionally prominent in discourse
Research questions

● How are possessives represented on the discourse level?

● Do different semantic possession relations affect representation in discourse?
  ○ *Sam’s car* [ownership] vs. *Sam’s doctor* [interpersonal relationship]

● Are different types of possessed entities more or less likely to be mentioned subsequently in the discourse? With what linguistic form?

● Can we find support for our animacy hypothesis, possessive hypothesis, or interaction hypothesis?
Method: sentence continuation paradigm

- Sentence continuation task measures the discourse prominence of competing referents (e.g. Arnold, 2001; Stevenson et al., 1994)
- Participants get a prompt sentence, produce an additional sentence which naturally continues the discourse
Analysis of sentence continuations

- Dependent variable(s): which entities from the prompt do people mention in their continuations? In what grammatical position? With what form?
  - Higher likelihood of mention → more prominent
  - Focus today on likelihood of mention (ask me about pronominalization data in Q&A 😃)

- Subject position is most prominent (e.g. Chafe, 1976; Crawley et al., 1990)
  - Thus the most prominent referent from the prompt is likely to be realized as the subject of the continuation (e.g. Stevenson et al., 1994)

- We understand mentions across the entire continuation as a correlated, perhaps more holistic measure
Experiment design: prompt structure

**Melissa lupted a/her chauffeur/backpack.**

- 2×2 design manipulating properties of direct object:
  - Animacy (human role nouns vs. alienable inanimates)
  - Possessed vs. indefinite
- Nonce verbs to minimize potential effects of verb semantics
  - Implicit causality (e.g. Hartshorne & Snedeker, 2013)
  - Nonce verbs can be held constant within items
  - Post-hoc analysis: no consistent biases for nonce verbs
- Role nouns’ stereotypical gender contrasted with name (Misersky et al., 2013)
  - This is only in order to mitigate potential pronoun ambiguity
Example targets (2 of 24)

<table>
<thead>
<tr>
<th>Indefinite Animate</th>
<th>Possessive Animate</th>
<th>Indefinite Inanimate</th>
<th>Possessive Inanimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melissa lupted a chauffeur.</td>
<td>Melissa lupted her chauffeur.</td>
<td>Melissa lupted a backpack.</td>
<td>Melissa lupted her backpack.</td>
</tr>
</tbody>
</table>
Example responses

- Jennifer pranned her surgeon.
  - She asked him how long her surgery would last.
  - The surgeon did a good job.
  - It wasn't very sanitary for an OR.
Coding responses

- Jennifer pranned her surgeon.
  - She asked him how long her surgery would last.

1. What is mentioned in the **subject position** of the continuation?
   - She $\rightarrow$ preceding subject

2. What is mentioned anywhere in the continuation?
   - She, her $\rightarrow$ preceding subject, him $\rightarrow$ preceding object

- Collapsing across all forms of mention (ask me about pronominalization data in Q&A 😊)
- 97% agreement in double-coded 10% subset of the responses
Statistical analysis

- Generalized linear mixed-effects (glmer) models in lme4 (Bates et al., 2015)
- Models fit to binomial outcome of mentioning a given entity from the prompt in a given position of the continuation → combinations yield four models
  - Preceding *subject* as *continuation subject*? Yes → 1, No → 0
  - Preceding *object* as *continuation subject*?
  - Preceding *subject* mentioned anywhere?
  - Preceding *object* as mentioned anywhere?
- Maximal convergent models
  - All have random intercepts for items and participants
  - Random slopes added when they did not result in non-convergence
Predictions

- The animacy hypothesis, possessive hypothesis, and interaction hypothesis make different predictions of the results.
- Predictions broadly relevant for subject position and across the continuation:
  - Subject position is a “winner take all” view of prominence.
  - Mentions across the continuation will be correlated but more inclusive.
- These predictions relate mainly to mentions of the preceding object, since that is where the experimental manipulation takes place.
Predictions: the animacy hypothesis

- The animacy hypothesis
  - Animate possessions are more prominent than inanimate ones
    - Mentions of animate objects > inanimate objects
    - Animacy effect in possessives parallel to its effect in indefinites
    - We expect a main effect of animacy in the models for mentions of the preceding object
Predictions: the possessive hypothesis

- The possessive hypothesis
  - Possessions are more prominent than simple NPs (here, indefinites)
    - Mentions of possessions > indefinites
    - Possessive effect in animates parallel to its effect in inanimates
    - We expect a main effect of being possessed in the models for mentions of the preceding object
  - Note that differences in givenness and specificity between possessions and indefinites (e.g. Barker, 2000; von Heusinger, 2011) could affect this prediction, but more on this in the results/discussion
Predictions: the interaction hypothesis

- The interaction hypothesis
  - Animate possessions are exceptionally prominent in discourse
    - Superadditive effect of animacy and possession together
    - We expect an interaction of animacy and being possessed in the models for mentions of the *preceding object*
Results: two sets of figures

- Jennifer pranned her surgeon.
  - She asked him how long her surgery would last.

1. What is mentioned in the subject position of the continuation?
   - Subject position is mutually exclusive, so proportions within a condition will sum to 1* (*except for a very small number of they responses)

2. What is mentioned anywhere in the continuation?
   - Both entities can be mentioned across the continuation, so proportions within a condition do not sum to 1
Results: subject position of continuations (Fig. 1)

“Melissa lupted a/her chauffeur/backpack.”
Results: subject position of continuations (Fig. 1)

“Melissa lupted a/her chauffeur/backpack.”
Results: subject position of continuations (Fig. 1)

- **Animacy effect:** preceding subjects mentioned more often as continuation subject when preceding object is inanimate (p<0.01)

"Melissa lputed a/her chauffeur/backpack."

![Bar chart showing proportion of continuations for different subject and object animacy conditions.](image.png)

Continuation subject refers to preceding...

- [subject]
- [object]
- [other]
Results: subject position of continuations (Fig. 1)

- **Animacy effect:** animate preceding objects more likely than inanimates to be mentioned in subject position of continuations (p<0.001)

```
Melissa lupted a/her chauffeur/backpack.
```
Results: subject position of continuations (Fig. 1)

- **Interaction:** animate possessed *preceding objects* are extra likely as continuation subjects (i.e. animacy:possession interaction, p=.05; simple effect, p=.03)

```
Melissa lupted a/her chauffeur/ her backpack.
```
Results: all positions of continuations (Fig. 2)

Continuation contains mention of preceding...

- subject
- object

```
“Melissa lupted a/her chauffeur/backpack.”
```
Results: all positions of continuations (Fig. 2)

“Melissa lupted a/her chauffeur/backpack.”
Results: all positions of continuations (Fig. 2)

- **No significant effects:** preceding subjects are equally likely across conditions to be mentioned anywhere in the continuation.

![Graph showing proportions of continuations](image)

“Melissa lupted a/her chauffeur/backpack.”
Results: all positions of continuations (Fig. 2)

- **Interaction:** animate possessed *preceding objects* are extra likely to be mentioned anywhere in the continuation (i.e. animacy:possession interaction, p<.01)

```
Melissa lupted a/her chauffeur/backpack.
```

![Graph showing interaction between animacy and possession]
Results: summary

- Animacy effects in subject position for preceding subjects and objects, but not across the entire continuation.
- **Interactions:** animate possessions particularly likely to be mentioned:
  - Effects in both subject position and across the entire continuation.
  - These effects not accounted for by either animacy or possession alone.
  - Cognitive importance of interpersonal relations influencing language?
Predictions revisited

1. Animacy Hypothesis
   ○ Mentions of animate objects > inanimate objects
   ○ Animacy effect in possessives parallel to its effect in indefinites

2. Possessive Hypothesis
   ○ Mentions of possessed objects > indefinite objects
   ○ Being possessed affects animates and inanimates similarly

3. Interaction Hypothesis
   ○ Possessed animate objects mentioned most often
   ○ Superadditive effect of animacy + possession
Predictions revisited

1. **✗ Animacy Hypothesis**
   - Mentions of animate objects > inanimate objects
   - Animacy effect in possessives parallel to its effect in indefinites

2. **✗ Possessive Hypothesis**
   - Mentions of possessed objects > indefinite objects
   - Being possessed affects animates and inanimates similarly

3. **✓ Interaction Hypothesis**
   - Possessed animate objects mentioned most often
   - Superadditive effect of animacy + possession
Research questions reviewed

- Are different types of possessed entities more or less likely to be mentioned subsequently in the discourse?

- Do different possession relations affect representation in discourse?

- Can we find support for our animacy hypothesis, possessive hypothesis, or interaction hypothesis?
Research questions reviewed

- Are different types of possessed entities more or less likely to be mentioned subsequently in the discourse? ✓ YES

- Do different possession relations affect representation in discourse?

- Can we find support for our animacy hypothesis, possessive hypothesis, or interaction hypothesis?
Research questions reviewed

- Are different types of possessed entities more or less likely to be mentioned subsequently in the discourse?  
  ✓ YES

- Do different possession relations affect representation in discourse?  
  ✓ YES, results compatible with such a theory

- Can we find support for our animacy hypothesis, possessive hypothesis, or interaction hypothesis?
Research questions reviewed

- Are different types of possessed entities more or less likely to be mentioned subsequently in the discourse?
  
  ✓ YES

- Do different possession relations affect representation in discourse?
  
  ✓ YES, results compatible with such a theory

- Can we find support for our animacy hypothesis, possessive hypothesis, or interaction hypothesis?
  
  ✓
Discussion

- Possessed animates are especially prominent in discourse, as measured by their likelihood of re-mention
  - In general, animates are more prominent in discourse and memory, but possessed animates seem to get a special boost in prominence
    - Possessed animates explicitly denote interpersonal relationships
    - May relate to non-linguistic theories on importance of interpersonal relationships (social, physiological, and adaptive benefits)

- Compatible with Di Eugenio’s (1998) Centering Theory account
  - Furthermore, we show that this boost is due to more than a simple animacy effect or the additive effects of animacy and possession
Discussion

- We observe expected animacy effects (e.g. competition for prominence between animate referents) but what about an overall possessive effect?
  - Possessions and indefinites may differ in givenness and specificity, which affect prominence (e.g. Barker, 2000; Kaiser, 2011; von Heusinger, 2011)
    - Potential to mask a main effect of possession
    - Maybe a different result with definites?

- Crucially, givenness/specificity differences do not explain interactions
  - Givenness and specificity should not vary with animacy
  - Choosing a different class of nominals to compare with possessions should modulate possessive effect, but interactions should remain
Thank you for your attention and feedback!

jstorbec@usc.edu
Appendix: pronominalization results

- Mentions of the preceding subject were much more likely to use a pronoun
Appendix: pronominalization results

- This holds across conditions, even in subject position with preceding animate objects, where the preceding object was more likely as continuation subject
  - Likelihood of mention ≠ likelihood of pronominalization (Kehler & Rohde, 2013)

Pronoun refers to preceding...

Subject of continuation

<table>
<thead>
<tr>
<th>Condition</th>
<th>Indefinite Animate</th>
<th>Possessed Animate</th>
<th>Indefinite Inanimate</th>
<th>Possessed Inanimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conditional probability of pronoun given referent</td>
<td>1.0</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Anywhere in continuation

<table>
<thead>
<tr>
<th>Condition</th>
<th>Indefinite Animate</th>
<th>Possessed Animate</th>
<th>Indefinite Inanimate</th>
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<td>0.8</td>
<td>0.7</td>
</tr>
</tbody>
</table>
Appendix: pronominalization results

Mention (pronoun) refers to preceding...

Subject of continuation

<table>
<thead>
<tr>
<th>Count of responses</th>
<th>Indefinite Animate</th>
<th>Possessed Animate</th>
<th>Indefinite Inanimate</th>
<th>Possessed Inanimate</th>
</tr>
</thead>
</table>

Anywhere in continuation

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<th>Count of responses</th>
<th>Indefinite Animate</th>
<th>Possessed Animate</th>
<th>Indefinite Inanimate</th>
<th>Possessed Inanimate</th>
</tr>
</thead>
</table>
## Appendix: item details

<table>
<thead>
<tr>
<th>Name</th>
<th>Nonce Verb</th>
<th>Animate Object</th>
<th>Inanimate Object</th>
<th>Name</th>
<th>Nonce Verb</th>
<th>Animate Object</th>
<th>Inanimate Object</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carol</td>
<td>debbed</td>
<td>butler</td>
<td>violin</td>
<td>Megan</td>
<td>gerped</td>
<td>chiropractor</td>
<td>clarinet</td>
</tr>
<tr>
<td>Emily</td>
<td>pletched</td>
<td>stockbroker</td>
<td>saxophone</td>
<td>Melissa</td>
<td>lupted</td>
<td>chauffeur</td>
<td>backpack</td>
</tr>
<tr>
<td>Helen</td>
<td>swugded</td>
<td>tattooist</td>
<td>unicycle</td>
<td>Rebecca</td>
<td>gweeshed</td>
<td>bodyguard</td>
<td>umbrella</td>
</tr>
<tr>
<td>Jennifer</td>
<td>pranned</td>
<td>surgeon</td>
<td>blanket</td>
<td>Sarah</td>
<td>chooped</td>
<td>plumber</td>
<td>scarf</td>
</tr>
<tr>
<td>Jessica</td>
<td>rulked</td>
<td>electrician</td>
<td>chandelier</td>
<td>Stephanie</td>
<td>shupped</td>
<td>mechanic</td>
<td>flashlight</td>
</tr>
<tr>
<td>Kimberly</td>
<td>chabbed</td>
<td>chef</td>
<td>fork</td>
<td>Veronica</td>
<td>brilted</td>
<td>priest</td>
<td>towel</td>
</tr>
</tbody>
</table>
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<th>Nonce Verb</th>
<th>Animate Object</th>
<th>Inanimate Object</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthony</td>
<td>jolfed</td>
<td>florist</td>
<td>toaster</td>
<td>Jason</td>
<td>joiped</td>
<td>congresswoman</td>
<td>wheelbarrow</td>
</tr>
<tr>
<td>Brad</td>
<td>churbed</td>
<td>receptionist</td>
<td>screwdriver</td>
<td>Joseph</td>
<td>tammed</td>
<td>babysitter</td>
<td>microwave</td>
</tr>
<tr>
<td>Brian</td>
<td>sibbed</td>
<td>waitress</td>
<td>basket</td>
<td>Kevin</td>
<td>blorned</td>
<td>stewardess</td>
<td>dictionary</td>
</tr>
<tr>
<td>Daniel</td>
<td>zatted</td>
<td>nurse</td>
<td>jacket</td>
<td>Mark</td>
<td>meared</td>
<td>housekeeper</td>
<td>stereo</td>
</tr>
<tr>
<td>Fred</td>
<td>risped</td>
<td>nanny</td>
<td>broom</td>
<td>Robert</td>
<td>dasped</td>
<td>secretary</td>
<td>television</td>
</tr>
<tr>
<td>James</td>
<td>fammed</td>
<td>hairdresser</td>
<td>thermometer</td>
<td>William</td>
<td>dreezed</td>
<td>psychic</td>
<td>helmet</td>
</tr>
</tbody>
</table>
Appendix: glmer formulae

subject_model <- glmer(glmer_subj ~ animacy * det
    + (1 + animacy | subjectID)
    + (1 | itemID)

object_model <- glmer(glmer_obj ~ animacy * det
    + (1 + animacy + det | subjectID)
    + (1 | itemID)

subject_model_anywhere <- glmer(itemSubjMention ~ animacy * det
    + (1 + animacy | subjectID)
    + (1 | itemID)

object_model_anywhere <- glmer(itemObjMention ~ animacy * det
    + (1 + animacy | subjectID)
    + (1 | itemID)
References


References


Di Eugenio, B. (1998). Centering in Italian. In M. Walker, A. Joshi & E. Prince (Eds.), *Centering theory in discourse* (pp. 115-137)


References


References


