Animacy and event structure modulate long-distance pronominal anaphora in discourse

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Resolving pronominal anaphora in discourse

Previous research suggests that pronominal anaphora resolution between **adjacent** clauses is modulated by factors including information structure [1,2], event structure [3], and (potentially) animacy [1].

How do these factors influence pronominal anaphora resolution between **non-adjacent** clauses? What other factors may play a role?

Two views of long-distance anaphora resolution

- The accessibility of a potential antecedent is modulated by its salience.
  - Factors that can facilitate short-distance anaphora resolution, like syntactic focus, may facilitate long-distance noun phrase anaphora resolution [4].
- The accessibility of a potential antecedent is structurally determined.
  - Rooted in formal pragmatic theories positing hierarchical discourse structure [5,6].
  - Rules of discourse structure-building dictate that only potential antecedents in certain structural positions are hierarchically accessible; the rest are inaccessible.

Hypotheses & Predictions

Prominence: Antecedent prominence modulates long-distance anaphora resolution. The more prominent an antecedent, the easier to resolve to it.

- Predicts that any salience-modulating factor can affect pronoun resolution, and thus discourse coherence.
- Allows interactions between such factors.

Grammatical constraint: Discourse-structural accessibility of potential antecedents governs long-distance anaphora resolution [5,6].

- Predicts that an unfolding discourse will become unacceptable at a sentence with a structurally unresolvable pronoun.
- Does not predict any (other) antecedent prominence effects.

The Stops-Making-Sense (SMS) Task [7]

- Non-cumulative, sentence-by-sentence presentation
- For each sentence, decide, *Does the story make sense so far?*
  - '*Yes*' response advances trial to next sentence.
  - '*No*' response bypasses any remaining sentences in trial.
- Linking assumption: Sentences with unresolvable/hard-to-resolve pronouns will be rejected at a higher rate than those without.

Experiment 1: Animacy (n = 41)

Key finding: Long-distance pronominal anaphora resolution appears to be easier/more acceptable with animate antecedents vs. inanimate ones.

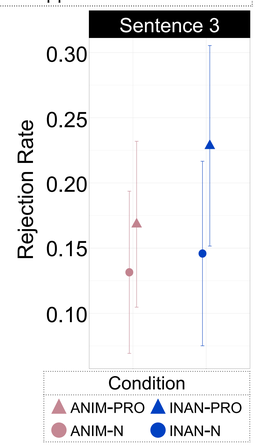
We view animacy as a hierarchy (animate>inanimate) [8] that maps to salience.

2x2 SMS task crossing Animacy (**ANIM**ate, **INAN**imate) and NP Type (Noun, **PRO**noun) for 40 items (+ 40 fillers).

Sentence	ANIMATE		INANIMATE	
1	Jessie saw **an elderly man** in front of a quaint farmhouse on her morning walk.		Jessie saw **a rickety mailbox** in front of a quaint farmhouse on her morning walk.	
2	She continued toward the end of the lane.			
3	N	PRO	N	PRO
	The man fell over.	He fell over.	The mailbox fell over.	It fell over.
4	Jessie circled back to investigate what had happened.			

brms **logistic m/e models for rejection rates at Sentence 3:**

Crossed model	$\hat{\beta}$	95% CrI	Pr(β<0)
***N vs. PRO**	-1.07	(-1.77, -0.47)	1.00
ANIM vs. INAN	-0.40	(-0.99, 0.22)	0.91
Animacy x NP Type	-0.58	(-1.74, 0.49)	0.86
Nested models	$\hat{\beta}$	95% CrI	Pr(β<0)
ANIM-N vs. INAN-N	-0.02	(-1.15, 1.22)	0.54
***ANIM-PRO vs. INAN-PRO**	-0.64	(-1.26, -0.05)	0.98
***ANIM-N vs. ANIM-PRO**	-0.78	(-1.66, 0.00)	0.97
***INAN-N vs. INAN-PRO**	-1.41	(-2.45, -0.58)	1.00



? Prominence, ✓ Grammatical constraint:

- PRO is rejected more frequently than N.

✓ Prominence, X Grammatical constraint:

- INAN-PRO is rejected more frequently than ANIM-PRO.

Chekhov's mailbox?

- At Sent. 2, INAN is rejected more frequently than ANIM (-0.66, [-1.17, -0.17]).
- Inanimates less likely than animates to be (independent) agents.
- Introducing an inanimate may lead to inference that it will be relevant in the continuation of the narrative. Sent. 2 foils this expectation.

Fillers: Same set used for both experiments.

- 20 fully coherent, 20 became incoherent at points ranging from Sentences 2-4.
- Varied causes of incoherence, unrelated to NP/pronominal anaphora.
- Incoherent fillers were rejected more frequently than coherent fillers, and more frequently at the expected incoherence points vs. elsewhere.

Experiment 2: Event structure (n = 48)

Key finding: Long-distance pronominal anaphora resolution may be slightly easier with verbs of (physical) contact vs. verbs of perception.

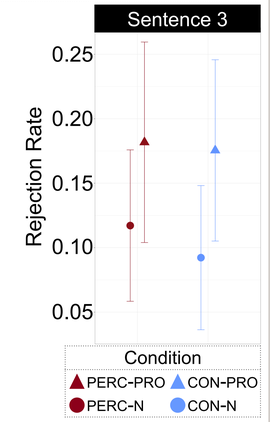
Tentative hypothesis: A contact verb's Theme is more salient than that of a perception verb because it's more affected by the event.

2x2 SMS task crossing Verb Type (**PERC**eption, **CON**tact) and NP Type (Noun, **PRO**noun) for 40 items (+ 40 fillers).

Sentence	PERCEPTION		CONTACT	
1	Jessie **saw** an elderly man in front of a quaint farmhouse on her morning walk.		Jessie **brushed by** an elderly man in front of a quaint farmhouse on her morning walk.	
2	She continued toward the end of the lane.			
3	N	PRO	N	PRO
	The man fell over.	He fell over.	The man fell over.	He fell over.
4	Jessie circled back to investigate what had happened.			

brms **logistic m/e models for rejection rates at Sentence 3:**

Crossed model	$\hat{\beta}$	95% CrI	Pr(β<0)
***N vs. PRO**	-0.82	(-1.41, -0.21)	0.99
CON vs. PERC	0.13	(-0.44, 0.66)	0.31
Verb Type x NP Type	-0.44	(-1.70, 0.66)	0.77
Nested models	$\hat{\beta}$	95% CrI	Pr(β<0)
PERC-N vs. CON-N	0.31	(0.42, -0.50)	0.22
PERC-PRO vs. CON-PRO	-0.10	(-0.92, 0.59)	0.59
***PERC-N vs. PERC-PRO**	-1.09	(-2.05, -0.24)	0.99
CON-N vs. CON-PRO	-0.63	(-1.36, 0.20)	0.94



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✓/? Prominence, X Grammatical constraint:

- PERC-PRO is rejected more frequently than PERC-N.

Discussion

Mapping discourse-structural positions to prominence?

- Can the NP Type effects we observe be attributed to discourse-related factors that are not rooted in grammatical constraints?
- To test: Long-distance pronominal anaphora that are structurally accessible.

Limited evidence that event structure affects long-distance anaphora:

- No effect of Verb Type in PRO conditions.
- Only tested two verbs; *brush by* may imply Theme is not particularly salient.

Conclusions

We find evidence in support of **Prominence**:

- Animates make long-distance pronoun resolution easier relative to inanimates.

We find mixed evidence regarding **Grammatical constraint**:

- Discourse coherence is lower with structurally inaccessible pronouns.
- However, animacy and (tentatively) event structure modulate the effect.

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