Coherence-Driven Effects in Relative Clause Processing

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Modeling sentence comprehension

- Combine words to form a sentence
- Combine sentences to form a coherent discourse

QUESTIONS:
- Do comprehenders bring expectations from the discourse level to bear on the resolution of syntactic ambiguity?
- Do these expectations impact online processing?
Relative clause attachment ambiguity

- Previous work on RC attachment suggests that low attachment in English is preferred (Cuetos & Mitchell 1988; Frazier & Clifton 1996; Carreiras & Clifton 1999; Fernandez, 2003; but see also Traxler, Pickering, & Clifton, 1998)

- RC attachment is primarily analyzed in consideration of syntactically-driven biases.

(1) Someone shot the servant of the actress who was on the balcony.
Discourse biases in RC processing

- Previous work: discourse context is referential context
  - RC pragmatic function is to modify or restrict identity of referent
  - RC attaches to host with more than one referent (Desmet et al. 2002, Zagar et al. 1997, Papadopoulou & Clahsen 2006)

(2) There was a servant who was working for **two actresses**. Someone shot the servant of **the actress** who was on the balcony.

(3) There were **two servants** working for a famous actress. Someone shot **the servant** of the actress who was on the balcony.
A different type of discourse bias

- Observation #1: RCs can also provide an explanation

(4) The boss fired the employee who always showed up late.

→ (cancelable) implicature that employee’s lateness is the explanation for the boss’ firing

AP News headlines with explanation-providing RC

(5) “Atlanta Car Dealer Murdered 2 Employees Because They Kept Asking for Raises” [article headline]

(6) “Boss Killed 2 Employees Who Kept Asking for Raises” [abbreviated news summary headline]
Biases from implicit causality verbs

- Observation #2: IC verbs are biased to explanations
  → in story continuations, IC verbs yield more explanations than NonIC verbs (Kehler, Kertz, Rohde, Elman 2008)

  (7) IC: John detests Mary. ___She is arrogant and rude___.
  (8) NonIC: John babysits Mary. ___Mary’s mother is grateful___.

- Observation #3: w/explanation, IC have next-mention bias
  → in sentence completions, IC verbs like detest yield more object next mentions (Caramazza, Grober, Garvey, Yates 1974; Brown & Fish 1983; Au 1986; McKoon, Greene, Ratcliff 1993; inter alia)

  (9) IC: John detests Mary because ___she is arrogant___.
  (10) NonIC: John babysits Mary because ___he/she/they___.
Proposal: IC biases in RC attachment

#1 Relative clauses can provide explanations
#2 IC verbs create an expectation for an upcoming explanation
#3 Certain IC verbs have a next-mention bias to the object

(11) NonIC: John babysits the children of the musician who …
   expected
   unexpected  
   (a) is a singer at the club downtown. (low)
   (b) are students at a private school. (high)

(12) IC: John detests the children of the musician who …
   expected  
   (a) is a singer at the club downtown. (low)
   (b) are arrogant and rude. (high)

- Discourse Hypothesis: IC verbs will increase comprehenders’ expectations for a high-attaching RC

- Null Hypothesis: Verb type will have no effect on attachment
Sentence completion study

IC:  John detests the children of the musician who …
NonIC:  John babysits the children of the musician who …

- Web-based experiment
- 52 monolingual English-speaking UCSD undergrads
- Instructed to write a natural completion
- 2 judges annotated responses:
  - RC function: ‘only restrict’ vs. ‘restrict AND explain’
  - RC attachment: ‘high’ vs. ‘low’
- Analysis only on trials with unanimous judge agreement
Completion results: RC function

More explanation-providing RCs following IC than Non-IC

IC: John detests the children of the musician who ...
NonIC: John babysits the children of the musician who ...
Completion results: attachment

More high-attaching RCs following IC verbs than NonIC

IC: John detests the children of the musician who …
NonIC: John babysits the children of the musician who …
Evidence that expectations about upcoming explanation-providing RCs influence RC attachment

Evidence in support of the discourse hypothesis

✗ Null Hypothesis: low attachments across the board
✓ Discourse Hypothesis: more high-attaching RCs following IC verbs than NonIC verbs

→ Question: are people using these discourse-level expectations in their online processing?
Online processing

- For online effects to emerge, comprehenders must be implicitly aware that:
  
  #1 Relative clauses can provide explanations
  #2 IC verbs create an expectation for an upcoming explanation
  #3 Certain IC verbs have a next-mention bias to the object

  → combine these discourse-level biases and expectations to make an online syntactic decision
Online reading study

IC: John detests the children of the musician who …
(low) is generally arrogant and rude.
(high) are generally arrogant and rude.

NonIC: John babysits the children of the musician who …
(low) is generally arrogant and rude.
(high) are generally arrogant and rude.

- Null Hypothesis: main effect of attachment height
  - low-attaching RCs easier to process than high-attaching RCs

- Discourse Hypothesis: verbtype x attachment interaction
  - high-attaching RCs easier in IC condition than in NonIC condition
  - low-attaching RCs harder in IC condition than in NonIC condition
Reading time study

- 58 monolingual English-speaking UCSD undergrads
- DMDX self-paced moving-window software
- Press button to reveal words & answer questions
- Analyses:
  - Reading time
  - Comprehension-question accuracy
Online results: residual reading times

IC.low: detests the children of the musician who is generally arrogant...
IC.high: detests the children of the musician who are generally arrogant...
NonIC.low: babysits the children of the musician who is generally arrogant...
NonIC.high: babysits the children of the musician who are generally arrogant...
Online results: critical region

Spillover_1:

IC.low: detests the children of the musician who is generally arrogant...
IC.high: detests the children of the musician who are generally arrogant...
NonIC.low: babysits the children of the musician who is generally arrogant...
NonIC.high: babysits the children of the musician who are generally arrogant...
Online results are consistent with offline results: bias to high attachments emerges following IC verbs.

As predicted, high-attaching RCs were read faster than low-attaching RCs in the IC condition, while the reverse was true in the NonIC condition → Crossover interaction.

Effects persist in comprehension-question accuracy.
- Significant crossover interaction by subjects.
- Low-attaching RCs in IC condition yielded worst accuracy.
Summary & Conclusions

- 3 Observations
  #1 Relative clauses can provide explanations
  #2 IC verbs create an expectation for an upcoming explanation
  #3 Certain IC verbs have a next-mention bias to the object

- Do people use discourse-level expectations and biases as they resolve local syntactic ambiguity?
  - YES, in RC processing
  - Where else might comprehenders be using discourse-level expectations…?

- Models of sentence processing need to incorporate these types of discourse-driven expectations.
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