Coherence and Donkey Anaphora: An Experiment

EZRA KESHET

EKESHET@UMICH.EDU

UNIVERSITY OF MICHIGAN

Background

COHERENCE AND ANAPHORA

Discourse Coherence

- Researchers have long pointed out unspoken connections between sentences (see Hobbs 1979, Kehler 2002).

- PARALLEL:
  - I like Semantics.
    You like it, too.

- EXPLANATION:
  - George was late to class.
    He had to shovel snow.

- RESULT:
  - Jill was cold. She shivered.

- NARRATION
  - Bob walked in. He sat down.

- ELABORATION.
  - Sarah was tall.
    She was over six feet tall.

- GENERALIZATION
  - Fred likes the soccer coach.
    Boys usually like him.

Discourse Coherence

- Notice that this coherence tends to drive pronoun interpretation (Hobbs 1979).

- PARALLEL:
  - I like Semantics. You like *it*, too.

- EXPLANATION:
  - George was late to class. *He* had to shovel snow.

- RESULT:
  - Jill was cold. *She* shivered.

- NARRATION
  - Bob walked in. *He* sat down.

- ELABORATION.
  - Sarah was tall. *She* was over six feet tall.

- GENERALIZATION
  - Fred likes the soccer coach. Boys usually like *him*.

Coherence and Anaphora

- Some coherence-driven anaphora is quite strong:
  - Margaret Thatcher admires Hillary Clinton, and George W. Bush absolutely adores her. (Kehler 2002)
- And choice of relation in ambiguous cases correlates with choice of antecedent:
  - Don likes Jim. He helped him win the contest.
    - Don likes Jim ***and therefore*** Don helped Jim…
    - Don likes Jim ***because*** Jim helped Don…

Experiment

- Kehler, Kertz, Rohde, & Elman (2008) ran a study to test how coherence constrains pronoun reference.
- They used a 2x2x2 design:
  - Pronoun Position, Coherence Relation, PP/NoPP
- Study participants saw cases like this:
  - (11) Samuel threatened Justin with a knife, and
    - a. . . . Erin blindfolded him (with a scarf).   [Parallel]
    - b. . . . Erin stopped him (with pepper spray).   [Result]
    - c. . . . he blindfolded Erin (with a scarf).   [Parallel]
    - d. . . . he alerted security (with a shout).   [Result]
- Results were designed to favor reverse reference.

Results

- Study participants overwhelmingly chose the coreference shown:

    - (11) Samuel threatened Justin with a knife, and

        - a. . . . Erin blindfolded him (with a scarf). [Parallel]
        - b. . . . Erin stopped him (with pepper spray). [Result]
        - c. . . . he blindfolded Erin (with a scarf). [Parallel]
        - d. . . . he alerted security (with a shout). [Result]

- For Parallel cases, they matched subject/subject, object/object.

- For Result cases, this pattern was reversed.

Two Follow-up Questions

- 1. Do coherence relations exist between embedded clauses?

  - The girl [who fell on the ice] [broke her arm].

- 2. Does coherence constrain the meanings of non-referential pronouns?

  - Every boy who saw a puppy wanted to pet it.

1. Embedded Discourse Coherence

- Similar relations and effects on pronouns seem to hold between embedded clauses:

- PARALLEL:
  - If you like Semantics, I like *it*, too.

- EXPLANATION:
  - George was late because *he* had to shovel snow.

- RESULT:
  - The girl who was cold couldn't stop *herself* from shivering.

- NARRATION
  - After Bob walked in, *he* sat down.

- ELABORATION.
  - When I say Sarah was tall, I mean *she* was over six feet tall.

- EXCEPTION
  - Although Fred hates the soccer coach, I've found that boys usually like *him*.

2. Coherent Donkey Pronouns

- Even with donkey anaphora:

- PARALLEL:
  - If you like a subject, then I like ***it***, too.
- EXPLANATION:
  - Whenever a boy was late, ***he*** had had to shovel snow.
- RESULT:
  - Each day a girl was cold, ***she*** shivered.

- NARRATION
  - Every time a man walked in, ***he*** sat down.
- ELABORATION.
  - When I say a woman is tall, I mean ***she*** is over six feet tall.
- EXCEPTION
  - Even when Fred hates a soccer coach, I've found that other boys usually like ***him***.

Experiment

COHERENT DONKEYS

Extension: Donkey Anaphora

- I recreated the Kehler et al. study using donkey anaphora instead of referential pronouns:
  - Whenever a puppy tackles a cat in the yard,
    - a. … another puppy licks it (in the house).   [Parallel]
    - b. … the owner scolds it (in the house).   [Result]
    - c. … it nips a kid (in the house).   [Parallel]
    - d. … it hides (in the tree).   [Result]
- This (perhaps necessarily) involved embedded coherence relations.

Materials

- Designed 68 Blocks of sentences sharing a stem:
  - Whenever a puppy tackles a cat in the yard,
  - Every time a senior boy taunts a freshman boy in the locker room,
  - Whenever a grandfather gave a grandson a birthday present in the living room,
- Used same 2x2x2 design to generate 8 endings:
  - Coherence Rel.:   Result / Parallel coherence relation
  - Pronoun Pos.:   Subject / Object pronoun position
  - PP: Whether ending PP included or not (NoPP)
- Ran a norming study to ensure the correct coherence bias for all 8x68 sentences.

Methods

- Recruited 40 Amazon Mechanical Turk participants, assigned randomly into 8 groups.

- Each group saw all 8 types of endings.

- But they saw a different ending for each block:

  - Whenever a puppy tackles a cat in the yard,

    - Group 1: … another puppy licks it.

    - Group 2: … another puppy licks it in the house.

    - Group 3: … the owner scolds it.

    - etc.

Methods, Cont'd

- Presented sentences one at a time, and asked which antecedent fit the pronoun best:

Whenever <u>a puppy</u> tackles <u>a cat</u> in the yard, another puppy licks it in the house.
Which underlined animal does the second puppy lick?

- ○ the first puppy
- ○ the cat

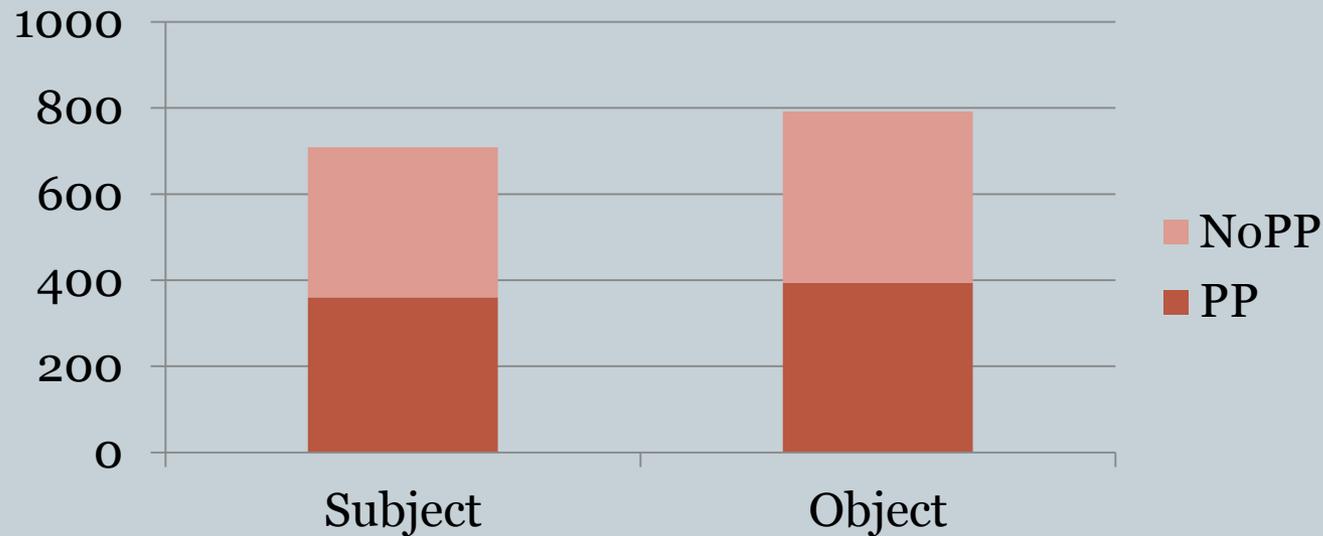- Comprehension questions tested for focus to task.

Results

- Performed two repeated measures ANOVA with either Participant or Block as random variable.
- Main Effect of Pronoun Position
  - Participants chose subject antecedents more often for object pronouns than for subject pronouns.
- Main Effect of Coherence
  - Participants chose subject antecedents more often for Parallel cases than for Result cases.
- Interaction of Pronoun Position and Coherence
  - Participants chose parallel antecedents in Parallel cases (subject for subject, object for object) and reversed antecedents in Result cases.
- Interaction of Coherence and PP (by Participants only)

Main Effect: Pronoun Position

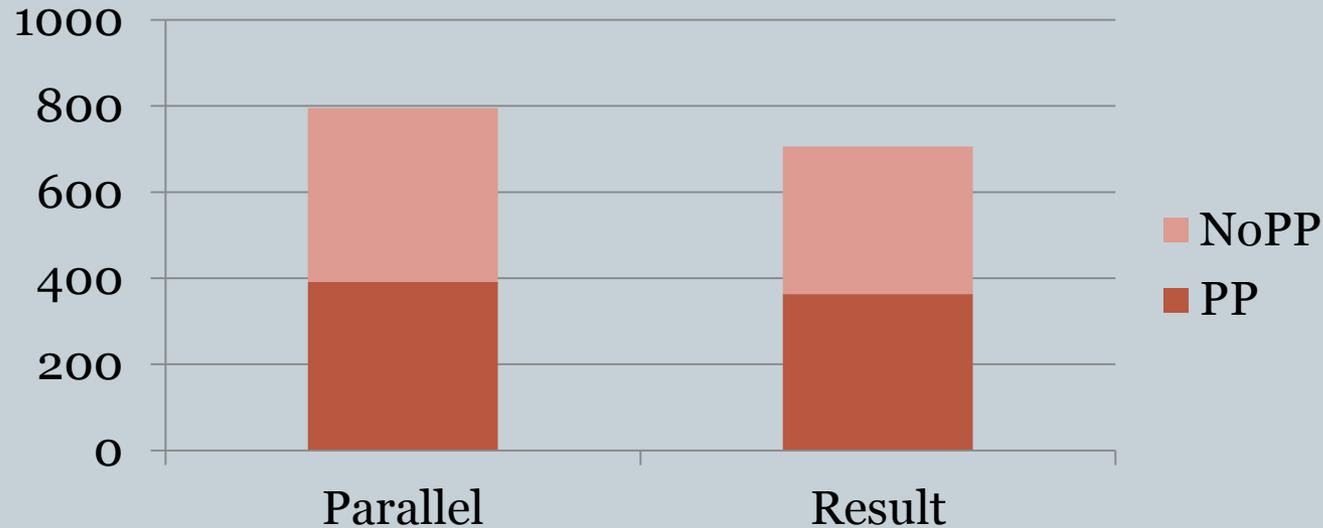- Total number of subject antecedents chosen by pronoun position and PP/NoPP:

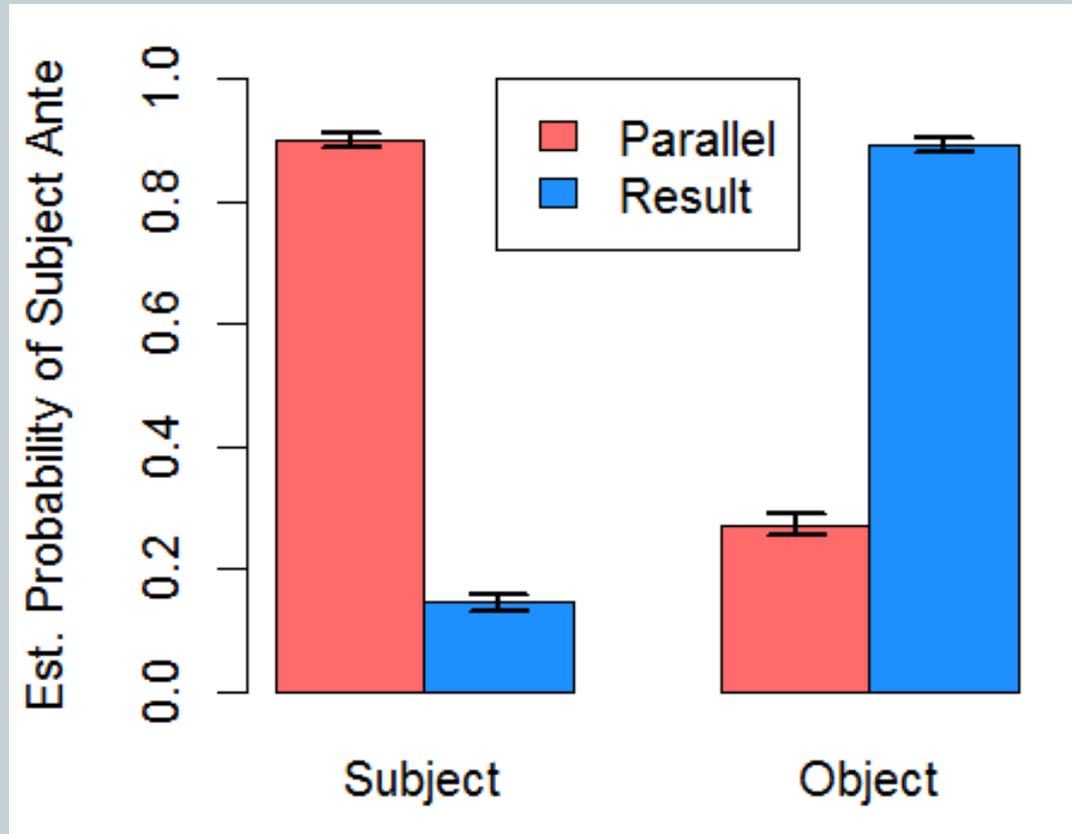- Significant: p < .001 (Part.); p < .05 (Block)

Main Effect: Coherence Relation

- Total number of subject antecedents chosen by Coherence and PP/NoPP:

- Significant: $p < 0.001$ (Part.); $p < 0.01$ (Block)

Interaction:
Pronoun Position and Coherence Relation

- Probability of subject antecedent by Pronoun Position and Coherence Relation

- Combined PP/NoPP

- Significant:
  - $p < 0.001$ (Part.)
  - $p < 0.001$ (Block)

Discussion

- Fully Parallel (PP) cases were not significantly different from partially Parallel ones (NoPP).
- Main effects of Coherence and Pronoun Position were somewhat surprising.
  - Norming study showed an overall bias towards Results.
  - Some participants may have flipped expected reference.
- Interaction between Pronoun Position and Coherence was expected.
  - Parallel clauses usually match subject/subject, object/object
  - Result clauses were designed to create a mismatch

Two Questions

- 1. Do coherence relations exist between embedded clauses?
  - Early indications are that they do, since we found the same strong effect of coherence relation on pronoun interpretation as in the unembedded cases.

- 2. Does coherence constrain the meanings of non-referential pronouns?
  - Again, these results indicate the coherence does affect the interpretation of non-referential pronouns.

Further Prediction

- Does coherence constrain the **global** or **local** context/assignment?

  - [Samuel threatened Justin and Erin blindfolded him_4]$^{[4 \rightarrow Justin]}$
  - [Samuel threatened Justin and [Erin blindfolded him_4]$^{[4 \rightarrow x]}$]$^{[...]}$

- Donkey pronouns are not referential, though, and therefore must be interpreted via a local assignment.

- Prediction:

  - Coherence-constrained pronouns should allow sloppy identity readings.

Sloppy Coherence (without c-command)

- ## Parallel
  - Everyone who knows John Belushi knows his brother. But no one who knows Dan Akroyd does ~~know Ackroyd's brother~~.

- ## Contrast
  - I like Sarah but I hate her political views. John feels the same way about Jill. (i.e. likes Jill but hates Jill's politics)

- ## Elaboration
  - Most people who are taller than John are way taller than him. Only one person who is taller than Bill is ~~way taller than Bill~~.

- ## Result
  - (discussing the famous televised presidential debate:) Kennedy looked good. People voted for him. Nixon looked bad. People didn't ~~vote for Nixon~~.

Thanks

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