

Discourse expectations & psycholinguistic methods

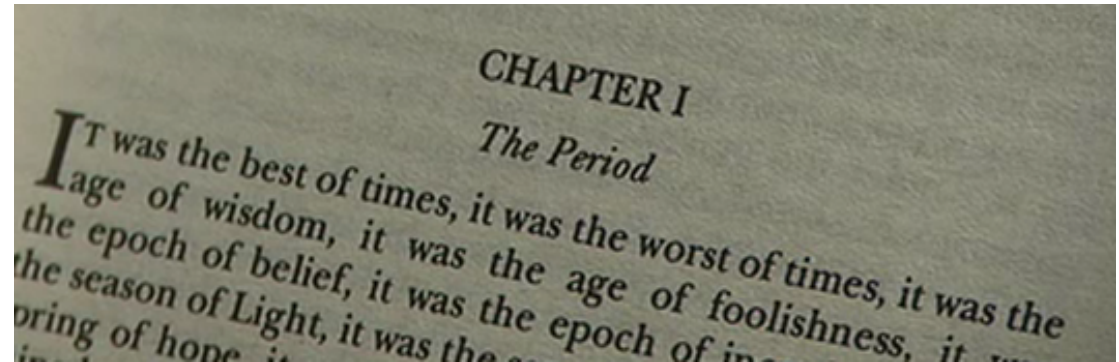
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Methods as a symptom of good research

- ▶ Good research requires a good question
- ▶ Novelty of ~~method~~ vs novelty of question?
- ▶ Some questions can rely on old methods
- ▶ Some questions may require new methods
- ▶ Best is convergence of evidence

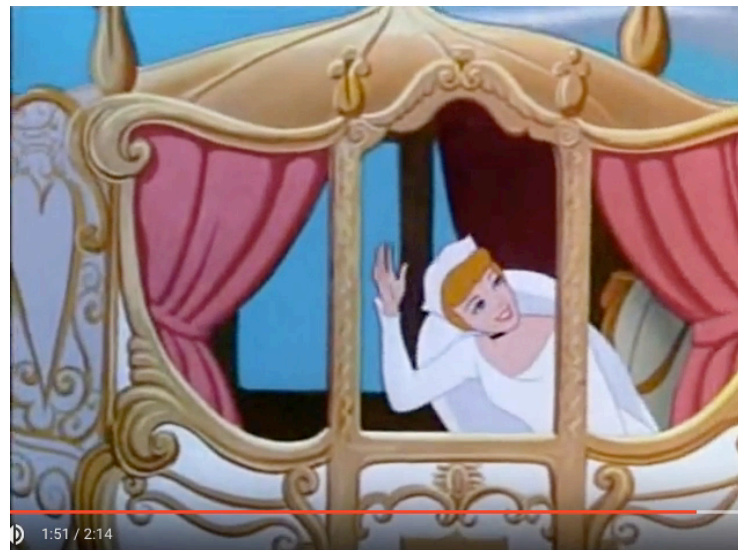
Predictability

- ▶ of form (word choice, sentence & discourse structure)



Dickens, *A Tale of Two Cities*

- ▶ of content (plot)



Disney, *Cinderella*

Unpredictability

▶ of form



Lerner & Loewe, *My Fair Lady*

▶ of content

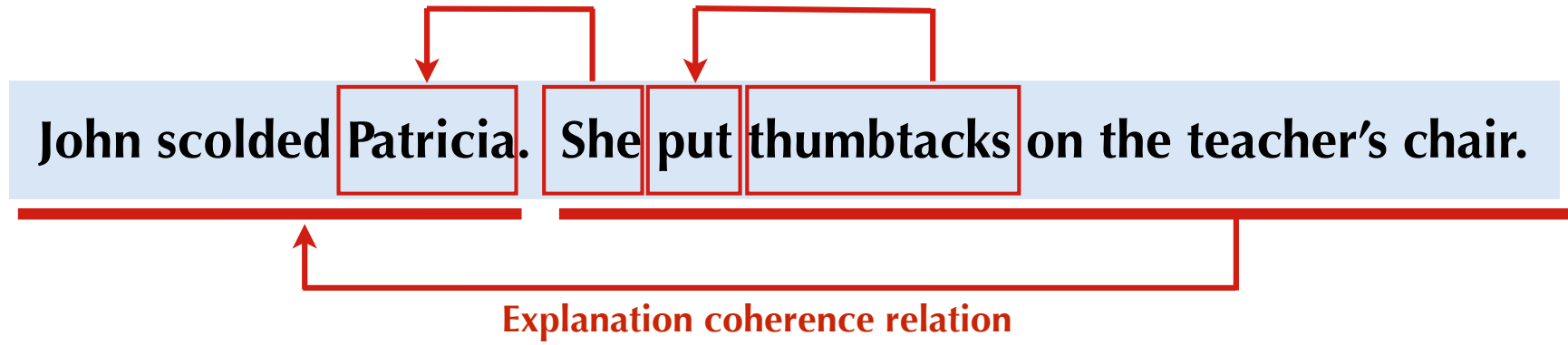


Trout Fishing in America,
Mary had a little lamb

Expectations in narrative: How to measure comprehenders' response to (un)predictability in content & form

- ▶ Why versus what next [anticipatory eye movements]
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Linguistic dependencies



The case for coherence

- ▶ The meaning of a discourse is greater than the sum of the meanings of its parts.
- ▶ Listeners assume juxtaposed statements don't appear together arbitrarily.

John scolded Patricia. ^{because} She put thumbtacks on the teacher's chair.

John scolded Patricia. [?] She was eating spinach.

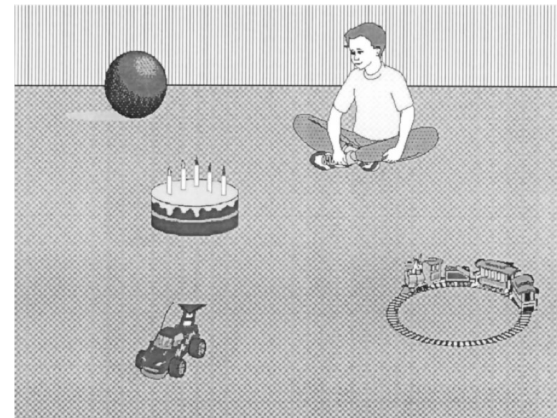
- ▶ Coherence models posit inventories of **relations** between segments of a discourse or **questions under discussion** (Asher & Lascarides 2003; Hobbs 1990; Kehler 2002; Mann & Thompson 1988; Marcu 2000; Polanyi 1988; Roberts 1996; Simons et al. 2015; Webber 2006).

Expectation-driven processing

- ▶ Comprehension is driven in part by an ability to make predictions.
- ▶ Listeners who anticipate **what message** a speaker may try to convey and **what words** will be produced are better equipped to handle the ambiguity in natural language.

The boy will move the cake.

The boy will eat the cake.

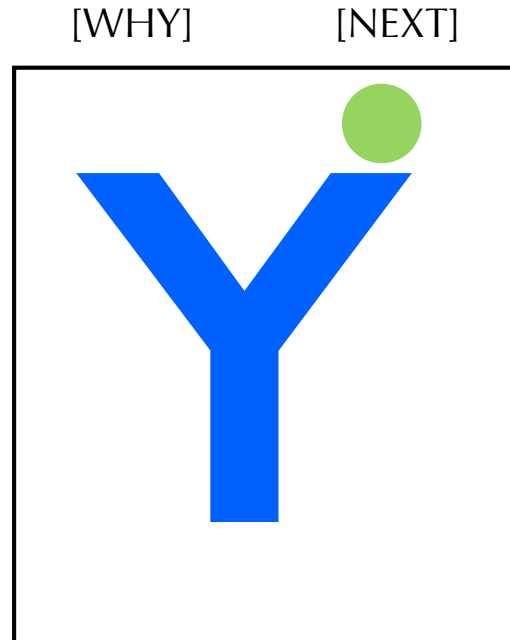


(Altmann & Kamide 1999)

Measuring anticipation: eye movements

- ▶ **Approach:** Implicit learning phase to train listeners to associate particular coherence relations with particular locations on the screen
- ▶ **Test** whether listeners anticipate WHY vs WHAT NEXT. If yes, more looks to preferred location after coherence cue.

Implicit learning



Leo takes the bus to work. He doesn't have a car.

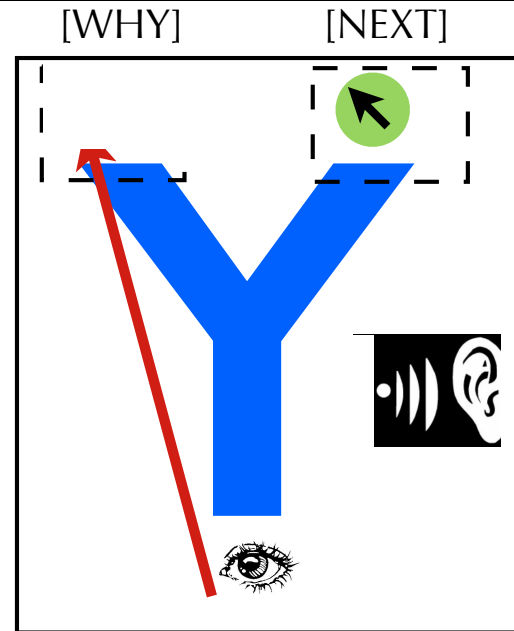
[WHY]



Amanda was in a car accident. The street was closed for several hours afterwards.

[NEXT]

Measuring anticipation: eye movements



Joe scolded Patricia in the hallway.

Implicit causality verb → WHY BIAS

WHY : She put thumbtacks on the teacher's chair.

NEXT : He then sent her to the principal's office



Heidi handed a book to Bob.

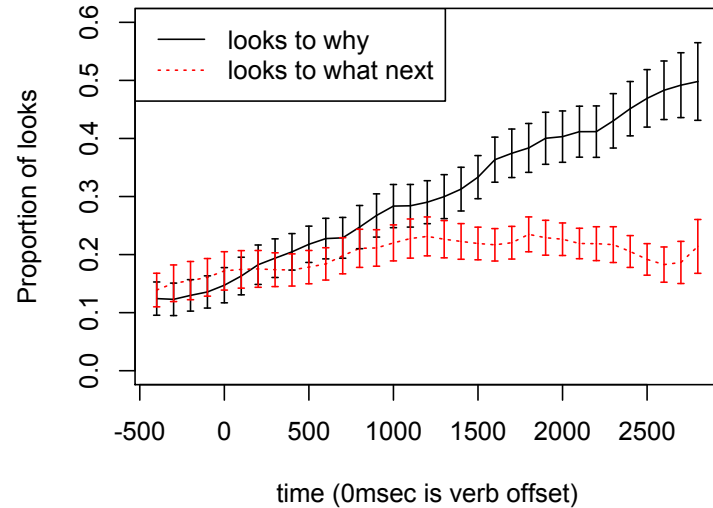
Transfer verb → WHAT NEXT

WHY : She thought he'd like the book.

NEXT : He sent her a thank you email.

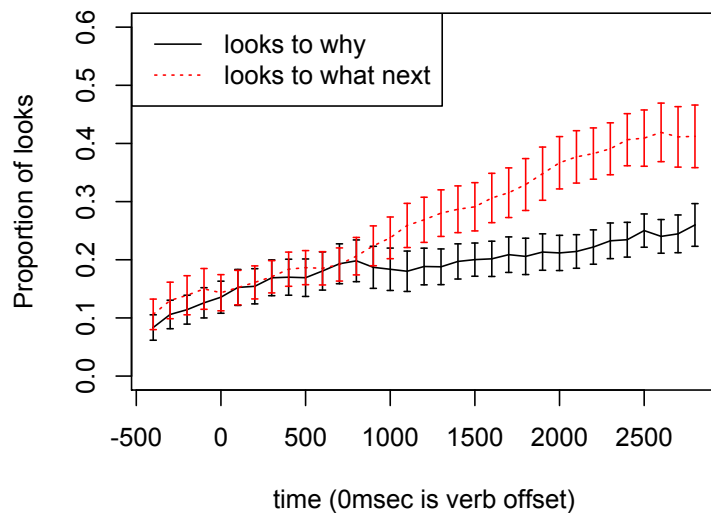
Eye-tracking results

Above-chance participants,
IC condition



John scolded Patricia in the hall.

Above-chance participants,
TOP condition



Heidi handed a book to Bob.

→ Evidence for coherence predictions

Predictions across intervening material

You know I wouldn't say anything against her...

... because she's such a nice person...

... and she's been working with us for so long...

... and she's always so supportive and helpful...

BUT!

Measuring anticipation: eye movements

- ▶ **Approach:** Participants read naturally while their eye movements are monitored
- ▶ **Test** if listeners keep track of discourse relations across “long” distances by measuring reading slowdown at an unexpected sentence type

Cues to signal upcoming relation

[intro] **Joseph got a job offer from the Edinburgh Zoo and he's pondering whether he should take it.**

[OT1H cue] ***On the one hand*, he needs the money that this job will pay**
[because] **because he should start paying off his student loans this year.**

[no contrast] **Also, his car needs to be serviced by the end of the month.**

[local contrast] **But the loans could be deferred for a few more months.**

[global contrast] **But he could keep looking for a nicer, better-paying job.**

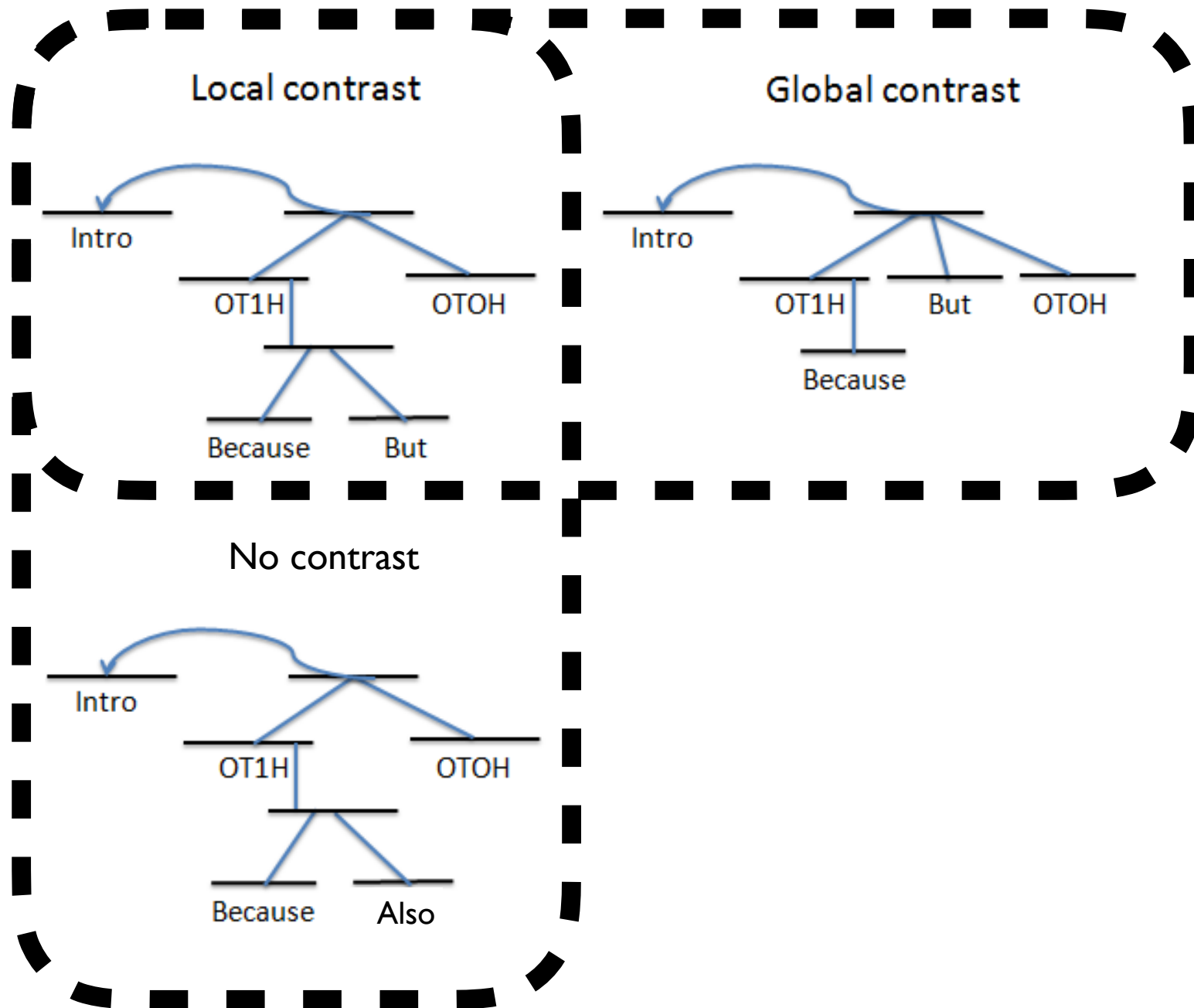
→ Prediction for particular words *On the other hand*?

→ Prediction for any type of contrastive meaning?

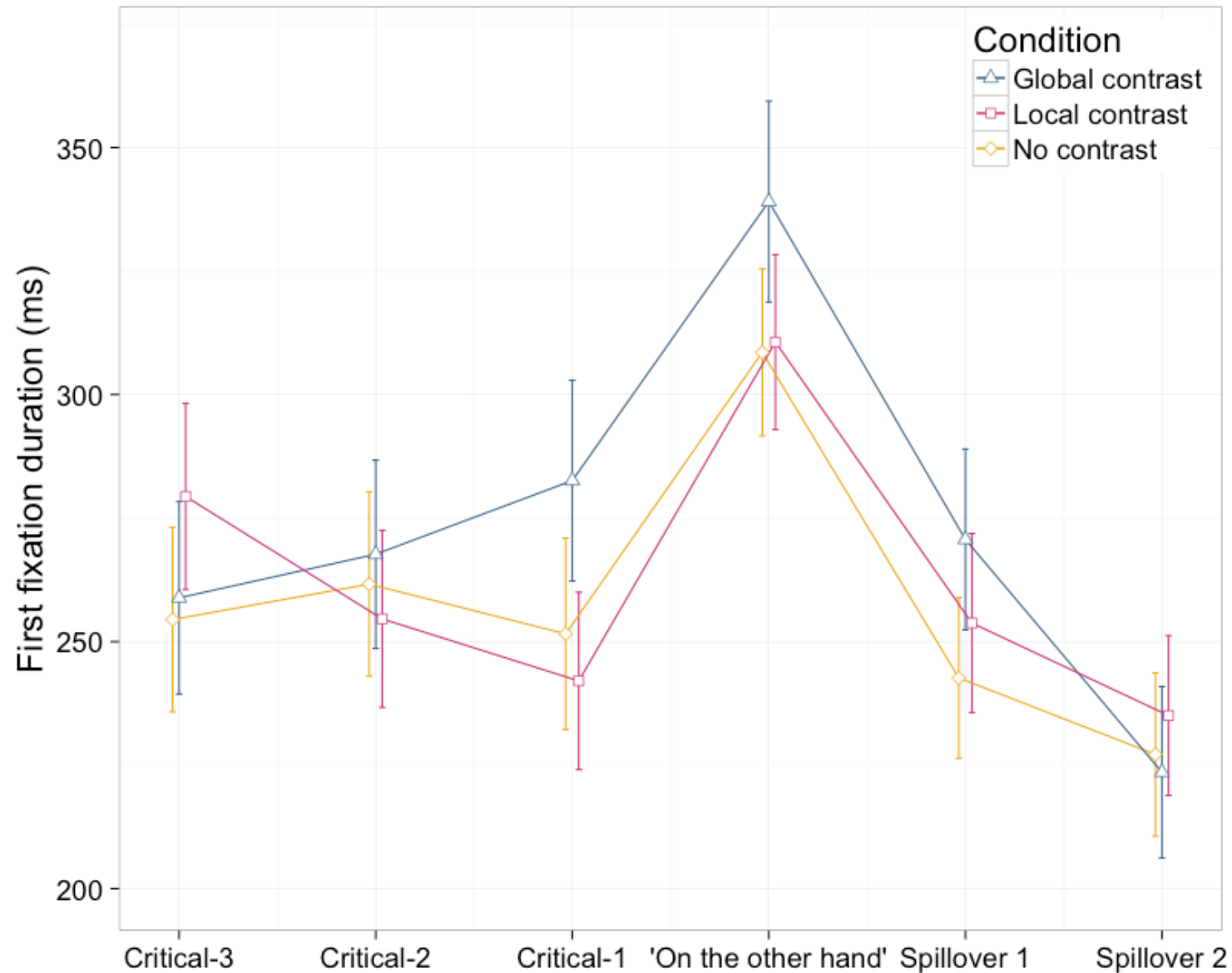
→ Prediction for contrast that links to *On the one hand*?

[OTOH] ***On the other hand*, he hates the idea of cleaning out panda cages and lion dens every day.**

Different discourse structures

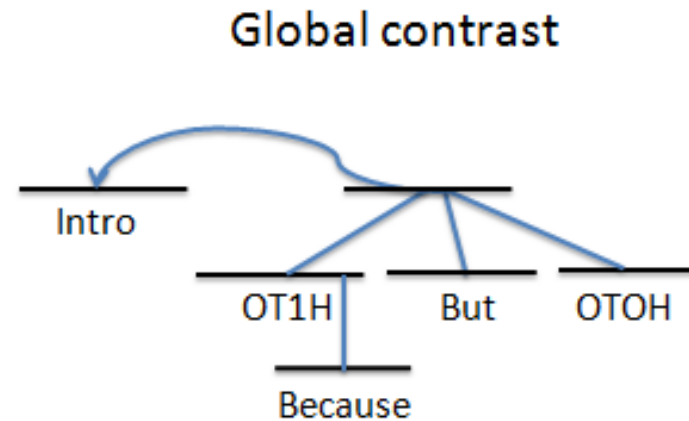
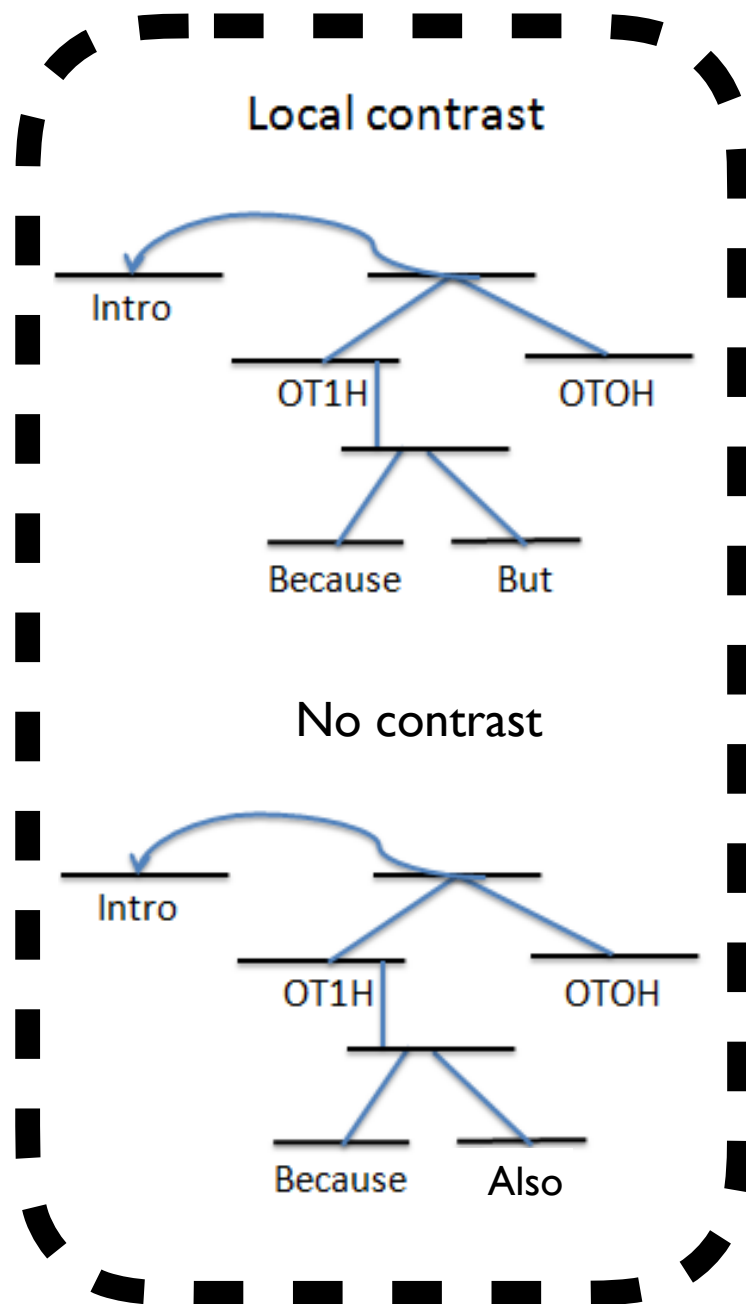


Eye-tracking results: *On the other hand*



→ Slowest reading when a global contrast has already been seen

Different discourse structures



→ Prediction not just of OTOH form or any contrast but a prediction for a particular link within the overall discourse structure

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Interpreting ambiguous pronouns

- ▶ Implicit causality contexts (Au 1986; Brown & Fish 1983; Caramazza, et al. 1974; McKoon, Greene, & Ratcliff 1993)

Mary scolded Jane because **she** had stolen a tennis racket.

Mary annoyed Jane because **she** had stolen a tennis racket.

- ▶ Transfer of possession contexts (Stevenson, Crawley, & Kleinman 1994; Arnold 2001)

John handed a book to Bill. **He** thought the title looked good.

- ▶ Surface structural cues are insufficient: Sometimes the pronoun favors subject in a parallel position, sometimes not
- ▶ Role for coherence relations?

Who will be mentioned next?

- ▶ **Approach:** Collect story continuations to see who a pronoun is used to refer to across different coherence relations

John_{SOURCE} handed a book to Bill_{GOAL}. He _____

- ▶ **Test** if biases vary by coherence relation

Coherence annotation

Explanation Matt passed a sandwich to David. He didn't want David to starve.

Result Matt passed a sandwich to David. He said thanks.

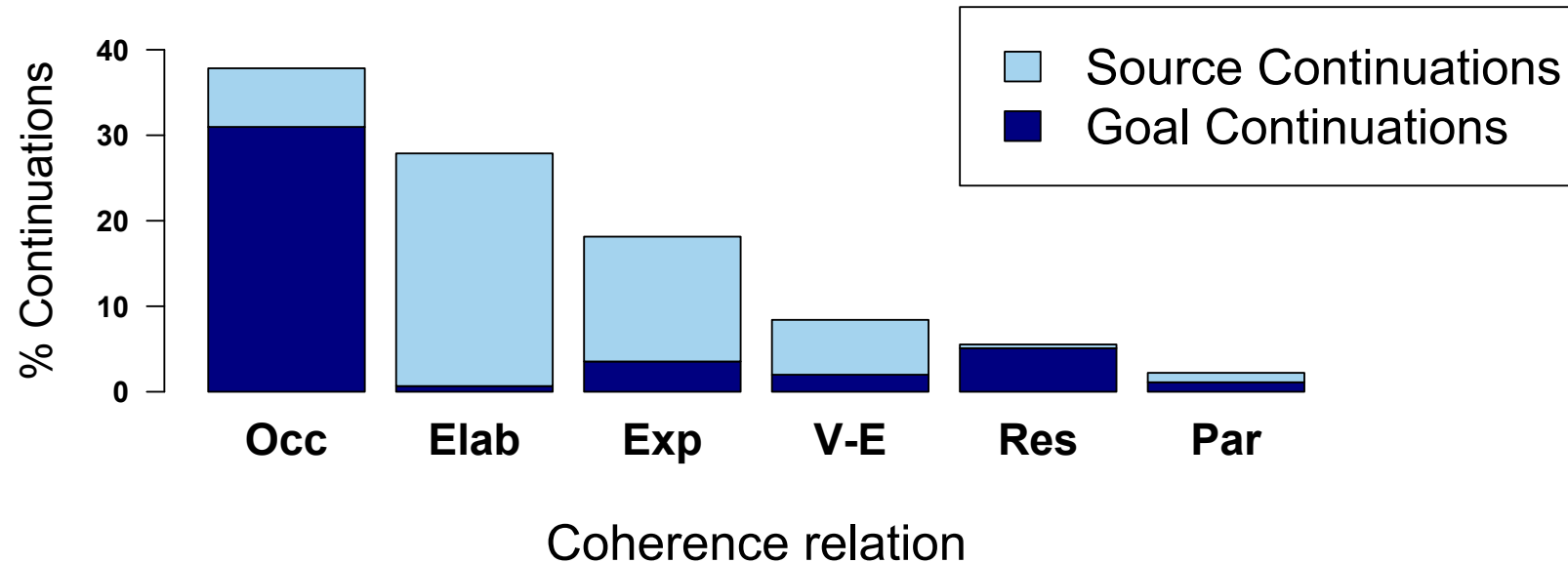
Violated-Expectation Matt passed a sandwich to David. He wanted it back though.

Parallel Matt passed a sandwich to David. He passed him an apple too.

Elaboration Matt passed a sandwich to David. He did so carefully.

Occasion Matt passed a sandwich to David. He ate it up.

Story continuation results



→ Interpretation of pronoun depends on what coherence relation is operative.

Measuring pronoun interpretation

- ▶ **Approach:** Self-paced reading where subjects read passages one word at a time
- ▶ **Instructions:** Expect a follow-on sentence that answers the question *Why?* or *What next?* (between subjects)

----- . -----

----- once .

Real-time pronoun interpretation

Source-referring pronoun

Jessica served chili to Emily. She explained to Emily

[WHY] ... **in the kitchen that** morning that everyone needs to try chili once.

[WHAT-NEXT] ... **in the kitchen that** night that the secret to chili
is real jalapeños.

Goal-referring pronoun

Jessica served chili to Emily. She explained to Jessica

[WHY] ... **in the kitchen that** morning that she can only eat soft foods.

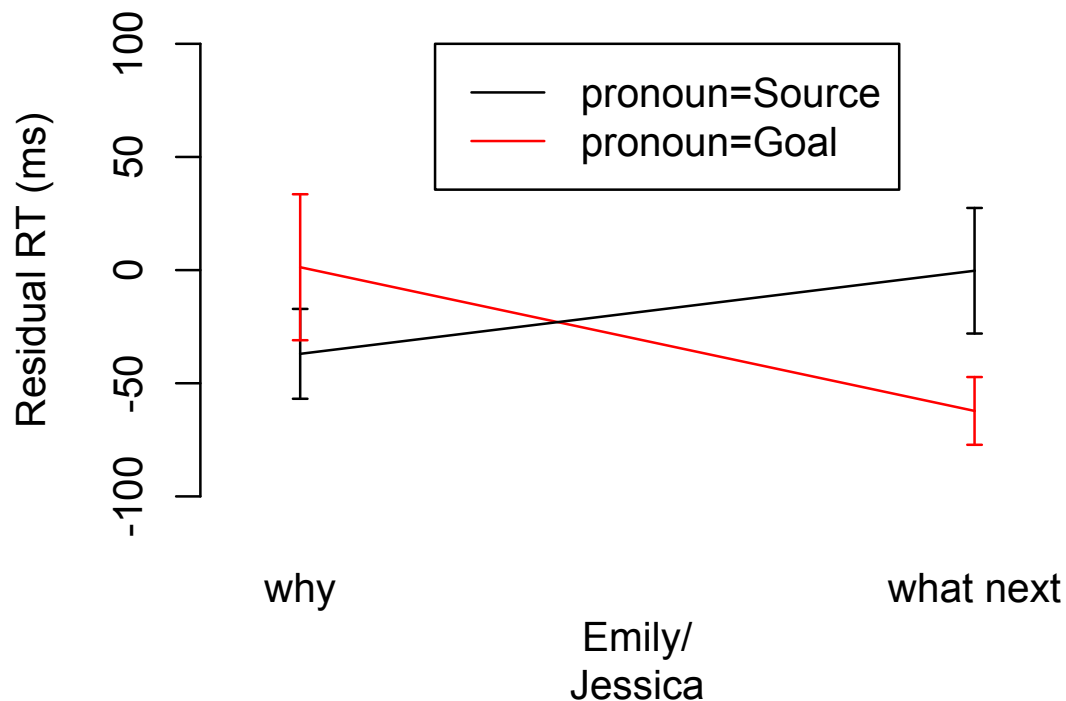
[WHAT-NEXT] ... **in the kitchen that** night that the chili was a bit too spicy.

→ At disambiguating name, does speed vary with WHY vs WHAT NEXT?

Results: reading times

[pronoun=Source] Jessica served chili to Emily. She explained to Emily ...

[pronoun=Goal] Jessica served chili to Emily. She explained to Jessica ...



→ Coherence-driven expectations guide pronoun interpretation

Why would anyone use a pronoun?

Joe was the bully of the neighbourhood.
He chased Tommy all the way home from school one day.
He watched Tommy hide behind a big tree and start to cry.
He yelled at Tommy so loudly that all the neighbours came outside.

Joe was the bully of the neighbourhood.
Joe chased Tommy all the way home from school one day.
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- ▶ **Measure:** self-paced reading
- ▶ **Repeated name penalty:** 'Joe' version is read more slowly than 'He' version (Gordon, Grosz, & Gilliom 1993)
- ▶ Being explicit isn't necessarily better; listeners expect the main character to be pronominalized even if doing so creates ambiguity.

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Interim summary: Comprehenders have expectations about...

- What type of message is coming next
- Who will be mentioned next
- How a referent will be mentioned

Expecting the unexpected

- ▶ Usual psycholinguistics story: Words are easier to process if they are **predictable** given previous linguistic context (Kliegl et al., 2004; Levy, 2008; among many others)

In order to chop some carrots, John was using a knife.

In order to brush his teeth, John was using a knife.

- ▶ However, comprehenders also expect discourse to be interesting and informative and hence **unpredictable** (Grice 1975; Shannon 1948).

Vary expectation/satisfaction of surprise

My classmate John is a boring person who always does things the way you'd expect.

[EXPECTED INSTRUMENT] For instance, in order to chop some carrots, he was using a knife yesterday in the afternoon.

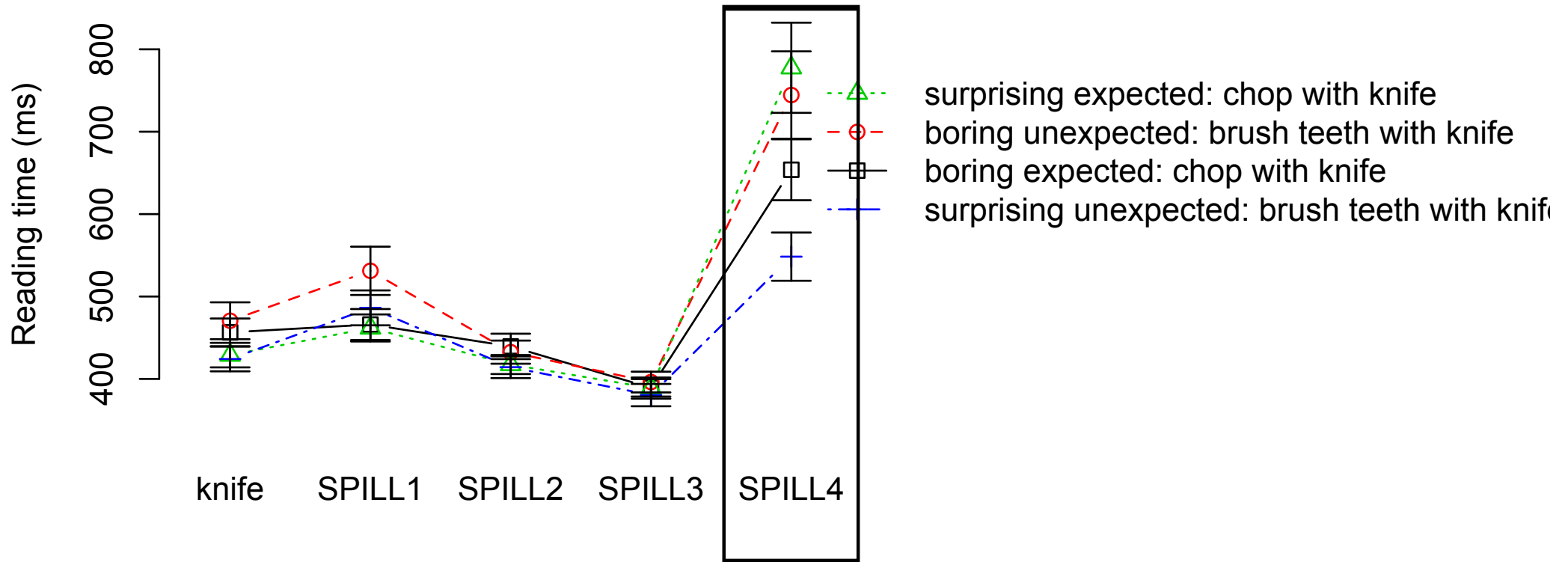
[UNEXPECTED INSTRUMENT] For instance, in order to brush his teeth, he was using a knife yesterday in the afternoon. → **unpredictable**

My classmate John is a surprising person who never does things the way you'd expect.

[EXPECTED INSTRUMENT] For instance, in order to chop some carrots, he was using a knife yesterday in the afternoon.

[UNEXPECTED INSTRUMENT] For instance, in order to brush his teeth, he was using a knife yesterday in the afternoon. → **informative!**

Self-paced reading results: Context cue



First word after knife: “boring” condition shows usual predictability effect
End of sentence: full cross-over interaction emerges

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These methods show comprehension of (very short) narratives reflects:

- The use of cues to anticipate who/what is coming next
- Reading facilitation when form/structure is predictable
- Along with an expectation for unpredictable content

▶ Thanks to collaborators



Andy Kehler



Vera Demberg



Jet Hoek



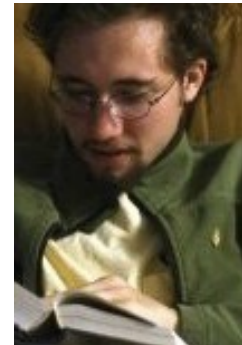
Merel Scholman



Jeff Elman



Sid Horton



Richard Futrell

▶ And thank you!