Negation facilities comprehension in English counterfactuals

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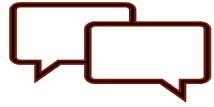[2]Department of Cognitive Science, Central European University

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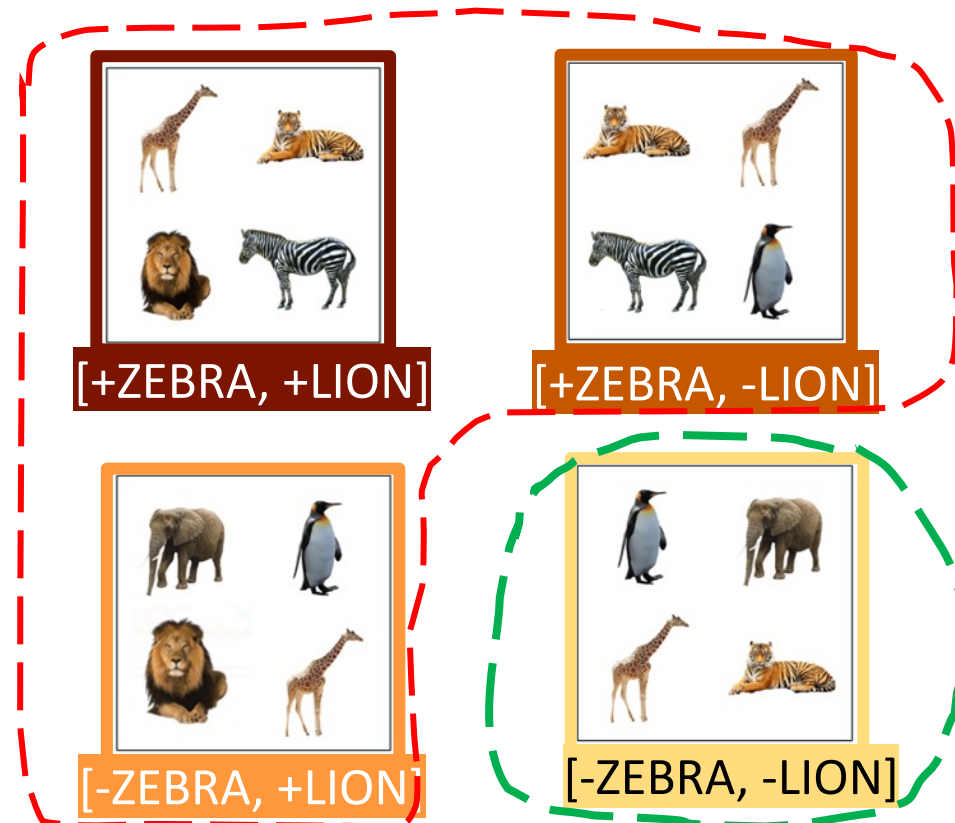
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Alternatives to reality: What was actually there?

If there had been zebras, then there would have been lions in the zoo.
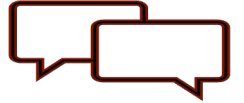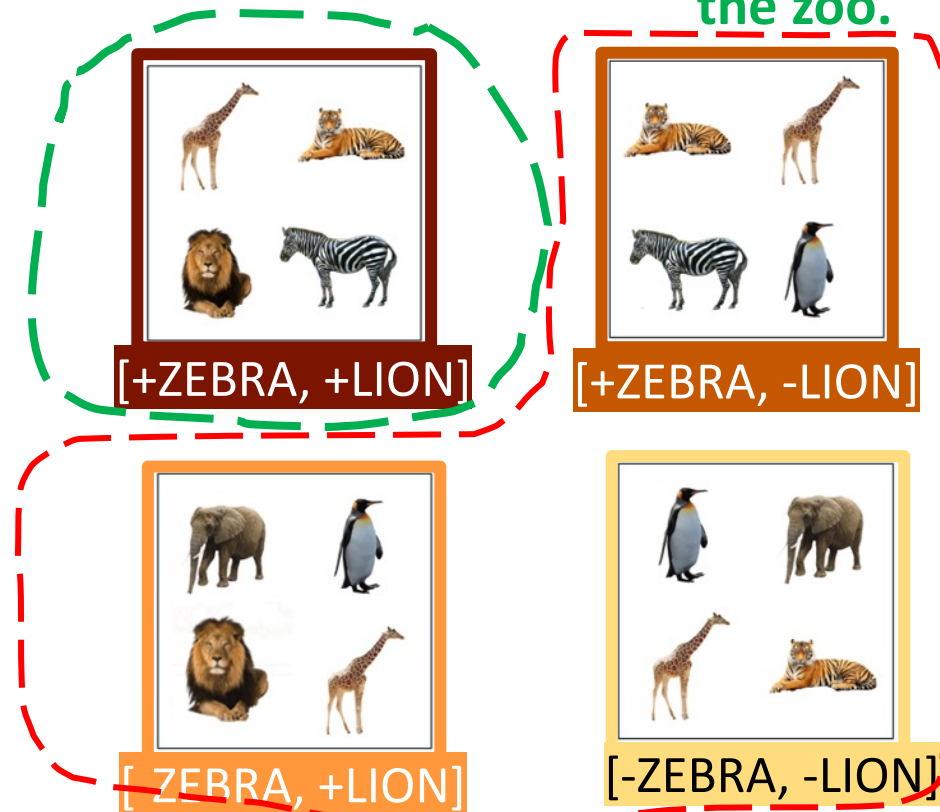
There were no zebras and no lions in the zoo.

[+ZEBRA, +LION]

[+ZEBRA, -LION]

[-ZEBRA, +LION]

[-ZEBRA, -LION]

- - - suppositional alternatives

- - - actual state

If there had been <u>no zebras</u>, then there would have been <u>no lions </u>in the zoo.

There were zebras and lions in the zoo.

[+ZEBRA, +LION]

[+ZEBRA, -LION]

[ZEBRA, +LION]

[-ZEBRA, -LION]

suppositional alternatives

actual state
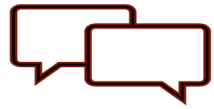
If there had been zebras, then there would have been lions in the zoo.

If there had been <u>no zebras</u>, then there would have been <u>no lions in</u> the zoo.
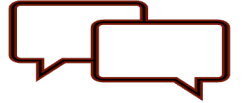
There were no zebras and no lions in the zoo.

There were zebras and lions in the zoo.

less well-specified inference

well-specified inference

[+ZEBRA, +LION]

[+ZEBRA, -LION]

[-ZEBRA, +LION]
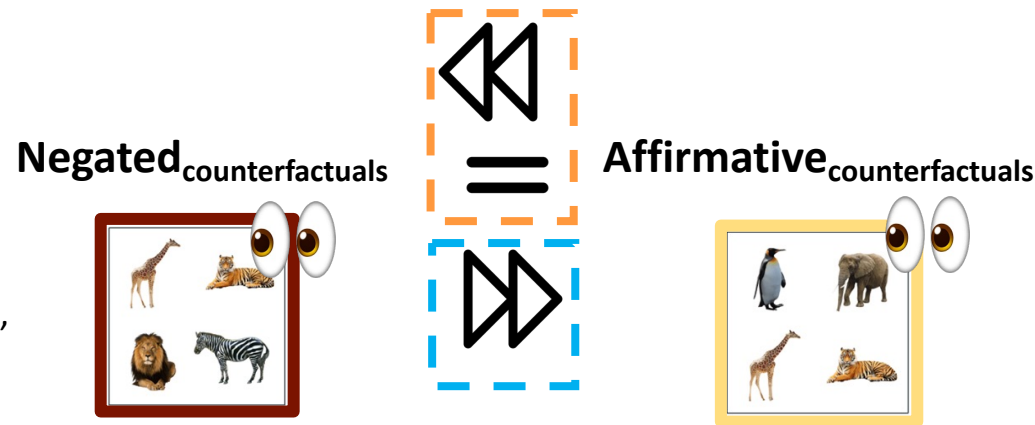
[-ZEBRA, -LION]

— — — suppositional alternatives

— — — actual state

Here we ask:

- Understanding counterfactual sentences is likely to be difficult as they comprise several features whose impact on online processing is still debated, including **(implicit) negation**, **non-factual supposition** and (pragmatic) **inference generation**.

Aim: To track the time-course of inferences based on affirmative and negative framed counterfactual statements using a **web-based visual world paradigm.**

i) Is it easier to comprehend negated counterfactuals than their affirmative counterpart?

Negatedcounterfactuals

Affirmativecounterfactuals

Two-step simulation approach (e.g., Carpenter & Just, 1975; Kaup et al., 2007)
- Presence of overt negation 'no'
- Two mental representations (suppositional vs actual state)

Dynamic pragmatic account (e.g.,Tian et al., 2010; Tian et al., 2016)
- Easier to accommodate the QuD, i.e., well-specified inferences

Here we ask:

- Understanding counterfactual sentences is likely to be difficult as they comprise several features whose impact on online processing is still debated, including **(implicit) negation**, **non-factual supposition** and (pragmatic) **inference generation**.

Aim: To track the time-course of inferences based on affirmative and negative framed counterfactual statements using a **web-based visual world paradigm.**

ii) How does the canonical order in counterfactuals modulate its processing?

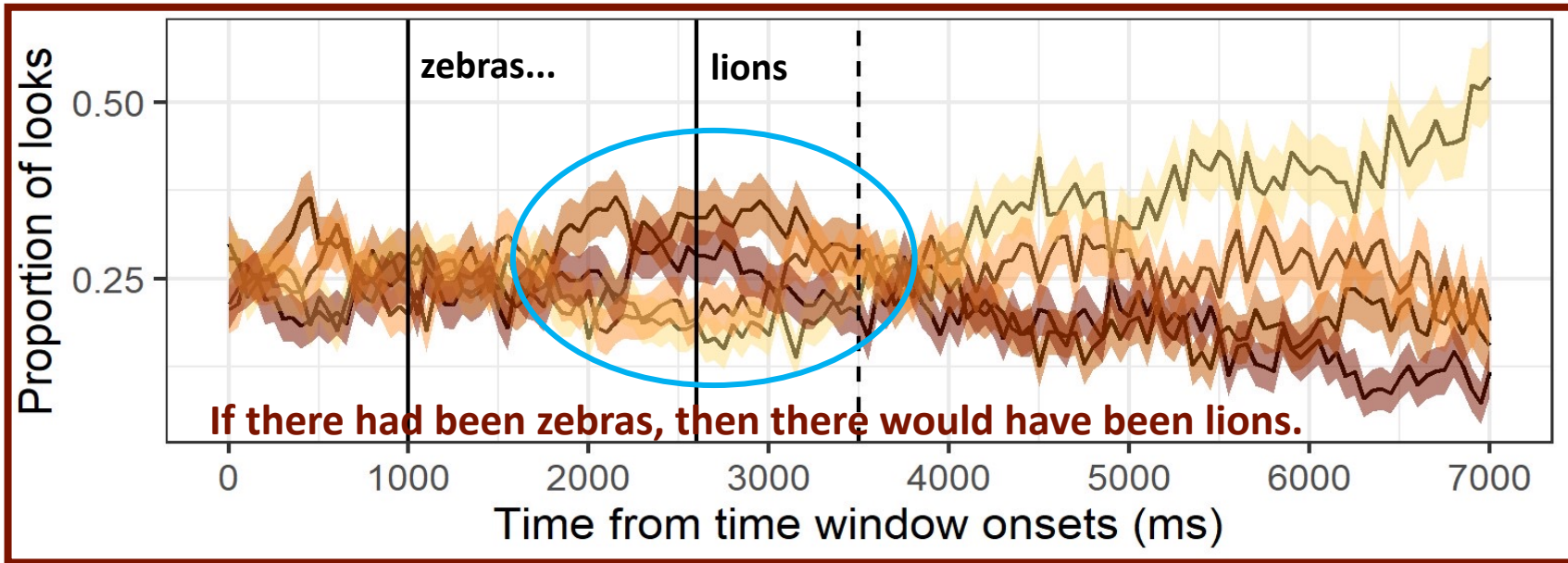**Non-canonical**$_{counterfactuals}$ **: There would have been lions if there had been zebras.**

Evaluation & re-evaluation of consequent-clause within the bounds of if-clause.

Possible to build a complete model of the actual world (i.e., *There would have been lions...*) even before the if-clause is heard.

Canonical$_{counterfactuals}$ **: If there had been zebras, there would have been lions.**
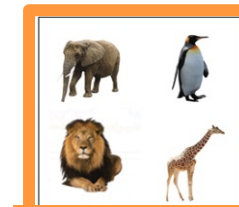
Suppositional State
[+ZEBRA, +LION]
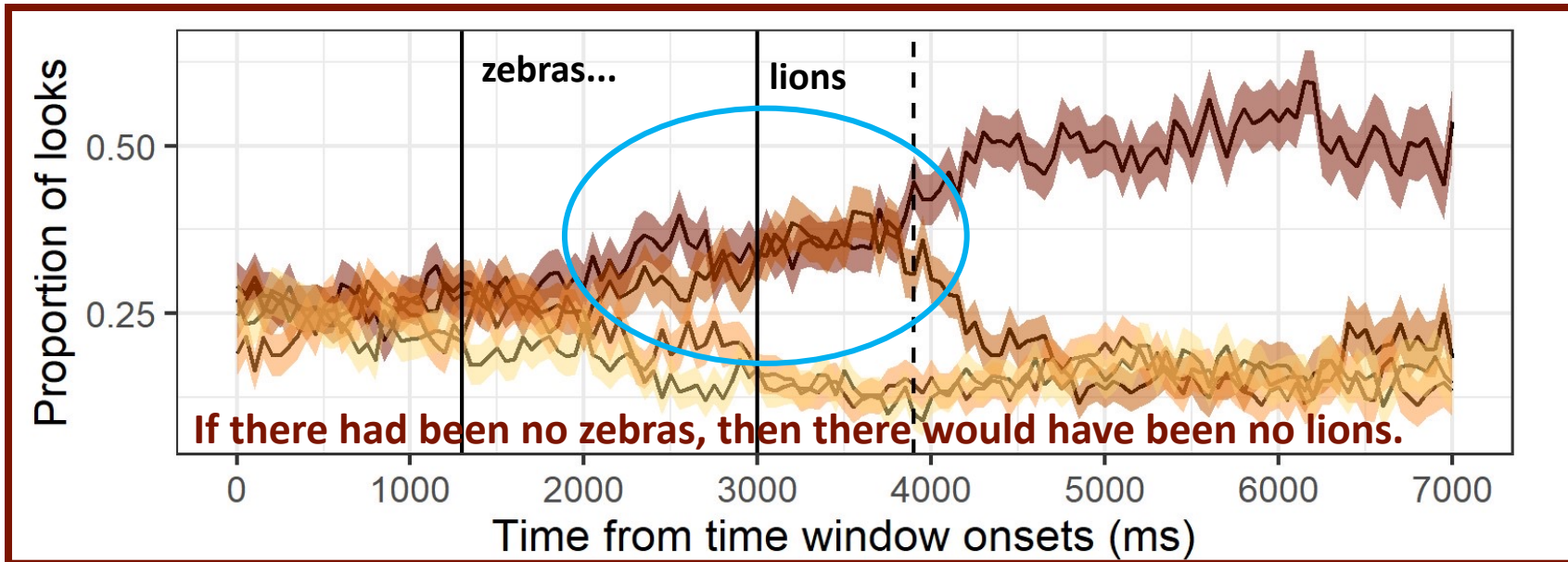
Antecedent-only
[+ZEBRA]

Consequent-only
[+LION]

Actual state
[-ZEBRA, -LION]

- **Activation of** suppositional state/**positive counterpart [+ZEBRA, +LION]** in counterfactual affirmatives (2000ms) and declarative negative sentences (250ms).
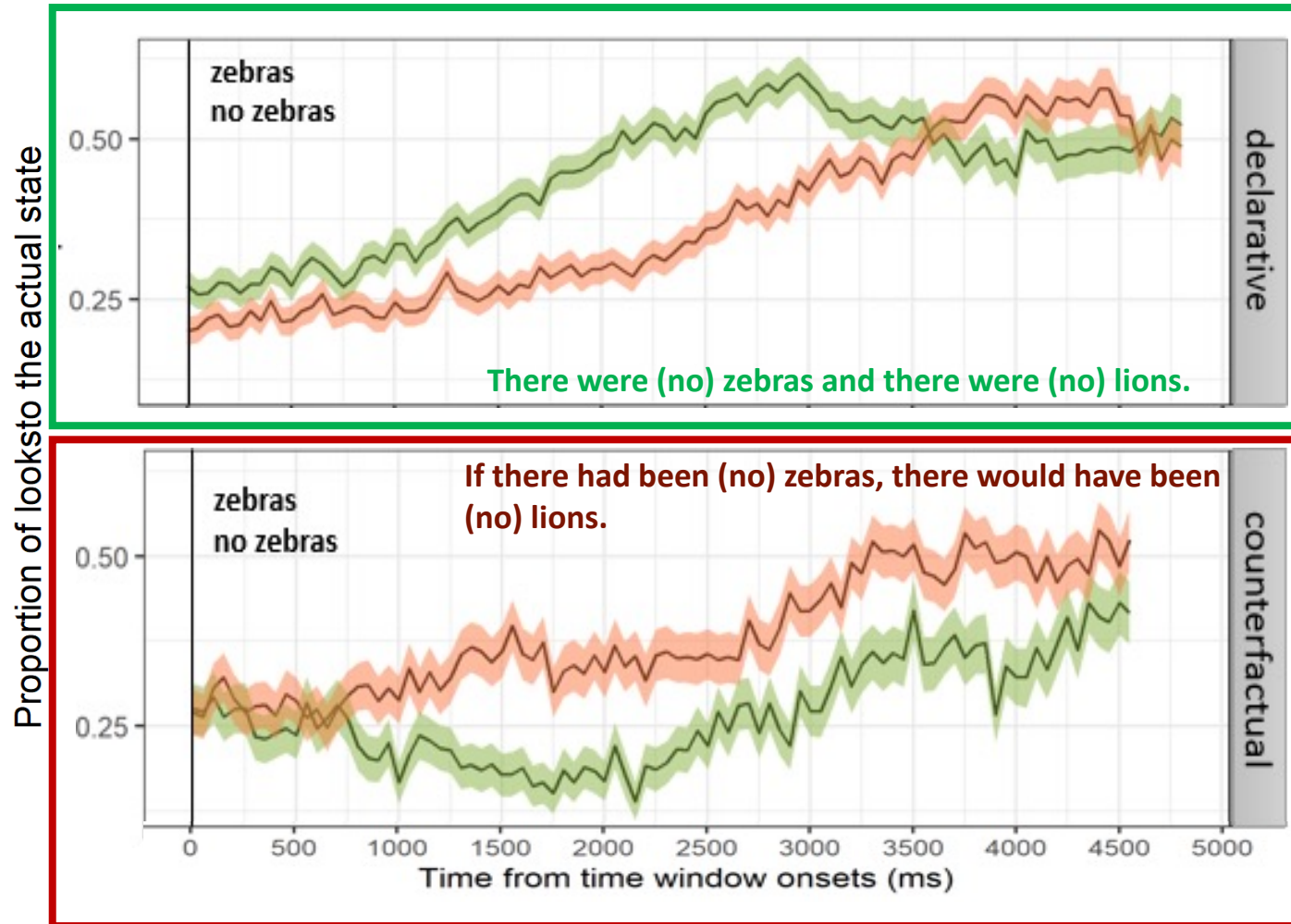
[+ZEBRA, +LION]

[+ZEBRA]

[+LION]

[-ZEBRA, -LION]

→ Negation and counterfactuals are said to activate alternative [-ZEBRA, -LION]

→ **No evidence that** people consider [-ZEBRA, -LION]:

Effect of polarity
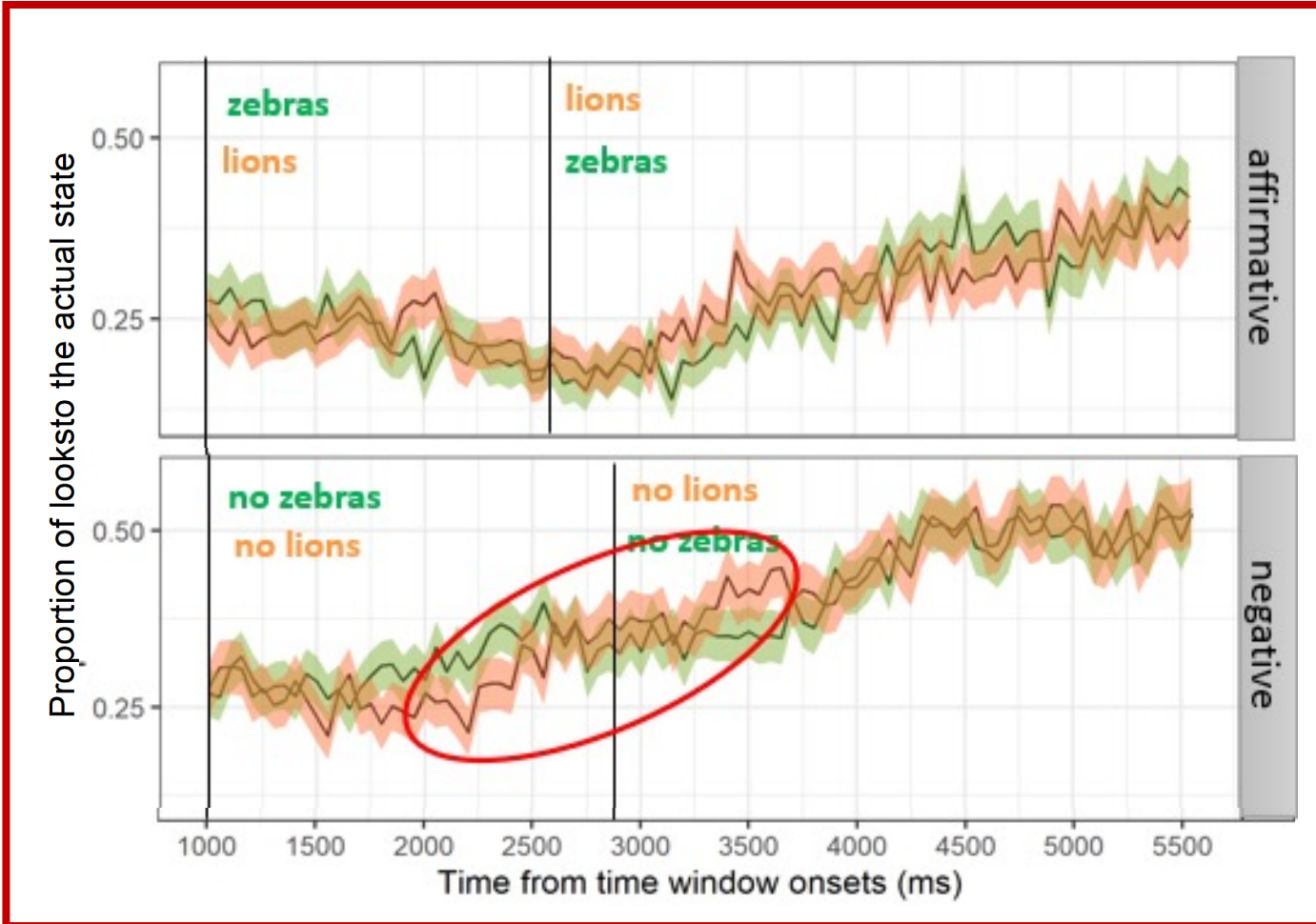

- When compared to declarative affirmatives, to reach the target interpretation participants were slower in negated condition, so it appears that **negation alone delays comprehension**.

- Earlier & faster looks to the target in negated counterfactuals than in affirmative counterfactuals.

[-ZEBRA, -LION]

- No difference in looking behaviors in affirmative counterfactuals between canonical vs non-canonical order

[+ZEBRA, +LION]

- Quicker and more confident in settling on the actual state interpretation in negated counterfactuals in non-canonical order

Discussion and Conclusion

Two main findings:
1. In both experiments, comprehending the actual state in **affirmative counterfactuals** was **difficult** for participants, and they activated the suppositional state (i.e.., affirmative content) in early stages of processing, which is in line with earlier studies (Orenes et al., 2019; Evcen & Wittenberg, 2021).

2. **Incremental integration** of morphosyntactic cues as soon as referents are unambiguous in **negated counterfactuals**, inverting the clause order enhanced this facilitation.

- Support for the dynamic pragmatic account of negation (Tian et al., 2010; Tian & Breheny, 2016): The positive argument might be represented due to the **difficulty of QUD accommodation** in affirmative counterfactuals.
  [*What was actually there*?] – The answer is well-specified in negative counterfactual with little room for uncertainty → easier QuD accommodation

- Overt negation interacts with implicit counterfactual negation in a facilitatory manner, indicating that the cognitive effort reported in counterfactual comprehension primarily arises from uncertainty over alternative states.

Thank you!

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