



Independence of pragmatic and lexico-semantic processing in picture-sentence verification

Stephen Politzer-Ahles¹, Xiaoming Jiang², Robert Fiorentino¹, and Xiaolin Zhou²
¹University of Kansas, ²Peking University



19th Annual Cognitive Neuroscience Society Meeting (2012)

Introduction: Scalar Implicatures

Some of has both logical and pragmatic readings:

- "Some of the students are hard-working."
→ *Some of* logically means "**at least one**", but implies "**not all**" by a process of *pragmatic enrichment*

The **some of**="not all" pragmatic enrichment is realized at a delay in many contexts (Bott et al., 2011; Hartshorne & Snedeker, submitted; Huang & Snedeker, 2009), but may be realized rapidly in others (Grodner et al., 2010; Degen & Tanenhaus, 2011; Politzer-Ahles et al., 2011).

Sometimes the pragmatic reading is infelicitous:

- # "Some of the elephants in the zoo have lungs."

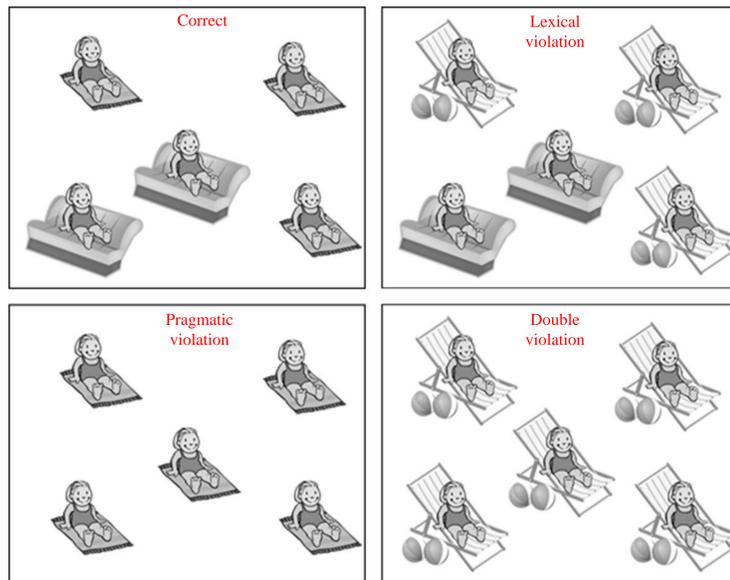
In contexts like (2), processing quantifiers may involve rapid generation and then effortful revision/inhibition of the scalar inference (Politzer-Ahles et al., 2011).

Does the revision of a preceding pragmatic violation (infelicitous quantifier) modulate the processing of a simple lexical violation downstream?

Present Study: Pragmatic Infelicity and Lexical Anomaly

Table of conditions

	Object match	Object mismatch
Felicitous quantifier	Correct	Lexical violation
Infelicitous quantifier	Pragmatic violation	Double violation



图片里，有的女孩坐在毯子上晒太阳。

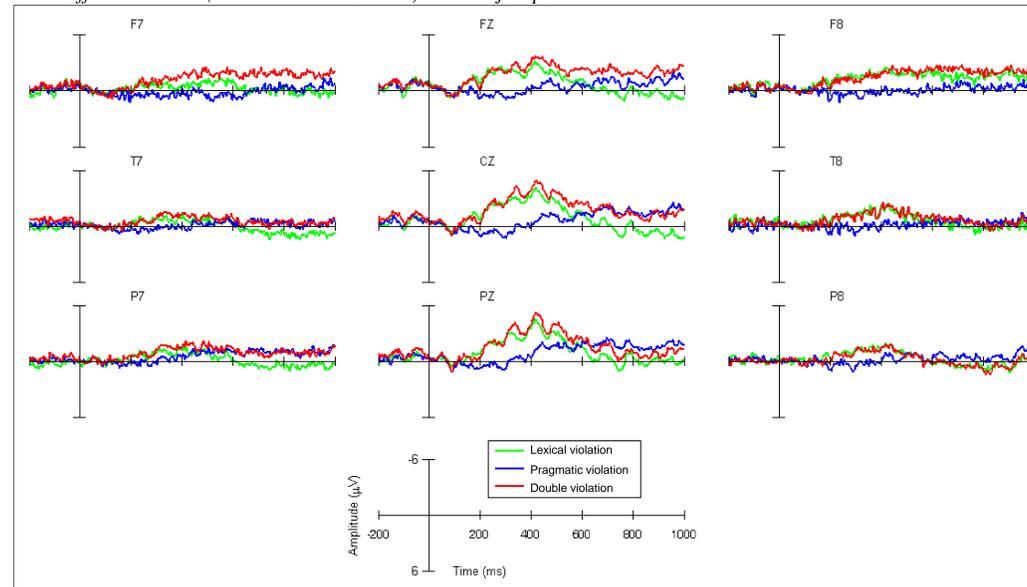
In the picture, some of the girls are sitting on blankets suntanning.

Participants and Procedure

- Participants:** 19 right-handed native speakers of Mandarin (4 additional participants excluded because of excessive artifacts)
- Procedure:** Picture followed by auditory sentence; task was to rate sentence-picture consistency on a 1-7 Likert scale.

ERP Results

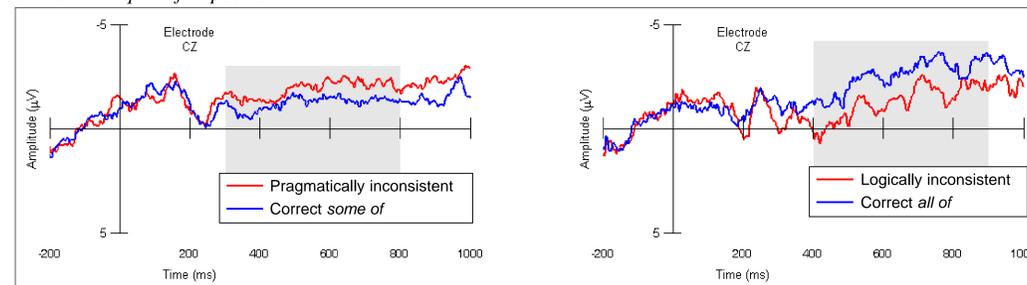
ERP difference waves (violation minus Correct) at the object position



Object position:

- Lexical violations elicited N400 effect ($p < .001$)
- Upstream pragmatic violations elicited late negativity on the object ($ps < .038$)
- Double violation elicited an additive effect with no evidence of an interaction

ERPs at the quantifier position



- Quantifier position:** Like in Politzer-Ahles et al. (2011), pragmatically inconsistent quantifiers were recognized early and elicited a sustained negativity ($p = .003$). Logically inconsistent quantifiers (from fillers) elicited a sustained positivity ($p = .004$).

Materials and EEG Methodology

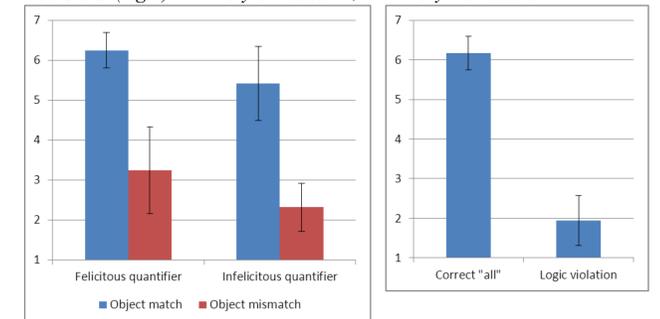
Materials:

- Critical items: 160 picture sets organized in 4 lists (40 trials per condition). Objects had high cloze probability.
- 80 fillers with *all of* (40 logically inconsistent, 40 logically consistent)
- 80 additional correct *all of*, 80 other quantifiers (40 correct, 20 object mismatch, 20 verb mismatch)

- EEG Acquisition & Analysis:** Recorded at 500 Hz with 0.016 – 100 Hz bandpass, re-referenced to averaged mastoids, ocular artifact removed using ICA (Makeig et al., 1996), baseline correction (200 ms pre-stim for quantifiers, 100 ms post-stim for objects), cluster-based statistical analysis (Maris & Oostenveld, 2007).

Behavioral Results

Ratings for critical "some of" sentences (left) and "all of" filler sentences (right). 7="very consistent", 1="very inconsistent".



Some of sentences (2x2 ANOVA):

- Significant effects of Match and Felicity ($ps < .001$), but no interaction ($p = .8$)

Pairwise comparisons:

- All comparisons significant ($ps < .003$) except for correct some vs. correct all, and logic violation vs. double violation

Individual differences:

- 13 of 19 participants reliably rated pragmatic violations worse than correct some (pragmatic responders).

Discussion

- The cognitive resources used for inhibition/revision of the pragmatic reading of *some of* are independent from those used for lexico-semantic processing.
- Replicated Politzer-Ahles et al. (2011) regarding the quantifier effects. Effects elicited at the quantifier cannot be solely due to mismatch with the picture, since inconsistent *some of* and *all of* elicit qualitatively different effects.
- Behavioral results show gradient acceptability of pragmatics- and quantification-related violations, which was not captured in binary acceptability judgments

References

- Bott, Bailey, & Grodner (2011). *J. Mem. Lang.*, 66, 123-142.
- Degen & Tanenhaus (2011). *Proc. 33rd Conf. of the Cog. Sci. Society*.
- Grodner, Klein, Carbarry, & Tanenhaus, (2010). *Cognition*, 116, 42-55.
- Hartshorne & Snedeker (submitted).
- Huang & Snedeker (2009). *Cog. Psych.*, 58, 376-415.
- Makeig, Bell, Jung, & Sejnowski (1996). *Advances in neural information processing systems* 8, 145-151. MIT Press.
- Maris & Oostenveld (2007). *J. Neurosci. Methods*, 164, 177-190.
- Nieuwland, Ditman, & Kuperberg (2010). *J. Mem. Lang.*, 63, 324-46.
- Noveck & Posada (2003). *Brain & Lang.*, 85, 203-210.
- Politzer-Ahles, Fiorentino, Jiang, & Zhou (2011). *3rd Neurobio. of Lang. Conf.*

Acknowledgements: This research was supported by the National Science Foundation East Asia and Pacific Summer Institutes (award ID #1015160). We thank Liang Yan, Wu Chunping, and Wu Yue for assistance in the construction of materials.