PRAGMATIC PREDICTIONS FROM THE VISUAL WORLD MODULATE NEURAL SEMANTIC ACTIVITY

MEREDITH BROWN, TREVOR BROTHERS, GINA R. KUPERBERG

Department of Psychology, Tufts University, USA
Department of Psychiatry, Massachusetts General Hospital, USA
Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, USA

QUESTION

How does the brain use relevant world knowledge (including information from the visual world) to infer and predict speakers' intended meaning?

APPROACH

Examining event-related potential (ERP) effects of processing prenominal adjectives in the presence of **visual contrast sets**[1]

"The target is the tall pitcher"

Target noun = **pragmatically expected**

Target object is part of a contrast set: tall pitcher vs. short pitcher

Target noun = **pragmatically unexpected**

Non-target object is part of a contrast set: tall ladder vs. short ladder

Target noun = **pragmatically intermediate**

Both target and non-target objects are part of contrast sets

MATERIALS & PROCEDURE

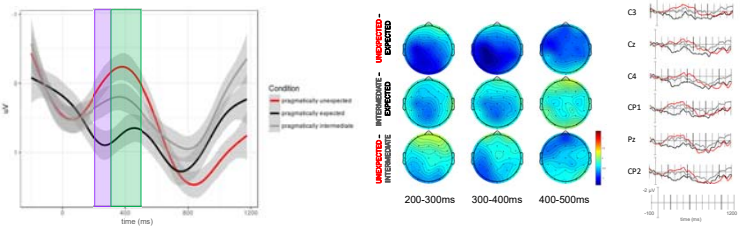
- 120 auditory critical items counterbalanced across the 3 conditions (differing only in contents of display)
- Half of adjectives relative (e.g. big, dim) & half absolute (e.g. orange, round), uniformly distributed across conditions
- Target nouns unique across items; adjectives repeated up to 4 times across critical items and fillers (with items pseudorandomized such that adjective repetitions were spaced out by at least 20 items)
- 2AFC location probe immediately following each item: Was the target picture in one of the red boxes?
- 24 participants, each with unique stimulus list (6 blocks)
- ERPs measured with 29 active tin electrodes & sampled at 200 Hz

PREDICTIONS

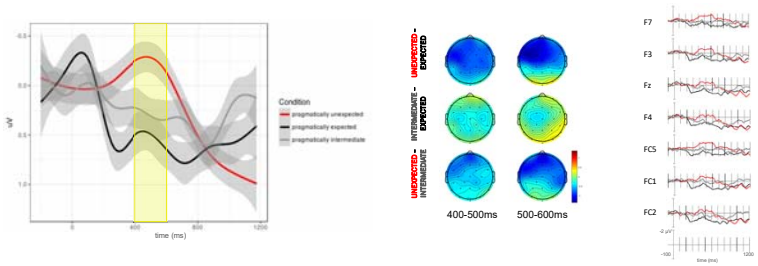
	Temporal ROI:	Spatial ROI:
1. When pragmatic context (visual display + adjective) renders the target noun **pragmatically expected**, we expect ERP evidence of semantic facilitation (i.e., N400 effects)[2]	300-500 ms	Cz, C3, C4, Pz, CP1, CP2
2. When pragmatic context renders the target noun **pragmatically unexpected**, we expect ERP effects of event structure reanalysis (i.e., P600 effects)[3]	600-1000 ms	Pz, P3, P4, Oz, O1, O2
3. Also in the **pragmatically unexpected** condition, we may see anterior negativity effects linked to cognitive demands of suppressing pragmatic prediction of incorrect adjective-noun structure (e.g. *tall ladder*) & enhancing activity of lower-probability target structure (e.g. *tall pitcher*)[4,5]	400-600 ms	Fz, F3, F4, F7, FC1, FC2, FC5

RESULTS

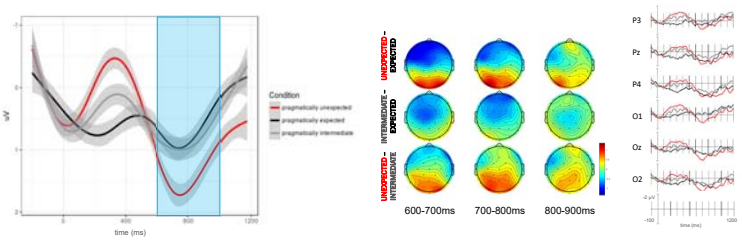
N400: Evidence of semantic facilitation when target noun is **pragmatically expected** relative to **unexpected** (graded effects with **intermediate**)



Anterior negativity: Evidence that listeners are suppressing **incorrectly predicted adjective-noun structure** & enhancing activity of lower-probability target structure



P600: Evidence of event structure reanalysis when target noun is **pragmatically unexpected** relative to **expected** or **intermediate**



CONCLUSIONS & FUTURE DIRECTIONS

Pragmatic information from contextually salient contrast sets in visual context can modulate neural activity related to semantic prediction, and can lead to prolonged neural processing when predictions are disconfirmed

Ongoing/future work:

[1] Examining ERPs time-locked to adjective as well as noun
[2] Evaluating potential effects of adjective type (relative vs. absolute)
[3] Using this paradigm to look at ERP effects combined and/or coregistered with eyetracking effects
[4] Adding manipulation of mood to examine effects of emotional state on predictive processing

1 Sedivy JC, Tanenhaus MK, Chambers CG, Carlson GN (1999) *Cognition, 71*(2), 109-47.
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3 Kiang M, Kuperberg GR (2015). *Language, Cognition, and Neuroscience*, 30(6), 648-72.
4 Baggio G, Choma T, van Lambalgen M, Hagoort P. (2010). *Journal of Cognitive Neuroscience, 22*, 2131-40.
5 Wittenberg E, Paczynski M, Wiese H, Jackendoff R, Kuperberg G. (2014). *Journal of Memory and Language, 73*, 31-42.

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