

Advantages of extending vs. mixing metaphors: An ERP study



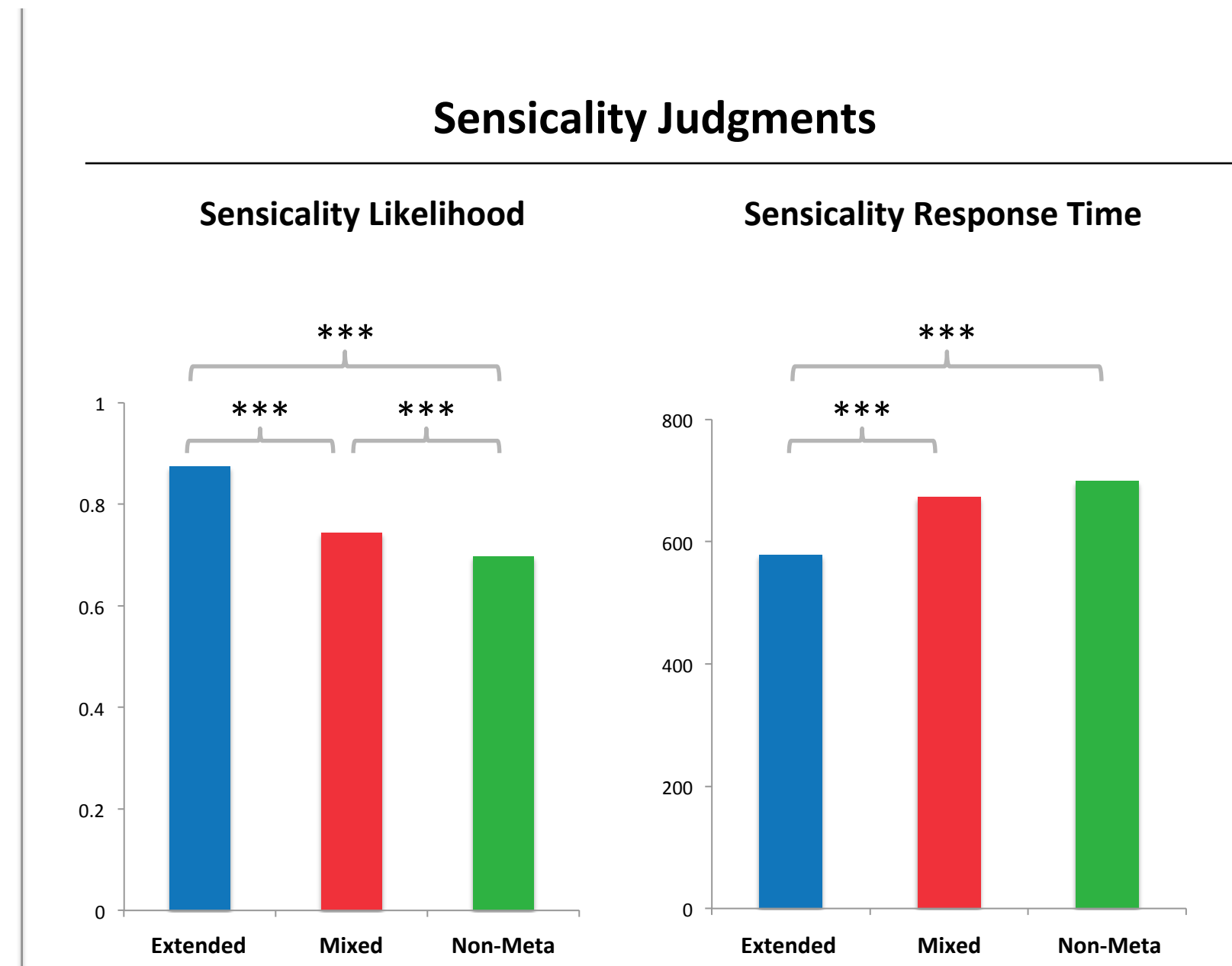
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Introduction

- Metaphors are pervasive in everyday language [1]
- They are often used to describe abstract concepts in a more concrete and vivid way
- On the one hand, widespread use of **extended metaphors** (a) suggests it is advantageous to activate a mapping between two domains (CRIME, VIRUS) when interpreting metaphoric language [2]
- Conversely, some have argued that spontaneous use of **mixed metaphors** (b) implies that such mappings may be “dead” (suppressed) for conventional metaphors [3]
 - Crime has become an **epidemic** and there’s no **antidote** strong enough to cure it!*
 - Crime has become a **beast** that’s roaring out of control and there’s no **antidote** strong enough to cure it!*
- Finally, not all metaphors are alike. Some are “better” than others, and may be better for a variety of reasons [4]
 - Aptness
 - Conventionality
 - Comprehensibility
 - Metaphoricity
 - Surprisingness

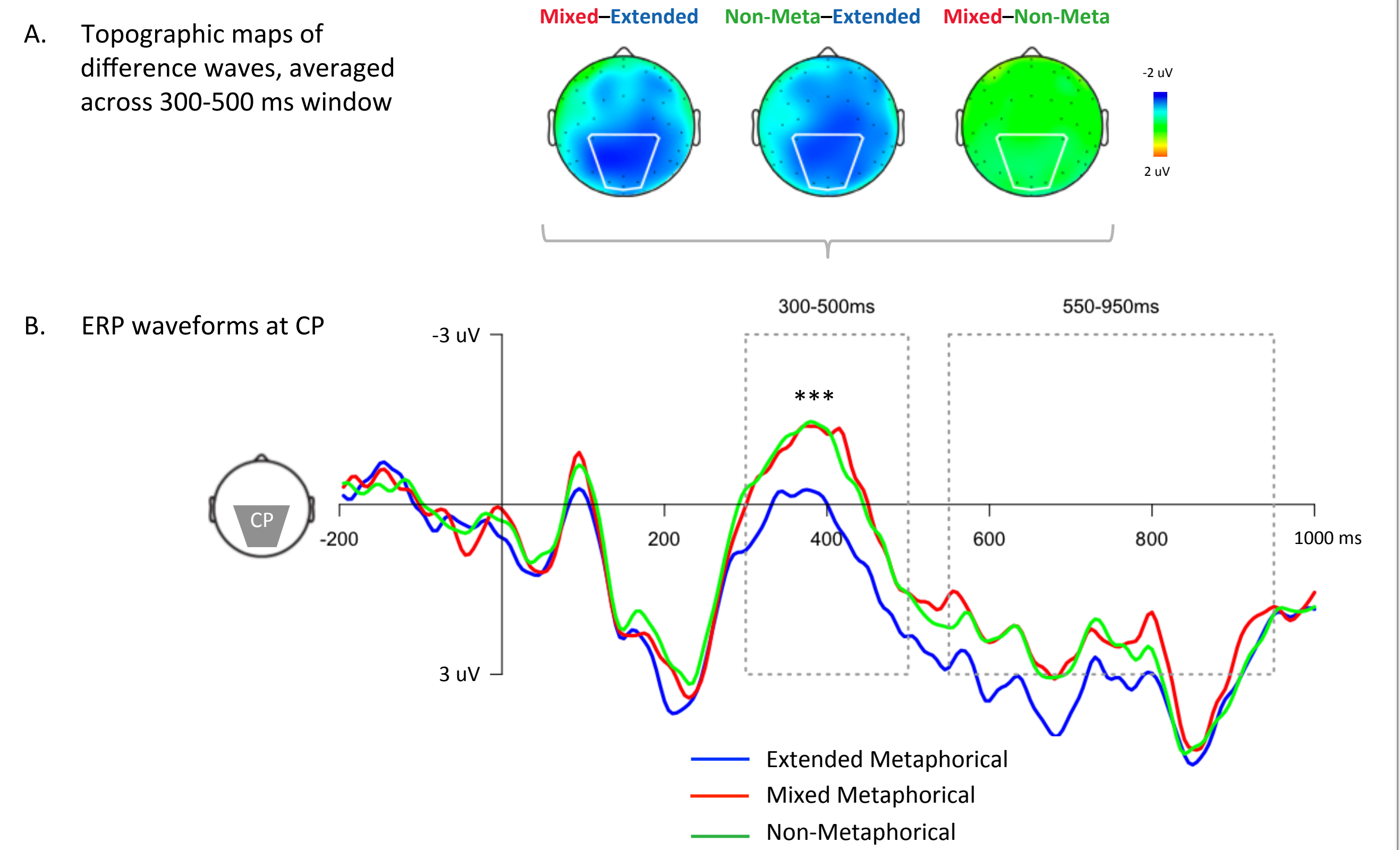
Behavioral Results



- Behavioral results replicate and extend the comprehension-time results of [2], who also found no evidence of latency differences between Mixed and Non-Meta contexts
- Conversely, the likelihood of making a sensicality judgment does differ between these conditions here

Results and Discussion

Grand Average ERPs



- N400s for Mixed and Non-Meta were significantly more negative than Extended ($p < .001$), which suggests they required more semantic effort to process (however, see below)

Research Questions

- Are conceptual mappings in conventional metaphors productive?
- Is there an online comprehension benefit for maintaining metaphoric consistency over switching metaphors mid-stream?
- Can offline measures of metaphor “goodness” predict behavioral and/or ERP effects?

Example Metaphor Stimulus Set

Story Context

A. Conventional Metaphor: CRIME IS A VIRUS
In big cities across America, crime has become an epidemic that can't be cured. It is beginning to infect small towns as well.

B. Conventional Metaphor: CRIME IS A BEAST
In big cities across America, crime has become a beast that is roaring out of control. It is beginning to prey on small towns as well.

C. Non-Metaphorical Description
In big cities across America, crime has become a problem that can't be solved. It is beginning to affect small towns as well.

Story Target Sentence (extended metaphor)

- There is no antidote strong enough to cure it.
- There is no cage strong enough to restrain it.

Mixed-Effects Analysis

Offline ratings as predictors of response time

Previous work shows correlations between metaphor ratings and response times for reading or sensicality judgments [4-8]

Research Question

Does Context affect response times above and beyond what is picked up by survey ratings?

Mixed-effects model¹

- Predictors: Context, Ease of Interpretation, Figurativeness
- Subject-wise error term: Intercept and slopes for all predictors
- Item-wise error term: Intercept and slope for Context

Results

Ease of Interpretation strongly predicted RT data ($p < .0001$), but no other factors were reliable

- Suggests that offline ratings related to Ease of Interpretation are indeed the best predictors of RT for positive (go) sensicality judgment
- Because Context also predicts Ease of Interpretation ratings, either:
 - Ratings of Ease of Interpretation already account for Context
 - Ease of Interpretation solely determines RT

¹ Including interactions among predictors did not improve the model

Mixed-effects modeling of individual ERP trials

Previous ERP research on metaphor processing has focused on grand averaged data

Research Question

Does item-wise rating data predict item-wise ERP effects at the N400 and/or P600?

N400 Window

Mixed-effects model¹

- Predictors: Context, Ease of Interpretation, Figurativeness
- Subject-wise error term: Intercept and slopes for all predictors
- Item-wise error term: Intercept and slope for Context

Results

Context strongly predicted the N400 ($p < .001$), but no other factors were reliable²

- In contrast to RT analysis, N400 responds to Context rather than Ease of Interpretation
- Suggests that Extended metaphorical context may provide priming for lexical item itself, rather than for its appropriate metaphoric interpretation

² Even if only positive sensicality trials are included

P600 Window

Mixed-effects model

- Predictors: Context, Ease of Interpretation, Figurativeness
- Subject-wise error term: Intercept and slopes for all predictors
- Item-wise error term: Intercept and slope for Context

Results

Figurativeness strongly predicted the P600 ($p < .001$), but no other factors were reliable³

- In contrast to either RT or N400 analyses, P600 responds to the Figurativeness of the target items (Note: Figurativeness was not predicted by Context in ratings study)
- Suggests that P600 reflects the cost of accessing the figurative meaning of the critical word (or suppressing the literal meaning [cf. 9])

³ Even if potential component overlap from N400 is accounted for

Methods

Participants

- 96 right-handed, native speakers of American English (48 male, 48 female)
- Mean age: 19.8 (range 18 to 23)

Stimuli – 108 short stories

36 Metaphorical Items **72 Filler Items**

Extended (A→1, B→2) Semantic Anomaly

Mixed (B→1, A→2) Syntactic Anomaly

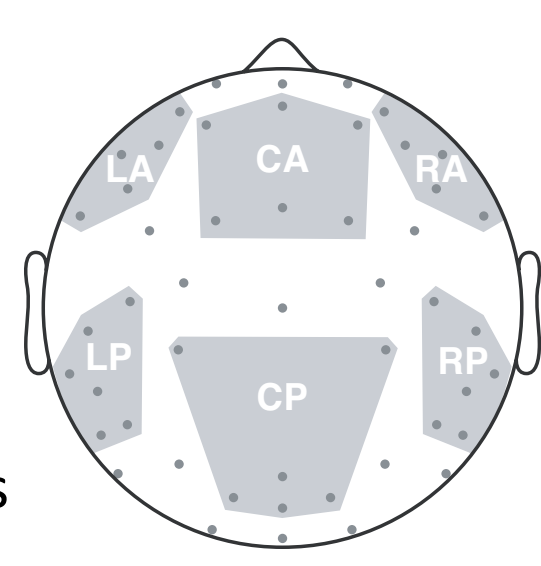
Non-Meta (C→1, C→2) Filler Control

Dual Task

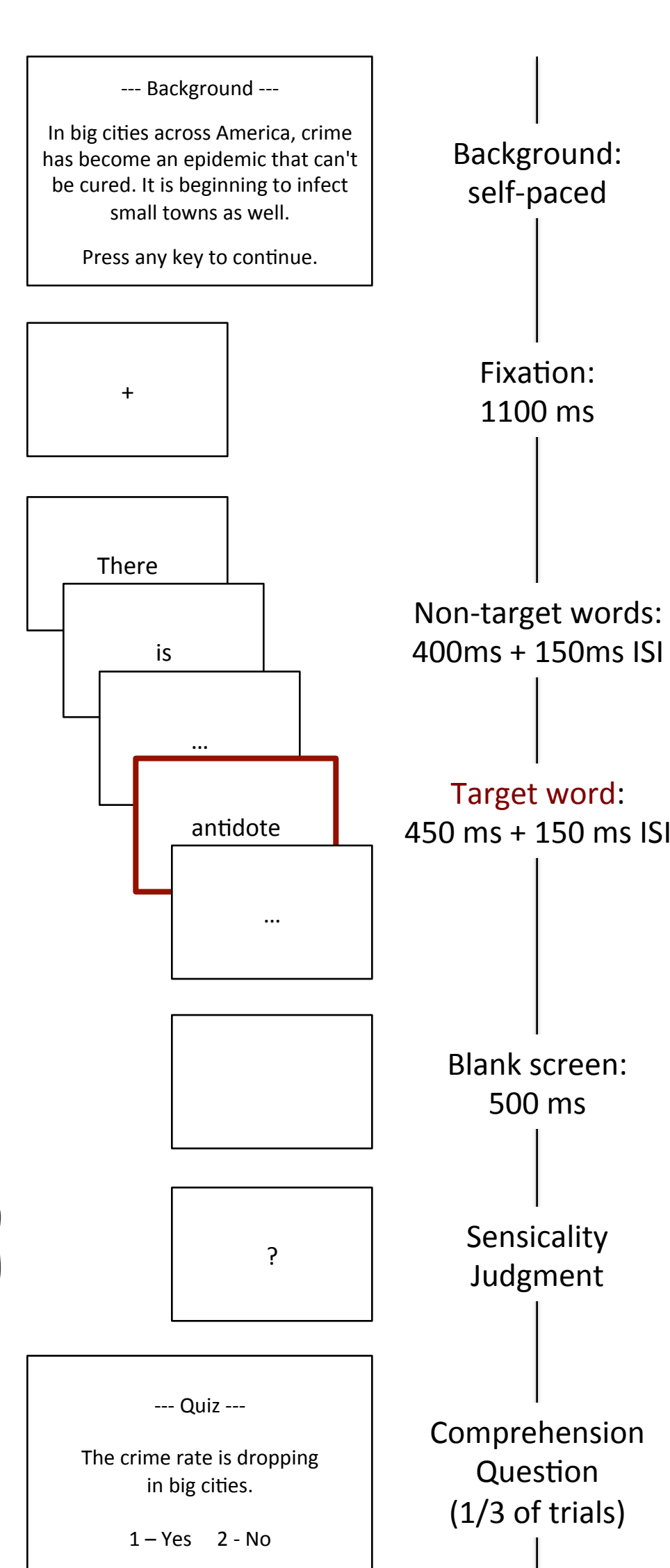
- Go/No-go sensicality judgment following each story
- Yes/No comprehension quiz following 1/3 of stories

EEG Recording

- 64-channel HydroCel Geodesic Sensor Net (EGI)
- Bandpass: 0.1-40 Hz
- Downsample: 200 Hz
- Rereference: Avg. mastiods
- Voltages averaged for analysis within six 6-channel groups



Procedure



Stimulus Ratings Study

- 1193 participants via Amazon Mechanical Turk
- 36 Metaphorical items (12 per condition)

Version A

Rated each item on 4 dimensions:

- Comprehensibility
- Conventionality
- Metaphoricity
- Surprisingness

Version B

Rated each item on 1 dimension:

- Aptness

Principal components analysis

Two PCs explained 92.8% of variance across all 5 dimensions:

- PC1 (74.1%) loaded highly on comprehensibility, conventionality, aptness, and (negatively) on surprisingness
→ “Ease of Interpretation” (sensitive to Context)
- PC2 (18.6%) loaded highly on metaphoricity
→ “Figurativeness” (not sensitive to Context)

Conclusions

The comprehension of extended metaphors is facilitated by first reading conceptually related conventional metaphors

- Therefore, conceptual mappings in conventional metaphors can be productive

Offline ratings of metaphors embedded in context provide further insight into this facilitation effect

- Results lend support to comprehension models in which N400 reflects retrieval of lexical information from semantic memory (rather than semantic integration) and P600 reflects reanalysis (e.g., of figurative content) [e.g., 9]
- Although Figurativeness of extended metaphors elicits reanalysis across all contexts (increased P600), initial lexical access is facilitated by an appropriate context (reduced N400); however, overall reading time and interpretation depends on metaphor quality (Ease of Interpretation), rather than on lexical access (context)

Overall, these findings suggest that metaphor productivity provides a communicative advantage (replicating and extending [4])

- Metaphoric categories may function as a conceptual alphabet
- Existing structural mappings can be extended on the fly
- Allowing a speaker to convey large amount of information with minimal effort

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Acknowledgments

This research was funded by the Department of Psychology, Swarthmore College

Many thanks to the RAs in the Swarthmore ERP Lab

Poster presented at the 26th Annual CUNY Conference on Human Sentence Processing University of South Carolina March 21-23, 2013