Conflict and Resolution in Semantic Processes Underlying Comprehension: An ERP Time-Frequency Analysis

Vaughn R. Steele, Edward M. Bernat, Paul F. Collins, Paul van den Broek, Christopher J. Patrick, Chad J. Marsolek
University of Minnesota

Introduction
Inference Generation during Comprehension

Laurie left early for the birthday party.
She spent an hour shopping at the mall.

* Motivated readers use background knowledge to infer that Laurie shopped for a gift.

Semantic Processes Involved

- Diffuse activation of semantically related concepts (e.g., "buy" -- house & living device; Reingold, 1975; inhibitory inhibition of nondominant concepts (e.g., living device; Ingham & Simpson, 1968; Stoyanov, 1978).
- Some of the semantic information integrated into long-term memory representation of the text (Karron, 1983).

ERP Correlate of Inference Generation

- Attenuation of N400 (kau & Ittyapal, 1986) is found when reading words that explicitly state information that had been generated in a preceding bridging inference (St. George et al., 1997).

Main Question:
How Many Processes Underlie the N400?

* Single Process
  Semantic Congruency Monitoring
  - N400 processes reflect conflict detection only; semantic integration occurs post-N400 time window

* Two Processes (Reads et al., 2004)
  First, Semantic Congruency Monitoring
  Thenn, Semantic Integration
  - N400 processes reflect initial conflict detection; then after conflict detection, semantic integration occurs during the N400 time window

Methods

Participants
N = 30 (15 males, 15 females)

Time-Frequency Decomposition
Theta filtered time-frequency decomposition

Behavioral Evidence of Inference Generation

Equal Amount of Theta for both Neutral Condition and Pseudoword Condition

More Theta for Neutral Condition than Inferred Condition

More Theta for Inferred Condition than Neutral Condition

Results

Time-Frequency Decomposition
Theta filtered time-frequency decomposition

Behavioral Evidence of Inference Generation

Equal Amount of Theta for both Neutral Condition and Pseudoword Condition

More Theta for Neutral Condition than Inferred Condition

More Theta for Inferred Condition than Neutral Condition

Conclusions

Behavioral and ERP analysis replication of previous inference generation and N400 literature

* Faster responses to words that correspond to precisely inferred information, and attenuated N400 to such words

* Time-frequency analysis allows dissociation between N400 neural processes (Bernat et al., 2008; Cohn et al., 1993)

Two separable processes underlie the N400

Theta: Conflict detection
More theta found for neutral and pseudoword conditions (reflecting greater conflict) compared to inferred conditions (reflecting less conflict).

Delta: Semantic integration
More delta found for inferred conditions (reflecting greater integration) compared to neutral and pseudoword conditions (reflecting less integration).

References


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