A Dynamic Approach to Semantic Computation: Evidence from Event-Related Potentials and Connectionist Attractor Networks

Ben D. Amsel
University of Toronto Scarborough

George S. Cree
University of Toronto Scarborough

Abstract: What factors determine speed of word meaning computation, and what is the time course of each factors influence? Implicated factors include correlations among, and distinctiveness of, semantic features, semantic richness, and the structural organization of features into cortical regions (by modality and/or object domain). Event-related potentials and connectionist attractor networks are well suited for this problem because they provide near-continuous measurement during word meaning computation. We explored the dynamics of a recurrent attractor network trained with verbal feature-based representations of concepts and show how feature-based statistical structure (e.g., correlations among features) affects concept settling dynamically through time. We also analyzed ERPs during a mental image-generation task using the identical items, incorporating measures of feature-based statistical structure, semantic richness (e.g., imageability), and modality-specific knowledge types (e.g., number of visual features). Using polynomial mixed-effects models, we demonstrate overlapping dynamic spatiotemporal effects of these measures, and discuss implications for theories of knowledge representation.