

Temporal dynamics of sensorimotor information encoding in convergence zones





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– How is semantic knowledge pieced together? –

- Theories of grounded cognition propose that **modality-specific regions** contribute to **semantic representations** (Binder & Desai, 2011; Martin, 2016; Pulvermüller, 2013).
- To create a holistic representation of a concept, however, information from modality-specific brain areas is processed in so-called
 convergence zones (Damasio, 1989)
- **Temporal information** is vital to understand how features are represented in potential hubs

- Statistical Testing

- Carry out cluster permutation in each ROI for each feature
- Divide into 200ms overlapping windows; 1000 permutations, threshold at p < 0.05

Results

Left Angular Gyrus

No clear temporal convergence

Significant

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Hypotheses

H1: Features are processed in parallel (spatio-temporal convergence; representational hub)

H2: Features are processed at different times (spatial convergence only)

- Stimuli

- Dataset of 915 unique words rated by saliency (0 to 6) of four features: color, motion, shape, sound
- 438 words and ratings from Binder et al. (2016) and 477 from Fernandino et al. (2016)







- random order
- 46 participants; 29 female

Convergence Zones

- One-tailed t-tests and threshold at p<0.005 (uncorrected) for 50ms time windows
- Collapse across time for each feature, and carry out **spatial conjunction analysis**
- Define convergence zone ROIs according to areas responsive to all 4 regressors

Dark red: one or two features

Red: three features

Orange: four features





Spatio-temporal convergence 750 to 950ms, and 1050 to 1250ms



Conclusion

Spatial convergence of semantic features revealed putative convergence zones in line with previous studies. However, timecourse analyses revealed temporal convergence only in two of these regions (ISTS, IFG), whereas in the AG and SPL different semantic features were processed in different time windows.

The lack of temporal convergence in these regions may suggest a role as a control or buffer region more than semantic integration.



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