How Do Brain Areas Work Together When We Think, Perceive, and Remember?

- Some examples of situations in which there must be coordination between brain areas:
  - Cross-modal integration for action and spatial awareness
  - Speech perception (McGurk Effect…)
  - Coordination of what and where
  - Attention and working memory (mutual engagement of fronto-parietal networks with content-specific brain areas)
  - Comprehension of language in a natural setting (where constraints come from the visible world as well as spoken language).
  - Memory for meaningful materials (requires coordination of cortical and hippocampal representations and processes).
- I argue that multi-regional cooperative computation is the rule in all aspects of human cognition and that the only reason we don't generally think that it is is that we have not until now had to tools to study it.

Approaches

- Investigation of synchronization of neural activity across brain areas using simultaneously recorded spikes, local field potentials, scalp EEGs, and/or MEG.
- Investigation of effects of congruity between inputs in different modalities on neural processes using above methods.
- Couple the above with fMRI and DTI tractography to pin-point cooperating brain areas.
- The above require convergent use of complex data sets, advances in current statistical analysis methods, further development of key information-theoretic concepts relevant to cross-regional cooperative activity.