Multi-scale modeling of the cocktail party problem (U01AG058532)

We live in very busy environments where our brains are constantly challenged by a cacophony of sound constantly reaching our ears –an intricate and ill-understood phenomenon called the cocktail party problem. The current proposal examines the hypothesis that rapid plasticity of brain circuits plays a crucial role in this process by adapting the neural representation of acoustic stimuli based on *both* memory and attentional feedback. By tying together the role of memory and attention in shaping the brain representation of complex soundscapes, the project takes a novel approach to tackling the cocktail party problem, offers innovative engineering solutions for sound technologies, and provides a new window into understanding the relationship between cognitive factors and sensory function; an issue of great interest especially for normal adults as well as aging brains.

Model Credibility Plan

The project start date is Sept 2018. Below are actions planned for the project:

Year 1: Develop model infrastructure for microscale processing of dynamic acoustic scenes.

Year 2: Parallel evaluation of the microscale model and tuning of model parameters guided by empirical data based on planned physiological and behavioral experiments

Year 3: Model development of mesoscale processing as well as bifurcation of model for adult and aging groups

Year 4: Extension of model to macroscale processing and integration of full hierarchical model

Year 5: Integration of system with engineering systems and validation against planned validation benchmarks

Credibility actions with CPMS TSR

1. Define context:
   The multiscale model will develop a hierarchical model operating over multiple scales to test the interaction between sensory and attentional processes in facilitating hearing in cocktail party settings
2. Appropriate data:
   Experimental data generated from the project both in human and animal models will be used to directly inform and validate the model
3. Evaluation within context:
   The model will be evaluated directly on the experimental data both in adult and aging populations
4. Explicit limitations:

The model assumes a number of simplifications including forgoing a biophysical model of network dynamics; and focuses on a systems approach to multiscale interactions of cortical networks

5. Version control:
   Best practices are being followed to guide version control as well as allow user interaction
6. Documentation:
   The team intends to fully document the model implementation following software development best practices
7. Broad dissemination:
   The team plans on making the model and its accompanying datasets and documentation widely available
8. Independent reviews:
   The broad dissemination plan includes cross tests and validation by collaborators as well as peer review process
9. Competing implementations:
   The development plans will consider varying platforms and cross implementations to test consistency
10. Conformity to standards:
    Best practices will guide the model development.