Movies in the Magnet: Emerging themes from naturalistic viewing studies in fMRI

Tuesday, Jun 19: 2:45 PM - 4:00 PM
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Symposium
Tuesday - Symposia PM
In addition to an ongoing interest in driving the brain in complex, dynamic ways, the need to decrease head motion and to collect data over a meaningful scan duration is currently combining with a burgeoning interest in detecting individual differences in the brain to further propel the use of naturalistic paradigms in neuroimaging. The learning outcomes for this symposium provide foundational background information about this emerging subfield (e.g., test-retest reliability, head motion statistics), orient researchers to ongoing work and resources applicable to a broad range of research interests, and set the stage for the next wave of studies by describing novel analytic approaches.
Objective

1a. Participants will be able to list at least three practical advantages of using naturalistic paradigms for fMRI research, and how these advantages apply in different populations (e.g., developmental, nonhuman primates, neuropsychiatric populations). 1b. Participants will also become familiar with open-science databases and naturalistic paradigms that are available to the community.
2. Participants will be able to discuss how naturalistic paradigms enable researchers to target complex cognitive processes in unique ways. Specifically, they will be able to delineate findings regarding memory and hippocampal functional connectivity collected during naturalistic viewing.
3. Participants will be able to describe how novel analytic approaches leverage the unique variability and duration of BOLD-signal changes evoked during movie watching. Further, participants will be able to identify the degree to which each analysis relies on (or overlooks) the time-locked nature of the signal changes.

Target Audience

Because naturalistic viewing paradigms are used across modalities (e.g., fMRI, MEG, EEG), we expect the audience to be fairly diverse, especially including researchers who work with difficult-to-study populations such as individuals with psychiatric disorders, infants and children, and nonhuman primates. Additionally, researchers interested in probing high-order cognitive processes using complex paradigms, studying temporal dynamics, individual differences, and more methodological work targeting novel analytic approaches, would find the symposium useful. Finally, we think that the open-science aspect of the symposium will further increase the diversity of the target audience.
Co Organizer

Christine Guo, QIMR Berghofer
Organizer

Tamara Vanderwal, Yale University

Presentations

Memory and hippocampal functional connectivity during early childhood. (index.cfm?do=ev.viewEv&ev=1675)

Resting-state functional connectivity MRI (rs-fcMRI) maps show robust connectivity between BOLD signal in the hippocampus and multiple cortical regions. Previous studies show that rsfcMRI maps relate to episodic memory in adults (Wang et al., 2010) and children (e.g., Riggins et al., 2016). The present study used the Inscapes movie

paradigm (Vanderwal et al., 2015) to examine age-related differences in the relation between hippocampal function connectivity and memory performance in two hundred 4- to 8-year-old children (M=6.2 years, SD=1.5). Results from the final sample of 137 children indicated age-related differences in relations between hippocampal functional connectivity and episodic memory in left lingual gyrus, especially between 5-7 years. The findings are consistent with previous behavioral findings indicating that episodic memory develops rapidly during this developmental period (Riggins, 2014) and illustrate the power of using the Inscapes movie paradigm to acquire rs-fcMRI data from very young children. Fengji Geng will be presenting this work, which was done in collaboration with Tracy Riggins and Elizabeth Redcay.

Presenter

Fengji Geng, University of Maryland

Bringing naturalistic viewing to scale in human and nonhuman populations. (index.cfm?do=ev.viewEv&ev=1676)

Naturalistic viewing paradigms are gaining increased attention in imaging studies due to their ability to improve scanner tolerability for difficult to scan populations (e.g., Vanderwal et al., 2015), as well as the range of novel analyses for which they are uniquely suited (e.g., Simony et al., 2016). Here, we report on the application of naturalistic viewing paradigms in the ongoing large-scale Healthy Brain Network, which is collecting multimodal imaging data from 10,000 children (ages: 5-21 years old) in the New York area. We will present results from the first 600 participants demonstrating advantages for naturalistic fMRI over resting fMRI in younger children, from a motion perspective (Alexander et al., in press). We will also discuss comparisons of motion profiles for resting state and naturalistic viewing fMRI in awake, nonhuman primate imaging studies, again demonstrating an advantage for naturalistic viewing. Finally, in each of the two populations (human, nonhuman), we will present data demonstrating high reliability for the detection of inter-individual differences between states.

Presenter

Michael Milham, Child Mind Institute

Naturalistic paradigms as a bridge between task-based and resting-state fMRI. (index.cfm?do=ev.viewEv&ev=1677)

One unique potential of naturalistic viewing paradigms is to act as a bridge between classical task-based imaging and resting-state assessments. Similar networks can be identified under both conventional task- and resting states, and it has been proposed that the wealth of knowledge gained from well-controlled experiments can be leveraged into a priori network models or dictionaries of whole-brain activity patterns for resting-state analyses. However, direct evaluation of these cross-state relationships remains difficult. Data from naturalistic viewing paradigms share many technical characteristics with resting-state data, and can therefore be subjected to the same analytical approaches. In contrast to resting-state data, states that are identified in naturalistic viewing datasets as matching with task-based models may be evaluated against the actual content presented to the subjects, providing a bridge between neuropsychological tasks and endogenously controlled states. The analyses we will develop using the proposed data set will aim at evaluating these cross-state differences and similarities in novel ways.

Presenter

Simon B.Eickhoff, Institute of Neuroscience and Medicine, Brain & Behaviour (INM-7), Research Centre Jülich

Relating behavioral phenotypes to inter-brain synchrony during a naturalistic task. (index.cfm?do=ev.viewEv&ev=1678)

Traditionally, naturalistic tasks have been used to study patterns of brain activity that are shared across the population, but individuals often interpret the same stimulus in different ways. How do an individual's personality traits modulate his or her brain activity to complex, emotionally evocative naturalistic stimuli? Using HBN data, I will present results from an extension of the inter-subject correlation (ISC) approach that can identify brain regions that are more synchronized among some pairs of participants than others, and relate similarity of brain response to similarity on a phenotypic measurement (e.g., the Social Responsiveness Scale, which measures social ability/autistic tendencies). This technique identifies regions of interest (ROIs) that can then be used in event-related analyses to explore neural responses to various features of a naturalistic stimulus, and how the magnitudes of these responses scales with behavioral phenotype. Ultimately this technique may allow us to use naturalistic stimuli as a brain "stress test" to predict present and future phenotypes in novel individuals.

Presenter

Emily Finn, PhD, National Institute of Mental Health