CABI NEWSLETTER

VOLUME 5, ISSUE 1

Georgia State University/Georgia Tech Center for Advanced Brain Imaging

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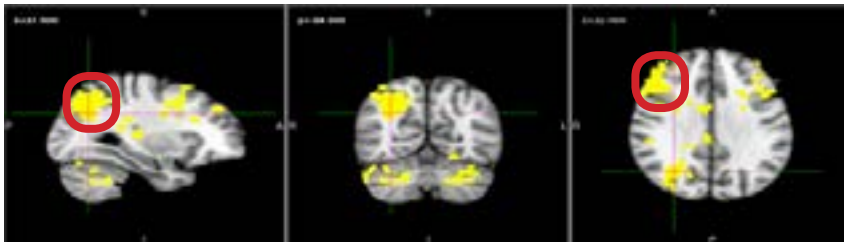
CABI FEATURED RESEARCH

Neural correlates of sequential learning for adjacent and non-adjacent dependencies

Christopher M. Conway, Leyla Eghbalzad, Joanne Deocampo, Sabrina Na, & Tricia King

The ability to learn sequential dependencies is essential for language acquisition and other cognitive skills. Recent studies suggest there may be separate cognitive processes involved in learning adjacent (e.g., "A-B") versus non-adjacent (e.g., "A-X-B") dependencies, but the neural correlates accompanying such learning are under-specified. We developed a sequential learning task in which sequences of printed nonsense syllables containing both adjacent and non-adjacent dependencies were presented. After incidentally learning these grammatical sequences, eighteen healthy adults (age M=22.5, 9 females) made familiarity judgments about novel grammatical sequences and ungrammatical sequences containing violations of the adjacent or non-adjacent dependencies while in a 3T MRI scanner. Analysis of the BOLD activity showed that increased activation for adjacent dependency learning was associated with a distributed frontal –parietal and cerebellar network, whereas increased activation for non-adjacent dependency learning was associated with the anterior cingulate cortex (ACC) (See Figures). The frontal-parietal network is known to be associated with working memory while the ACC is proposed to be important for cognitive control, error/conflict detection, as well as allocation of attention and selection of appropriate responses. Furthermore, these networks were differentially correlated with distinct out-of-scanner cognitive measures such as working memory and processing speed.The frontal-parietal, anterior cingulate, and cerebellar regions appear to be engaged as a robust neural network supporting the cognitive functions required for sequential learning. Each of these regions was differentially recruited depending upon the type of dependency (adjacent versus non-adjacent) and each was associated with different cognitive processes. These findings provide the basis for understanding the neural underpinnings of sequential pattern learning and may help elucidate the nature of some learning and language disorders. In the future, we plan to employ this paradigm with a variety of clinical populations to further understand the role of sequential learning in contributing to language and cognitive outcomes.

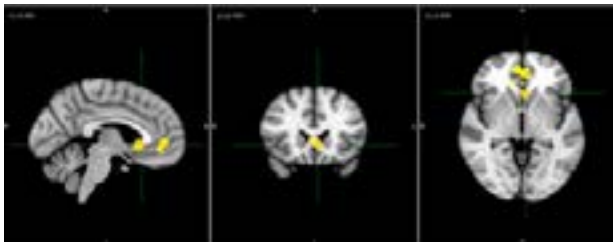
Results: Adjacent dependency (Ungrammatical vs. Grammatical)



Superior parietal lobe (BA 7 & 5)

Middle and superior frontal gyrus (BA 46)

Results: Non-adjacent dependency condition (Ungrammatical vs. Grammatical)



Dorsal part of the anterior cingulate cortex (BA32) and subcollosal gyrus (BA 25)

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SAVE THE DATE

Colleen A. Hanlon, Ph.D.

Dept. of Psychiatry and Behavorial Sciences,Charleston, SC

November 17th, Friday

9:30am-10:30am CABI Conference Room

April 3, 2018

Callosum Poster Session @ CABI

4:00 - 6:00pm

Upcoming Events

CABI Users Meeting

9:30am - 10:30am
(3rd Thurs of each month)
Monthly meeting of CABI users to discuss neuroimaging issues.

Introducing New Faculty

Thackery Brown, Ph.D. is an incoming Assistant Professor in the Georgia Tech School of Psychology and the Center for Advanced Brain Imaging. There, he will direct the Memory, Affect, and Planning (MAP) Laboratory. Dr. Brown received his Ph.D. in Psychology from Boston University under the mentorship of Dr. Chantal Stern, and completed his postdoctoral training at Stanford University with Dr. Anthony Wagner. Through the use of immersive virtual navigation paradigms and multivariate analysis techniques applied to functional imaging data, his research seeks to further our understanding of how humans encode, remember, and navigate their lives in naturalistic settings.

Vishwadeep Ahluwalia by way of Mumbai, India graduated as a Biomedical Engineer. I moved to Richmond, Virginia to pursue a Master's degree in Biomedical Engineering at Virginia Commonwealth University. In 2004, I enrolled into a Doctoral program in Medical Physics during which I trained in functional neuroimaging and spectroscopy techniques. As a post-doc, my research focused on applying MRI techniques in studying the cognitive deficits in patients with liver cirrhosis.

Vonetta Dotson, Ph.D. is an Associate Professor at GSU. She received her Ph.D. from the University of Florida. She specializes in clinical neuropsychology; cognitive neuroscience of depression;aging. Her research program centers on understanding the underlying neurobiology of depression and its relationship to cognitive changes and functional deficits in older adults. This work is translational in nature, with the goal of improving the diagnosis and treatment of mood disorders.

Seed Grand Recipients

Mukesh Dhamala, Ph.D. (GT)-"Benefits of video games in real-time decision-making"
Matthew Barrett (GT) - "Integrating Data from the Multidimensional Generalized Graded Unfolding Model and Functional Magnetic Resonance Imaging"
Robin Morris, Ph.D.(GT/GSU) and Doby Rahnev, Ph.D. (GT) - "Examining the Effects of Theta Burst Stimulation (TBS) on the Neural Network Associated with Reading in Adult Struggling Readers."
Ayanna Howard, Ph.D. (GT) -"Effectiveness of Functional Strength Training and Virtual Reality Games on Improving Arm Function in Children with Cerebral Palsy"
David Washburn, Ph.D. (GSU) -"The Cognitive Neuroscience of Answered Prayer"

Message From The Director

There will be some exciting changes to CABI over the next year. First, as you are aware, Jaemin Shin, left CABI for other opportunities at GE. I'm sure you all agree that we are sorry to see him leave and thank him for all the hard work he did for CABI since it opened. CABI has hired a new research scientist, Vishwadeep Ahluwalia. We look forward to his starting on November 1st. The second major change is the GSU and GT administrations have agreed to upgrade our 3T Trio to a 3T PRISMA. This upgrade will improve scanning capabilities for most users. The tentative plan is to upgrade in summer 2018. More details about the upgrade will be forthcoming. As always, I encourage users to reach out to CABI staff if you have questions or concerns. We are committed to working with you to help you achieve your research objectives.