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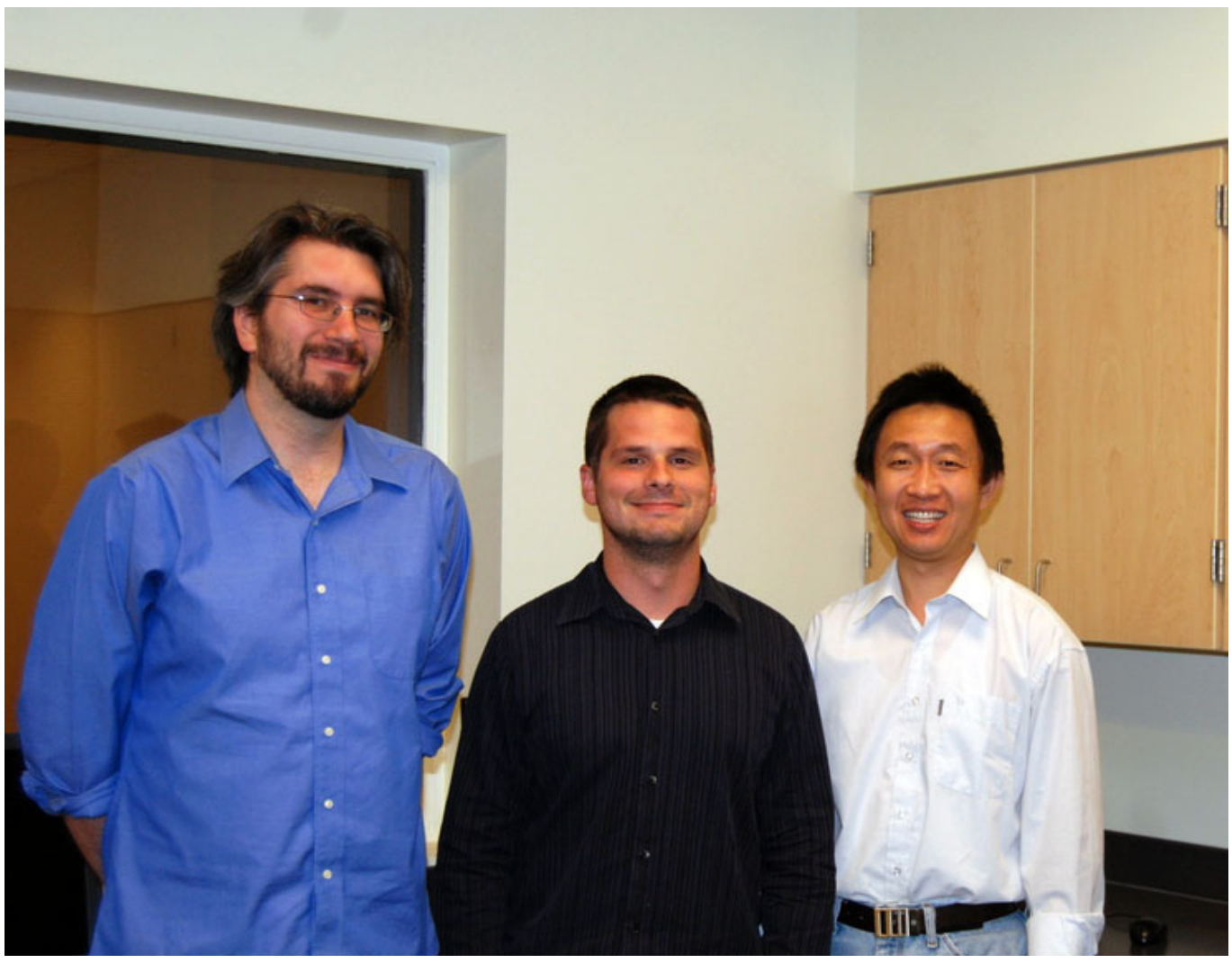
Affiliate Lab Interview
Wil Cunningham

Wil Cunningham, an affiliate of the CCSN, studies social neuroscience and the motivational processes underlying emotional responses with the Center for Cognitive and Behavioral Brain Imaging (CCBBI) and the Social Cognitive Lab at Ohio State University. In his research, Cunningham explores the way in which different goals and motivation change the way the brain works.



ABOVE (from left): Wil Cunningham, Associate Professor of Psychology; Nathan Arbuckle, graduate student; and Xiangrui Li, Ph.D., Lab Supervisor of the Center for Cognitive and Behavioral Brain Imaging at Ohio State University.

A PERSON'S GOAL CHANGES THE PROCESSING OF THE ENTIRE BRAIN. THIS CHALLENGES OUR IMPLICIT IDEA THAT THE MIND IS A BLANK SLATE.

WIL CUNNINGHAM

What is the current focus of your research?

In the last few years, our lab has shifted focus from attitudes to emotions. We have sought to answer the question, "What elements give rise to emotional states?" Emotion is complicated— generally, the word refers to subjective emotional experience, but we also study the antecedents and consequences of emotion. One of our lines of research looks at affective disorders. Recently, we have been looking at mania and anhedonia, and we are also interested in the connection between motivation and emotion.

What have you learned about mania?

In collaboration with June Gruber, an assistant professor of psychology at Yale University, and Tabitha Kirkland, a graduate student at Ohio State University, our lab began to explore the connection between mania and happiness. We wanted to determine whether or not mania was extreme happiness. In studying mania, researchers often refer to a continuum of emotional experience running from depression to sadness to happiness to mania. To better understand how mania fits into the emotional continuum, we have constructed a study using survey, interview and experience sampling data for three hundred participants. We plan to then bring back a subsample of these participants to collect fMRI data.

This research is in nascent stages, but the results may change our conventional understanding of mania.

WE HAVE SOUGHT TO ANSWER THE QUESTION, "WHAT ELEMENTS GIVE RISE TO EMOTIONAL STATES?"

WIL CUNNINGHAM

What methods and concepts do you employ to study motivation and emotion?

Our dominant line of research examines the way motivation and goals shape the dynamic processing of the brain. This is contrary to most people's conceptions of the brain at work—most people think that the brain creates a vertical representation of the world, and then uses information to form thoughts, emotions, decisions, and behaviors. For example, person would conceive of a stimulus as positive or negative, and presume a stimulus causes some degree of arousal, and then seek to determine where that stimulus' value is encoded in the brain.

In our research, we have looked to see how changing people's goals (e.g., making different stimuli important) changes an individual's brain. For example, the amygdala tends to be more active with negative than positive stimuli. But if you are in a situation where you are looking for positive attributes, the amygdala is sensitive to positive information. In this way, a person's goal changes the processing of the entire brain. Likewise, in looking at the visual cortex, when we vary the type of stimulus people are looking for, we find that event related potentials (ERPs) are altering as fast as one hundred milliseconds after stimulus presentation. This challenges the implicit idea that the mind is a blank slate. Our research indicates that the brain changes even before stimuli are presented. Because the mindset is altered before the stimulus, a person's first perceptions change in a goal relevant way.

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Affiliate Lab Interview *Continued*

ABOVE: Wil Cunningham, Associate Professor of Psychology at Ohio State University.

RIGHT: Wil Cunningham and collaborators in the CCBBI's brain imaging facility.

This is critical, because to control impulsive behavior, a person should not wait until he or she is at the brink. The mind can be prepared to respond in a certain way, so initial impulses that seem paramount may not be important.

In one experiment examining motivation, conducted with Jay Van Bavel, an assistant professor of psychology at New York University, participants are placed into groups. In one condition, each person is told he or she is a sentry, and in another condition, each person is told that he or she is a spy. There is a well-known memory bias for in-group members. Generally, in a later memory task, people remember members of an in-group more than members of an out-group. Surprisingly, in the spy condition of this experiment, people remember members of the out-group, producing an out-group memory effect.

The brain is not static. It is constantly changing, rewiring, reconnecting to deal with the challenges of everyday life. As we answer more of these questions—"What is the processing characteristic of the medial prefrontal cortex? Of the amgydala? How do they change in different situations and with different stimuli?"—we are learning that these brain areas might not be operating at the level of the words we use to describe them. The amygdala is not merely a threat detector. It is doing something that is helpful to us when looking for threats, but another explanation may be needed to more completely understand its function.

What is the role of computational social neuroscience in understanding these situations?

I have been influenced by the work of Randy O'Reilly, a professor of psychology and neuroscience at the University of Colorado, and Michael Frank, an assistant professor of neuroscience at Brown University. If we are to bridge the psychological, observational level of analysis with the neural level of analysis, we must carefully articulate these underlying processes. Computational neuroscience seeks to move toward the mathematical representations of these processes, to allow us to start thinking about inputs, transformations, and outputs of distributive systems. We need to move beyond the words, because the words are just heuristics. This computational layer between the imaging and the psychological level allows us to not correlate our words with brain activity, but correlate computations with brain activity.

O'Reilly and Frank have done work building neural, biological models of phenomena they would like to more accurately explain. From these models, different lesion patterns can be employed, and the models can be tested to see if their activity is similar to that of lesion patients. From here, we can start to better understand individual differences in structure and function.

These new concepts also add a level of falsifiability to social neuroscience data. With words, it is easy to inaccurately explain someone else's conclusions. Similarly, with imaging data, it is very easy to force your theory into the data you gathered. I love the idea of residual analysis, where you spend time figuring out what your theory did not explain. There is so much in the neuroscience that suggests that we need to be rethinking our approaches. For example, a task may activate reward areas, but there are twelve different areas that are called reward areas, and they are not all activated every time. The question is not if activation is associated with reward, but which aspect is associated with reward? Computational approaches can help us access this understanding, and answering these questions will be very interesting.

IN THE COGNITIVE NEUROSCIENCES, WE ARE IN THE PROCESS OF FINDING NEURAL EVIDENCE FOR THESE ABSTRACTIONS, FORGETTING THEY WERE ABSTRACTIONS IN THE FIRST PLACE.

WIL CUNNINGHAM

What does the future hold?

I believe psychology is at the very beginning of a major revolution. It seems every thirty or forty years we rip apart all of our concepts and rebuild them. Many of our theoretical constructs are abstractions:; they are shorthand for the real variables of interest. We are very attached to these shorthand descriptors, to the point of believing they are real. In the cognitive neurosciences, we are in the process of finding neural evidence for these abstractions, forgetting that they were abstractions in the first place. In this way, imaging may be used to reify the things we already believe to be true. Because there are so many voxels of activation in the brain, we can find the story that confirms our ideas, rather than looking for disconfirming evidence. This is problematic for many reasons.

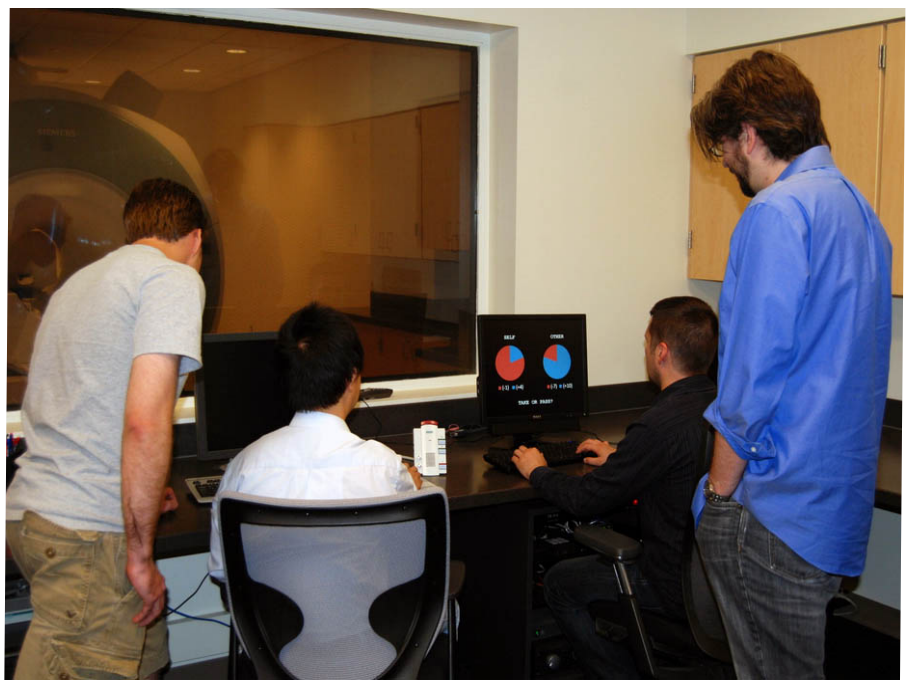
Likewise, regarding psychological explanations, we need to be a level beneath the levels of categories we use. For example, we are used to talking about something like emotion versus cognition, but what are the fundamental computations that give rise to emotion? What is shared? What is different?

REGARDING PSYCHOLOGICAL EXPLANATIONS, WE NEED TO BE A LEVEL BENEATH THE LEVELS OF CATEGORIES WE USE.

WIL CUNNINGHAM

To offer an analogy, we need to move from a kind of science that functions like Microsoft Word, a self-contained program, to science where modules are shared across a variety of different platforms, like Word, Powerpoint, and Excel. There could be a whole new level of description that can link the neurosciences to emotion, memory, and other psychological constructs at a different level of analysis. This could be the future of cognitive affect and social neuroscience.

If we accept the premise that we are on the cusp of a revolution in the description of psychological constructs, it may be in our interest to invest in deeper levels of explanation of these concepts, rather than working to reify a temporary theory. ■



RECENT PUBLICATIONS BY WIL CUNNINGHAM

Gruber, J., Cunningham, W. A., Kirkland, T., & Hay, A. C. (in press). Feeling stuck in the present? Mania proneness and history associated with present-oriented time perspective. *Emotion*.

Kesek, A., Cunningham, W. A., Packer, D. J., & Zelazo, P. D. (in press). Indirect goal priming is more powerful than explicit instruction in children. *Developmental Science*.

Kirkland, T. & Cunningham, W. A. (in press). Mapping emotions through time: How affective trajectories inform the language of emotion. *Emotion*.

Cunningham, W. A., Arbuckle, N. L., Jahn, A., Mowrer, S. M., & Abduljalil, A.M. (2010). Aspects of neuroticism and the amygdala: Chronic tuning from motivational styles. *Neuropsychologia,* 48:3399-3404.

Cunningham, W. A., Van Bavel, J. J., & Johnsen, I. R. (2008). Affective flexibility: Evaluative processing goals shape amygdala activity. *Psychological Science*, 19:152-160.

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