

Unifying experience and the brain

The next step is to correlate the coded experiences data with data from the brain itself. A team of researchers led by Kathleen Garrison at Yale University, including Santoyo and Kerr, did just that in a paper in *Frontiers in Human Neuroscience* in August 2013. The team worked with deeply experienced meditators to correlate the mental states they described during mindfulness with simultaneous activity in the posterior cingulate cortex (PCC). They measured that with real-time functional magnetic resonance imaging.

They found that when meditators of several different traditions reported feelings of “effortless doing” and “undistracted awareness” during their meditation, their PCC showed little activity, but when they reported that they felt distracted and had to work at mindfulness, their PCC was significantly more active. Given the chance to observe real-time feedback on their PCC activity, some meditators were even able to control the levels of activity there.

“You can observe both of these phenomena together and discover how they are co-determining one another,” Santoyo said. “Within 10 one - minute sessions they were able to develop certain strategies to evoke a certain experience and use it to drive the signal.”

Toward therapies

A theme of the conference, and a key motivator in Santoyo and Kerr's research, is connecting such research to tangible medical benefits. Meditators have long espoused such benefits, but support from neuroscience and psychiatry has been considerably more recent.

In a February 2013 paper in *Frontiers in Human Neuroscience*, Kerr and colleagues proposed that much like the meditators could control activity in the PCC, mindfulness practitioners may gain enhanced control over sensory cortical alpha rhythms. Those brain waves help regulate how the brain processes and filters sensations, including pain, and memories such as depressive cognitions.

Santoyo, whose family emigrated from Colombia when he was a child, became inspired to investigate the potential of mindfulness to aid mental health beginning in high school. Growing up in Cambridge and Somerville,