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### **UNM Professor and Student Explore Brain Connections in Search of a Disease**



Schizophrenia is a disease that can't yet be diagnosed with a medical test. Psychiatrists must instead study a patient's symptoms for a long period of time before making a diagnosis. That's a source of frustration for both doctors and patients, so one researcher at the MIND Institute on the University of New Mexico campus is searching for that critical physical clue in the way the human mind works while it's idling.

***Photo: Vince D. Calhoun is director of image analysis and MR research for the MIND Institute and associate professor of electrical and computer engineering.***

Some of the latest results are in an article written by UNM senior Abigail G. Garrity as part of her senior project that appears in the March issue of the *Journal of American Psychiatry*. Garrity is mentored by Vince D. Calhoun, the director of image analysis and MR research for the MIND Institute and an associate professor of electrical and computer engineering. The paper is based on Calhoun's research in ways to look at brain scans.

The heart of that research is a new way to look at which parts of the brain are activated when it is idling. Called "default mode," the research looks at the way some areas of the brain are activated when a healthy subject is just lying in a Functional Magnetic Resonance Imaging machine, and how the active areas change when a subject is called on to perform a specific task, such as reacting to a tone. The same test was given to subjects who have been diagnosed with schizophrenia, but in many cases the "default mode" areas of the brain continued to be active, even when the subject was responding to directions.

That led the researchers to suggest that default mode regions of the brain may be overactive in a way that interferes with normal thoughts and functioning, perhaps interrupting the internal monologue that humans generate and contributing to the delusional thoughts and hallucinations that are characteristic of schizophrenics.

#### **Calhoun's Research**

Calhoun has written extensively about independent component analysis, a software that uses blind source separation to tease out the confusing and overlapping functions of the brain that show up in functional magnetic resonance imaging. He has adapted the software to try to separate patterns in the brain that can be linked to specific activity.

Since much of his research is funded by the National Institutes of Health, his software tool is freely available on his website at <http://www.ece.unm.edu/~vcalhoun/>. Calhoun also teaches courses on how to work with the software.

Calhoun says his interest is in application, and research is a way to develop the methods needed to solve concrete problems. That's one reason he has spent so much time developing the tools to interpret brain scans, one of the few researchers involved in this complex specialty.

He says his specialty developed from his roots as an engineer who also worked for twelve years at Johns Hopkins in the psychiatry department. That taught him about the need to bridge the problems researchers have in developing the tools they need to answer their questions about how the human mind works. He has been at UNM since October 2006, and he says he is now interested in teaching students to apply engineering principles to biomedical problems.

Calhoun is also interested in multimodal data fusion - an exercise that takes different instances of brain imaging scans, puts them together, and looks at the possible implications. He thinks about which parts of the brain are active at various times, looks at how those parts might be linked, and what that might mean for potential treatments.

One of his postdoctoral students is currently looking at a combination of genetic information and imaging information to try to determine what part genetics might play in the development of schizophrenia, and what other things might influence development of the disease.

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