

## Summertime statistics

**Psychologists at APA's newest Advanced Training Institute learned to use nonlinear methods to analyze data.**

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Psychology professor Christine Charyton, PhD, studies the work of musicians, engineers and other creative folk. Recently, she began a project analyzing the music of jazz great John Coltrane. She intended to use the software program Humdrum to search for mathematical patterns in the seemingly free-flowing music.

Early on, though, Charyton realized that this type of analysis would require sophisticated statistical methods that went beyond the standard linear methods she had learned in graduate school. So in July, Charyton, a visiting assistant professor at Ohio State University–Newark, attended the APA Science Directorate's Advanced Training Institute (ATI) on nonlinear methods for psychological science—the first ATI to feature such training.

For the past seven years, the Science Directorate has offered summer ATIs to teach graduate students and psychologists new research skills. This year's other topics included functional magnetic resonance imaging, performing Web-based research, structural equation modeling and using large-scale databases.

The nonlinear methods institute, held at the University of Cincinnati, was organized and led by psychologists Guy Van Orden, PhD, then of Arizona State University and now at the University of Cincinnati; John Holden, PhD, of California State University, Northridge; and Michael Riley, PhD, and Kevin Shockley, PhD, both of the University of Cincinnati.

Charyton says she found the workshop valuable—and that it helped her find what she was looking for in the jazz pieces.

"If you listen to [the music] it sounds like a Jackson Pollack painting looks—free-form," she says. "But we found a pattern."

### **New method, new questions**

Nonlinear methods of analysis excel at finding these types of nested and repetitive patterns in complicated data. Scientists in other fields such as physics and biology first developed the methods, says Van Orden. The methods, he explains, allow researchers to study how complex dynamic systems orchestrate their many parts to change and work together over time. Van Orden himself, for example, studies the way that different areas of the brain and body are intertwined in cognitive tasks such as language and reading.

"I was trained to look for components of language in the mind and brain," he says. "But the way I think about language now allows me to take into account the body too, and the interdependencies among the mind and the body and the world in language."

Behavioral scientists have also used nonlinear methods to study such topics as how people organize their limbs together when walking, Van Orden says.

Holden, who studies the psychology of reading, says that using nonlinear methods led him to discover fractal patterns in people's response times on a reading task—the same patterns emerged over 300 or 400 trials as over 3,000 or 4,000.

"Nonlinear methods allow you to ask questions from a different perspective and look for patterns of self-organization," Holden says. "For example, people have found patterns in a person's mood across time—that your mood today is correlated to your mood yesterday. It allows you to frame human performance in those terms."

### **No expertise necessary**

The 12 participants in the ATI were a diverse group, says Van Orden. They included graduate students and early-career psychologists, a developmental psychologist, a clinical psychologist and movement scientists, among others.

One thing many of them shared, however, was little experience in the subject.

"We purposefully didn't require any background in the subject," says Van Orden, who taught at a level that could be understood by anyone with a graduate-level knowledge of psychology statistics. "When I was trying to learn these things, too often I would get in over my head," he says. "I think that taught me something about where the right level would be."

The participants attended lectures, learned to use new statistical software and in some cases analyzed data that they'd brought from their personal research projects. They also heard from guest lecturers, such as psychologist Michael Turvey, PhD, and Claudia Carello, PhD, both of the University of Connecticut, who discussed cross-disciplinary issues, such as what psychologists can learn from physicists and biologists who use nonlinear methods.

"It was exciting for me to sit and learn," says Van Orden.

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For more information about the 2007 Advanced Training Institutes, visit [www.apa.org/science/ati.html](http://www.apa.org/science/ati.html).

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