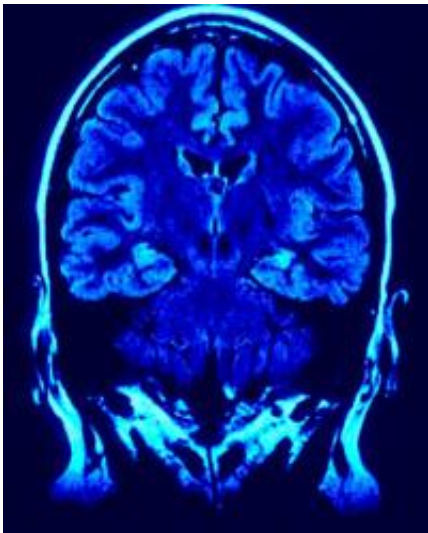# Music can spark creativity in math and science (w/ video)

May 16 2011, By Miles O'Brien and Marsha Walton

Credit: Morguefile

From records to boom boxes to CDs and iPods, music has long been part of the lifeblood of being a teenager. Learning math and science in class is not always such a priority.

Parag Chordia, director of the [Music](#) Intelligence Lab at Georgia Tech, is finding ways to bring those two disparate realities together.

"How can music be used to think about scientific problems, how can music be used to sort of catalyze our thinking in other areas?" asks Chordia.

With support from the National Science Foundation (NSF), Chordia is researching the neurological roots of the creative process. And music is a key ingredient.

"We've never found a culture that has no language--we've never found a culture that has no music. So, music seems to be universal," he says.

While music and arts programs are often the first subjects to be cut when school budgets are tight, Chordia says that may not be the best strategy.

"To be a great engineer; to really produce innovative products and to advance the frontiers of science, you have to be creative. And it's not just that music is a diversion or an extracurricular, but it's actually something that's fundamental to life and mind," he says.

"One of the difficulties of teaching math and science is that it quickly becomes very abstract. You have to have points of reference that people can relate to and it becomes much easier. So, whether we're talking about teaching basic mathematical concepts, or designing experiments, you can design experiments around music," he explains.

Statistics, for instance, can be used to model music.

"For example, if you listen to a melody, a [melody](#) is made up of all these different little motifs, and those motifs go together to make up larger patterns and those larger patterns form bigger blocks that we build on," says Chordia.

"So it's very similar to language, where you have these low level acoustic units like phonemes, which form [syllables](#), which form words. So, what we are trying to do here represents that process of pattern formation," he says.

Studies show that at different ages, music connections do work as teaching tools.

"At the college level, students who have access to music programs are much more likely to graduate because it increases retention," says Chordia. "And people have, in terms of early learning, shown that exposure to music at an early age, intensive exposure in music does improve cognitive outcomes."

Chordia understands the creative process from many angles. He is a master of the sarod, a classic Indian instrument. He is also a mathematician. And his research works to see how all those elements work together.

"Is creativity just the gift of a few--just sprinkled on a few people and that's it? I would argue no, that creativity is something that we all have inside of us and what it's all about is finding out, how do we unlock that creativity," he says.

Using tools like electroencephalograms (EEGs) and functional magnetic resonance imaging (fMRI), Chordia is investigating whether "real-time creativity," like improvising in a jazz band, uses the brain in a different way.

"When a person is improvising, are they entering into a uniquely creative state, and if so, what is that state all about?" he asks.

Brain scans show a distinct difference when professional musicians are playing composed music, versus when they are improvising. Future studies could be designed to try to home in on exactly what is happening when someone is experiencing deep creative insight.

Other work in the Music Intelligence Lab involves music and computers.

Graduate student Avinash Sastry investigates "computational creativity." While that may sound beyond the scope of what we think these machines usually do, the aim is to let computers do what they do best, to free up human teachers and composers for their best work.

Sastry writes computer programs that analyze musical compositions; then, the computers write their own music.

"So we have a database of compositions, giving it [the computer] some idea of what it is going to expect. So it analyzes all this, and builds up this big tree of probabilities. It's going to try and predict what's going to happen at every step and it's going to use that information to try and compose its own sequence of strokes as it goes on," explains Sastry.

Sastry says he has done some double takes when he hears original music composed by a computer.

"So sometimes you get these gems of music that just pop out, and we are working on trying to isolate those things and use that in a more constructive way," he says.

Sastry says he can easily see this as being an educational tool for children, and even musicians. The human composer gives the computer something to start with, and it can then try to help you compose.

"So the idea is to use everything together ... use their computational ability along with our emotions, our ability, our creativity, put everything together and make some sort of collaboration!" says Sastry.

An iPhone app Chordia and colleagues created gives a psychological boost to people who may not think they have any musical skills.

It's called LaDiDa, and it now has more than ten million users.

"You sing into the app, it listens to what you are singing, and it composes music to match. Our goal is to make music expression as ubiquitous as social expression," says Chordia.

"I'm a terrible singer, and I think part of the whole point of this technology is to let people like myself actually get the confidence to make music."

There are many YouTube videos of LaDiDa users, from Chordia himself to Mishka the singing dog, using the simple app, and in most cases, sounding much better after the app's music has been added.

"A lot of the people we are targeting are young people between 13 and 18, who are really engaged in music. And they want to have the experience of making music. We get emails all the time, 'I was afraid to sing but now it makes me want to sing all the time'," says Chordia.

And those musical experiences that feed the mind may also spark greater proficiency in science and technology.

"Creativity lies at the heart of the modern economy," he says.

Provided by National Science Foundation

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