

# Brain scans of rappers shed light on creativity

Functional magnetic resonance imaging shows what happens in the brain during improvisation.

Daniel Cressey

15 November 2012



**Open Mike Eagle**

Open Mike Eagle, one of the authors of the latest study, performs on Knocksteady TV.

Rappers making up rhymes on the fly while in a brain scanner have provided an insight into the creative process.

Freestyle rapping — in which a performer improvises a song by stringing together unrehearsed lyrics — is a highly prized skill in hip hop. But instead of watching a performance in a club, Siyuan Liu and Allen Braun, neuroscientists at the US National Institute on Deafness and Other Communication Disorders in Bethesda, Maryland, and their colleagues had 12 rappers freestyle in a functional magnetic resonance imaging (fMRI) machine.

The artists also recited a set of memorized lyrics chosen by the researchers. By comparing the brain scans from rappers taken during freestyling to those taken during the rote recitation, they were able to see which areas of the brain are used during improvisation. The study is published today in *Scientific Reports*<sup>1</sup>.

The results parallel previous imaging studies in which Braun and Charles Limb, a doctor and musician at Johns Hopkins University in Baltimore, Maryland, looked at fMRI scans from jazz musicians<sup>2</sup>. Both sets of artists showed lower activity in part of their frontal lobes called the dorsolateral prefrontal cortex during improvisation, and increased activity in another area, called the medial prefrontal cortex. The areas that were found to be 'deactivated' are associated with regulating other brain functions.

"We think what we see is a relaxation of 'executive functions' to allow more natural de-focused attention and uncensored processes to occur that might be the hallmark of creativity," says Braun.

He adds that this suggestion is "a little bit controversial in the literature", because some studies have found activation of the dorsolateral prefrontal cortex in creative behaviour. He suggests that the discrepancy might have to do with the tasks chosen to represent creativity. In studies that found activation, the activities — such as those that require recall — may actually be less creative.

"We try to stick with more natural creative processing, and when we do that we see this decrease in the dorsal lateral regions," says Braun.

### **Pump down the volume**

Rex Jung, a clinical neuropsychologist at the University of New Mexico in Albuquerque, has also studied the link between brain structures and creativity, finding an inverse relationship between the volume of some frontal lobe structures and creativity<sup>3</sup>. "Some of our results imply this downregulation of the frontal lobes in service of creative cognition. [The latest paper] really appears to pull it all together," he says. "I'm excited about the findings."

Jung says that this downregulation is likely to apply in other, non-musical areas of creativity — including science.

The findings also suggest an explanation for why new music might seem to the artist to be created of its own accord. With less involvement by the lateral prefrontal regions of the brain, the performance could seem to its creator to have "occurred outside of conscious awareness", the authors write.

Michael Eagle, a study co-author who raps under the name Open Mike Eagle, agrees: "That's kind of the nature of that type of improvisation. Even as people who do it, we're not 100% sure of where we're getting improvisation from."

Liu says that the researchers are now working on problems they were unable to explore with freestylers — such as what happens after the initial burst of creative inspiration.

"We think that the creative process may be divided into two phases," he says. "The first is the spontaneous improvisatory phase. In this phase you can generate novel ideas. We think there is a second phase, some kind of creative processing [in] revision."

The researchers would also like to look at how creativity differs between experts and amateurs of a similar artistic ilk to freestylers: poets and storytellers.

*Nature* | doi:10.1038/nature.2012.11835

### **References**

---

1. Liu, S., *et al.* *Sci. Rep.* <http://dx.doi.org/10.1038/srep00834> (2012).
2. Limb, C. J. & Braun, A. R. *PLoS ONE* **3**, e1679 (2008).
3. Jung, R. E., Grazioplene, R., Caprihan, A., Chavez, R. S. & Haier, R. J. *PLoS ONE* **5**, e9818 (2010).