

Creative and Noncreative Problem Solvers Exhibit Different Patterns of Brain Activity, Study Reveals

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PHILADELPHIA

Why do some people solve problems more creatively than others? Are people who think creatively somehow different from those who tend to think in a more methodical fashion? These questions are part of a long-standing debate, with some researchers arguing that what we call “creative thought” and “noncreative thought” are not basically different. If this is the case, then people who are thought of as creative do not really think in a fundamentally different way from those who are thought of as noncreative. On the other side of this debate, some researchers have argued that creative thought is fundamentally different from other forms of thought. If this is true, then those who tend to think creatively really are somehow different.

A new study led by John Kounios, professor of Psychology at Drexel University and Mark Jung-Beeman of Northwestern University answers these questions by comparing the brain activity of creative and noncreative problem solvers. The study, a published “Article in Press” in the journal *Neuropsychologia*, reveals a distinct pattern of brain activity, even at rest, in people who tend to solve problems with a sudden creative insight -- an “Aha! Moment” – compared to people who tend to solve problems more methodically.

At the beginning of the study, participants relaxed quietly for seven minutes while their electroencephalograms (EEGs) were recorded to show their brain activity. The participants were not given any task to perform and were told they could think about whatever they wanted to think about. Later, they were asked to solve a series of anagrams – scrambled letters that can be rearranged to form words [MPXAELE = EXAMPLE]. These can be solved by deliberately and methodically trying out different letter combinations, or they can be solved with a sudden insight or “Aha!” in which the solution pops into awareness. After each successful solution, participants indicated in which way the solution had come to them.

The participants were then divided into two groups – those who reported solving the problems mostly by sudden insight, and those who reported solving the problems more methodically – and resting-state brain activity for these groups was compared. As predicted, the two groups displayed strikingly different patterns of brain activity during the resting period at the beginning of the experiment – before they knew that they would have to solve problems or even knew what the study was about.

One difference was that the creative solvers exhibited greater activity in several regions of the right hemisphere. Previous research has suggested that the right hemisphere of the brain plays a special role in solving problems with creative insight, likely due to right-hemisphere involvement in the processing of loose or “remote” associations between the elements of a problem, which is understood to be an important component of creative thought. The current study shows that greater right-hemisphere activity occurs even during a “resting” state in those with a tendency to solve problems by creative insight. This finding suggests that even the spontaneous thought of creative individuals, such as in their daydreams, contains more remote associations.

Second, creative and methodical solvers exhibited different activity in areas of the brain that process visual information. The pattern of “alpha” and “beta” brainwaves in creative solvers was consistent with diffuse rather than focused visual attention. This may allow creative individuals

to broadly sample the environment for experiences that can trigger remote associations to produce an Aha! Moment. For example, a glimpse of an advertisement on a billboard or a word spoken in an overheard conversation could spark an association that leads to a solution. In contrast, the more focused attention of methodical solvers reduces their distractibility, allowing them to effectively solve problems for which the solution strategy is already known, as would be the case for balancing a checkbook or baking a cake using a known recipe.

Thus, the new study shows that basic differences in brain activity between creative and methodical problem solvers exist and are evident even when these individuals are not working on a problem. According to Kounios, "Problem solving, whether creative or methodical, doesn't begin from scratch when a person starts to work on a problem. His or her pre-existing brain-state biases a person to use a creative or a methodical strategy."

In addition to contributing to current knowledge about the neural basis of creativity, this study suggests the possible development of new brain imaging techniques for assessing potential for creative thought, and for assessing the effectiveness of methods for training individuals to think creatively.

Kounios, J., Fleck, J.I., Green, D.L., Payne, L., Stevenson, J.L., Bowden, E.M., & Jung-Beeman, M. The origins of insight in resting-state brain activity, *Neuropsychologia* (2007), doi:10.1016/j.neuropsychologia.2007.07.013

See also:

Jung-Beeman, M., Bowden, E.M., Haberman, J., Frymiare, J.L., Arambel-Liu, S., Greenblatt, R., Reber, P.J., & Kounios, J. (2004). Neural activity when people solve verbal problems with insight. *PLoS Biology*, 2, 500-510.

Kounios, J., Frymiare, J.L., Bowden, E.M., Fleck, J.I., Subramaniam, K., Parrish, T.B., & Jung-Beeman, M.J. (2006). The prepared mind: Neural activity prior to problem presentation predicts subsequent solution by sudden insight. *Psychological Science*, 17, 882-890.

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News Media Contact: Niki Gianakaris, Assistant Director, Drexel News Bureau
215-895-6741, 215-778-7752 (cell) or ngianakaris@drexel.edu

Contact universityrelations@drexel.edu, 215-895-1530