Study shows individual differences in brain activity can be predicted using task-free fMRI

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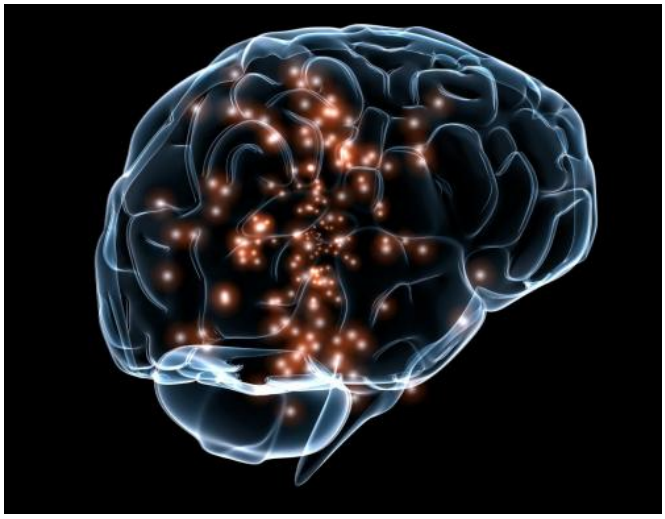

Credit: Wikimedia Commons

(Medical Xpress)—A team of researchers with Oxford University has found that it is possible to use task-free fMRI images to predict brain activity during the performance of certain tasks. In their paper published in the journal *Science*, the team describes their study and analysis of brain scans, what they found, the model they built and what their results might be used for in the future.

Up till now, most studies looking to better understand the relationship between brain activity that occurs as a person lies still, but thinks about certain activities, and brain activity that occurs as a person actually does those activities, has focused on people as a group. In this new effort, the researchers focused on individuals—they wanted to know if fMRI imagery taken of people engaging in task-free thinking could be used to predict unique brain patterns for those same people when they were actually participating in the tasks they had thought about earlier.

The study consisted of obtaining fMRI images from 98 people who had participated in and allowed data about them to be stored in the Human Connectome Project (HCP) database. Those people had initially been asked to lie still while fMRI images were made of their brain, as they thought about different activities and then again as they actually engaged in those activities. The data allowed the researchers to build a model whose purpose was to predict brain behavior during certain activities. Thus, the images from the people in the database could be input into the model, and then the results of the model could be compared with the actual scans of the people when they later were actually engaged in the activities, to see if actual brain activity patterns matched with those that had been predicted. The researchers report that their model successfully predicted 46 out of 47 tasks—the exception was a gambling task that involved subcortical brain regions.

The team suggests their findings indicate that their model could possibly be used as a means of creating brain activity maps for people or patients who cannot actually perform the tasks they imagine, such as those with brain or other physical injuries, or even infants, as a means of developing appropriate therapies for helping them gain, or regain such abilities.

More information: I. Tavor et al. Task-free MRI predicts individual differences in brain activity during task performance, *Science* (2016). DOI: 10.1126/science.aad8127

Abstract
When asked to perform the same task, different individuals exhibit markedly different patterns of brain activity. This variability is often attributed to

volatile factors, such as task strategy or compliance. We propose that individual differences in brain responses are, to a large degree, inherent to the brain and can be predicted from task-independent measurements collected at rest. Using a large set of task conditions, spanning several behavioral domains, we train a simple model that relates task-independent measurements to task activity and evaluate the model by predicting task activation maps for unseen subjects using magnetic resonance imaging. Our model can accurately predict individual differences in brain activity and highlights a coupling between brain connectivity and function that can be captured at the level of individual subjects.