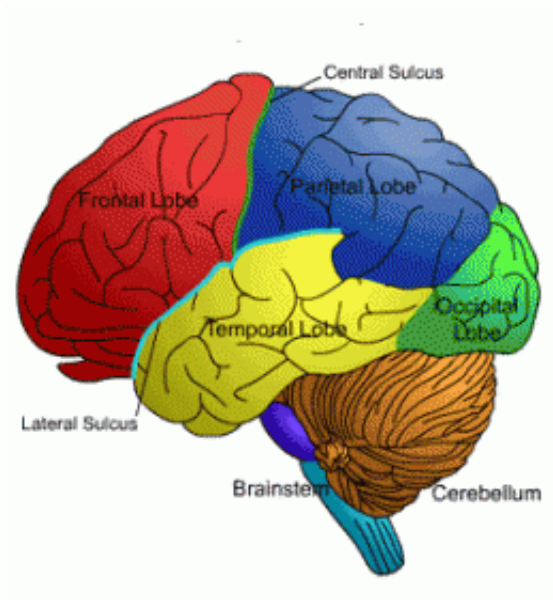


Study links hippocampus with unconscious bias

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Brain diagram. Credit: dwp.gov.uk

(Medical Xpress)—A new US study into brain function has found links between preferences and the regions of the brain involved in connecting new memories to old ones. The associations formed provide shortcuts the subconscious can use for decision making.

The hippocampus is an area of the brain known to be one in which links between memories are formed, but until now it was not known that this brain region is involved in steering the brain towards making particular

choices over others when faced with new decisions for which we have no previous experiences to draw on.

In a paper published in the journal *Science*, research psychologists G. Elliott Wimmer and Daphna Shohamy of Columbia University in New York report on their study, which used [functional magnetic resonance imaging](#) (fMRI) of regions of the brain. In the study, they asked 31 volunteers to complete a three-part task while in the machine. Throughout the task their brain activity was determined by the [fMRI](#).

In the first part of the task (association) the subjects were shown paired [images](#). One image of each pair was a circle with a colorful pattern inside, while the other was either a landscape, body part or [human face](#). The same circle was shown with the same image each time, enabling the subjects to associate each image with the appropriate circle.

In the second part of the task (reward) the volunteers were shown images of just the circles, and this time they were told that they would receive a reward of \$1 for viewing half of the circle images. In this way the subjects were able to learn to associate some of the circle images with money.

In the third part of the task (decision making) the subjects were shown paired images again, but this time the pairs were either two of the circles or two of the original images of landscapes, body parts or faces. Participants were asked to choose one of each pair for a possible reward.

The researchers expected the subjects to select the images initially linked with the circles that earned them rewards in the second part of the task, and they did find that most of the participants behaved as expected, selecting images associated with the circles that had earned them \$1. However, the subjects varied in their ability to make the association, and this variation allowed the researchers to study the differences in [brain](#)

[activity](#) among subjects during the three stages of the experiment. The data for three of the participants was excluded because they showed no evidence of simple reward learning.

The study found that subjects in whom the hippocampus was most active in the second phase were more likely to select images associated with the rewarding circles, but those same subjects also reported being unaware of the associations, which strongly suggests the linkages were being made in the hippocampus at the subconscious level.

Subjects also showed a stronger bias towards the images associated with the reward circles if there was heightened activity during the second stage in the regions of the brain associated with vision or in the striatum, which is the reward center.

The results suggest that several areas of the [brain](#) are involved in evaluating new stimuli and associating them with previous memories, but the process is strongly associated with the hippocampus.

The findings could have application, for example, in the design of new products, which could incorporate aspects of earlier products (such as color, logo or font) to stimulate the association and produce an unconscious bias towards those products over other equally new products.

The findings also suggest that misguided biases such as racism could stem from unconscious associations. (Guilt by association is a commonly known bias.) These biases have long been known, but the current study clearly shows their association with the [hippocampus](#).

More information: Preference by Association: How Memory Mechanisms in the Hippocampus Bias Decisions, *Science*, 12 October 2012: Vol. 338 no. 6104 pp. 270-273. [DOI: 10.1126/science.1223252](https://doi.org/10.1126/science.1223252)

ABSTRACT

Every day people make new choices between alternatives that they have never directly experienced. Yet, such decisions are often made rapidly and confidently. Here, we show that the hippocampus, traditionally known for its role in building long-term declarative memories, enables the spread of value across memories, thereby guiding decisions between new choice options. Using functional brain imaging in humans, we discovered that giving people monetary rewards led to activation of a preestablished network of memories, spreading the positive value of reward to nonrewarded items stored in memory. Later, people were biased to choose these nonrewarded items. This decision bias was predicted by activity in the hippocampus, reactivation of associated memories, and connectivity between memory and reward regions in the brain. These findings explain how choices among new alternatives emerge automatically from the associative mechanisms by which the brain builds memories. Further, our findings demonstrate a previously unknown role for the hippocampus in value-based decisions.

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