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'Mind-reading' experiment highlights how brain records memories

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It may be possible to "read" a person's memories just by looking at brain activity, according to research carried out by Wellcome Trust scientists. In a study published today in the journal *Current Biology*, they show that our memories are recorded in regular patterns, a finding which challenges current scientific thinking.

Demis Hassabis and Professor Eleanor Maguire at the Wellcome Trust Centre for Neuroimaging at UCL (University College London) have previously studied the role of a small area of the brain known as the hippocampus which is crucial for navigation, memory recall and imagining future events. Now, the researchers have shown how the hippocampus records memory.

When we move around, nerve cells (neurons) known as "place cells", which are located in the hippocampus, activate to tell us where we are. Hassabis, Maguire and colleagues used an fMRI scanner, which measures changes in blood flow within the brain, to examine the activity of these places cells as a volunteer navigated around a virtual reality environment. The data were then analysed by a computer algorithm developed by Demis Hassabis.

"We asked whether we could see any interesting patterns in the neural activity that could tell us what the participants were thinking, or in this case where they were," explains Professor Maguire, a Wellcome Trust Senior Research Fellow. "Surprisingly, just by looking at the brain data we could predict exactly where they were in the virtual reality

environment. In other words, we could 'read' their spatial memories."

Earlier studies in rats have shown that spatial memories - how we remember where we are - are recorded in the hippocampus. However, these animal studies, which measured activity at the level of individual or dozens of neurons at most, implied that there was no structure to the way that these memories are recorded. Hassabis and Maguire's work appears to overturn this school of thought.

"fMRI scanners enable us to see the bigger picture of what is happening in people's brains," she says. "By looking at activity over tens of thousands of neurons, we can see that there must be a functional structure - a pattern - to how these memories are encoded. Otherwise, our experiment simply would not have been possible to do."

Professor Maguire believes that this research opens up a range of possibilities of seeing how actual memories are encoded across the neurons, looking beyond spatial memories to more enriched memories of the past or visualisations of the future.

"Understanding how we as humans record our memories is critical to helping us learn how information is processed in the hippocampus and how our memories are eroded by diseases such as Alzheimer's," added Demis Hassabis.

"It's also a small step towards the idea of mind reading, because just by looking at neural activity, we are able to say what someone is thinking."

Professor Maguire led a study a number of years ago which examined the brains of London taxi drivers, who spend years learning "The Knowledge" (the maze of London streets). She showed that in these cabbies, an area to the rear of the hippocampus was enlarged, suggesting that this was the area involved in learning location and direction. In the

new study, Hassabis, Maguire and colleagues found that the patterns relating to spatial memory were located in this same area, suggesting that the rear of the hippocampus plays a key role in representing the layout of spatial environments.

More information: Hassabis, D. et al. Decoding neuronal ensembles in the human hippocampus. *Current Biology*, 12 March 2009.

Source: Wellcome Trust (news : web)