

# How we know a dog is a dog: Concept acquisition in the human brain

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A new study explores how our brains synthesize concepts that allow us to organize and comprehend the world. The research, published by Cell Press in the September 24th issue of the journal *Neuron*, uses behavioral and neuroimaging techniques to track how conceptual knowledge emerges in the human brain and guides decision making.

The ability to use prior knowledge when dealing with new situations is a defining characteristic of human intelligence. This is made possible through the use of concepts, which are formed by abstracting away the common essence from multiple distinct but related entities. "Although a Poodle and a Golden Retriever look very different from each other, we can easily appreciate their similar attributes because they can be recognized as instances of a particular concept, in this case a dog," explains lead study author, Dr. Dharshan Kumaran from the Wellcome Trust Centre for Neuroimaging at University College London.

While there is little doubt that humans form and use concepts all the time, not much is known about how conceptual knowledge is created in the brain or how it guides us to make efficient choices. It has long been suggested that the [hippocampus](#), a [brain](#) structure critical for [memory formation](#), plays a critical role in the acquisition of conceptual knowledge. However, thus far, there has been little concrete evidence to support this claim. Dr. Kumaran and colleagues designed an experimental paradigm that would allow them to track the emergence and application of conceptual knowledge.

Participants played a game in which they had the opportunity to win money by correctly predicting whether it would be sunny or rainy based on the appearance of the night sky, denoted by patterns on a computer screen. Early on in the experiment, participants simply memorized the outcome associated with each pattern in isolation. However, they quickly noticed that groups of patterns were conceptually related, much in the same way as Poodles and Golden Retrievers. By structuring the problem in this fashion, participants were able to solve the task, and even successfully apply their knowledge to a different setting where the concepts were similar but the patterns themselves new.

By using parallel behavioral and neural measures, the researchers found that a functionally coupled circuit involving the hippocampus and ventromedial prefrontal cortex underpinned the emergence of conceptual knowledge. Interestingly, however, it was the hippocampus alone that predicted which participants would be able to successfully apply the concepts they had learned to a visually novel setting. "What this suggests is that perhaps the hippocampus creates and stores these concepts, and passes this information to the prefrontal cortex where it can be put to use, for example in making choices where financial reward is at stake," explains Dr. Kumaran.

Taken together, the results highlight the role of the hippocampus in acquiring new concepts, perhaps through its unique networking capacities which allow multiple memories to be related to one another. "Our study offers neurobiological insights into the remarkable capacity of humans to discover the conceptual structure of their visual experiences, and reveals how so-called "memory" regions like the hippocampus team up with "decision modules" in the prefrontal lobe to put this information to use," concludes Dr. Kumaran.

Source: Cell Press ([news](#) : [web](#))

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