Brain research shows past experience is invaluable for complex decision making

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Researchers funded by the Biotechnology and Biological Sciences Research Council (BBSRC) have shown that past experience really does help when we have to make complex decisions based on uncertain or confusing information. They show that learning from experience actually changes the circuitry in our brains so that we can quickly categorise what we are seeing and make a decision or carry out appropriate actions. The research is published today (13 May) in *Neuron*.

Lead researcher, Dr Zoe Kourtzi from the University of Birmingham, said: "What we have found is that learning from past experience actually rewires our brains so that we can categorise the things we are looking at, and respond appropriately to them in any context.

In selecting a course of action that is most likely to be successful, the brain has to interpret and assign meaning to inherently uncertain sensory information - being able to do this is vital for our survival! This ability is especially critical when we are responding and acting in relation to visual stimuli that are highly similar to each other. For example, this is what is happening when you are trying to recognise friends in a crowd or discern a tumour from healthy tissue on a medical scan.

"We have shown that this learning process is not just a matter of learning the structure of the physical world - when I look at something I'm not just playing a game of 'snap' in my head where I try to match images to each other. In fact, areas in our brains are actually trained to learn the rules that determine the way we interpret sensory information."

Dr Kourtzi and colleagues wanted to find out about the human brain mechanisms that mediate flexible decision making through learning, which have so far not been well understood, despite it being fairly clear that successful decisions benefit from previous experience. They combined measurements of behaviour and brain signals to study how volunteers learned to discriminate between highly similar visual patterns and to assign them in different categories.

Volunteers used two different rules to assign visual patterns into categories. As a result, patterns belonging to the same category based on one of the rules could be members of different categories based on the alternate rule. "This flexible learning paradigm allowed us to test for brain changes related to the perceived rather than the physical similarity between visual patterns," explains Dr. Kourtzi. "Our use of brain imaging in combination with mathematical techniques enabled us to extract sensitive information about brain signals that reflected the participant's choice."

"What we've shown is that we don't just get better at the task of picking out a familiar face amongst a crowd, for example. Our results tell us that previous experience can train circuits in our brains to recognise perceived categories rather than simply the physical similarity between visual patterns," said Dr Kourtzi. "Based on what we found, we propose that learned information about categories is actually retained in brain circuits in the posterior areas of the brain. From there we think it is fed through to circuits in frontal areas that translate this information into flexible decisions and appropriate actions depending on the requirements and context of the task."

Dr Janet Allen, Director of Research, BBSRC said: "We have to be able to understand how healthy brains work before we can see what has gone wrong when a person's brain is affected by disease. This work also shows that the complex human brain has evolved an incredibly effective

mechanism for making good decisions that lead to successful everyday actions - something that has surely been a significant evolutionary advantage."

Source: Biotechnology and Biological Sciences Research Council (news : web)