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Déjà vu: Where fact meets fantasy

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Mr P, an 80-year-old Polish émigré and former engineer, knew he had memory problems, but it was his wife who described it as a permanent sense of déjà vu. He refused to watch TV or read a newspaper, as he claimed to have seen everything before. When he went out walking he said the same birds sang in the same trees and the same cars drove past at the same time every day. His doctor said he should see a memory specialist, but Mr P refused. He was convinced that he had already been.

Déjà vu can happen to anyone, and anyone who has had it will recognise the description immediately. It is more than just a sense that you have seen or done something before; it is a startling, inappropriate and often disturbing sense that history is repeating, and impossibly so. You can't place where the earlier encounter happened, and it can feel like a premonition or a dream. Subjective, strange and fleeting, not to mention tainted by paranormal explanations, the phenomenon has been a difficult and unpopular one to study.

Now that is changing, spurred in part by Mr P and a handful of people who, like him, have dementia and experience continuous déjà vu, and also by the discovery that there is a group of people with epilepsy who have déjà vu-like auras before a seizure. They are making it possible for researchers to catch the process in action, bringing hope that the secrets of this strange and disturbing phenomenon could finally be unlocked. Surprisingly, not only is déjà vu proving an interesting window on the peculiar ways that our memory works, it is also providing a few clues about how we tell the difference between what is real, imagined, dreamed and remembered - one of the true mysteries of consciousness.

Speculations about past lives or telepathy aside, the first biological explanations of déjà vu were based on ideas that two sensory signals in the brain - perhaps one from each eye or each hemisphere of the brain - for some reason move out of sync, so that people have the experience of reliving the same event. "Mental diplopia", as it was called, is intuitively appealing but the evidence is stacked against it. Information from the two eyes mixes very early in visual processing, long before we perceive a scene. What's more, déjà vu - rather ironically as the term means "already seen" - can occur in blind people, according to Chris Moulin, a psychologist at the University of Leeds, UK, (*Brain and Cognition*, vol 62, p 264). Then there are the cases of people who have had their two cortical hemispheres surgically separated in an attempt to relieve intractable epilepsy. If the mental diplopia idea were correct you might expect them to have permanent déjà vu, yet there are no reports of this happening.

A second intuitive explanation is some sort of distortion in time perception. Somehow, incoming signals must get misinterpreted and labelled with an inappropriate time stamp, making the experience seem old as well as current. If the brain's memory system is like a tape recorder, it is as if the recording head has got muddled with the playback head. It is an interesting analogy, but it does not appear to have any anatomical basis in the brain.

Now another theory is gaining credibility. Perhaps déjà vu feels like reliving a past experience because we actually are - at least to some extent. Psychologist Anne Cleary of Colorado State University in Fort Collins came to this idea via an interest in memory problems. Keen to explain instances such as when something seems to be on the tip of the tongue, or when we recognise a face but can't place it, she started looking for parallels with déjà vu. "One particular theory of déjà vu is that it may be a memory process," she says. "Features of a new situation may be familiar from some prior situation."

Her first experiments seem to support this. In one, she was able to induce familiarity for images of celebrity faces or well-known places, even if the viewer couldn't place the image, simply by first presenting subjects with lists of their names. In another study volunteers reported familiarity with words that sounded similar to ones presented in an earlier list. Nevertheless, Cleary acknowledges that this can't be the whole story. "Déjà vu is unique in that it is not just another instance of familiarity, it actually feels wrong," she says.

How to account for this? One possibility is that déjà vu is based on a memory fragment that comes from something more subtle, such as similarity between the configuration or layout of two scenes. Say you are in the living room of a friend's new house with the eerie feeling that you have been there before, yet knowing you can't possibly. It could be just that the arrangement of furniture is similar to what you have seen before, suggests Cleary, so the sense of familiarity feels misplaced.

To test the idea, her team produced a large range of images showing scenes such as a bar, a bowling alley, landscapes or rooms from a house. Volunteers saw a subset of these, then they were tested on a new set, half of which were entirely novel and the other half resembling scenes from the first set in structure and configuration but not content. Not only did the similar layouts produce familiarity without recall, subjects also reported a sense of the inexplicable, having been told that all the scenes were different.

Although the familiarity idea appeals to many, Moulin, for one, is not convinced. His scepticism stems from a study of a person with epilepsy that he conducted with Akira O'Connor, now at Washington University in St Louis, Missouri. This 39-year-old man's auras of déjà vu were long-lasting enough to conduct experiments during them. The researchers reasoned that if familiarity is at the root of déjà vu, they should be able to stop the experience in its tracks by distracting the man's attention away from whatever scene he was looking at. However, when he looked away or focused on something different, his déjà vu did not dissipate, and would follow his line of vision and his hearing, suggesting that real familiarity is not the key. The fact that an epilepsy aura can cause déjà vu at all suggests that it is erroneous activity in a particular part of the brain that leads to misplaced feelings of familiarity, suggests Moulin.

Hypnotic dissociation

But how? Moulin and O'Connor think déjà vu is the consequence of a dissociation between familiarity and recall. We know that we can have a sense of familiarity for a face or name without actually remembering where we know it from. Using hypnosis, O'Connor and Moulin have been able to create a more mysterious sense of familiarity that leads people to draw parallels with déjà vu. One group of people was given a puzzle to solve. Then, while under **hypnosis**, they were told they would be given the puzzle again, but would not recall it. Another group did not do the puzzle but were told under **hypnosis** that they would be given it later and that they would experience feelings of familiarity but not understand why. Both situations produced a sense of eerie familiarity, which some people likened to déjà vu. Moulin and O'Connor hope that their ability to induce a déjà vu-like state in the lab will help them probe the phenomenon. They also believe these experiments support the idea that familiarity

and recall are dissociable, and that you can have a sense of familiarity without actually having any prior experience of something.

Studies of the brain also support the idea that separate circuits mediate recollection and familiarity, according to John Aggleton and Malcolm Brown of Cardiff University, UK, who recently reviewed brain imaging and animal studies (*Trends in Cognitive Sciences*, vol 10, p 455). They point out that different parts of the medial temporal lobe, at the side of the brain, are responsible for different aspects of memory recall (see illustration). The curved tube-like hippocampus, which runs through the centre of the lobe, mediates recollection, particularly of autobiographical memories. Meanwhile, the studies show that the surrounding parahippocampus, particularly the perirhinal cortex, may provide the feelings of familiarity.

This fits well with the evidence from brain scans of Mr P and others like him, who show huge degeneration of neurons in the medial temporal lobe, and the fact that it is epilepsy originating in the medial temporal lobe that leads to *déjà vu* auras.

It is possible that both Moulin and Cleary are correct. The perirhinal cortex may store information about spatial relationships, rather than time, place and sequence of events, and so normal familiarity feelings could come largely from layout and configuration, backing Cleary's findings. Indeed, there may be many ways to produce false familiarity, according to psychologist Alan Brown of Southern Methodist University in Dallas, Texas, author of *The déjà vu experience* (Psychology press, 2004). His own experiments indicate some other possibilities. For example, he has induced the feeling by distracting volunteers while they saw a glimpse of a scene and then moments later giving them a good look. "If you take a brief glance when distracted, and look at the same scene again afterwards, it can feel like you've seen it before but much earlier," says Brown. He has also induced it by showing people images of things they had forgotten. "Just as a stomach ache can hurt the same way but be caused by lots of different processes, it could be the same way with *déjà vu*," he says.

The real problem with explaining *déjà vu*, however, is not how we can get familiarity without recognition, but why it feels so disturbing. "We'd get it all the time if it were just familiarity with real experiences," says Ed Wild from the Institute of Neurology in London. He suggests that mood and emotion are also important contributors to the sensation of *déjà vu*. We need the right combination of signals, not just the layout of a scene but how we feel at the time, to believe something is familiar when really it is not.

A matter of degree

Moulin agrees it may be matter of degree. The regions thought to mediate recall, familiarity and emotions are all extremely closely linked. A small amount of stimulation could produce a mild sense of familiarity, while a stronger stimulus could spread into neighbouring emotion regions producing a more disturbing feeling, or even the striking sense of doom or premonition some people report with *déjà vu*.

Cognitive neuroscientist Stefan Köhler from the University of Western Ontario in London, Canada, believes the role of emotion is even more central in generating the sense of weirdness that accompanies *déjà vu*. He recently had the chance to image the brain of a person cured of epilepsy with *déjà vu* auras by removal of a large tumour that was triggering the seizures. The excised areas consisted of parts of the hippocampus and perirhinal cortex, but also included the amygdala. It suggests that this region, which is known to be heavily tied up with emotion, was also involved in creating the *déjà vu*. Köhler speculates that without the appropriate emotional arousal, perhaps the brain cannot recognise a person or place we have encountered before as truly familiar. On the other hand, inappropriate emotional arousal may make us believe something is familiar when actually it is not.

The final element of déjà vu, a sense that it feels impossible, probably comes from the reasoning parts of our brain. According to Köhler, when our rational knowledge tells us one thing, but our emotional instincts tell us another, it can feel very wrong. This final element is missing in people with dementia, including Mr P, who accept their experiences as perfectly normal. Köhler suspects this may be because neurodegeneration in these individuals has caused a disconnection between the temporal lobes, which are generating sensations, and the frontal lobes which are continuously interpreting them.

Our brains are looking for associations all the time. Déjà vu is interesting, says Kohler, because it points to a brain mechanism that helps you interpret what you are doing. When you are having a memory, you have the sensation of recollection. It feels like having a memory, and doesn't feel like daydreaming or current reality. "Déjà vu is a fault in a kind of cognitive process that is going on in the background all the time. When it goes wrong, it's very striking," says Moulin. At the extreme, patients with permanent déjà vu - dubbed déjà vécu, for already experienced - actually make up stories to make sense of it ([New Scientist, 7 October 2006, p 32](#)).

While déjà vu is starting to divulge some of its secrets, there is still a long way to go before we understand how we actually decide what is real, imagined, dreamed or experienced, and how these various tags lead to such different conscious experiences. One anecdotal finding that came to light while working on this article is that people who think a lot about déjà vu are more prone to it. I had déjà vu about reading about déjà vu, and researchers have had déjà vu about having déjà vu. It certainly retains mystery enough to justify further study. After all, says Wild, "déjà vu is one of weirdest brain experiences that normal people have".

Stranger and stranger yet

About 10 per cent of people claim never to have experienced déjà vu, while some individuals report having it regularly.

Children first get it at around age 8 or 9, suggesting that a degree of cognitive maturity is required.

Déjà vu happens less as you get older and more when you are tired, anxious or stressed.

It is particularly prevalent in people with certain conditions known to produce problems in time perception, such as schizophrenia and epilepsy.

Although there is no gene for déjà vu, it is possible that certain versions of genes associated with epilepsy make some of us more prone to it.

Just reading this article could give you déjà vu.