

Oprah, Luke Skywalker and Maradona -- new study investigates how our brains respond to them

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Oprah Winfrey. Image: Alan Light, via Wikimedia Commons

Pictures paint concepts of a thousand words- now, for the first time, scientists studying the brain have worked out how words paint concepts in our minds.

The team, including Professor Rodrigo Quian Quiroga at the Department of Engineering of the University of Leicester in the UK, Professor Itzhak Fried at the University California Los Angeles and Professor Christof Koch at the California Institute of Technology, has published these findings in the journal [Current Biology](#). It is published online on 23 July and in the print issue on 11 August.

The results are important for understanding how perception and memory formation occurs.

Professor Rodrigo Quian Quiroga, head of Bioengineering at the University of Leicester, led the study which concluded that, although processing of visual and auditory information occur along completely separate pathways, the visual and auditory processing routes converge to end up firing the same single neurons.

He said: "Different [pictures](#) of Marilyn Monroe can evoke the same mental image, even if greatly modified as in Warhol's famous portraits. This process relates to one of the most fascinating questions in neuroscience: how do neurons in the brain manage to abstract and disregard irrelevant details to recognize highly variable pictures as the same person?"

Professor Quian Quiroga said various studies had provided insights into how [visual information](#) is processed in the brain. He added:

"Interestingly, in humans, the same "concept" of Marilyn can be evoked with other stimulus modalities, for instance by hearing or reading her name. Brain imaging studies have identified cortical areas in the human [temporal lobe](#) that are selective to voices and words. However, how visual, text and sound information can elicit a unique percept is still largely unknown."

The University of Leicester team in collaboration with UCLA and Caltech used presentations of pictures, spoken and written names to show that single neurons in the human [hippocampus](#) and surrounding areas respond selectively to representations of the same individual using different sensory prompts.

For example a neuron responded to three pictures of the TV host "Oprah

Winfrey", to her name written in the computer screen and to a computer synthesized voice saying "Oprah"; another one fired to different pictures and the written and pronounced name of "Luke Skywalker", from the classic movie "Star Wars". Another neuron fired strongly to the pictures and the written and spoken name of the ex-football star "Diego Maradona", even to a picture of Maradona in the soccer field when his face was not visible but the patient still recognized as Maradona.

They also found that such degree of abstraction -in the sense that neurons fired the same to different pictures or the name of a particular person- increased along the hierarchical structure within the areas they recorded from.

Moreover, Professor Quian Quiroga found neurons responding to his own pictures and name, thus suggesting that such neuronal representations can be generated relatively fast, because he was unknown to the patient a day or two before the recording took place.

Said Professor Quian Quiroga: "These results demonstrate that single neurons can encode concepts in a very abstract way, even if evoked by different sensory modalities"

The study breaks new ground by demonstrating how neurons previously studied by the team respond not only to picture, but to written and spoken names too.

Professor Quian Quiroga said: "The processing of visual and auditory information follows completely different cortical pathways in the brain, but we are showing that this information converges into single [neurons](#) in the hippocampus, at the very end of these pathways for processing sensory information.

"This work gives us further understandings of how information is

processed in the brain, by creating a high level of abstraction which is important for perception and [memory formation](#) given that we tend to remember abstract concepts and forget irrelevant details."

Source: University of Leicester ([news](#) : [web](#))

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