In people with OCD, actions are at odds with beliefs

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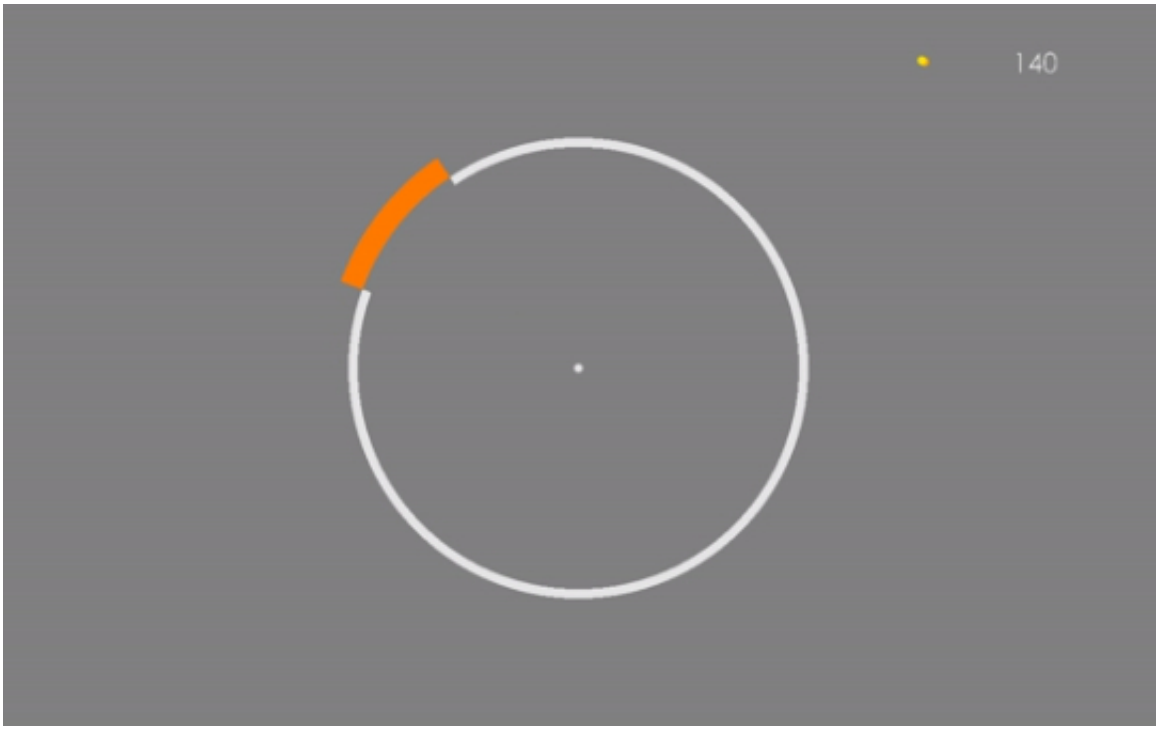

The repeated behaviors that characterize obsessive-compulsive disorder are a manifestation of an underlying brain dysfunction that is not yet well understood. Now, in a study appearing on September 28 in the journal *Neuron*, scientists in the UK report the use of a mathematical model that they say will help them get at the root of what causes OCD. They find that people with OCD develop an internal, accurate sense of

how things work but do not use it to guide behavior.

"This study shows that the actions of people with OCD often don't take into account what they've already learned," says senior author Benedetto De Martino , principal investigator of the Brain Decision Modelling Laboratory at University College London. The study was led by graduate students Matilde Vaghi and Fabrice Luyckx.

The researchers were able to measure the degree to which beliefs and action were dissociated from one another, and they found that the degree of uncoupling could predict the severity of OCD symptoms. "This was very surprising to me," De Martino adds. "It's the first time anyone has been able to calculate the degree of dissociation and show that it correlates with the severity of the disease."

De Martino's lab is focused on developing a mechanistic understanding of the connection between confidence and action. Specifically, his group looks at how certainty guides the decisions that we make. For example, if you are certain that it will rain, you will take an umbrella with you. "But we suspect that in people with OCD, this link is broken," he explains. "Someone with OCD will tell you that they know their hands are clean, but nevertheless they can't stop washing them. Two things that are normally linked together—confidence and action—have become uncoupled."

To study the connection, the investigators developed a test to measure this phenomenon. Forty-nine volunteers (24 with OCD and 25 matched controls) were recruited to play a video game in which they had to catch coin-like objects in a bucket. After several trials, both sets of participants were able to state with confidence where they thought the coins were coming from. Yet while the healthy participants were able to set their buckets based on that belief, those with OCD continued to second guess themselves, disregarding the confidence they felt and

chasing every coin by constantly moving their buckets around.

This type of study belongs to a relatively new field of research called computational psychiatry, which is focused on developing mathematical models to understand the defects in the brain that lead to detrimental behaviors. "Medicine today is very much about decoding the mechanisms in the body," De Martino says. "When we are talking about something like a heart valve, that's a mechanical part that can be clearly understood. But the brain is a computational device that has no mechanical parts, so we need to develop mathematical tools to understand what happens when something goes wrong with a brain computation and generates a disease."

"This model not only gives us greater insight into OCD, but also into the normal, healthy brain as well," says De Martino. "Just as studying people with lesions in the hippocampus has historically taught us about the inner workings of memory, studying people with OCD can give us new insights into how beliefs and actions are linked."

He adds that once such tools are developed, they are likely to be useful in developing new approaches for diagnosis, which could lead to early detection and early intervention. "This would be a game-changer in the field," he concludes.

More information: *Neuron*, Vaghi and Luyckx et al.: "Compulsivity reveals a novel dissociation between action and confidence" www.cell.com/neuron/fulltext/S0896-6273(17)30841-3 , DOI: 10.1016/j.neuron.2017.09.006

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