People estimate their own abilities based on others' performance

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Credit: Rice University

Ratings of our own abilities are strongly influenced by the performance of others, according to a study published July 20 in *Neuron*. Interacting with high performers makes us feel more capable in cooperative team settings, but less competent in competitive situations. Moreover, the degree of "self-other-mergence" is associated with activity in a brain region previously implicated in theory of mind—the ability to understand the mental states of oneself and others.

"We found that although people estimated their abilities on the basis of their own performance in a rational manner, their estimates of themselves were partly merged with the performance of others," says first author Marco Wittmann, a doctoral student in cognitive neuroscience at the University of Oxford. "The findings potentially have implications for social interactions in the workplace as well as clinical disorders such as depression."

Estimating the abilities of ourselves and others is key for survival, guiding decisions about which social groups to join and whether to attack or retreat. In daily life, we constantly judge ourselves and others about everything from intellectual merit to athletic prowess. A wealth of psychology research has shown that comparisons with other people can be used as an effective means for self-evaluation, and conversely, people base judgments of other people on knowledge of their own traits. However, relatively little is known about which brain regions are involved in estimating the abilities of oneself and others.

In the new study, Wittmann and his colleagues set out to address this question by combining behavioral experiments with functional magnetic resonance imaging. Twenty-four subjects participated in two games that involved either assessing the colors of shapes or estimating elapsed time. They were also told that two other players were performing the same task at the same time. After each trial, the subjects were given feedback on their own performance and the performance of the other two players.

Before the next trial began, the subjects were asked to rate the expected performance for themselves and the other players.

The researchers also assessed how the subjects' expected performance ratings were influenced by cooperative and competitive contexts. During cooperative trials, the scores of the subjects and the other players were summed together for points that could translate into a monetary reward at the end of the experiment. But during competitive trials, points were awarded based on the difference between the subjects' score and the scores of the other players.

In cooperative situations, the subjects evaluated themselves more positively when the other players performed well and more negatively when the other players performed poorly. But in the competitive context, the subjects evaluated themselves more negatively when interacting with high performers compared to low performers. "Our behavioral findings match well with what people experience in their workplace," Wittmann says. "They might feel better or worse about themselves depending on how well the group they are working with is doing, or they might feel worse about themselves when facing a strong competitor."

The brain imaging data revealed that two distinct regions in frontal cortex tracked the estimated abilities of oneself and others. Activity levels in the perigenual anterior cingulate cortex depended on how well subjects performed in recent trials. Past studies have shown that this brain region is involved in judging one's own traits and thinking about oneself and similar others.

On the other hand, dorsomedial frontal area 9 tracked the performance of the other players and integrated this information with estimates of one's own abilities. Specifically, activity in area 9 reflected "self-other-mergence," predicting the degree to which the subjects' self-ability ratings changed as a result of engaging with high performers. This brain

region is part of the theory-of-mind network in humans, and research in monkeys has shown that the structure and function of area 9 are influenced by social dominance status and social network size. Taken together, these findings suggest that area 9 may integrate information about oneself and others to compute one's own position in a social network.

"Learning about oneself and others is not only important for humans," Wittmann says. "For example, choices to attack or retreat are vital for many animals and these choices can be based on how strong you think you yourself and another competitor are. In a way, when you think about dominance hierarchies in animals, for them it is very important to know about the value of themselves and others in that hierarchy. In humans, social hierarchies exist but they are less pervasive and depend on quickly changing social reference groups, for example, within one's family, or at work, or in a sports team."

According to Wittmann, the next step is to test how self-other-mergence and area 9 activity are affected in clinical populations. "We are wondering whether the brain mechanisms underlying self and other evaluation might be altered in clinical syndromes such as depression, where people can feel helpless when facing their daily tasks," he says. "It seems intuitive that people with depression might judge how well they are doing differently compared to non-depressed people. I think it would be worth following this up."

More information: *Neuron*, Wittmann et al.: "Self-Other Mergence in the Frontal Cortex during Cooperation and Competition" www.cell.com/neuron/fulltext/S0896-6273(16)30300-2 , DOI: 10.1016/j.neuron.2016.06.022

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