

## What is more rewarding: A soccer goal or prize money?

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Bernd Weber (left) and Alexander Niklas Häusler are from the Center for Economics and Neuroscience at Bonn University. Credit: (c) Photo: Volker Lannert/Uni Bonn

Soccer fans hold their breath in situations like these: Two players on a



team are in front of the opponent's goal with the attacking player having to make an important decision: Is it better to pass the ball to the teammate or to take the shot yourself? What happens in the brain during the course of such situations and upon scoring a goal is very similar to the processes and reward sequence with monetary incentives. This is what researchers at the Center for Economics and Neuroscience (CENs) of the University of Bonn discovered together with their colleagues at the University of Bonn Hospital and the Life&Brain Center. They are now presenting their results in the journal *PLOS ONE*.

As a preliminary study, the researchers showed 200 different photos depicting such scenes in front of the opponent's <u>goal</u> to 377 German soccer <u>players</u>. The players were asked to estimate in each situation whether they would pass the ball or take aim at the goal themselves and about the chances of scoring a goal from each point of view. "Using this method, we obtained representative data from experienced soccer players regarding the situations in which, based on experience, the chances of scoring a goal are higher when passing or shooting," says Prof. Dr. Bernd Weber from the Center for Economics and Neuroscience of the University of Bonn.

The next step of the study followed by using these results: The <u>brain</u> activity in a total of 33 male soccer players was measured using magnetic resonance imaging (MRI) while they were shown situations in front of the goal using video goggles. With the push of a button, they were able to report whether they would pass the ball to a teammate or would rather prefer to shoot the ball themselves. They subsequently learned whether or not a goal was made.

"Two phases of the experiment are of particular interest to us. Firstly, which processes in the brain take place during the decision to either pass or shoot the ball. Secondly, which brain areas are active when a goal is scored or not," says lead author Alexander Niklas Häusler, a doctoral



student of Prof. Weber at the CENs and an active amateur soccer player himself. Using the recording of brain activity, it could be decoded which regions induce the decisions, how they work together, and how this relates to frustration or euphoria after the shot.

## **Reward areas of egotistical players were not more active**

A personality test was used to investigate the egoism of the soccer players participating in the study. In contrast to expectations, the players with a more egotistical personality did not demonstrate increased activity in the reward areas when they scored a goal themselves. On the contrary: Brain regions associated with learning and reflection were significantly more active in these players when a goal was made after the ball was passed to a teammate. "Our results indicate that more egotistical players perceive goals after their own shots as rather normal and are less positively surprised by their goal," says Häusler.

Are athletes wired differently during soccer games or does the brain work similarly in everyday situations? To answer this question, the scientists conducted a standard monetary incentive test with the same <u>soccer players</u>: Again in the MRI, the participants had to guess which of up to four boxes displayed a hidden filled-in circle. If they guessed the correct box, they won money. "With this classical experiment, various aspects of reward processing can be investigated very well," says Häusler.

## The brain works very similarly upon soccer goals and financial wins

It came to a surprise that during soccer decisions and also during decisions involving monetary incentives, very similar regions of the



reward network in the brain were activated: From studies involving monetary incentives, it is known that the so-called ventral striatum and the ventromedial prefrontal cortex play crucial roles here. The former is responsible for calculating the chances of success, for example, for scoring goals or winning money. The latter appraises the expected reward if the action is met with success. From many studies, the researchers at the University of Bonn know that the regions are always particularly active if the event unexpectedly surpasses the previously held expectations.

"Although athletic successes and <u>monetary incentives</u> are very different things, the results demonstrate that the reward processing of goals in comparison to money takes place in an amazingly similar way in the brain," reports Prof. Weber.

## More information: *PLOS ONE*:

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