

# Punishment can enhance performance, academics find

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The stick can work just as well as the carrot in improving our performance, a team of academics at The University of Nottingham has found. A study led by researchers from the University's School of Psychology, published recently in the *Journal of Neuroscience*, has shown that punishment can act as a performance enhancer in a similar way to monetary reward.

Dr Marios Philiastides, who led the work, said: "This work reveals important new information about how the brain functions that could lead to new methods of diagnosing [neural development](#) disorders such as [autism](#), ADHD and [personality disorders](#), where decision-making processes have been shown to be compromised."

The Nottingham study aimed at looking at how the efficiency with which we make decisions based on ambiguous sensory information—such as visual or auditory—is affected by the potential for, and severity of, anticipated punishment.

To investigate this, they asked participants in the study to perform a simple perceptual task—asking them to judge whether a blurred shape behind a rainy window is a person or something else.

They punished incorrect decisions by imposing monetary penalties. At the same time, they measured the participants' brain activity in response to different amounts of monetary punishment. Brain activity was recorded, non-invasively, using an EEG machine which detects and

amplifies [brain signals](#) from the surface of the scalp through a set of small [electrodes](#) embedded in a swim-like cap fitted on the participants' head.

They found that participants' performance increased systematically as the amount of punishment increased, suggesting that punishment acts as a performance enhancer in a similar way to monetary reward.

At the neural level, the academics identified multiple and distinct brain activations induced by punishment and distributed throughout different areas of the brain. Crucially, the timing of these activations confirmed that the punishment does not influence the way in which the brain processes the sensory evidence but does have an impact on the brain's decision maker responsible for decoding sensory information at a later stage in the decision-making process.

Finally, they showed that those participants who showed the greatest improvements in performance also showed the biggest changes in [brain activity](#). This is a key finding as it provides a potential route to study differences between individuals and their personality traits in order to characterise why some may respond better to reward and punishment than others.

A more thorough understanding of the influence of punishment on decision-making and how we make choices could lead to useful information on how to use incentive-based motivation to encourage certain behaviour.

**More information:** The paper, Temporal Characteristics of the Influence of Punishment on Perceptual Decision Making in the Human Brain, is available online via the *Journal of Neuroscience*.

Provided by University of Nottingham

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