

A New Approach to the Pay-Performance Question

Have you ever wondered
how our brains process
monetary incentives?

Does being paid for a task that you would gladly do for free alter how you think about that task? Does it change how you feel about that task?

Among my circle of friends, I am the “official math tutor.” I frequently field questions about algebra and geometry via phone, text message and Skype for the tweens and teenagers of my friends. I do this free of charge, for a variety of reasons: My personal relationships with these kids and their parents, my love of teaching and my desire to help out when I can, to name just a few. It was suggested by one of my friends that I should open a virtual tutoring center, charge for my services and generate a bit of extra income on the side. I recoiled at the idea. Why would I ever do such a thing? It wasn’t the entrepreneurial aspect that horrified me — I’ve done the startup thing in the past — and it wasn’t the time commitment — I was already spending time doing this with my friends’ children. I can’t really explain what the source of my reaction was, but it was a very strong, and negative, reaction.

A new experiment from neuroscience may help explain my reaction, and help us understand the complex relationship between pay and performance (Strombach, Hubert, and Kenning. 2015. “The Neural Underpinnings of Performance-Based Incentives,” *Journal of Economic Psychology* 50.).

Strombach, Hubert and Kenning used functional magnetic resonance imaging (fMRI) to examine how our brains respond to performance-related monetary incentives. Specifically, they performed an experiment to explore how monetary incentives affect actual performance and how changes in incentives present themselves in underlying

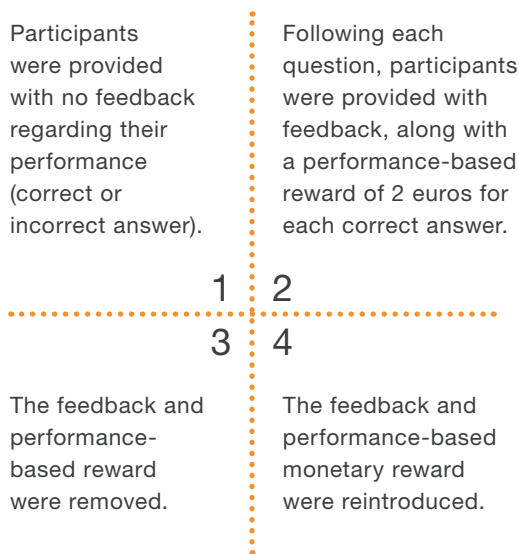


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neural activation. Participants in the study were shown simple addition, subtraction, multiplication and division questions. Each question was accompanied by a solution and participants were asked to indicate whether the solution was correct. Participants were given 65 calculations divided across four blocks of questions:



Performance was directly measured in terms of percentage of correct responses. Neural activity served as a proxy for the motivation to perform and for the underlying cognitive processes. The authors expected to find that when task-related behaviors and incentive-related behaviors are combined, as in the case of performance-based pay, three neural processes will occur:

- 1 | Activation and deactivation in reward-related areas of the brain reflecting the introduction and removal of monetary rewards.
- 2 | Activation of task-related areas of the brain in response to the cognitive task.
- 3 | Effort-related and attention-related changes in BOLD (blood oxygenation level dependent) signals will be present, accompanied by changes in performance in the experiment.



Neural activation patterns found in the present experiment correspond to the idea that the removal of the monetary incentives decreased the effort that was put into solving the tasks, along with reduced cognitive control and motivationally driven behavior.

Both the behavioral and neurological results of the experiment are interesting. The authors summarized their behavioral findings:

We found a significant decrease in performance in response to the removal of monetary incentives. Overall, we were able to confirm our hypothesis that taking a monetary reward away leads to decreased performance. Interestingly, no changes in performance due to the introduction of monetary rewards were observed.

The authors noted, however, that “because subjects did not anticipate the performance-based rewards (during Block 2), they may have been performing at the maximum level when the experiment began (during Block 1).”

The neurological results help to explain this somewhat unexpected behavioral result:

Neural activation patterns found in the present experiment correspond to the idea that the removal of the monetary incentives decreased the effort that was put into solving the tasks, along with reduced cognitive control and motivationally driven behavior. Removing the monetary incentives appears to de-motivate participants



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to the extent that performance level drops below the initial performance baseline, although the difficulty of the arithmetic calculations is the same throughout the experiment.

The introduction of the monetary incentive produced changes in the ventral striatum (vStr), an area of the brain sensitive to rewards, indicating that participants perceived the incentive as rewarding. The removal of the monetary incentive was linked to a decrease in BOLD (blood oxygenation level dependent) signals for reward-related brain regions, as well as to a decrease in performance. The ventromedial prefrontal cortex (vmPFC), thought to reflect subjective values — in this experiment, the value of solving the arithmetic problems — responded differently. The introduction of the monetary incentive was accompanied by a deactivation of the vmPFC, suggesting that the subjective value of the task is smaller after subjects are rewarded with money.

The observed neural activation patterns support the behavioral model proposing that the introduction of monetary incentives contingent upon performance undermines intrinsic motivation to perform, leading to reduced performance (e.g., Deci, Koestner, and Ryan. 1999. “A Meta-Analytic Review of Experiments Examining the Effects of Extrinsic Rewards on Intrinsic Motivation.” *Psychological Bulletin* 125(6).

The key takeaway from this is that the effect of performance pay is not as straightforward as it may seem. The human brain is a complex and

mysterious thing. Rewarding performance through financial incentives changes the way we think and feel about performing those tasks. It affects us at a neurological level. The introduction of monetary incentives can crowd out our intrinsic motivation, resulting in diminished performance. This, coupled with our tendency to strongly prefer avoiding losses to acquiring gains (Tversky and Kahneman. 1992. “Advances in Prospect Theory: Cumulative Representation of Uncertainty.” *Journal of Risk and Uncertainty* 5(4): 297–323), means that any introduction or expansion of performance pay programs requires a consideration of not only what the immediate impact on performance will be but also of the potential for a large negative impact on performance in the long run if those programs are not sustainable. If we become financially unable or culturally unwilling to sustain those programs down the road, the net impact of discontinuing these programs may be worse than never having adopted the programs in the first place. [WR](#)

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