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The neural underpinnings of performance-based incentives

Tina Strombach [a,b,*], Marco Hubert [c], Peter Kenning [b]

[a] Comparative Psychology, Heinrich-Heine-University Düsseldorf, Düsseldorf, Germany
[b] Chair of Marketing, Heinrich-Heine-University Düsseldorf, Düsseldorf, Germany
[c] Department for Corporate Management and Economics, Zeppelin University, Friedrichshafen, Germany

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ABSTRACT

Pay-for-performance is commonly applied in order to favorably modulate behavior and increase performance. However, the removal of an incentive leads to a significant decrease in performance. Although there is behavioral evidence that incentives have an effect on performance, the neural underpinnings of the underlying cognitive processes are not certain. We hypothesize that performance is affected by monetary incentives, and that these changes are reflected by the dopaminergic reward system. In this study, we use the direct measure of performance and measure the underlying cognitive processes by using functional magnetic resonance imaging (fMRI) simultaneously. We find that incentives induce changes in reward-related brain regions, but not in task-related neural representations. Interestingly, when monetary incentives are introduced, blood oxygenation level dependent activity increases in the ventral striatum, being sensitive to reward, and decreases in the ventromedial prefrontal cortex, representing the subjective value. We suggest that pay-for-performance does not directly affect performance by modulating neural activity in task-relevant regions, but affects the reward representation during task completion. Therefore, we conclude that performance-contingent incentives need to be applied carefully. This finding is of special interest for employee compensation in unstable economic environments, as companies in unstable environments might not permanently ensure pay-for-performance.

1. Introduction

That behavior is often guided by incentives in the form of rewards is a widely recognized condition (Locke, 1968; Schultz, 2006). Specifically, rewards are understood to initiate and modulate behavior (Schultz, 2006), and substantial research evidence demonstrates that such incentives affect performance (Bloom, 1999; Goldman, 2005; Jenkins, Mitra, Gupta, & Shaw, 1998; Locke, Feren, McCaleb, Shaw, & Denny, 1980; Rynes, Gerhart, & Parks, 2005). However, opinions about the impact of rewards on performance remain far from unanimous, as the direction of the effect continues to be a topic of controversy both in psychology and economics (Albrecht, Abeler, Weber, & Falk, 2014; Camerer & Hogarth, 1999; Kamenica, 2012). When monetary incentives are introduced, intrinsic motivation to perform is overshadowed by the money, resulting in behavior that is predominantly elicited by financial incentives. Many theories indicate that this crowding out of motivation by financial incentives leads to a drop in performance (Deci, 1971; Deci, Koestner, & Ryan, 1999; Frey & Oberholzer-Gee, 1997;

* Corresponding author at: Heinrich-Heine-University Düsseldorf, Universitätsstrasse 1, 40225 Düsseldorf, Germany. Tel.: +49 211 81 10273.
E-mail address: tina.strombach@hhu.de (T. Strombach).

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Murayama, Matsumoto, Izuma, & Matsumoto, 2010; Ryan & Deci, 2000). Nevertheless, an equally substantial amount of research demonstrates that monetary incentives can have a positive impact—possibly by increasing the effort that is invested in solving a task (Bloom, 1999; Jenkins et al., 1998; Locke et al., 1980). Although the effect of incentives has not yet been definitely established, performance-based incentive systems (e.g., performance-based compensation plans, cash gifts, Christmas bonuses, annual bonuses, stock options, etc.) are widespread in today's corporate world (Camerer & Hogarth, 1999; Le Blanc & Mulvey, 1998; Merchant & Van der Stede, 2007; Rosenthal, Frank, Li, & Epstein, 2005).

Because the behavioral findings regarding performance-based incentives have not been definitively established, the ways in which performance-based monetary incentives change the neural representation of a specific task need to be investigated. A better understanding of the effects may reveal how such measures impact performance at a neural level. Neuroscience offers a method for investigating the latent but significant effects of monetary incentives on performance. Such insights may be very beneficial in a variety of corporate and institutional settings where performance measures are implemented on a regular basis. Because we are interested in the sequential effect of incentives, we observed reactions to the introduction of a monetary incentive, as well as subsequent responses to the removal of the incentive, noting, particularly, how these changes are reflected at the neural level. Subjects were presented with a cognitively engaging, but solvable, arithmetic task while measuring blood oxygenation level dependent (BOLD) signals, which are an indirect measure of relative neural activation, and which allow inferences about the regions activated during a specific cognitive task (Huettel, Song, & McCarthy, 2004). Comparing BOLD signals that are recorded before performance-based rewards are introduced (baseline), during the administration of a pay-for-performance and subsequent to the removal of the incentives could be expected to reveal brain regions associated with processing such changes in incentives. As the task will remain the same in all conditions (i.e., before the incentive has been offered, when incentives are introduced and after the incentive has been removed), this experimental design is well suited to examining both the extent to which monetary incentives affect performance on a behavioral level, and how this is reflected in neural activation.

2. Theory and hypotheses development

2.1. Incentives and performance

Since the early 1960s, researchers have been interested in investigating the relationship between payment and performance (Lawler, 1971; Locke, 1968), so far with inconclusive results. While many studies have shown that money has a positive effect on motivation and performance (Bloom, 1999; Jenkins et al., 1998; Lazear, 2000; Locke et al., 1980), others have demonstrated that performance-based payments are disadvantageous as motivational factors (Frey & Oberholzer-Gee, 1997; Locke et al., 1980). Though most researchers generally agree that there is a connection between monetary incentives and performance (Camerer & Hogarth, 1999; Kamenica, 2012; Locke et al., 1980), research in psychology and economics presents divergent opinions about such a relationship. While the greater number of researchers in psychology have concluded that monetary incentives undermine performance (Deci, 1971; Deci et al., 1999), economic researchers generally endorse the opposite view. The research on the psychology of motivation (Deci & Ryan, 1985, 2000, 2012; Ryan & Deci, 2000) highlights the importance of the autonomous self and the freedom to make personal decisions as a prerequisite for a high motivation to perform. They suggest that rewards that are contingent upon engagement, competition, or performance undermine intrinsic motivation and, consequently, lead to reduced performance in a given task. The introduction of incentives might also be detrimental in the same way that added incentives make people self-conscious about an automatic activity (Baumeister, 1984; Baumeister & Showers, 1986; Camerer & Hogarth, 1999). A series of behavioral observations and experiments indicated that the introduction of larger-than-average monetary incentives reduces performance in, for example, automatic actions or sporting events (Baumeister, 1984; Mobbs et al., 2009). These experiments suggest that the increase in incentives may lead to arousal beyond an optimal level, and may result in explicit monitoring that can interfere with the activity itself. In other words, preoccupation with a reward may lead to pressure-induced performance decrements (Baumeister, 1984; Baumeister & Showers, 1986; Schlenker, Phillips, Boniecki, & Schlenker, 1995). Thus, in psychological terms, intrinsic motivation is expected to be high enough to produce steady effort even in the absence of financial rewards, and incentives are likely to reduce performance (Camerer & Hogarth, 1999).

In contrast, the conventional view proposed by economists states that behavior is initiated only when a reward is available, thereby implying that monetary incentives can be used to initiate a desired behavior (Camerer & Hogarth, 1999). When focusing on economic experiments to investigate the role of incentives, if subjects earn money for good performance, they work harder, more persistently, and more effectively (Camerer & Hogarth, 1999). A field study by Libby and Lipe (1992) also shows that the introduction of monetary incentive systems induces greater effort and results in better performance. Thus, economic and psychological theories make different predictions about the effect that monetary incentives have on performance. The general view of relationships between incentives, motivation, and performance is inconclusive. However, the initial level of intrinsic motivation to complete a task seems to be a core component to determine the effect of incentives on performance. Thus, the inconclusive results may be driven by the nature of the task or by the amount of intrinsic motivation and personal interest that the task elicits. According to a meta-analysis developed by Jenkins et al. (1998), the effect of money on motivation to perform is modulated by the level of personal interest a person has in the task.