Motivation and Emotion (2020) 44:797–809
https://doi.org/10.1007/s11031-020-09856-0

ORIGINAL PAPER

Cognitive labor shapes the desire for social and monetary compensation

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Accepted: 3 September 2020 / Published online: 14 September 2020

Abstract

When do people want something back for their mental labor? Based on equity theory, we propose that conscious experiences of *success* and *effort*—which emerge during cognitive work—shape people's subsequent desire for social and monetary rewards. We examined this idea in a series of experiments, in which participants carried out a cognitive task, in which we manipulated task difficulty (easy vs. difficult) and performance feedback (high vs. low) within subjects. After each trial of this task, we probed people's desire for compensation, in terms of social appreciation or money. Findings were in line with the *entitlement hypothesis*, which assumes that the experience of success can cause people to feel entitled to money. However, we found only indirect support for the *effort compensation hypothesis*, which assumes that the feeling of effort increases the subsequent desire for compensation, and no support for the *intrinsic reward hypothesis*, which assumes that people desire less social appreciation after already having experienced success. When considered together, our results suggest that labor-related feelings (of success and effort) shape people's subsequent desire for money and social appreciation in several ways. These findings have potential implications for the effective use of performance feedback in work contexts.

Keywords Cognitive labor · Feeling of effort · Feeling of success · Phenomenology · Effort-reward imbalance · Fairness · Monetary markets · Social markets · Task switching · Task performance

Introduction

Humans, like other animals, tend to desire some compensation for their labor. At the office, for example, employees desire money for successfully completing projects; at school, students desire good grades for working hard on assignments; at home, romantic partners desire appreciation for cooking dinner. Anecdotes like these suggest that people estimate how much labor they have invested in a certain situation—and then, translate their estimate into a desire for compensation. In this research, we aim to examine the psychological processes that shape this desire. Specifically, we examine how people decide *what* and *how much* they want in return for their labor. We approach this question by investigating the case of how cognitive work changes people's desire for monetary and social compensation.

The compensation of labor is a common theme in social and work psychology. Perhaps most notably, *equity theory* generally suggests that effort put into work should be in balance with the rewards that ensue (Adams 1963). Indeed, research shows that so-called effort–reward imbalances—e.g., working hard for low pay and little appreciation—are associated with unpleasant outcomes, such as high stress, low well-being, and poor health (de Jonge et al. 2000; Siegrist et al. 2004). So, on first sight, as people try to reduce effort–reward imbalances, work that feels *effortful* should incite the desire for compensation, whether this takes the form of money or social appreciation.

Yet, for two reasons, it is potentially worthwhile to develop a more nuanced view of labor compensation. First, although people indeed experience the costs of cognitive labor (as feelings of *effort*; Kurzban et al. 2013), they also tend to experience the benefits (as feelings of *success*, Lewin 1936). Clearly, it would be odd to assume that only the experienced costs of labor, not the benefits, are translated into the desire for compensation. Second, not all forms of compensation are created equal. Specifically, as we will detail below, money—as compared to other rewards—has some distinct

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qualities (Bijleveld and Aarts 2014; Heyman and Ariely 2004). Thus, to explain the desire for compensation, a psychological analysis at least needs to consider (a) both costs and benefits of labor and (b) the distinct status of money as a reward.

In what follows, we will provide such an analysis. We will first consider the feeling of effort, or the experienced costs of labor. Then, we will consider the feeling of success, or the experienced benefits. We present four experiments to test our proposal.

The feeling of effort

Familiar to almost all people, the *feeling of effort* is the experience of how hard work feels (Preston and Wegner 2009). The feeling of effort arises when people carry out difficult tasks, including difficult cognitive tasks. The feeling of effort is usually considered to be aversive state, and indeed, people generally avoid spending effort (Brehm and Self 1989; Kool et al. 2010; Richter et al. 2016; Zipf 1949). In several disciplines (e.g., work psychology, cognitive psychology, ergonomics), the feeling of effort is assumed to reflect the *costs* of cognitive work (Bijleveld 2018; Kurzban et al. 2013; Preston and Wegner 2009; Robinson and Morsella 2014).

Equity theory, a classic model of fairness, suggests that people evaluate the ratio of *inputs* (i.e., what they invest in their work, e.g., effort and time) and *outcomes* (i.e., what they get back from their work, e.g., money and appreciation), against some comparison standard (e.g., their own prior input/outcome ratio, or the input/outcome ratio of colleagues; see Chun et al. 2018), in order to evaluate whether rewards are fair (Adams 1963; Arvanitis and Hantzi 2016; Walster et al. 1973). So, equity theory proposes that higher inputs increase the input/outcome ratio, suggesting that people should desire more compensation after experiencing their own work as effortful.

Based on the ideas that (a) difficult cognitive work triggers the feeling of effort, and that (b) the feeling of effort signals the subjective cost of mental action, we propose that difficult (vs. easy) tasks increase people's desire for compensation, both in the form of social appreciation and money (*effort compensation hypothesis*).

The feeling of success

When people perform cognitive tasks, they monitor their own performance. Indeed, research from neuroscience suggests that performance monitoring enables people to flexibly respond to (changes in) task characteristics (Carter et al. 1998). Likely as a result of performance monitoring, people often become aware of their own successes and failures (Ullsperger et al. 2010). The feeling of success can be considered a pleasant state, arising from task performance, that signals that one is making progress towards, or is meeting, some goal (see Lawrence et al. 2002; Lewin 1936; van der Weiden et al. 2013). We propose that the feeling of success can affect people's desire for compensation via two distinct routes.

First, it seems reasonable to assume that success experiences are intrinsically rewarding (Komaki et al. 1996). Specifically, neuroimaging research shows that the act of giving accurate responses—and getting feedback on those accurate responses—is associated with activity in the ventral striatum (Elliott et al. 2000; Satterthwaite et al. 2012; Ullsperger and von Cramon 2003; Vink et al. 2013), a brain structure that is involved in reward motivation in several ways (Knutson et al. 2008). So, it may be the case that, in terms of equity theory, the feeling of success serves as a pleasant outcome of cognitive work—or in other words, that the feeling of success operates as a reward by itself. Via this route, positive performance feedback should lead people to desire *less* (additional) compensation.

Second, societal institutions are generally designed such that successful work leads to *more*, not less, compensation (e.g., Dewhurst et al. 2009). Indeed, one could argue that the feeling of success can operate as an input—i.e., as a signal that people contributed value to their work. Indeed, research from work psychology shows that people who think they performed well, feel entitled to more compensation (Bylsma and Major 1992; Motowidlo 1982). Via this route, positive performance feedback should lead people to desire *more* compensation for their work.

Considering these two pathways via which the experience of success may affect people's desire for compensation, a key question arises: which of the two is more important? Or, perhaps more realistically: what external conditions cause the mind to prefer one pathway over the other? Prior studies on different types of markets provide a cue for answering the latter question. In this research (Heyman and Ariely 2004), participants were asked to carry out some task (e.g., a computerized effort task). Some participants had the prospect of earning money; other participants, non-monetary gifts. The researchers, in turn, measured how hard participants worked. Intriguingly, findings showed that while participants took into account the value of money (people worked harder for more money), they did not take into account the value of gifts (people did not work harder for larger gifts). These findings support the idea that when potential rewards are non-monetary, people assume they are in a so-called *social exchange context*, in which they generally behave altruistically (Fiske 1992), e.g., by helping other people regardless of what they get in return. Whenever people can earn money, they assume that they are in a so-called *economic exchange context*, in which they tend to maximize their own earnings (Fiske 1992; Caruso et al. 2017; DeVoe and Iyengar 2010; Vohs et al. 2006).

Drawing from this prior work, we expect that different market contexts affect how success feedback is processed. In social exchange markets—where social appreciation, but not money, can be earned—we assume that the feeling of success operates as a reward in itself. We therefore propose the (somewhat counter-intuitive) *intrinsic reward hypothesis:* high (vs. low) performance feedback *decreases* the desire for social appreciation. In monetary exchange markets, we expect that the feeling of success operates as an input—i.e., it signals that one did a good job, which entitles people to compensation. So, we propose the *entitlement hypothesis*: high (vs. low) performance feedback *increases* the desire for monetary rewards.

The present research

To test our three independent hypotheses (*effort compensation hypothesis*, *intrinsic reward hypothesis*, *entitlement hypothesis*), we conducted four experiments. In all experiments, we used a cognitive labor task adapted from Kool et al. (2010). In this task, participants performed a computerized card game, while we manipulated task difficulty (to increase the feeling of effort) and performance feedback (to increase the feeling of success) on a trial-by-trial basis. First, in Studies 1a and 1b, we checked whether these manipulations were successful (i.e., whether they affected feelings of effort, Study 1a; and feelings of success, Study 1b). In Study 2, we examined how the manipulations affected people's desire for social appreciation (*effort compensation hypothesis* and *intrinsic reward hypothesis*). In Study 3, we examined how the manipulations affected people's desire for money (*effort compensation hypothesis* and *entitlement hypothesis*).

Method

Open science

Planned sample sizes, exclusion criteria, and analyses were preregistered, unless otherwise noted. We report all measures, manipulations, and exclusions. Data and scripts are available at https://osf.io/f8avm/.

Participants and design

We conducted power analysis using GPower 3.1.9.2, based on prior findings by Morsella et al. (2009), who studied the effect of task difficulty on people's *urge to err* (a conscious experience that is presumably related to the feeling of effort; Morsella et al. 2009). Based on the weakest of the relevant effect sizes from this prior paper, $\eta^2_p = 0.38$, we calculated that we would need only $N = 11$ to attain $1 - \beta = 0.95$ (with $\alpha = 0.05$, assuming only a low correlation between repeated measures, $r = 0.20$). However, as our studies differed from this prior work in important ways (e.g., we used a different cognitive task; we planned to use different statistical techniques), we interpreted results from this power analysis with great caution. To be conservative, we recruited 50 participants from Radboud University's community for each study.

People could participate if they were 18–30 years old, could speak Dutch, and were not colorblind. Participants received course credits or a €5 gift voucher. After data collection, but before analysis, we excluded participants who gave identical responses on the main dependent measure (feeling of effort, feeling of success, desire for appreciation, desire for money) in > 90% of the trials. Also, we excluded participants whose accuracy on the computer task was < 60%.

In Study 1a, the final sample consisted of 47 participants (39 females; mean age = 22.8, *SD* = 2.6). In Study 1b, the final sample consisted of 50 participants (39 females; mean age = 21.9, *SD* = 2.6). In Study 2, the final sample consisted of 50 participants (41 females; mean age = 22.0, *SD* = 2.1). In Study 3, the final sample consisted of 47 participants (40 females; mean age = 21.6, *SD* = 2.2).

In all studies, participants completed several runs of a switch task (see below). Runs were either difficult or easy; after each run, participants received either high or low performance feedback. Thus, all studies had a 2(difficulty: easy vs. difficult) × 2(performance feedback: low vs. high) within-subjects design, with 11 repetitions per condition.

Procedure

Upon arrival, participants were seated in a cubicle and they received task instructions on paper. These task instructions mentioned the study was about "how people feel when they carry out mental tasks". Accordingly, participants learned that they were to perform several mental tasks, after each of which they were to answer a question about how they felt.

To help participants understand our questions (Table 1), we provided some additional context in Study 2 and 3. In Study 2, we wrote:

> In this study, we are interested in how you feel while you are playing this card game. When people do tasks like this (for example, at work or at school), it is often the case that they would like some appreciation for their work. An example of such appreciation would be a compliment from their manager or teacher. We are interested to learn how much appreciation you would consider to be fair. So (…), we will repeatedly ask you how strongly you desire appreciation at that point in

Table 1 Overview of the dependent measures

Study	Item	Anchors
1a	How effortful did the task feel?	Very light–very heavy
1b	How well did it go?	Very poorly–very well
2	How much desire for appreciation do you have?	Very little–very much
3	How much desire for money do you have?	€0–€2

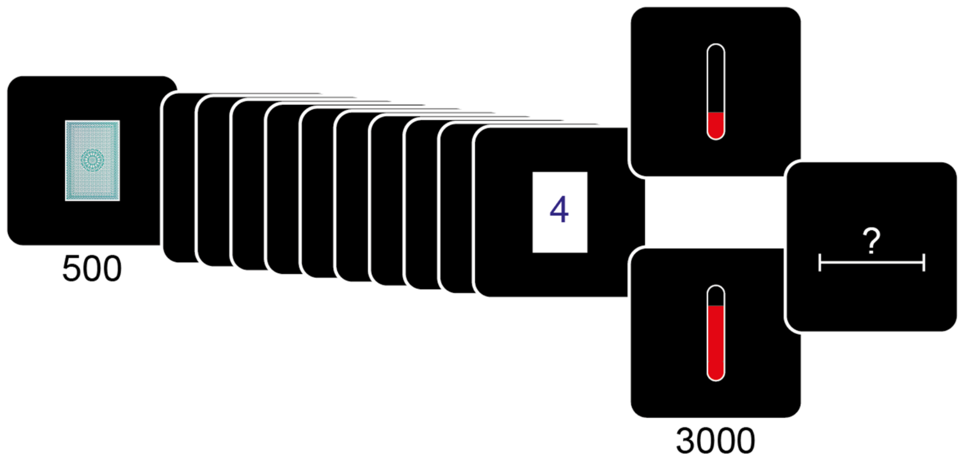

Fig. 1 Schematic overview of one run of the switch task. Numbers refer to durations in milliseconds. The question that was asked in the last screen (see Table 1) was the only difference between the studies

> time. You can give your answer on a line that ranges from "very little" to "very much".

In Study 3, we wrote:

> In this study, we are interested in how you feel while you are playing this card game. When people do tasks like this (for example, at the office), it is often the case that they get paid for their work. An example of such a payment would be a salary or a bonus. We are interested to learn how much money you would consider to be fair. So (…), we will repeatedly ask you how strongly you desire money at that point in time. You can give your answer on a line that ranges from €0 to €2, which are amounts that are common in lab studies like this one.

While participants read the instructions, the experimenter was present to answer questions. After that, the experimenter started the task and left. When participants were done, they were debriefed and paid.

Task

We used a switch task adapted from Kool et al. (2010). This task was presented as a card game. In this task, participants responded to a sequence of 10 cards, each of which contained a digit (1–9; except 5). Digits were either blue or purple. When the digit was *blue*, participants had to indicate whether the digit was lower or higher than five. When the digit was *purple*, participants had to indicate whether the digit was even or odd. They responded using the A (lower than five; even) and L (higher than 5; uneven) keys on the keyboard. Participants were instructed to respond fast and accurately.

After they had responded to 10 cards, participants received performance feedback (see below). Finally, they answered a question about the feeling of effort, the feeling of success, the desire for appreciation, or the desire for money (Table 1). They answered this question on a visual analogue scale, on which they could slide a pointer with the arrow keys on the keyboard. For consistency, in all studies, responses were stored as a number ranging from 0 (left anchor) to 2 (right anchor). Figure 1 presents an overview of the task. Throughout this paper, we refer to the sequence of events in Fig. 1 as a *run*.

Participants completed 2 practice runs and 44 experimental runs. The order of the 44 experimental runs was random (without restrictions; e.g., it was possible to be exposed to the same condition twice in a row). Randomization was done for each participant separately.

Difficulty manipulation

Switching back and forth between different sets of instructions is difficult (Monsell 2003). In line with this principle, difficulty was manipulated by varying the number of switches between the two colors (Kool et al. 2010). In easy runs, the probability of a new card having a different color than the previous one, was 10%; in difficult runs, 90%. Thus, in easy runs, participants hardly ever needed to switch between the tasks. In difficult runs, they had to switch almost all the time. The color of the digit on the first card was selected at random (with replacement).

Performance feedback manipulation

At the end of each run, participants received performance feedback, visualized on a thermometer (Fig. 1). In part, feedback was based on people's performance during that run. So, the thermometer generally indicated a higher score when people were faster and more accurate. Importantly, however, performance feedback also depended on the trial type. Specifically, after low performance feedback runs, feedback appeared in the lower half of the thermometer. After high performance feedback runs, in the upper half.

More formally, a performance score was calculated after each run, based on participants' speed and accuracy. Following Bijleveld et al. (2014, 2010), we first computed a performance score $S = ½ * c * (T/\lambda)$, with $S \geq 0$, where c was a constant representing the full height of the thermometer, T reflected the mean response time for all cards in that run, and λ was a participant-specific ability parameter. Thus, higher S reflected worse performance. T was computed by averaging the response times for all 10 cards of that run. However, before averaging these response times, we implemented a penalty for making errors, by replacing response times for inaccurate cards by λ. λ, in turn, was computed by averaging response times from all cards in previous runs, and multiplying this average by 2; λ was calculated separately for easy vs. difficult runs. On high performance feedback runs, feedback on the thermometer F was computed as $F = c - S$, with $F \geq ½ * c$. On low performance feedback runs, $F = ½ * c - S$, with $F \geq 0$.

Statistical analyses

Main analyses

Considering the nested structure of the data (runs nested within participants), we took a linear mixed-effects modeling approach (Bates et al. 2015). Thus, in all analyses we report, the *run* was the unit of analysis. By including a *random intercept* in our models, we took into account that participants may differ in their general level of the dependent variable (e.g., some people may generally desire more appreciation than others). In line with established guidelines (Barr et al. 2013), all models also included *random slopes* for all within-subjects predictors. This was done to take into account that the relation between the independent and dependent variables may be stronger for some people than for others (e.g., some people may be more sensitive to performance feedback than others). For each experiment, confirmatory testing was done with a linear mixed-effects model that included a *fixed intercept*, *fixed main effects* for difficulty and performance feedback, and a *fixed interaction effect* between difficulty and feedback.

Consistent with our mixed-effects modeling approach, we computed Cohen's d-values using procedures suggested by Judd et al. (2017).[1] We computed p-values based on Satterthwaite approximation of degrees of freedom (df; Kuznetsova et al. 2017). In line with the latter method, we reported df-values as decimal numbers.

Additional analyses

For all studies, we examined participants' performance—speed and accuracy—with the same type of models as those used in the main analyses. We expected that people would be slower and less accurate on difficult (vs. easy) runs. We preregistered this analysis for speed only, and only for Studies 1a and 1b. For consistency, we will report this analysis for all studies. For completeness, we will report analyses for accuracy as well.

For Studies 2 and 3, as preregistered, we tested whether the effect of difficulty on the desire for appreciation (Study 2) and money (Study 3) is mediated by performance (speed and accuracy). As explained below, these analyses allow us to examine the idea that difficult runs cause people to perform worse, which *in turn* changes their desire for appreciation and money. We followed the approach from Imai et al. (2010), which allows for examining mediation in linear mixed-level models.

Results

Descriptives

Overall, participants self-reported the feeling of effort slightly below the midpoint of the scale in Study 1a ($M = 0.92$, $SD = 0.34$). The feeling of success was rated

[1] In particular, we computed Cohen's d as.

$$d = \frac{\mu 1 - \mu 2}{\sqrt{\sigma_I^2 + \sigma_D^2 + \sigma_F^2 + \sigma_{DxF}^2 + \sigma_E^2}}$$

where $\mu 1 - \mu 2$ is the estimated difference between the two conditions of interest; σ_I^2 is the random intercept variance; σ_D^2, σ_F^2, and σ_{DxF}^2, are the random slope variances for the main effects and the interaction; and σ_E^2 is the residual variance. Note that this way of calculating d requires independent variables to be effect coded (i.e., levels need to be coded as –1 vs. 1).

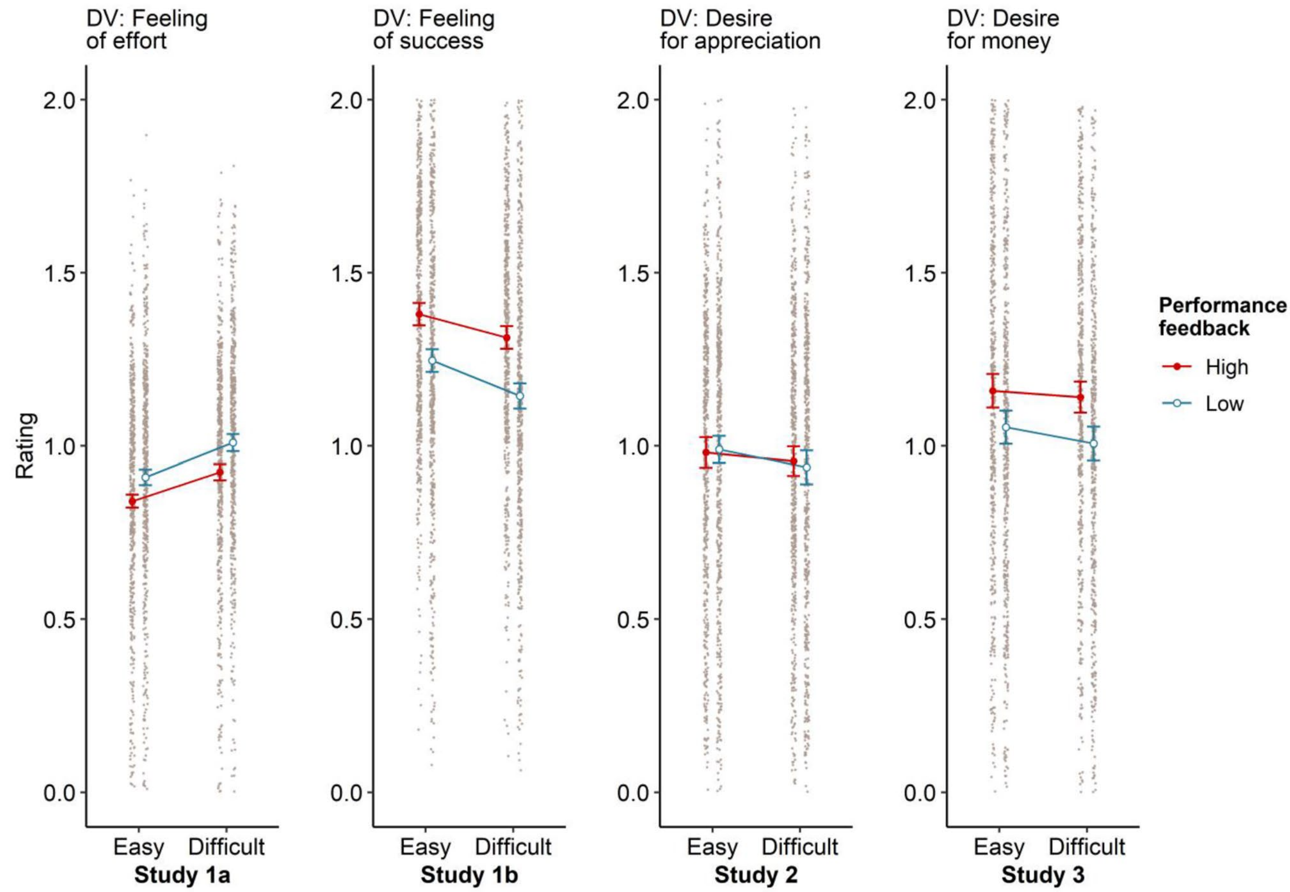

Fig. 2 Mean ratings of the feeling of effort (Study 1a), feeling of success (Study 1b), desire for appreciation (Study 2) and desire for money (Study 3). Means are shown separately for easy vs. difficult trials, and separately for high vs. low performance feedback trials. Error bars indicate 95% within-subjects confidence intervals around the means (Cousineau 2005). Small, light dots in the background represent individual observations

above the midpoint in Study 1b ($M = 1.27$, $SD = 0.40$). The desire for appreciation was rated around the midpoint in Study 2 ($M = 0.97$, $SD = 0.42$). The desire for money was rated slightly above the midpoint in Study 3 ($M =$ €1.09, $SD = 0.49$). Means per condition are plotted in Fig. 2, along with their within-subjects confidence intervals.

Main analyses

Parameter estimates of our linear mixed-level analyses are plotted in Fig. 3. We will now discuss findings from these analyses in greater detail.

First, before examining our main hypotheses, we examined whether our manipulations affected feelings of effort and success. In Study 1a, there was a main effect of difficulty, $t(46.4) = 6.01$, $p < 0.001$, $d = 0.27$, showing that people felt more effort in difficult runs. Also, there was a main effect of feedback, $t(47.3) = 5.47$, $p < 0.001$, $d = -0.23$ showing that people felt less effort after receiving positive performance feedback. The difficulty × feedback interaction was not significant, $t(167.3) = 0.72$, $p = 0.471$, $d = -0.03$. In Study 1b, there was again a main effect of difficulty, $t(52.2) = 5.37$, $p < 0.001$, $d = -0.22$, showing that people felt less success in difficult runs. Also, there was a main effect of feedback, $t(49.0) = 5.38$, $p < 0.001$, $d = 0.39$, showing that people felt more success after getting positive performance feedback. Together, results from Studies 1a and 1b show that our manipulations were successful: difficult tasks *increased* feelings of effort (while *diminishing* feelings of success), positive performance feedback *increased* feelings of success (while *diminishing* feelings of effort).

Second, we tested the *effort compensation hypothesis*, i.e., the prediction that difficult tasks should increase desire for both appreciation and money. In Study 2, the main effect of difficulty was significant, $t(49.1) = 2.69$, $p = 0.010$, $d = -0.09$, but the direction of this effect was opposite to our prediction: difficult (vs. easy) tasks *diminished* desire for appreciation. In Study 3, the main effect of difficulty was not

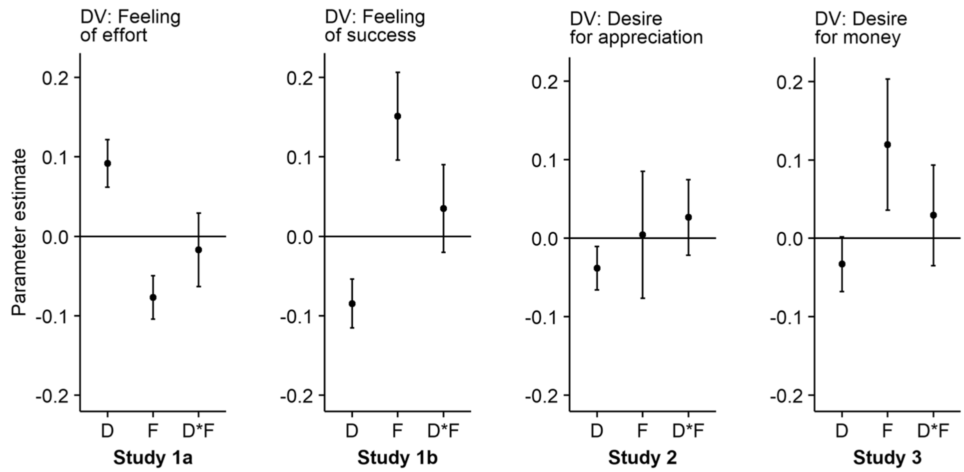

Fig. 3 Parameter estimates from general linear mixed models. Error bars indicate 95% confidence intervals around the estimates. D = Main effect of difficulty; F = Main effect of performance feedback; D*F = Difficulty × feedback interaction

Table 2 Parameter estimates (with confidence intervals and p-values) from mediation analyses

Study	Pathway	Effect	Estimate	95% CI	p
Study 1a	Difficulty → Accuracy → Feeling of effort	TE	0.10	[0.07, 0.14]	< .001
		ADE	0.08	[0.05, 0.11]	< .001
		ACME	0.02	[0.01, 0.04]	< .001
	Difficulty → Time → Feeling of effort	TE	0.11	[0.06, 0.15]	< .001
		ADE	0.04	[0.00, 0.07]	.022
		ACME	0.07	[0.04, 0.10]	< .001
Study 1b	Difficulty → Accuracy → Feeling of success	TE	− 0.09	[− 0.12, − 0.06]	< .001
		ADE	− 0.05	[− 0.07, − 0.03]	< .001
		ACME	− 0.04	[− 0.06, − 0.02]	< .001
	Difficulty → Time → Feeling of success	TE	− 0.09	[− 0.12, − 0.05]	< .001
		ADE	− 0.02	[− 0.05, 0.02]	.277
		ACME	− 0.07	[− 0.08, − 0.05]	< .001
Study 2	Difficulty → Accuracy → Desire for appreciation	TE	− 0.04	[− 0.07, − 0.01]	.007
		ADE	− 0.02	[− 0.04, 0.01]	.168
		ACME	− 0.02	[− 0.03, − 0.01]	< .001
	Difficulty → Time → Desire for appreciation	TE	− 0.04	[− 0.08, − 0.01]	.021
		ADE	0.00	[− 0.03, 0.02]	.785
		ACME	− 0.04	[− 0.07, − 0.01]	.002
Study 3	Difficulty → Accuracy → Desire for money	TE	− 0.05	[− 0.09, 0.00]	.033
		ADE	− 0.03	[− 0.07, 0.01]	.158
		ACME	− 0.02	[− 0.03, − 0.01]	.003
	Difficulty → Time → Desire for money	TE	− 0.05	[− 0.09, − 0.01]	.023
		ADE	0.05	[0.01, 0.09]	.023
		ACME	− 0.10	[− 0.14, − 0.06]	< .001

The *total effect* (TE) reflects the total main effect of difficulty on the relevant dependent variable. The TE estimates mirror the estimates reported in Fig. 3. The *average direct effect* (ADE) reflects the part of the TE that *cannot* be explained by the relevant mediator. The *average causal mediation effect* (ACME) reflects the part of the TE that *can* be explained by the relevant mediator

significant, $t(51.0) = 1.85$, $p = 0.070$, $d = -0.07$. If anything, however, the effect of difficulty was again opposite to our prediction (numerically, difficult tasks were associated with a *diminished* desire for money). We further examine these unexpected findings under Additional analyses.

Third, we tested the *intrinsic reward hypothesis*, i.e., the prediction that high performance feedback should decrease desire for appreciation. In Study 2, there was no significant main effect of feedback, $t(49.0) = 0.11$, $p = 0.913$, $d = 0.01$, indicating no evidence for our prediction.

Fourth, we tested the *entitlement hypothesis*, i.e., the prediction that high performance feedback should increase desire for money. In Study 3, we found a main effect of feedback, $t(46.0) = 2.79$, $p = 0.008$, $d = 0.24$, supporting our prediction.

Additional analyses

As additional manipulation checks, we examined whether task difficulty affected speed and accuracy. As expected, in all studies, people were slower on difficult runs (*M*s = 11.1–12.4 s; *SD*s = 3.9–5.5) compared to easy runs (*M*s = 8.8–10 s; *SD*s = 3.0–4.1), *t*s > 9.07, *p*s < 0.001, *d*s > 0.47, and accuracy was lower during difficult runs (*M*s = 0.91–0.93; *SD*s = 0.09–0.11) compared to easy runs ($M = 0.94$–0.95; *SD*s = 0.08–0.10), *t*s > 2.36, *p*s < 0.023, *d*s < −0.10.

The latter findings may seem trivial—still, however, we felt they were potentially important, as they can potentially explain the unexpected finding that difficult tasks diminished the desire for appreciation. After all, people may become aware of their own decreased performance (being slower, making errors) during difficult tasks. This awareness of one's own decreased performance may, in turn, diminish the feeling of success and the desire for appreciation.

If this explanation is true, the effect of difficulty on the desire for appreciation should be mediated by speed and accuracy. We tested this prediction by using the procedure suggested by Imai et al. (2010), which is suitable for examining mediation in linear mixed-level models. This procedure can be used to decompose the total effect (TE) of one variable on another variable into an average direct effect (ADE; e.g., difficulty → desire for appreciation) and an average causal mediation effect (ACME; e.g., difficulty → speed → desire for appreciation). We used this approach to examine both potential mediators (speed and accuracy) and all dependent variables (feeling of effort, feeling of success, desire for appreciation, and desire for money). Results are presented in Table 2.

Together, results in Table 2 support the possibility that difficult runs diminished the desire for appreciation and for money *through* decreases in performance. Indeed, the effect of difficulty on the feeling of effort (Study 1a) and the feeling of success (Study 1b) was mediated by both speed and accuracy (all ACMEs were significant). Similarly, in Study 2, the effect of difficulty on the desire for appreciation was mediated by speed and accuracy (both ACMEs were significant). Moreover, in Study 3, the effect of difficulty on the desire for money was mediated by both speed and accuracy, too (both ACMEs were significant). Thus, the unexpected finding that task difficulty diminished, not increased, people's desire for money can be explained by the finding that people were less successful—and *felt* less successful—during difficult runs.

For Study 3, this mediation analysis (Table 2) yielded another interesting finding. In particular, results suggested that task difficulty affected the desire for money in two distinct ways. First, there was an indirect effect (ACME) with a *negative* sign, as described in the previous paragraph. However, there was also a direct effect (ADE) with a *positive* sign. So, on the one hand, difficult runs made people desire *less* money, probably because they felt that they performed poorly during those runs (see Study 1b). But on the other hand, difficult tasks also made people desire *more* money (perhaps because they felt more effort; see Study 1a). Although this direct effect became visible only in this mediation analysis (i.e., after accounting for the indirect effect through speed, which was approximately twice as strong), this result is in line with the effort compensation hypothesis.

Discussion

The idea that labor should lead to reward is deeply engrained in culture (e.g., see Marx 1867; Twain 1889; and Houellebecq 2003). It thus seems plausible that people desire compensation after they have delivered cognitive work. But how does this desire emerge?

Overview of main findings

First, we tested the *effort compensation hypotheses*, the prediction that difficult tasks increase people's desire for both appreciation and money. We found no direct support for this idea. Somewhat counterintuitively—or at least, going against the predictions from mainstream fairness theories—we found the opposite effect: difficult tasks led to a *lower* desire for compensation, especially a lower desire for social approval (Study 2). Post-hoc, we reasoned that this unexpected effect might be explained by the fact that people performed worse during difficult tasks. Findings supported this idea: difficult tasks were associated with diminished feelings of success, and this finding could largely be explained from the fact that people were slower on difficult trials (Study 1b). Moreover, the relationship between difficulty and the desire for compensation was also mediated by speed and accuracy in Studies 2 and 3. So it seems, people can readily detect when they perform poorly (Ullsperger et al. 2010), at least in our task. Such performance monitoring, in turn, may cause people to desire less reward. Perhaps, this effect overshadowed the hypothesized effect (if it exists at all).

In Study 3, however, one of our analyses turned out to be in line with the effort compensation hypothesis. Intriguingly, mediation analysis showed that difficulty affected the subsequent desire for money in two opposing ways at the same time. First, difficult tasks *decreased* the desire for money, through worse performance (as described in the previous paragraph). Second, difficult tasks also directly *increased* the desire for money (in line with the effort compensation hypothesis). Although we preregistered this analysis, we did not predict this pattern of findings. Therefore, this dual route account should be interpreted with caution; also, we should not accept the effort compensation hypothesis (after all, confirmatory analysis does not support it). We do feel, however, that these dynamics are potentially interesting, and that they warrant further examination.

Second, we tested the *intrinsic reward hypothesis*, the prediction that high (vs. low) performance feedback decreases the desire for appreciation. We found no support for this prediction in Study 2. Post-hoc, we suspect that this hypothesis may have been too ambitious. After all, it proposed a full reversal of the effect that we observed in Study 3. We should note, though, that the effect of feedback on the desire for appreciation (Study 2) was visibly different from the effect of feedback on the desire for money (Study 3; see Figs. 2 and 3). Thus, although the intrinsic reward hypothesis was not supported by the data, our findings nevertheless suggest a clear difference between social and monetary markets in how people process performance feedback.

Third, we tested the *entitlement hypothesis*, the prediction that high performance feedback increases the desire for money. Findings from Study 3 supported this hypothesis. This finding is in line with prior work that shows that merely exposing people to the possibility of earning money, causes them to behave in such a way to maximize self-interest (Caruso et al. 2017; DeVoe and Iyengar 2010; Fiske 1992; Heyman and Ariely 2004; Vohs et al. 2006). The present findings suggest a psychological mechanism that drives such behavior: the desire for money is readily incited by labor in contexts where money can be earned.

In sum, by contrast to what is often assumed (e.g., de Jonge et al. 2000), difficult tasks *decreased* people's desire for social approval and money, likely because people felt unsuccessful during difficult tasks. When people received high performance feedback, by contrast, they felt an *increased* desire for money, but not an increased desire for appreciation.

Overview of further findings

Studies 1a and 1b were designed as a first test of our manipulations and our task. Although these studies were not designed to test our main hypotheses, we did pre-register several initial predictions about the effects of our manipulations on the feeling of effort and the feeling of success. These predictions were largely confirmed (see 'Overview of main findings'). However, we also did two findings that were, at the time, unexpected. First, for Study 1a, aside from the two main effects, we predicted a difficulty × feedback interaction. Specifically, as rewards generally have a greater impact when tasks are challenging (Richter et al. 2016), we predicted that the effect of performance feedback should be especially strong in difficult tasks (in easy tasks, we expected feelings of effort to be low regardless of feedback). We did not find support for this idea. As we predicted an interaction for only one of the four studies, and as we did not find an interaction in any of them, we chose to not pursue this idea further.

Second, in our pre-registration for Study 1b, we did not predict the main effect of difficulty on feelings of success; however, we did find this effect. This finding suggests that there was cross-talk between our manipulations. That is, difficulty did not just increase feelings of effort; it also diminished feelings of success (through decreases in performance). Similarly, positive feedback did not just increase feelings of success; it also diminished feelings of effort (as we predicted). This two-way cross-talk does not challenge our previous interpretations; however, we do feel that this phenomenon is intriguing and warrants attention in future research.

Is the feeling of effort related to effort expenditure?

In Study 1a, we found that the feeling of effort goes up with task difficulty. This finding is intuitive and consistent with previous work (e.g., Bijleveld 2018). Yet, our approach—in which we manipulated task difficulty, not effort—raises the intriguing question of whether the feeling of effort corresponds to the actual expenditure of effort (Steele 2020). In our view, the answer to this question depends on how effort is conceptualized and defined. While not the main focus of this paper, we briefly discuss two possibilities.

First, if we define effort expenditure in physiological terms (e.g., "resource mobilization for instrumental behavior at a point in time", Gendolla et al. 2011, p. 420), there probably is no strong correspondence between effort expenditure and the feeling of effort. Specifically, previous research suggests that is unlikely that processes related to the mobilization of resources (e.g., innervation of the sympathetic branch of the autonomous nervous system), translate into conscious feelings of effort (Bijleveld 2018; Marcora 2009).

Second, if we define effort in cognitive terms (e.g., "the processes that determine how close the actual level of performance is to the maximum level of performance", paraphrasing Shenhav et al. 2017, pp. 100–101), it seems possible that people do experience the actual expenditure of effort. In fact, the feeling of effort may serve as an internal signal that tracks the costs of cognitive control, and, thereby, affects judgments and decisions (Inzlicht et al. 2018; Tooby et al. 2008). However, the present research cannot provide a test of the latter possibility, as we have no precise means of estimating maximum performance, and thus, cannot estimate effort expenditure (within the framework laid out by Shenhav et al. 2017). Future research would thus be needed to more precisely unravel the association between information processing and its constraints (e.g., Musslick et al. 2017), and conscious feelings of effort.

Potential implications

In applied settings, performance feedback is often used as a tool to enhance performance (DeNisi and Murphy 2017; Hattie and Timperley 2007; Komaki et al. 1996). In addition, positive performance feedback can be used by managers and teachers, to establish positive working and teaching climates, respectively (Dutton and Ragins 2007; Ramani et al. 2018). Yet, our results illustrate that positive feedback may have an unintentional side effect: positive performance feedback may incite people's desire for money. Speculatively, as a result, performance feedback may make employees feel *less* satisfied with their current salary or bonus. Clearly, this is not the goal managers aim to achieve when they give positive feedback to their employees.

This research highlights the importance of distinguishing between money and other types of compensation, when trying to understand human motivation. That is, in line with prior work, our research suggests that money vs. social appreciation create different exchange contexts, characterized by distinct norms and rules (Fiske 1992; Heyman and Ariely 2004). In particular, our findings suggest that it is problematic to assume that appreciation can compensate for money, or vice versa. Although both may, in essence, function as rewards—i.e., as stimuli that are desired, that energize behavior, and that shape learning and decision making (Schultz 2006)—both categories affect cognition and behavior in distinct ways. This research may aid future attempts to clarify the mechanisms that underlie these effects.

Finally, in research on fairness, participants are often exposed to *outcome distributions* (e.g., person A gets $10, person B gets $2), which are produced by *procedures* (e.g., a dictator game, a resource dilemma, or a lottery). As a dependent variable, participants indicate whether they find that distribution *fair* (e.g., Kahneman et al. 1986). Our research is not a substitute for this type of research, which has led to important insights. However, one could argue that occupational and educational settings do not just consist of outcome distributions and procedures: they involve cognitive labor as well. Along with prior work, the present research highlights that the conscious experiences that emerge from such labor are potentially important—at least, these may affect people's current desires (the present findings), their judgments (e.g., Preston and Wegner 2007), and their actions (e.g., Reber and Greifeneder 2017) in various ways.

Limitations

Here we discuss three limitations of this research. First, although our manipulations were effective (task difficulty affected the feeling of effort; performance feedback affected the feeling of success), neither manipulation was very subtle. Indeed, in making design decisions, we prioritized the potential for large effect sizes over subtlety. However, as a result of these design choices, we cannot (and do not) claim that participants were unaware of the manipulations; they may have noticed differences in difficulty and/or distortions in feedback. In fact, it is possible that awareness of the manipulations contributed to their (strong) effects on feelings of effort and success. In future research, it seems especially worthwhile to examine whether it matters whether participants noticed that they received distorted feedback. Although we have no (formal or informal) indications that participants noticed the distortion, we acknowledge that this is a possibility.

Second, the samples that we used to test our hypotheses consisted of university students. Thus, it is too early to claim that our conclusions extend to, for example, employees. Moreover, our samples consisted mainly of females, and it should be noted that there are known gender differences in how people perceive their own performance (men tend to overestimate; Beyer 1990) and in how they process performance feedback (men are more sensitive to competition; Berlin and Dargnies 2016). Thus, at this stage, we have to be careful with making generalizations.

Third, we used self-report items to assess people's desires for appreciation and money. However, we note that there is a long research tradition in psychology that suggests that people do not always have conscious access to their motives and desires (Schultheiss and Brunstein 2010). Moreover, so-called *implicit motives* have been found to be associated with various behaviors (e.g., Furley et al. 2019; Stoeckart et al. 2018). It is an interesting avenue for further research to examine whether and how implicit motives can be triggered by feelings of effort and success.

Conclusion

This research shows that experiences of effort and success emerging from labor can shape the desire for compensation. How these experiences are interpreted and weighted, however, depends on the kind of exchange context people find themselves in. It thus seems that the desire for monetary vs. social rewards have distinct psychological origins.

Author contributions All authors contributed to the research design. Laura Schmitz collected the data. Laura Schmitz and Erik Bijleveld programmed the software, analyzed the data, and wrote the first draft. Harm Veling provided critical revisions. All authors read and approved the final manuscript.

Funding Erik Bijleveld was supported by Grant 016-165-100 from the Netherlands Organization for Scientific Research.

Data availability Data and code are available at https://osf.io/f8avm/.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethics approval This research was approved by the Ethics Committee of the Faculty of Social Sciences (ECSS), Radboud University. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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