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Can Delaying Positive Feedback Prevent Performance Drops? An Action Control Perspective on Coasting

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Positive feedback is often given in an attempt to boost people's performance. In many cases, however, recipients may interpret positive feedback as evidence that they are making more progress toward their goal than expected, leading them to reduce the priority of their goal and coast. Such coasting is adaptive because it allows recipients to shift attention toward other goals, but it can cause unintended performance drops on the task at hand. Based on action control theories, we propose that performance drops on the focal task can be prevented by delaying positive feedback until after individuals have started preparing for their next performance. During this preparatory phase of goal pursuit, individuals shield their focal goal against distractions and may even interpret positive feedback as an encouragement that boosts their performance. We tested this idea in three well-powered experiments (total $N = 395$), including a preregistered replication. We measured performance after the feedback on a task that served the same performance goal as underlies the positive feedback. Across experiments, we found that immediate positive feedback impaired subsequent performance, indicating coasting. Supporting our hypothesis, when positive feedback was delivered after participants started preparing for the next task, it did not impair subsequent performance; in fact, it boosted performance. Importantly, when positive feedback was delayed but participants had not yet started preparing for the next task, it undermined performance as much as immediate positive feedback did. These findings shed new light on the mechanisms underlying coasting and have implications for feedback interventions.

Keywords: positive feedback, motivation, performance, coasting, feedback timing

Supplemental materials: https://doi.org/10.1037/mot0000416.supp

Positive feedback refers to positive evaluations of a person's goal-directed actions (Hattie & Timperley, 2007). It is a popular tool to boost people's performance in achievement domains, including sports, education, and work, with benefits for self-efficacy, mood, and relationship quality (see Bandura, 1982; Brummelman, 2018; Ilies & Judge, 2005; Lemay, 2020; Locke & Latham, 1990). People are generally eager to seek out positive feedback (e.g., Ashford & Cummings, 1983; Hepper et al., 2011; Ilgen et al., 1979; Sedikides, 2018) and they enjoy receiving it (e.g., Belschak & Den Hartog, 2009; Kluger et al., 1994; Ilies & Judge, 2005). While positive feedback can improve performance (Locke & Latham, 1990; Williams & DeSteno, 2008), it often fails to work as intended and may even undermine performance (e.g., Podsakoff & Farh, 1989; for overviews, see Brummelman, 2020; Deci et al., 1999; Fishbach et al., 2014; Henderlong & Lepper, 2002; Kluger & DeNisi, 1996). This has led some people to stop providing positive feedback altogether, as expressed by the cynical music teacher Terence Fletcher in the movie *Whiplash*: "There are no two words in the English language more harmful than 'good job'." Performance drops after positive feedback are often seen as evidence of coasting: Positive feedback is thought to signal that sufficient progress has been made toward the focal goal, so that the goal diminishes in priority and effort can be throttled back (Carver, 2003). While coasting is generally an adaptive strategy that enables individuals to pursue multiple goals simultaneously (rather than sacrificing all other goals for the focal goal), it can have unintended consequences when positive feedback is meant to enhance progress toward the focal goal.

The present research aims to uncover when and why positive feedback does not lead to performance drops, thereby identifying a strategy for preventing performance drops. Based on theories of intentional action control (Gollwitzer, 2012; Kuhl, 2000), we hypothesized that performance drops after positive feedback can

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The online supplemental materials, including additional analyses, the data and code of the three reported experiments, and two pilot studies, are publicly accessible at https://osf.io/kcwbp/?view_only=dc6c7cf4c86540a48cdff0021fd9be5c. The preregistration of Study 3 can be found at https://osf.io/mdhcu/?view_only=0db5d0fa5ab049538ad257963478baf7.

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be prevented by delaying the positive feedback until after people have started to mentally prepare for their next performance. During this preparatory phase before the actual performance, people are better able to shield their goal pursuit from disruptions, and they may even utilize the rewarding experience of receiving positive feedback to energize their on-task behavior. We report a series of randomized experiments, including a preregistered replication, testing our hypotheses, measuring people's performance on the task they start working on after receiving the positive feedback. To allow for coasting effects to occur, the task after the feedback served the same goal as underlies the positive feedback (Carver, 2003).

Positive Feedback and Coasting

The concept of coasting (Carver, 2003; Carver & Scheier, 2008) originates from cybernetic models (Simon, 1967) and emotion theories (Clore et al., 2001; Frijda, 1994; Izard, 1977; see also Hirt et al., 1996; Martin et al., 1993). According to these frameworks, positive feedback has an informational function for people's inferences about the rate of goal progress (Amir & Ariely, 2008; Huang et al., 2012; Seo & Patall, 2021; see also Harkin et al., 2016). Positive feelings arise when positive feedback signals that progress toward the focal goal is better than expected (e.g., when you are making more progress on the writing of your article than you expected). The coasting hypothesis posits that the positive feelings are construed as a sign that the priority of the focal goal can be temporarily reduced, so that effort can be throttled back. Reduced goal priority "ensues a scanning for potential next actions […]. Such scanning would use information about goals waiting in line, but also information from the environment. Without the latter, there would be no chance to recognize and act on unexpected opportunities" (Carver, 2003, p. 251). In other words, coasting leads people to shift limited resources—time and effort—toward concurrent goals that were originally lower in priority (e.g., preparing a lecture), or, when no other goals are waiting in line, toward enticing new alternatives (e.g., having coffee with a friend).

There is both direct and indirect evidence for the coasting hypothesis. One set of experiments provides direct evidence (Thürmer et al., 2020). Participants completed a task that rewarded accuracy and speed. When they were told that their accuracy was above the target and their speed was on target, their accuracy decreased (demonstrating coasting) and their speed increased (demonstrating shifting). Most other empirical support for coasting is indirect. Overall, studies suggest that positive feedback causes performance drops when people are motivated to search for signs that goal progress is sufficient and that they can lean back on their current activity. For example, positive feedback causes performance drops when people have been working on the task for some time and they are confident that they will achieve their goal (Fishbach et al., 2010, 2014; Huang et al., 2019; Louro et al., 2007). Positive feedback also causes performance drops when people experience the task as tedious, or when they perform the task out of a sense of obligation or norm adherence rather than genuine pleasure (Baumeister et al., 1990; Förster et al., 2001; Fulford et al., 2010; Schultz et al., 2007; Van Dijk & Kluger, 2004, 2011). Finally, positive feedback also causes performance drops when concurrent goals are activated that are also high in priority but cannot be reached simultaneously with the focal goal (Thürmer et al., 2020; see also Louro et al., 2007; Orehek et al., 2011).

Coasting prevents individuals from investing limited resources in optimizing one focal goal at the expense of all other goals (Carver, 2003). While this process is undoubtedly adaptive for navigating multiple goals, it is sometimes desirable to continue to prioritize a task despite receiving positive feedback. Imagine, for example, a teacher who is mentoring a student who is struggling with mathematics. When the student shows signs of improvement, the teacher decides to give positive feedback. But the teacher does not want the student to coast; instead, they want the student to interpret the positive feedback as encouragement to keep working on the next mathematics task. Given the popularity of positive feedback as a motivational tool and its undisputed benefits (e.g., positive mood), it would be useful to know how coasting-related performance drops after positive feedback can be prevented. Previous research has suggested that performance drops can be prevented by changing the construal of positive feedback. For example, when people infer from positive feedback that they are committed to the task rather than that they have made sufficient progress, positive feedback boosts performance (Fishbach et al., 2010; 2014; see also Williams & DeSteno, 2008). People are more likely to infer from positive feedback that they are committed when they are motivated to gauge their commitment, such as when they have little experience with the task (Fishbach et al., 2014). Thus, changing people's construal is one way to prevent coasting.

Positive Feedback as Encouragement

In the present research, we explore a different and novel way to remedy performance drops after positive feedback. We propose that performance drops can be prevented by delaying the positive feedback until after people have started mentally preparing for their next performance. Our reasoning is grounded in theories of intentional action control (Gollwitzer, 2012; Kuhl, 2000). According to the mindset theory of action phases (Gollwitzer, 2012), nonhabitual behavior traverses through several action phases, from the preparatory phase (i.e., when people prepare to implement an action) to the actional phase (i.e., when people implement an action) to the evaluative phase (i.e., when people evaluate an action). Typically, positive feedback is given during the evaluative phase. During this phase, people tend to be open-minded (Fujita et al., 2007; Gollwitzer, 2012) and may reprioritize their goals in the face of feedback. If positive feedback signals that sufficient progress toward a goal has been made, people may decide to assign this goal a lower priority, leading to performance drops (i.e., the coasting hypothesis; Carver, 2003). During the preparatory face, however, people shield their goal pursuit from information that is distracting or casts doubt on the desirability and feasibility of the focal goal (Fujita et al., 2007; Gollwitzer, 2012). Thus, if delivered during the preparatory phase, positive feedback may not lead to performance drops.

We theorize that positive feedback, if delivered during the preparatory phase, may even encourage improved performance. According to personality systems interactions theory (Kuhl, 2000; Kuhl et al., 2021), people actively maintain difficult intentions (i.e., intentions that require ad hoc coordination of multiple behavioral routines) in working memory in a state of preparedness until they have found the right context for enacting the intentions. Positive feedback may, then, signal that the context is right, thereby facilitating the enactment of the intention (i.e., positive feedback as start signal; Kuhl & Kazén, 1999; for a related perspective, see Schwarz & Bohner, 1996). In line with this assumption, previous work (Kazén & Kuhl, 2005; Kuhl & Kazén, 1999) has found that priming positive cues ("success") relative to neutral cues improved Stroop performance in trials that added a second task (either another Stroop task or a filler task) after the initial Stroop task. Notably, positive cues improved performance only on the first task of a trial, which suggests that the positive cue serves a start signal to enact the first intended behavior. Another possibility is that positive feedback does not function as a start signal but instead makes individuals more committed to the goal by rendering the goal more valuable to them (i.e., positive feedback as a commitment amplifier; e.g., Balleine & O'Doherty, 2010; Custers & Aarts, 2010). The start-signal and amplifier explanations can be teased apart in setting for which goal a person prepares when receiving positive feedback: is it the same goal as the one for which the feedback is received, or is it a different goal? For example, imagine a student during finals who has just completed a mathematics assignment and has begun mentally preparing a new mathematics assignment or an essay. The student then receives positive feedback on their initial mathematics assignment. If the positive feedback boosts performance on the essay, this would suggest that the feedback acted as a general start signal, facilitating the enactment of the next intended action regardless of domain. By contrast, if the positive feedback improves performance only on the subsequent mathematics assignment, this would suggest that the feedback amplified motivation specifically toward the original goal domain (i.e., mathematics) by increasing its subjective value.

The Present Research and Hypotheses

Here, we present three experiments, including a preregistered replication, examining the hypothesis that performance drops after positive feedback can be prevented by delaying positive feedback until after recipients have started preparing for their next performance. To allow for coasting effects to occur, we assessed performance after the positive feedback with respect to the same goal as underlies the feedback (Carver, 2003). Across all three experiments, we distinguished immediate feedback (i.e., feedback provided immediately after performance) from delayed feedback (i.e., feedback provided during the preparatory phase, when people are ready to initiate the first action toward the upcoming performance; see Figure 1). We activated the preparatory phase through a preparation cue procedure (Jostmann & Koole, 2007) that breaks down the next performance into multiple action steps (Kuhl & Kazén, 1999).

First, we hypothesized that immediate positive feedback (relative to neutral feedback) would lead to a drop in performance (i.e., coasting). Second, and extending research on coasting, we hypothesized that delayed positive feedback (relative to neutral feedback) would not lead to a drop in performance (i.e., shielding). To be sure, we did not preregister our hypothesis that delayed positive feedback would boost performance relative to neutral feedback. We reasoned that, even without positive feedback, individuals might be highly motivated to perform. However, we did explore whether delayed positive feedback would boost performance relative to immediate positive feedback.

We used randomized within-person designs, in which participants received predetermined positive or neutral feedback on their performance. We used neutral feedback (rather than negative feedback) as the control condition, as this is considered most stringent (Kluger & DeNisi, 1996). Adhering to the American Psychological Association's Transparency and Openness Promotion Guidelines, for each study, we reported how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in the study. All materials, data, additional analyses, and the code of the three reported experiments, as well as two pilot studies, are publicly accessible on the Open Science Framework at https://osf.io/kcwbp/?view_only=dc6c7cf4c86540a48cdff0021fd9be5c (Jostmann & Brummelman, 2025). The preregistration of Study 3 can be found at https://osf.io/mdhcu/?view_only=0db5d0fa5ab049538ad257963478baf7. We used Statistical Package for the Social Sciences 28.0.1.0 for data analysis with $\alpha = .05$, two-tailed. All studies were approved by the Ethics Review Board of the University of Amsterdam.

Study 1

The purpose of Study 1 was to test the primary hypotheses that positive feedback would undermine performance, except when it is delayed until individuals have entered the preparatory phase of the next performance. We developed a paradigm in which participants completed a series of randomized trials of a calculation task (adapted from Mazar et al., 2008). After each trial, participants received preprogrammed performance feedback. The feedback was either positive or neutral, and was provided either before (i.e., immediately) or after (i.e., delayed) people entered the preparatory phase of the next trial. To start the preparatory phase, we adapted a preparation cue procedure (Jostmann & Koole, 2007) that breaks down performance on the next trial into multiple action steps (Kuhl & Kazén, 1999). Participants received an announcement informing them about the type of tasks they had to do in the upcoming trial: either a calculation task followed by a filler task versus only a calculation task. In half of the trials, the calculation task was followed by a filler task. To prevent that participants would establish a routine and fail to activate the preparatory phase for performing the critical calculation task, we randomized the order of trials (i.e., a calculation task followed by a filler task vs. only a calculation task) across participants.[1]

Our primary outcome variable was accuracy rate on the calculation task. Our secondary outcome variable was response speed, which should be interpreted in relation to accuracy rates. A high response speed indicates better performance only if it is not accompanied by low accuracy rates. For example, if response speed increases and accuracy rates remain the same (or increase), this would indicate better performance.

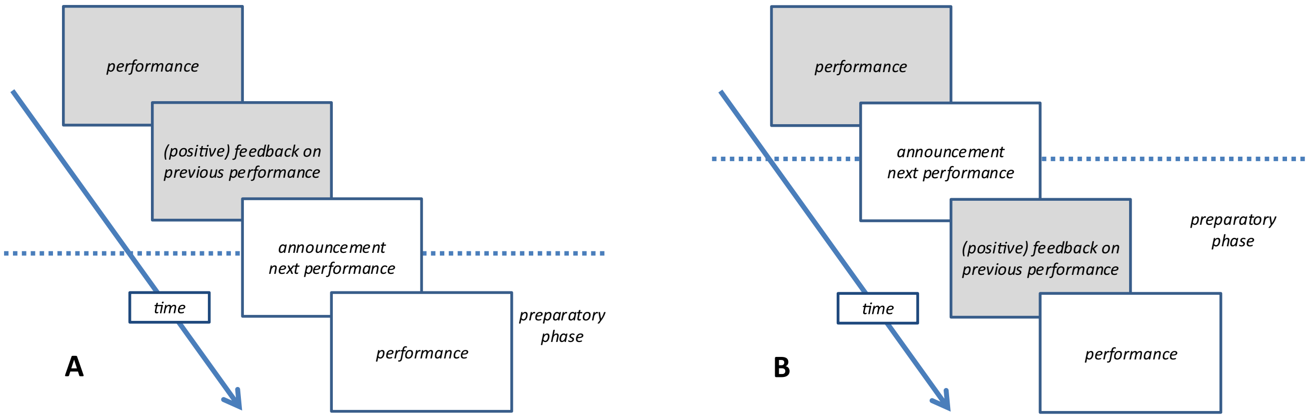
Method

Participants

Because we had no reliable a priori knowledge about the effect size, we ran a pilot study (see the online supplemental materials). Based on the pilot study, we decided to recruit a sample of 185 participants, so as to achieve sufficient power ($1 - \beta > .80$) for

[1] When trial type (i.e., a calculation task followed by a filler task vs. only a calculation task) was included as a factor in the analyses of Studies 1 and 2, the three-way interaction between feedback valence, feedback timing, and trial type on calculation accuracy was significant in Study 1 but not in Study 2. As this effect was neither hypothesized nor robust, we do not discuss it further (for full information, see the online supplemental materials).

Figure 1
Schematic Overview of (A) Immediate Feedback and (B) Delayed Feedback



Note. See the online article for the color version of this figure.

detecting small effects ($d \sim 0.2$; Faul et al., 2007). Participants were recruited through the online platform Amazon Mechanical Turk™ (Peer et al., 2017).

A total of 26 were excluded from the analyses because they did not complete the experiment ($n = 14$), were unusually slow to complete the study (>2.5 *SD* above the group mean; $n = 5$), made many errors on the calculation task (>2.5 *SD* above the group mean; $n = 5$), or indicated that they had done a very similar study in the past ($n = 2$). Excluding these participants did not influence the statistical significance of our findings (i.e., no significant effect became nonsignificant, and no nonsignificant effect became significant). The final sample consisted of 159 participants (ages 22–69 years, $M = 39.60$ years, $SD = 11.91$, 57.9% female).

Procedure and Design

We used a 2 (feedback valence: positive vs. neutral) × 2 (feedback timing: immediate vs. delayed) within-subjects design.

Participants were informed that the study consisted of 66 trials, with a break halfway through. Unbeknownst to participants, the initial trial of the study and the initial trial after the break were warm-up trials, leaving 64 experimental trials for analysis. Participants were informed before each trial whether the trial would consist of a single task (i.e., the calculation task) or two tasks (i.e., the calculation task followed by a filler task). The purpose of these announcements was to activate the preparatory phase (Jostmann & Koole, 2007). To prevent ceiling effects on accuracy rates, and to make it more difficult for participants to generate their own performance feedback, participants were informed that both accuracy and speed were important. To induce a sense of time pressure, participants were shown a timer counting up from zero during the calculation task.

Performance Measure

Each trial consisted of a calculation task that contained a matrix of eight numbers. Participants had to identify the two numbers that added up to 10.00 (e.g., 4.81 and 5.19). There was only one correct solution for each matrix. For each participant, we excluded trials with response times that were higher than 2.5 *SD* above the participant's own mean (2.9% of all responses). (Applying this exclusion criterion did not affect our findings in Studies 1–3; see Additional Analyses Studies 1–3 section.) Accuracy rate was indexed as the proportion of correct responses that were not excluded ($M = 0.93$, $SD = 0.08$), ranging from 0 (*nothing correct*) to 1 (*everything correct*). Response speed was indexed as the log-transformed time on correctly solved calculation tasks, from the appearance of a task on the screen until the participant had left the screen after task completion. To facilitate the interpretation, we present raw means and *SD* in seconds as descriptive statistics (general $M = 16.04$, $SD = 6.18$).

Positive Feedback

After each trial, participants received either positive feedback ("Good job!;" "Well done!") or neutral feedback ("- ◆ -") on their "performance in the previous trial." They were informed that positive feedback meant that they outperformed comparable participants on the same trial or themselves on previous trials "in terms of accuracy and speed." Neutral feedback meant that they had not outperformed others or themselves. Following previous research (Kazén & Kuhl, 2005), they were told that it was possible to receive positive feedback even after an inaccurate or slow response if other participants had performed even worse or slower (which was logically possible because the calculation tasks required two correct responses each time). The purpose of diffusing the performance standard across accuracy and speed was to prevent that participants could easily generate their own performance feedback. Feedback was either provided immediately after completing the previous trial and before the announcement of the upcoming trial, or it was delayed until after the upcoming trial had been announced.

Results

Accuracy

We first conducted a 2 (feedback valence: positive vs. neutral) × 2 (feedback timing: immediate vs. delayed) repeated measures analysis on accuracy rates on the calculation task, which revealed an interaction between valence and timing, $F(1, 158) = 43.61$,

$p < .001$, $\eta_p^2 = .22$. As hypothesized, when provided immediately, positive feedback ($M = 0.91$, $SD = 0.12$) decreased accuracy rates relative to neutral feedback ($M = 0.95$, $SD = 0.08$), $F(1, 158) = 30.85$, $p < .001$, $\eta_p^2 = .16$. By contrast, when the feedback was delayed until after the announcement of the next trial, positive feedback ($M = 0.95$, $SD = 0.08$) improved accuracy rates relative to neutral feedback ($M = 0.93$, $SD = 0.10$), $F(1, 158) = 12.02$, $p = .001$, $\eta_p^2 = .07$. Furthermore, when provided immediately (vs. delayed), positive feedback reduced accuracy rates, $F(1, 158) = 33.18$, $p < .001$, $\eta_p^2 = .17$. For descriptive information, see Figure 2 and the online supplemental materials.

Response Speed

The same analysis on response speed also revealed an interaction between feedback valence and timing, $F(1, 158) = 9.93$, $p = .002$, $\eta_p^2 = .06$. When provided immediately, positive feedback ($M = 15.24$, $SD = 6.55$) raised response speed relative to neutral feedback ($M = 16.59$, $SD = 6.51$), $F(1, 158) = 51.98$, $p < .001$, $\eta_p^2 = .25$. When delayed until after the announcement of the next trial, positive feedback ($M = 15.80$, $SD = 6.36$) also raised response speed relative to neutral feedback ($M = 16.54$, $SD = 6.53$), $F(1, 158) = 13.99$, $p < .001$, $\eta_p^2 = .08$, but this effect was smaller. Furthermore, when provided immediately (vs. delayed), positive feedback raised response speed, $F(1, 158) = 22.17$, $p < .001$, $\eta_p^2 = .12$.

Discussion

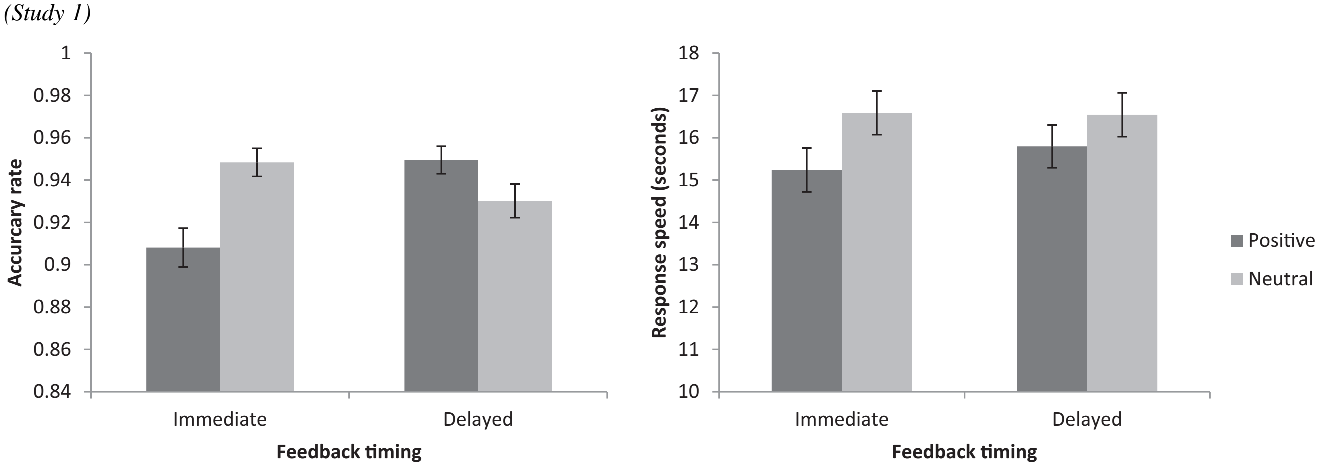
Consistent with our hypotheses, immediate positive feedback impaired performance, but delayed positive feedback did not. Thus, it is possible to prevent performance drops after positive feedback by delaying the feedback until after individuals have started preparing for their next performance. Positive feedback sped up responses across the board, but especially when provided immediately. This means that immediate positive feedback raised response speed while lowering accuracy, indicating lower performance overall. By contrast, delayed positive feedback raised response speed and increased accuracy, indicating higher performance overall. This supports the idea that coasting, and hence performance drops, can be prevented when the feedback is received during the preparatory phase of the next performance. Moreover, delayed positive feedback (relative to delayed neutral feedback and relative to immediate positive feedback) led to a performance boost, which suggests that delayed positive feedback transformed into an encouragement.

Study 2

The purpose of Study 2 was to replicate the effects of Study 1 while ruling out an alternative explanation. In Study 1, we proposed that delayed feedback prevented performance drops because it was provided in the preparatory phase of intentional goal pursuit. As preparatory phase activation was confounded with feedback timing, however, one could argue that delayed positive feedback prevented performance drops because, unlike immediate positive feedback, it provided an additional (i.e., "spaced") opportunity to strengthen participants' memory for how to solve the calculation tasks (Smith & Kimball, 2010). To rule out this nonmotivational alternative explanation in Study 2, we removed the confound between mental preparation and feedback timing, by varying whether or not participants entered the preparatory phase in the next trial. Specifically, we varied across trials whether participants would receive a preparation cue to prompt the preparatory phase. We expected that delayed positive feedback would prevent performance drops only when it was preceded by a preparation cue. A second issue we fixed in Study 2 related to the valence of the neutral feedback. In Study 1, receiving neutral feedback meant that participants had not performed above expectations, which could be perceived as negative feedback. To address this issue, in Study 2, we changed the neutral feedback and made it truly ambiguous and therefore uninformative. We told participants that neutral feedback would not indicate anything; it could mean they performed worse, better, or similar relative to some standard (Ullsperger & von Cramon, 2003).

Figure 2

Average Accuracy Rates and Response Speed (in Seconds) for the Calculation Task as a Function of Feedback Valence and Feedback Timing (Study 1)



Note. $N = 159$. This figure includes all trials ($k = 64$); feedback referred to the calculation task in the previous trial and was provided before (immediate) or after (delayed) the activation of the preparatory phase of the current trial; bars indicate standard errors.

Method

Participants

To achieve $1 - \beta > .80$ for detecting a medium effect size ($d \sim 0.5$), we needed at least 31 participants (Faul et al., 2007). As the design of Study 2 was more complex, we aimed for a higher sample size. The total sample consisted of 113 participants, all university students. Six were excluded from the analyses because they were younger than 18 ($n = 1$), they did not complete the study ($n = 1$), made an unusually high number or errors in the number search task (>2.5 *SD* above the group mean; $n = 3$), or erroneously claimed during an exit interview to having received positive feedback on all trials ($n = 1$). Excluding these participants did not influence the statistical significance of our findings. Of the remaining 107 participants (ages 18–30 years, $M = 19.60$ years, $SD = 1.85$), 73% was female.

Procedure and Design

We used a 2 (feedback valence: positive vs. neutral) × 2 (feedback timing: immediate vs. delayed) × 2 (announcement type: simple vs. activation of the preparatory phase) within-subjects design.

Participants completed the study in individual cubicles in our university's lab space. We used the same procedure and materials as in Study 1, with two exceptions. First, in half of the trials, we removed any information about the type of tasks in the upcoming trial (i.e., a calculation task followed by a filler task vs. only a calculation task). In these trials, the announcement simply stated that a new trial was about to begin. We reasoned that such simple announcements would not trigger the preparatory phase because participants could rather passively await the next trial (for similar procedures in which the presence vs. absence of preparation cues is manipulated on the trial level, see Chiew & Braver, 2014; Fröber & Dreisbach, 2016). This manipulation allowed us to compare the effects of delayed positive feedback when the preparatory phase was activated versus when it was not activated while keeping the timing of the feedback constant (i.e., closely to the next performance). Second, we made the neutral feedback message truly noninformative. Participants were told that seeing the neutral sign (**- ◆ -**) could mean that they did or did not perform above expectations on the previous trial.

Performance Measure

The same calculation task was used as in Study 1. We identified outliers (2.9% of all responses) as in Study 1 and removed them before analysis. Accuracy rate was $M = 0.96$ ($SD = 0.03$). Response speed was $M = 13.18$ ($SD = 3.54$).

Results

Accuracy

We started with a full 2 (feedback valence: positive vs. neutral) × 2 (feedback timing: immediate vs. delayed) × 2 (announcement type: simple vs. activation of the preparatory phase) repeated measures analysis on accuracy rates of the calculation task, which revealed a significant three-way interaction between valence, timing, and announcement type, $F(1, 106) = 6.71$, $p = .011$, $\eta_p^2 = .06$ (see Figure 3).

We first analyzed the trials with simple announcements ($k = 32$), which did not activate the preparatory phase, no matter whether the feedback was presented before or after the announcement. A 2 (feedback valence: positive vs. neutral) × 2 (feedback timing: immediate vs. delayed) analysis revealed only a main effect of valence, $F(1, 106) = 16.37$, $p < .001$, $\eta_p^2 = .13$, with positive feedback ($M = 0.95$, $SD = 0.06$) lowering accuracy rates relative to neutral feedback ($M = 0.97$, $SD = 0.04$). There was no significant interaction between feedback valence and timing, $F(1, 106) = 0.09$, $p = .766$, $\eta_p^2 = .00$. Thus, as hypothesized, positive feedback received outside of the preparatory phase reduced accuracy rates irrespective of how closely it was received after the previous performance.

We then analyzed the trials where the announcement activated the preparatory phase ($k = 32$). A 2 (feedback valence: positive vs. neutral) × 2 (feedback timing: immediate vs. delayed) repeated measures analysis revealed the hypothesized interaction effect between valence and timing, $F(1, 106) = 17.08$, $p < .001$, $\eta_p^2 = .14$. When provided immediately, positive feedback ($M = 0.95$, $SD = 0.08$) lowered accuracy rates relative to neutral feedback ($M = 0.98$, $SD = 0.06$), $F(1, 106) = 6.88$, $p = .010$, $\eta_p^2 = .06$. By contrast, when delayed, positive feedback ($M = 0.99$, $SD = 0.04$) improved accuracy relative to neutral feedback ($M = 0.96$, $SD = 0.06$), $F(1, 106) = 13.20$, $p < .001$, $\eta_p^2 = .11$. Positive feedback lowered accuracy when it was provided immediately (vs. delayed), $F(1, 106) = 17.84$, $p < .001$, $\eta_p^2 = .14$.

Response Speed

The same analysis on response speed revealed a significant Feedback Valence × Feedback Timing × Announcement Type interaction, $F(1, 106) = 15.58$, $p < .001$, $\eta_p^2 = .13$.

We first examined the Valence × Timing interaction in trials with simple announcements ($k = 32$), which did not activate a preparatory phase. The analysis revealed a main effect of valence, $F(1, 106) = 4.02$, $p = .047$, $\eta_p^2 = .04$, with positive feedback ($M = 12.55$, $SD = 3.79$) leading to somewhat faster responses than neutral feedback ($M = 12.93$, $SD = 3.71$). There was no significant interaction between valence and timing, $F(1, 106) = 0.00$, $p = .973$, $\eta_p^2 = .00$.

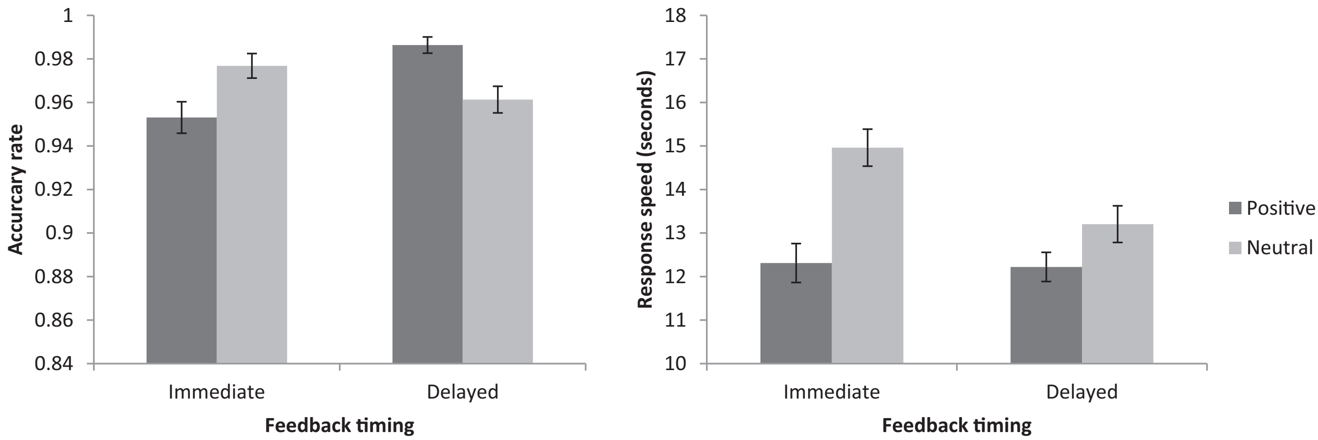
We then examined the Valence × Timing interaction for trials where the announcement activated the preparatory phase ($k = 32$). The analysis revealed a significant interaction, $F(1, 106) = 42.86$, $p < .001$, $\eta_p^2 = .29$. When provided immediately, positive feedback ($M = 12.31$, $SD = 4.63$) raised response speed relative to neutral feedback ($M = 14.96$, $SD = 4.39$), $F(1, 106) = 86.41$, $p < .001$, $\eta_p^2 = .45$. When delayed, positive feedback ($M = 12.22$, $SD = 3.46$) also raised response speed relative to neutral feedback ($M = 13.20$, $SD = 4.36$), $F(1, 106) = 4.84$, $p = .030$, $\eta_p^2 = .04$, but this effect was smaller. A direct comparison between immediate positive feedback and delayed positive feedback revealed no significant difference in response speed, $F(1, 106) = 3.79$, $p = .054$, $\eta_p^2 = .04$.

Discussion

Study 2 replicated Study 1 in a laboratory setting by showing that delayed positive feedback prevents performance drops. We ruled out the alternative explanation that delayed positive feedback prevents performance drops because it provided participants with a memory advantage for how to solve the calculation tasks. We found that when no preparatory phase was activated, accuracy rates dropped after positive feedback regardless of when the positive feedback

Figure 3

Average Accuracy Rates and Response Speed (in Seconds) for the Calculation Task as a Function of Feedback Valence and Feedback Timing (Study 2)



Note. $N = 107$. This figure includes only trials in which a preparatory phase was activated ($k = 32$); feedback referred to the calculation task in the previous trial and was provided before (immediate) or after (delayed) preparatory phase activation of the current trial; bars indicate standard errors.

was received. Moreover, we ruled out that the difference between positive and neutral feedback was driven by the neutral feedback being construed as negative feedback. We made the neutral feedback truly ambiguous and replicated the Study 1 findings. Together, these findings provide further support for our hypotheses. Notably, performance actually improved after delayed positive feedback as compared to delayed neutral feedback and as compared to immediate positive feedback, which suggests, as in Study 1, that the delayed positive feedback has transformed into an encouragement.

Study 3

Study 3 had two core aims. The first aim was to conduct a preregistered replication of our main hypothesis. The second aim was to better understand the process by which delayed positive feedback alleviates performance drops. As delayed positive feedback improved performance in Studies 1 and 2, we concluded that delaying positive feedback turned the positive feedback into an encouragement that energizes goal pursuit. This might have happened through two possible mechanisms. One is that delayed positive feedback signals that the context is right to initiate the intended behavior, in particular the first of the multiple action steps that make up the intention (Kuhl & Kazén, 1999). Another possible mechanism is that delayed positive feedback amplifies commitment to the goal because it makes the goal more attainable or more valuable (Balleine & O'Doherty, 2010). To decide empirically between the alternative mechanisms, we modified the design and added a low-priority task (i.e., a word search task) that appeared either before or after the high-priority task (i.e., a calculation task). Feedback always referred to the high-priority calculation task only. If delayed positive feedback serves as a generic start signal to initiate the first steps of the activated intention, it should improve performance on the first task after the feedback, regardless of whether the first task is a high-priority task or a low-priority task. If delayed positive feedback amplifies commitment, however, it should improve performance only on the high-priority task.

We preregistered study design, hypotheses, and data-analysis plans at https://osf.io/mdhcu/?view_only=0db5d0fa5ab049538ad257963478baf7. A nonpreregistered pilot of the study can be found in the online supplemental materials.

Method

Participants

To achieve $1 - \beta > .80$ for detecting a small to medium effect size ($d \sim 0.4$), we needed at least 31 participants (Faul et al., 2007). As the design in Study 3 was substantially more complex than Study 2, we set the sample size to $N = 150$. We recruited through prolific.co, an online crowdsourcing platform (Peer et al., 2017). We lost one participant due to a technical problem, and thus our sample was 149 participants. In line with preregistered exclusion criteria, 20 participants were removed from our analyses: because they took more time than 2.5 *SD* above the sample mean to complete the study ($n = 3$), they claimed to have participated in a similar study before ($n = 10$), or they made an unusually high number of errors in the number search task (>2.5 *SD* above the sample mean; $n = 7$). Removing them did not change the statistical significance of our findings. The final sample consisted of 129 participants (ages 18–62 years, $M = 29.19$, $SD = 10.66$; 45.7% female).

Design and Procedure

For our confirmatory analyses, we used a 2 (feedback valence: positive vs. neutral) × 2 (feedback timing: immediate vs. delayed) within-subjects design with performance on the high-priority calculation task (i.e., accuracy and speed) as dependent variables. For exploratory analyses including low-priority task performance, see below and the online supplemental materials.

The procedure was identical to that of Study 1, with one important exception. Participants learned that there were two tasks: a high-priority task (i.e., a calculation task) and a low-priority task (i.e., a word search task). We told them that all feedback would refer to their performance on the high-priority task only (never to their performance on the low-priority task), and they were reminded of this each time they received positive feedback. Each trial included both tasks (one calculation task, one word-search task), but the order of the tasks was counterbalanced (i.e., half of the trials started with a calculation task followed by a word search task; the other half of trials started with a word search task followed by a calculation task; see Figure 4). Task order (i.e., whether a trial started with the calculation task followed by the word search task or vice versa) was randomized across trials. In the announcement of the new trial, participants were informed about the order in which the tasks appeared. Participants were instructed to pay attention to the task order information "because the calculation task is the most important task." As task order varied randomly across trials, we reasoned that trial performance required the ad hoc coordination of multiple action steps and hence activate a state or preparedness (Jostmann & Koole, 2007; Kuhl & Kazén, 1999). Providing task order information was thus the procedure to elicit the preparatory phase (Gollwitzer, 2012). The preparatory phase was activated in all trials just like in Study 1. Before the start of the first trial, participants performed a series of practice trials and had to correctly answer questions that showed that they had understood the instructions. As in Study 2, the neutral feedback was truly noninformative.

High-Priority Task

The same calculation task as used in Studies 1–2 served as the high-priority task (accuracy rate: $M = 0.92$, $SD = 0.10$; response speed: $M = 15.27$, $SD = 4.97$; 3.1% of all responses were outliers and excluded from analysis).

Low-Priority Task

A word search task served as the low-priority task. In each trial, participants were shown a 4×4 matrix of letters. Participants had to indicate as quickly as possible whether a word search task included zero, one, two, or three English words consisting of exactly four letters (e.g., HOME). They were told that target words could be hidden straight from top to bottom, straight from left to right, or diagonally from top left to bottom right. As for the calculation task, a clock counting up from zero was displayed when the word search task appeared on the screen. Following our preregistered criteria, we removed three matrices from our analyses because the correct response was provided less often than any of the three incorrect responses. Of the remaining matrices, accuracy rate was $M = 0.78$ ($SD = 0.14$), and response speed was $M = 9.18$ ($SD = 2.77$); 2.8% of responses were outliers and removed.

Results

Confirmatory Analyses

Consistent with Study 1, our preregistered hypotheses apply only to the high-priority task (i.e., the calculation task) and only to trials where the high-priority task comes before the low-priority task ($k = 32$).[2] We hypothesized a significant interaction effect between feedback valence (positive vs. neutral) and feedback timing (immediate vs. delayed) on performance accuracy on the high-priority task. We hypothesized the following contrasts: For immediate feedback, we hypothesized that positive feedback would lead to lower accuracy rates than neutral feedback. For delayed feedback, we hypothesized that positive feedback would lead to similar or even higher accuracy rates compared to neutral feedback. In addition, we hypothesized a main effect of valence on performance speed on the high-priority task, with quicker responses after positive feedback than after neutral feedback. For the results, see Figure 5.

Accuracy. A 2 (feedback valence: positive vs. neutral) $\times$ 2 (feedback timing: immediate vs. delayed) repeated measures analyses on accuracy rates during the high-priority task for trials where the high-priority task was the first task ($k = 32$) revealed the hypothesized interaction between valence and timing, $F(1, 128) = 20.39$, $p < .001$, $\eta_p^2 = .14$. When provided immediately, positive feedback ($M = 0.88$, $SD = 0.16$) lowered accuracy rates relative to neutral feedback ($M = 0.95$, $SD = 0.11$), $F(1, 128) = 30.49$, $p < .001$, $\eta_p^2 = .19$. When delayed, positive feedback ($M = 0.94$, $SD = 0.12$) did not significantly raise or lower performance compared to from neutral feedback ($M = 0.94$, $SD = 0.11$), $F(1, 128) = 0.29$, $p = .591$, $\eta_p^2 = .00$. Positive feedback lowered accuracy when it was provided immediately (vs. delayed), $F(1, 128) = 27.19$, $p < .001$, $\eta_p^2 = .18$.

Speed. A 2 (feedback valence: positive vs. neutral) $\times$ 2 (feedback timing: immediate vs. delayed) repeated measures analyses on response speed during the high-priority task for trials where the high-priority task was the first task ($k = 32$) did not reveal the predicted main effect of feedback valence, $F(1, 128) = 1.22$, $p = .271$, $\eta_p^2 = .01$, but it did reveal a significant interaction between feedback valence and timing, $F(1, 128) = 23.39$, $p < .001$, $\eta_p^2 = .15$. When provided immediately, positive feedback ($M = 16.09$, $SD = 6.48$) decreased response speed relative to neutral feedback ($M = 14.71$, $SD = 5.85$), $F(1, 128) = 13.38$, $p < .001$, $\eta_p^2 = .10$, which is different from what we observed in Studies 1 and 2. When delayed, positive feedback ($M = 15.13$, $SD = 5.60$) increased response speed relative to neutral feedback ($M = 16.00$, $SD = 5.69$), $F(1, 128) = 6.53$, $p = .012$, $\eta_p^2 = .05$, which is the same pattern as we observed in Studies 1 and 2. A direct comparison between immediate positive feedback and delayed positive feedback revealed no significant difference in response speed, $F(1, 128) = 2.59$, $p = .110$, $\eta_p^2 = .02$.

Exploratory Analyses

We continued with a series of exploratory analyses to test the psychological mechanisms underlying our findings.

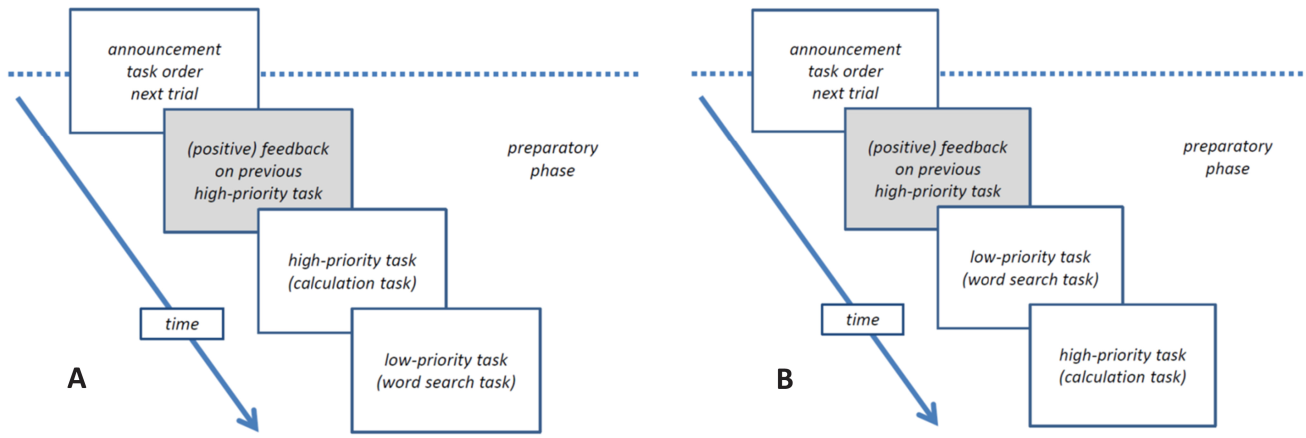
Start Signal or Commitment Amplifier? If delayed positive feedback (which was provided on the high-priority task) is a generic start signal that ignites the execution of the first action that one intends to do, it should improve performance on the first task after the feedback, regardless of whether the first task is high or low in priority. However, if delayed positive feedback amplifies commitment for the goal to perform well on the high-priority task, it should improve performance on the high-priority task only.

To decide between these two possibilities, we examined performance on the low-priority task in trials where the low-priority task was the first task ($k = 16$). Delayed positive feedback ($M = 0.84$, $SD = 0.17$) raised accuracy rates relative to neutral feedback

[2] We had no hypotheses for high-priority task performance in trials where the high-priority task was the second task. For descriptive information and analyses, see the online supplemental materials.

Figure 4

Schematic Overview of Task Order Variations in Delayed Feedback Trials With the High-Priority Calculation Task Preceding (A) Versus Following (B) the Low-Priority Word Search Task (Study 3)



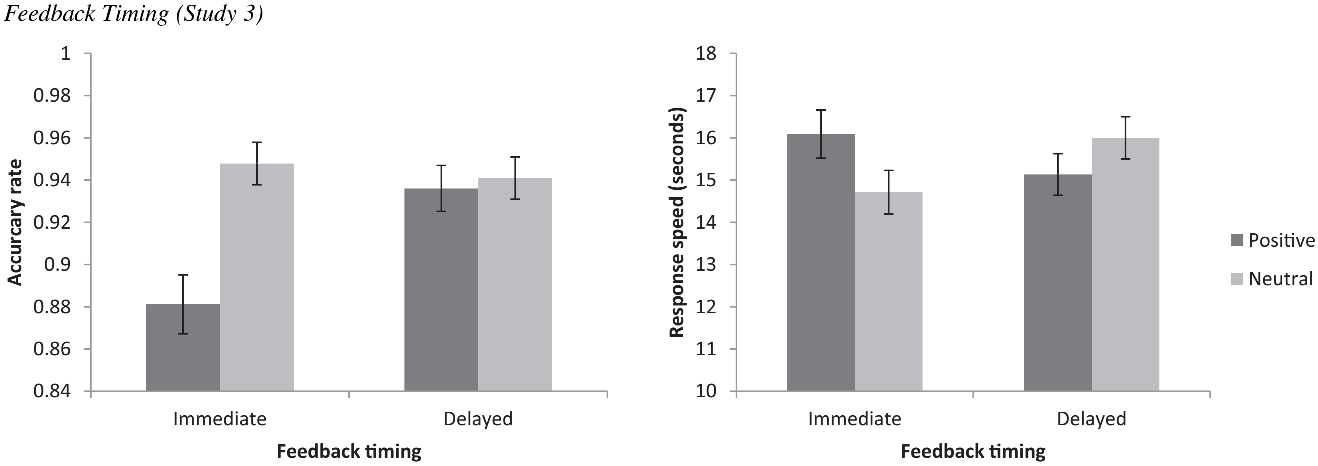
Note. See the online article for the color version of this figure.

($M = 0.78$, $SD = 0.19$), $F(1, 128) = 15.60$, $p < .001$, $\eta_p^2 = .11$. Delayed positive feedback ($M = 8.97$, $SD = 3.28$) increased response speed relative to neutral feedback ($M = 9.62$, $SD = 3.18$), $F(1, 128) = 35.51$, $p < .001$, $\eta_p^2 = .22$. Thus, in line with the start signal explanation but not with the commitment amplifier explanation, delayed positive feedback on the high-priority task facilitated performance on the low-priority task when the low-priority task was the first task after the feedback (see Figure 6).

One could argue, however, that delayed positive feedback on the high-priority task has inadvertently amplified commitment toward both the high-priority task and the low-priority task, for two reasons. (a) One possibility is that participants construed the two tasks as a single task. Disconfirming this possibility, accuracy rates were higher in the high-priority calculation task ($M = 0.92$, $SD = 0.10$) than in the low-priority word search task ($M = 0.80$, $SD = 0.14$), $t(128) = 9.86$, $p < .001$, while participants found the calculation task ($M = 3.30$, $SD = 1.06$) actually more difficult (1 = *very easy*; 6 = *very difficult*) than the word search task ($M = 2.22$, $SD = 1.14$), $t(128) = 8.18$, $p < .001$. Participants thus construed the two tasks as separate tasks and prioritized the high-priority task over the low-priority task, as intended. (b) Another possibility is that participants construed the feedback as pertaining to both tasks. In the exit survey, an unexpected 34.9% of the participants erroneously stated that the feedback pertained to both tasks, despite our frequent reminders during the experiment that the feedback referred exclusively to the high-priority task. We therefore reran above analyses excluding those participants (and one additional participant who stated that the feedback referred

Figure 5

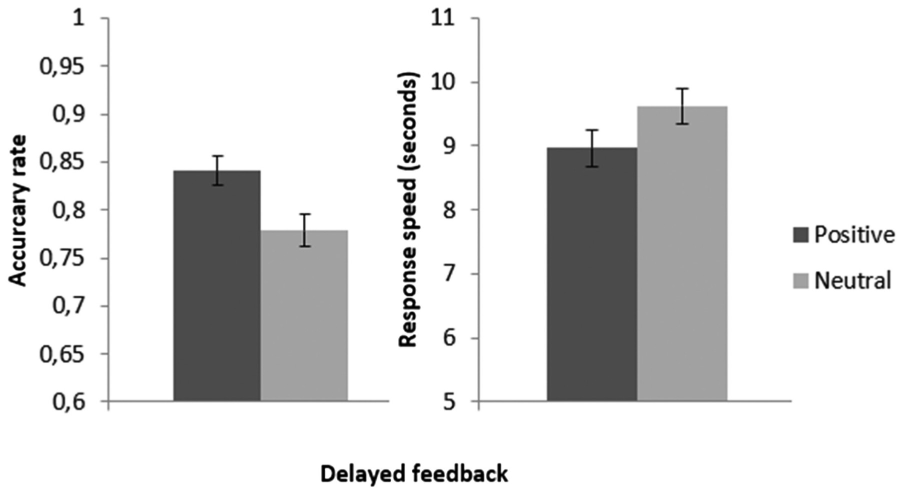
Average Accuracy Rates and Response Speed (in Seconds) for the High-Priority Calculation Task as a Function of Feedback Valence, and Feedback Timing (Study 3)



Note. $N = 129$. This figure includes only trials where the high-priority calculation task was the first task to perform ($k = 32$); feedback referred to the calculation task in the previous trial and was provided before (immediate) or after (delayed) the activation of the preparatory phase of the current trial; bars indicate standard errors.

Figure 6

Average Accuracy Rates and Response Speed (in Seconds) for the Low-Priority Word Search Task as a Function of Feedback Valence (Delayed Feedback Trials; Study 3)



Note. $N = 129$. This figure includes only trials where the low-priority word search task was the first task to perform ($k = 16$); the feedback referred to the calculation task in the previous trial and was provided after the activation of the preparatory phase of the current trial (i.e., delayed feedback); bars indicate standard errors.

exclusively to the low-priority task; reduced sample size $N = 83$), which did not change the results (for full information, see the online supplemental materials). Taken together, the findings support the start signal explanation and not the amplified commitment explanation. This conclusion is in line with our assumption that during the preparatory phase, the goal is shielded against priority changes.

Discussion

Study 3 provides a preregistered replication of the main findings of Studies 1 and 2. Consistent with our hypotheses, we found that immediate positive feedback led to performance drops, but that delayed positive feedback did not. One hypothesis was not confirmed: We did not find that positive feedback sped up responses across the board. Specifically, delayed positive feedback sped up responses, but immediate positive feedback slowed down responses. This should be interpreted in combination with accuracy rates. Immediate positive feedback led to slower and less accurate responses, which reflects a performance drop, whereas delayed positive feedback led to faster and equally accurate responses, which reflects a performance boost. Thus, overall, Study 3 supports the notion that delaying positive feedback turns into an encouragement.

The second aim of Study 3 was to explore two mechanisms of encouragement. Delayed positive feedback improved performance on the first task following the feedback, regardless of whether this task was high or low in priority, which supports the start signal mechanism but not the amplified commitment mechanism. This suggests that delayed positive feedback boosts performance because it ignites the execution of the first action that a person has prepared themselves to do even if the feedback does not relate to the action. We ruled out the alternative explanations that participants construed the two tasks as one single task or that participants perceived the feedback as pertaining to both tasks.

Additional Analyses Studies 1–3

In all our studies, we conducted additional analyses (for a complete overview, see the online supplemental materials).

First, we tested the robustness of our findings. (a) We controlled for participants' perceptions of task difficulty. (b) We reran the analyses while excluding trials with performance-incongruent feedback (i.e., positive feedback after an incorrect response on the calculation task; across studies, 3.1% of the positive feedback was performance-incongruent). (c) We reran our analyses while excluding participants who expressed doubts about the veracity of the feedback during exit surveys (6.1% of the participants) and those who explicitly stated that the feedback was fake (an additional 7.6%). (d) We reran our analyses excluding participants who failed to indicate during the exit surveys that the feedback pertained to the previous trial even when it was presented after the announcement of the next trial (9.4%). (e) We reran our analyses excluding participants who did not understand that the neutral feedback in Studies 2 and 3 was truly uninformative (9.7%). (f) We reran our analyses in Study 3 excluding participants who failed to indicate that the calculation task was the high-priority task (7.0%) and who erroneously stated that the feedback pertained to both tasks (34.9%). (g) We reran the main analyses in Studies 1–3 without applying the preregistered outlier exclusion rule (the rule that served to exclude trials with response times that were higher than 2.5 *SD* above the participant's own mean). In all these analyses, the critical Valence × Timing interaction remained significant.

Second, we examined whether participants were aware of the performance benefits of delayed positive feedback (if so, the effects we found could reflect demand effects). In all three studies, during an exit questionnaire, only a fraction of participants (4.1%) said that delayed positive feedback felt most motivating. Overall, 20.3% preferred immediate positive feedback, 42.3% preferred positive feedback regardless of when it was provided, and 30.2% claimed that their motivation was not influenced by the feedback. We conclude that participants were largely unaware of the performance benefits of delayed positive feedback.

Third, we tested for moderation of several personality variables including achievement motivation (Elliot & McGregor, 2001), behavioral inhibition system and behavioral activation system (Carver & White, 1994), action versus state orientation (Kuhl & Beckmann, 1994), and need for closure (Roets & van Hiel, 2011). There was no significant moderation. Together, our additional analyses attest to the robustness of our findings.

General Discussion

Performance drops after positive feedback are commonly explained as coasting, an adaptive mechanism that prevents individuals from investing limited resources (i.e., time, effort) in one goal over other goals. In some cases, however, performance drops may be perceived as undesirable, such as when one tries to boost performance on a single focal goal (e.g., when a teacher praises a struggling student for showing signs of improvement, they want the student to hold on to the goal). The aim of the present research was to better understand when and why performance drops after positive feedback do not occur, thereby identifying strategies to prevent performance drops. Based on theories of intentional action control (Gollwitzer, 2012; Kuhl, 2000), we argued that performance drops can be prevented by shifting the timing of positive feedback until after individuals have started to mentally prepare for their next performance. To test our predictions, we developed a novel paradigm in which positive feedback was provided right after individuals completed the task (i.e., immediate feedback) or delayed until after individuals had started preparing for the next task (i.e., delayed feedback). Across three well-powered experiments, including a preregistered replication, immediate positive feedback impaired performance, in line with the coasting hypothesis. Supporting our novel predictions, delayed positive feedback did not impair performance. In fact, delayed positive feedback improved performance, which suggests that shifting the timing transformed the positive feedback into an encouragement. These findings shed new light on the motivational mechanisms that underlie performance after positive feedback and show a novel way how performance drops can be prevented.

Theoretical Implications

Our findings suggest that there are two pathways to prevent coasting. Existing research has identified one pathway: changing the construal of the positive feedback such that it signals high commitment rather than sufficient progress (Fishbach et al., 2010). In support of this assumption, positive feedback boosts performance when people are uncertain and search for signs that inform them about their level of commitment (Fishbach et al., 2014). Our research identifies another pathway: delaying the feedback until after people have started preparing for the next performance such that their performance is shielded from interference and the positive feedback may serve as an encouraging start signal for their subsequent behavior. While built on theories of intentional action control (Gollwitzer, 2012; Kuhl, 2000), this perspective is compatible with the coasting hypothesis, which suggests that inferences about progress and commitment can shape goal priorities (Carver, 2003), but it extends this notion by arguing that the impact of these inferences can be reduced by manipulating the action phase in which the positive feedback is received.

Consistent with an action control perspective, delayed positive feedback prevented performance drops. However, as Study 2 showed, simply delaying the positive feedback is not sufficient (for a review of feedback timing effects, see Lechermeier & Fassnacht, 2018). The feedback needs to be received after individuals have started preparing themselves for performing again. During such preparatory phase, the focal goal is shielded against reductions in priority (Gollwitzer, 2012) and attention is focused on implementing the first necessary action (Kuhl & Kazén, 1999). Also, positive cues received during the preparatory phase may terminate the preparatory phase and encourage the initiation of the intended action (Kuhl & Kazén, 1999). As such, positive feedback received during the preparatory phase may be transformed into an encouragement. Supporting this notion, immediate positive feedback actually improved performance. The scope of the performance improvements did vary somewhat across studies, with higher accuracy rates and faster responses in Studies 1 and 2, and faster responses in Study 3. Collectively, our findings suggest that positive feedback can improve performance if delayed until after individuals have started preparing for their next performance.

We theorized that performance boosts after positive feedback may be explained by two different mechanisms. One possible mechanism is that delayed positive feedback serves as a generic start signal that ignites the execution of the first action that a person intends to do (Kuhl & Kazén, 1999). Another possible mechanism is that delayed positive feedback makes the goal more valuable or more attainable and hence amplifies commitment toward the task (Balleine & O'Doherty, 2010). Consistent with the former start signal perspective, positive feedback improved performance in Study 3 on the first task after the feedback, regardless of whether the feedback related to the task or not. Translating this to the example of a student during finals, preparatory praise on a mathematics assignment improves performance on a subsequent essay. In sum, delayed positive feedback is good for performance because it encourages the very action that one intends to execute at that moment (Kuhl & Kazén, 1999).

Are there plausible alternative explanations of why delayed positive feedback did not impair performance just as immediate positive feedback did? First, individuals might have been less receptive to positive feedback when it was delayed. This is unlikely, however, because delayed positive feedback actually improved performance relative to delayed neutral feedback. To corroborate this, future research should show that immediate positive feedback does not elicit stronger positive reactions than delayed positive feedback (for supportive evidence, see Gable & Harmon-Jones, 2011). Second, individuals might have interpreted delayed positive feedback as pertaining to the next task (rather than the previous task). This is unlikely either, however, because exit interviews showed that the vast majority of participants construed delayed feedback accurately as feedback.

While our work shows that only delayed positive feedback improves performance, there is literature showing that immediate positive feedback may, in some cases, improve performance too (e.g., Oettingen et al., 2012; Williams & DeSteno, 2008; for reviews see Deci et al., 1999; Fishbach et al., 2014; Kluger & DeNisi, 1996; Locke & Latham, 1990). How can these perspectives be reconciled? We suggest that even immediate positive feedback can sometimes turn into an encouragement (Kazén & Kuhl, 2005), such as when praise makes one feel proud of one's achievement (Williams & DeSteno, 2008). When individuals are proud of their achievement and expect to be praised for it, they may be more committed to pursue it in the future (Becker et al., 2019; Hofmann & Fisher, 2012). In our studies, we did not observe increased commitment after immediate positive feedback. Rather, our work shows that positive feedback facilitates the initiation of intended action when the feedback is delayed until individuals have started preparing for their next performance. This approach harnesses people's capacity to proactively shield their intentions against distractions and changes in goal priority (Gollwitzer, 2012; Kuhl, 2000; for a related perspective, see Braver, 2012).

Applied Implications

Our findings have potential applied implications. A construal perspective on interventions suggests that positive feedback should be provided when receivers are likely to interpret the feedback as a sign of high commitment to the task, such as when the task is novel and people are motivated to gauge their level of commitment (for critical discussions, see Fishbach et al., 2010, 2014). The present action control perspective suggests an additional way to prevent performance drops after positive feedback: manipulating the timing of the positive feedback by making strategic use of action phases. Parents, teachers, and coaches may delay their positive feedback on a school test until the recipient is already preparing for the next task. This might be particularly useful in cases when the recipient is familiar with the task and, therefore, certain about their level of commitment.

Strengths, Limitations, and Future Directions

To our knowledge, this research is the first to consider the potential of strategically varying the action phase in which positive feedback is provided (for an analogy in affective priming research, see Alexopoulos et al., 2012). Our research has several strengths, including its novel theoretical predictions, its use of objective performance measures, its large sample sizes, and its embrace of open science (e.g., preregistration, open data, open materials). Also, we ruled out several alternative explanations.

Our research also has limitations. First, we did not directly assess the hedonic impact of positive feedback. We would expect that the positivity of immediate feedback is as strong as the positivity of delayed feedback. Often, hedonic experiences are not accessible to conscious awareness (Berridge & Winkielman, 2003), so we call for research that captures subtle changes in people's facial expressions (Rosenberg & Ekman, 2020) or verbal expressions (Kamiloğlu et al., 2020) that reflect hedonic response. Second, we used predetermined feedback to maintain maximum experimental control. We took several measures to ensure that participants did not discard the feedback as irrelevant (e.g., by diffusing performance standards across accuracy and speed to render positive feedback after inaccurate responses plausible), and we reanalyzed the data after excluding suspicious participants, and after excluding responses following performance-incongruent feedback. Still, future research should replicate the present findings without deception. Third, we induced the preparatory phase in a rather subtle way by breaking down overall trial performance into multiple tasks and providing preparation prompts (Jostmann & Koole, 2007; Kuhl & Kazén, 1999). While this is an effective trial-by-trial manipulation of the preparatory phase (see also Chiew & Braver, 2014; Fröber & Dreisbach, 2016), real-life interventions might be more effective when they are more engaging. A promising procedure could be to induce an implemental mindset (Gollwitzer & Bayer, 1999), where people make specific plans about how exactly they are going to implement their goals (e.g., the goal to increase physical fitness) and which goal-related actions they will do next (e.g., to register for an advanced gym class). Receiving positive feedback on previous behavior (e.g., attendance at the beginners class) is expected to boost goal performance, if one has activated an implemental mindset. Finally, to explore the range of settings to which the present ideas can be applied, it would be interesting to see whether delayed positive feedback boosts performance when participants can decide after the positive feedback whether to continue with the focal task, or to stop and have leisure time instead (e.g., Algermissen et al., 2019; Goswami & Urminsky, 2017).

Our findings also generate new research directions. One important direction will be to systematically investigate the interplay between feedback interventions that rely on changing the construal of the feedback (Fishbach et al., 2010, 2014), and those that make strategic use of action phases such as in the present research. Specifically, we suggest that both types of interventions have their merits and may therefore be complementary. Changing the construal might be helpful when performance needs to be improved beyond the initial first task. By contrast, manipulating the action phase might prove useful when the key challenge is to get started, or when it is difficult to further increase commitment, such as toward the end of goal pursuit (Louro et al., 2007).

Constraints on Generality

We see two constraints on generality. First, we have recruited predominantly Western samples (for more information, see the online supplemental materials). Positive feedback tends to motivate people from Western cultures more strongly than people from Eastern cultures (Heine et al., 2001), but perhaps this is only true for immediate positive feedback. If delayed positive feedback has a start signal function, as the present findings suggest, the performance boost might be equally strong for Western people and Eastern people. Second, we used a simple calculation task that requires stamina (throughout the experiment) but does not trigger mathematics anxiety in most people (Goswami & Urminsky, 2017). For example, performance impairments after immediate positive feedback might be weaker when a task requires little stamina.

Conclusions

Teachers, sports coaches, and supervisors are often interested in optimizing performance, and many of them rely on positive feedback as a means. The cynical movie character Terence Fletcher, however, believed that there are no two words in the English language more harmful than "good job." It is true that positive feedback sometimes impairs performance. Such performance drops might reflect an evolutionary mechanism for adaptive goal reprioritization, but they are not inevitable. Across three experiments, we found that performance impairments can be prevented by delaying the feedback until after people have started to mentally prepare for their next performance. This transforms positive feedback into an encouragement that can actually boost the next performance. Thus, the solution should be neither to provide positive feedback indiscriminately, nor to renounce it altogether, but to provide the feedback precisely when people are ready for their next performance.

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