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The Role of Performance Feedback on the Self-Efficacy–Performance Relationship

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We report 3 studies that explore the moderating role of performance feedback on the within-person relationship between self-efficacy and performance. In Study 1, we provided participants with either very little feedback (current trial performance) or a wider range of previous performance markers (baseline performance and current trial performance) before making efficacy judgments. In Study 2, we refined the self-efficacy measure by providing participants with more detailed feedback regarding their past performance. In Study 3, we applied the methodology from Studies 1 and 2 to a task in which negative self-efficacy effects have been prevalent (i.e., golf putting). Results revealed that performance feedback moderated the self-efficacy–performance relationship. When we provided participants with minimal performance feedback, their self-efficacy was negatively related to subsequent performance; when we provided more detailed feedback, self-efficacy was positively related to subsequent performance. Studies 2 and 3 further confirmed these findings. Results across studies confirm that feedback is an important moderator of the self-efficacy–performance relationship, which can shed light on the equivocal findings to date.

Keywords: self-efficacy, feedback, negative, positive, moderation

Although effective human functioning requires requisite skills to perform actions, one must also have the efficacy beliefs to effectively apply such skills (Bandura, 1997). Bandura's (1977) self-efficacy theory has been used to predict behavior by assessing individuals' personal judgment in their ability to perform at specific levels of performance. Bandura (1997) states that self-efficacy is an antecedent of goal acceptance, resource commitment and performance. In Bandura's (1977, 1986) original model self-efficacy beliefs are drawn from four major sources: mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states.

As Bandura (1997) noted, mastery experiences are the most influential source of self-efficacy. Further, a reciprocal relationship exists between self-efficacy beliefs and performance where the better people perform, the more efficacious they become. In turn, increased efficacy beliefs leads one to engage with more difficult goals and tasks, hence increasing subsequent performance levels (e.g., Chase, 2001; Escartí & Guzman, 1999; Waung, MacNeil, & Vance, 1995). A spate of meta-analyses conducted across various disciplines have shown strong positive effects between self-efficacy and performance (e.g., Moritz, Feltz, Fahrbach, & Mack, 2000; Multon, Brown, & Lent, 1991; Orbell, Johnston, Rowley, Davey, & Espley,

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2001; Sherer et al., 1982; Stajkovic & Luthans, 1998). At the between-person level of analysis, more than 93% of studies have found positive correlations between self-efficacy and performance (Sitzmann & Ely, 2011; Stajkovic & Lee, 2001).

However, over the last decade a number of researchers have questioned the use of between-person correlational studies when examining the self-efficacy and performance relationship (e.g., Beattie, Lief, Adamoulas, & Oliver, 2011; Richard, Diefendorff, & Martin, 2006; Vancouver & Kendall, 2006; Vancouver, Thompson, Tischner, & Putka, 2002; Vancouver, Thompson, & Williams, 2001; Woodman, Akehurst, Hardy, & Beattie, 2010; Yeo & Neal, 2006). As self-efficacy is a theory about self-beliefs, then self-efficacy research should be conducted at a within-person level of analysis, allowing one to examine the reciprocal relationship between self-efficacy and performance (e.g., Gilson, Chow, & Feltz, 2012). However, at this level of analysis it has been proposed that self-efficacy can in some cases have a negative relationship with performance (Vancouver et al., 2001, 2002).

One reason for the negative self-efficacy effect relates to goal discrepancy. That is, an increase in self-efficacy typically allows one to set more challenging goals, which creates a goal discrepancy (the difference between one's current state and one's desired end state). However, if individuals believe they are making more progress than is necessary to meet such goals (due to high efficacy beliefs), then they may reduce their efforts toward goal pursuit. Consequently, according to Powers (1973, 1991) individuals with high self-efficacy may invest less effort in achieving their goals than individuals with low efficacy beliefs. While testing such a proposition, Vancouver et al. (2001, 2002) found a negative relationship between self-efficacy and performance across four studies using an analytical task at a within-person level of analysis.

Numerous studies have further tested Vancouver et al.'s (2001, 2002) initial research findings. In short, a recent meta-analysis on the within person self-efficacy and performance relationship (Sitzmann & Yeo, 2013), found that out of 38 published and unpublished studies, one third revealed null effects, one third revealed negative effects, and one third revealed positive effects between self-efficacy and performance. It is thus clear that the relationship between self-efficacy and performance is not best explained as a main effect, and it is incumbent on researchers to search carefully for theoretically meaningful moderating variables.

Recent research attention has started to examine moderating variables that may explain when there is a negative self-efficacy effect. For example, Schmidt and DeShon (2009) tested the relationship between self-efficacy and performance by the degree of prior success or failure on a current task (i.e., mastermind task; Vancouver et al., 2001). They reported that following poor or substandard performances, self-efficacy had a positive relationship with subsequent performance. In contrast, self-efficacy was negatively related to subsequent performance when participants followed a more successful prior performance. Therefore, it seems that following successful performance, high levels of self-efficacy may lead to complacency and effort may be withdrawn due to one's beliefs that performance levels may be easily maintained (see also Woodman et al., 2010). Schmidt and DeShon (2010) further examined the moderating effect of performance ambiguity, which was manipulated by telling or not telling participants how many solutions there were to an anagram task. They found that self-efficacy had a negative effect upon subsequent performance when the task was high in ambiguity, and a positive effect when the task was low in ambiguity.

However, another form of task ambiguity may more readily explain some of the negative effects shown in previous research, namely performance feedback. As stated, self-efficacy theory posits that mastery experiences produce stronger and more generalized beliefs than other sources of efficacy (Bandura, 1997). It is also hard for individuals to make statements about their actions without having access to information regarding mastery experiences (Sinclair & Vealey, 1989). However, in the majority of research examining the within-person self-efficacy and performance relationship, information about how well participants perform across trials is not presented (e.g., Beattie, Fakehy, Woodman, 2014; Beattie et al., 2011; Richard et al., 2006; Schmidt & Deshon, 2009; Seo & Ilies, 2009; Vancouver et al., 2001, 2002; Vancouver & Kendall, 2006; Yeo & Neal, 2006). If information regarding how well one has performed on previous trials is withheld, then another level of ambiguity is formed. For example, Bandura (1997) stated that if individuals cannot monitor their performance "they are at a loss to know what skills to enlist, how much effort to mobilize, how long to sustain it, and when to make corrective adjustments in their strategies" (p. 66). This in part may explain why self-efficacy has been shown to have limited effects upon subsequent performance in some of the studies reported above. Hence, in order to make a more detailed informed self-efficacy judgment in relation to improving upon previous performances, it would be prudent to provide participants with a wider knowledge of previous performances. Therefore, the purpose of Study 1 was to examine the possible moderating effect of performance feedback upon the self-efficacy–performance relationship.

A further form of ambiguity exists in the way that self-efficacy has previously been measured. In previous studies noted above (and that of Study 1) participants are only asked to rate their efficacy beliefs with how well they can perform on their next trial. This measure ignores a wealth of information (e.g., previous performances) that may be available to the participant if they do not use a reference point upon which to improve. Therefore, Study 2 used a different measure of self-efficacy where self-efficacy beliefs were based upon improving from a baseline performance.

As Study 1 and 2 used race car simulation and lap times as a measure of performance, Study 3 used the methodological approach from Study 1 and 2 and applied it to a different performance setting, where negative and nonsignificant effects of self-efficacy upon performance have been prevalent (i.e., golf putting; Beattie et al., 2011, 2014). As such, we could further test the external validity from Study 1 and 2 into a setting where self-efficacy has been shown to have a negative, albeit weak, relationship with subsequent performance.

To return to Study 1, half of the participants received performance feedback (in practice and competition) in relation to their current trial before making a self-efficacy judgment (replicating previous studies; e.g., Beattie et al., 2011; Vancouver et al., 2001, 2002). The other half of the participants were provided with three practice laps on the experimental race track where a baseline level of performance could be used as an additional source of information to monitor progress. Participants were reminded of their baseline performance level and their current performance level before they completed the self-efficacy questionnaire. It was hypothesized that self-efficacy would have a negative relationship with subsequent performance when performance feedback was low, but a positive relationship with subsequent performance when performance feedback was higher.

Study 1

Method

Participants. Eighty-seven participants (62 men and 25 women, M_{age} = 22.44, *SD* = 3.91) completed the study. As we used a driving simulator, we required all participants to have had either no or minimum exposure to driving simulator games (i.e., to have played fewer than 2 hr per week). After ethical approval, all participants provided informed consent before participating in the study.

Measures.

Self-efficacy. To replicate previous researchers' (e.g., Vancouver & Kendall, 2006; Vancouver et al., 2001, 2002) methodology, we asked participants to compete a single-item self-efficacy magnitude response by asking them to indicate the race time in seconds (e.g., 300) that they thought they could achieve in their subsequent trial. Self-efficacy strength was recorded by asking participants to rate their degree of confidence in their ability to achieve that time (on a scale ranging from 0% to 100%). We used self-efficacy magnitude and strength in all subsequent analyses. Because we used a single-item measure of self-efficacy, we report the reliability estimate from the null model in the HLM output. The reliability estimate has been reported in previous research studies because it allows one to assess stability rather than internal consistency (e.g., Vancouver et al., 2001, 2002). Reliability for self-efficacy magnitude and strength were .96 and .88, respectively.

Performance. We used the number of seconds that a participant took to complete two laps of a designated race track from a rolling start as the dependent variable. The rolling start was a default set by the game. Participants took control of the car approximately 20 s before the start/finish line, where the timer started upon crossing the line and stopped two laps later. No other racing cars were on the track.

Apparatus. We used a driving simulator incorporating a Logitech G25 game seat, steering wheel, pedals, and gear shift lever set. We also used the game console PlayStation 3, displayed on a Hewlett Packard w2207h LCD–TFT 22-in. widescreen TV. The game used was Grand Turismo5. Half the participants raced on Track 2 (Super Speed Way track) as a practice track with competitive laps occurring on Track 3 (Fuji Speed Way track). The other half of the participants raced on Track 3 (Fuji Speed Way track) for practice and competitive laps. The experimenter was present at all times.

Procedure. Participants attended one session where they were briefed on the study details and provided informed consent. In both conditions, the experiment consisted of 10 trials: three practice trials and seven experimental trials. Each trial in both conditions consisted of two laps.

In the low-feedback condition, to avoid gaining previous performance experiences, Track 2 (Super Speed Way track) was used as a practice track; it is a simple oval track that is relatively easy to drive. Participants had three practice laps. Performance feedback was provided (i.e., time) after the first and second practice trials, in which the participants were introduced to and completed the self-efficacy questionnaire. Participants did not complete the self-efficacy questionnaire after Practice Trial 3, as they were being transferred over to the more difficult race track. After completion of the practice session participants competed on the more difficult race track (Fuji Speed Way). After completing the first experimental trial and every trial thereafter, participants were made aware of their current race time and completed the self-efficacy questionnaire in relation to the subsequent trial.

In the high-feedback condition, to gain some experience upon which to base efficacy judgments, participants had three practice trials on the same track that the experimental trials were on (Track 3; Fuji Speed Way track). Participants were introduced to, and completed, the self-efficacy questionnaire after their first and second practice trials. Further, before participants completed the self-efficacy questionnaire in the experimental condition, they were reminded what their best baseline performance time was and their time on the trial that they had just completed. On each subsequent experimental trial, after they were reminded of their baseline performance and present lap time, participants completed the self-efficacy questionnaire.

Across both conditions, this procedure was replicated until all seven trials were completed. To maintain motivation throughout the task, a £50 cash prize was offered to the person with the fastest overall trial time.

Results

Pearson product-moment correlations were conducted to examine the between-person relationship between self-efficacy and subsequent performance. Self-efficacy magnitude had a significant positive correlation with race time (r = .87, $p < .001$). In other words, the more participants believed they could improve, the better they performed. Self-efficacy strength was not significantly correlated with race time (r = −.02, p = .60; see Table 1 for means, standard deviations, and bivariate interclass correlation coefficients [ICC2]).

We used HLM (Version 7; Raudenbush & Bryk, 2002) to examine the within-person level effects. As data were nested within individuals across time, we used group mean centering for all Level-1 variables (i.e., self-efficacy magnitude and strength, previous and subsequent performance). To examine the proportion of variance accounted for across the Level-2 units (i.e., participants), we calculated intraclass correlations (ICC1). The ICC1 for performance, self-efficacy magnitude, and self-efficacy strength were .82, .80, and .47, respectively. This indicated that 47%–82% variance of the variables of interest was accounted for between participants.

Given that participants in the high-feedback condition completed their practice trials on the experimental track (rather than the less complex track in the low-feedback condition), there was the possibility that participants in the high-feedback condition gleaned a performance advantage when compared with the low-feedback condition. However, there were no significant differences across the conditions on race time ($\gamma_{01} = -4.29$, p = .13), self-efficacy magnitude ($\gamma_{01} = -5.95$, p = .09), or strength ($\gamma_{01} = -2.63$, p = .33). The within-person effects revealed a significant increase in race time over

Table 1
Means, Standard Deviations, and Bivariate Correlations (ICC2) Between Self-Efficacy Magnitude and Self-Efficacy Strength and Performance Across Studies 1, 2, and 3

Variable	*M*	*SD*	ICC1	ICC2	ICC2
Study 1					
Performance	286.4	16.3	.82		
Self-efficacy magnitude	286.2	17.95	.80	.87***	
Self-efficacy strength	68.93	16.54	.47	−.02	−.05
Study 2					
Performance	310.2	11.7	.86		
Self-efficacy magnitude	9.75	4.21	.75	−.26***	
Self-efficacy strength	846.6	394.7	.78	−.21***	.97***
Study 3					
Performance	54.62	11.98	.82		
Self-efficacy magnitude	14.89	7.88	.80	.26***	
Self-efficacy strength	1351	759	.47	.26***	.96***

Note. ICC = intraclass correlation coefficient.
*** $p < .001$.

the seven trials ($\gamma_{10} = -1.75$, $p < .001$). Self-efficacy magnitude and strength also decreased across trials ($\gamma_{10} = -2.23$, $p < .001$; $\gamma_{10} = -1.42$, $p < .001$); that is, as the participants become more skilled at the task, their efficacy beliefs regarding improving upon their present race time reduced (as room for improvement reduced). After controlling for trial and previous performance, self-efficacy magnitude was not related to subsequent performance ($\gamma_{30} = -.07$, $p = .42$). However, self-efficacy strength was related to subsequent performance ($\gamma_{30} = .08$, $p < .001$). That is, the more confident participants were of improving upon their present trial, the worse they performed (i.e., race times increased).

Finally, there was a significant Self-Efficacy × Feedback interaction for self-efficacy magnitude ($\gamma_{31} = -.38$, $p < .001$) but not for self-efficacy strength ($\gamma_{31} = .06$, $p = .15$). Specifically, as hypothesized, in the low-feedback condition, self-efficacy magnitude was negatively related to race time (i.e., as self-efficacy magnitude increased, race time worsened). However, in the high-feedback condition, as self-efficacy magnitude increased, race times improved (see Table 2 and Figure 1). To follow up the interaction, separate analyses were conducted for each condition. In the low-feedback condition, self-efficacy magnitude was not significantly related to race time ($\gamma_{30} = .09$, $p = .26$). In the high-feedback condition, as self-efficacy magnitude increased, race time improved ($\gamma_{30} = -.29$, $p < .05$).

Discussion

The purpose of Study 1 was to examine the moderating effects of performance feedback on the within-person self-efficacy–performance relationship. The main hypothesis was supported in that in the low-feedback condition, self-efficacy magnitude had a negative (albeit not significant) relationship with performance. In the high-feedback condition, self-efficacy magnitude had a significant and positive relationship with subsequent performance. This finding supports previous research that links performance ambiguity (or lack of performance feedback) with the negative self-efficacy and performance relationship (e.g., Schmidt & DeShon, 2010).

However, as mentioned, self-efficacy was assessed in a way that may form another level of ambiguity. That is, the efficacy measure only asks participants to rate what they perceive they can do on a subsequent trial. Not only does this measure ignore previous performance accomplishments, it only assesses self-efficacy on one level of magnitude (i.e., "What can you do on your next trial?"). The reliability of single-item self-efficacy questionnaires has also been criticized in previous research (e.g., Lee & Bobko, 1994). This may also explain the spurious re-

Table 2
Main and Conditional Interactive Effects Between Self-Efficacy and Performance in Study 1

Step	γ	*SE*	*df*	Variance (%)
Self-efficacy magnitude as dependent variable				
Trial	−2.23***	.17	86	46.74
Previous performance	.69***	.03	86	90.88
Self-efficacy strength as dependent variable				
Trial	−1.42***	.29	86	5.38
Previous performance	.08	.07	86	25.38
Subsequent performance as dependent variable				
Trial	−1.75***	.14	86	36.68
Previous performance	.03	.03	86	39.72
Self-efficacy magnitude	−.07	.09	86	44.46
Self-efficacy strength	.07***	.02	86	42.12
Condition interaction				
Self-efficacy magnitude	−.37***	.08	85	45.35
Self-efficacy strength	.06	.04	85	42.08

*** $p < .001$.

sults between magnitude and strength. If, however, the self-efficacy measure included a hierarchical structure with specific reference to the potential for performance improvement (e.g., Beattie et al., 2011, 2014), and under conditions of high-performance feedback, then self-efficacy should be strongly and positively related to performance. Thus, the hypothesis for Study 2 was that a stronger positive relationship between self-efficacy and performance would occur compared to Study 1.

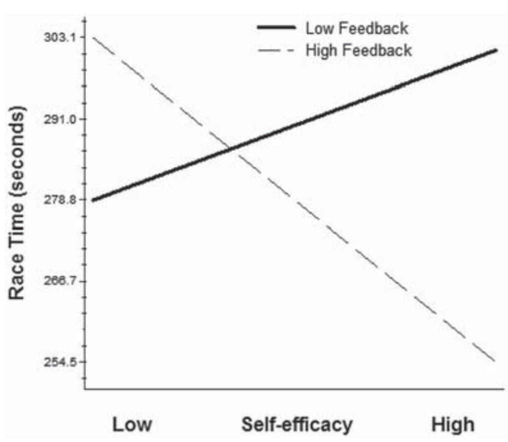

Figure 1. The interaction between self-efficacy and feedback on race time performance (lower race times represent better performance).

Study 2

Method

Participants. Forty-four participants (38 men and 6 women; M_{age} = 24.10, *SD* = .85) completed the study. Participation requirements were identical to Study 1.

Measures.

Self-efficacy. We assessed self-efficacy magnitude in 30 intervals (1-s) by asking participants to answer with a *yes* or *no* response to the statement, "I am confident in my ability to reduce my baseline time by one second" to "I am confident in my ability to reduce my baseline time by 30 seconds." We used 30 s as the maximum improvement because none of the 87 participants in Study 1 improved by a time greater than 30 s. We scored magnitude by counting the number of *yes* responses (i.e., 1 to 30) and self-efficacy strength by asking participants to rate the degree of confidence (i.e., 0% to 100%) for each time that they had indicated with a *yes* on the magnitude measure. Thus, a participant could record a total self-efficacy strength score between 0 and 3,000. Before completing the self-efficacy measure, we told participants their present race time performance and reminded them of their baseline time. Consequently, we used the baseline performance on the self-efficacy measure to glean participants' ratings of performance improvement. Reliability estimates for self-efficacy magnitude and strength were .70 and .65, respectively.

Performance. Performance was measured in an identical fashion to that of Study 1.

Apparatus. The apparatus was the same as in Study 1.

Procedure. The procedure was identical to that of the high-feedback condition in Study 1.

Results

Self-efficacy magnitude had a significant negative correlation with race time ($r = -.26$, $p < .001$). Self-efficacy strength also had a significant negative correlation with race time ($r = -.21$, $p < .001$; see Table 1 for means, standard deviations and bivariate correlations). An increase in self-efficacy was correlated with a decrease in race time. We used HLM (Version 7; Raudenbush & Bryk, 2002) in the same way as in Study 1. The ICCs for performance, self-efficacy magnitude, and self-efficacy strength were .86, .75, and .78, respectively. Hence, 75%–86% of the performance variance was accounted for by self-efficacy across participants.

With regard to the within-person set of results, race times significantly decreased (improved) over the seven trials ($\gamma_{10} = -1.28$, $p < .001$). Self-efficacy magnitude and strength significantly increased across trials ($\gamma_{10} = 1.22$, $p < .001$; $\gamma_{10} = 114.91$, $p < .001$). After controlling for trial and previous performance, self-efficacy magnitude ($\gamma_{30} = -.28$, $p = .02$), and self-efficacy strength ($\gamma_{30} = -.003$, $p = .007$) significantly predicted subsequent race time. That is, the higher the self-efficacy the lower (better) race time became (see Table 3 and Figure 2). However, when comparing the regression coefficient difference from the high-feedback condition in Study 1 and the present study, no significant difference emerged ($t_{81} = .04$, $p = .94$).

Discussion

The purpose of Study 2 was to confirm and extend the findings from the high-feedback condition in Study 1. Study 1 purposely used a self-efficacy measure that had been associated with negative self-efficacy effects (e.g., Vancouver et al., 2001, 2002), where reference to previous performance was not acknowledged in the self-efficacy measure. By providing performance feedback in Study 1, a marginal significant positive relationship emerged. In Study 2, the results revealed a strong significant positive relationship between self-efficacy and performance (but not significantly stronger).

The purpose of Study 3 was to further confirm and extend the results of the previous two studies by examining in a new light previous research that has revealed a negative self-efficacy–performance relationship in a golf putting paradigm (i.e., Beattie et al., 2011, 2014). We argue that participants in these studies suffered from a lack of feedback and that providing feedback to participants will reveal positive self-efficacy effects. To further extend the feedback protocols from Studies 1 and 2, we pro-

Table 3
Main Effects Between Self-Efficacy and Performance in Study 2

Step	γ	*SE*	*df*	Variance (%)
Self-efficacy magnitude as dependent variable				
Trial	1.22***	.09	43	56.82
Previous performance	−.64***	.04	43	87.80
Self-efficacy strength as dependent variable				
Trial	114.9***	9.68	43	57.80
Previous performance	−61.9***	4.68	43	88.21
Subsequent performance as dependent variable				
Trial	−1.28***	.10	43	52.46
Previous performance	−.11	.06	43	55.34
Self-efficacy magnitude	−.28***	.11	43	55.88
Self-efficacy strength	−.003***	.001	43	55.64

*** $p < .001$.

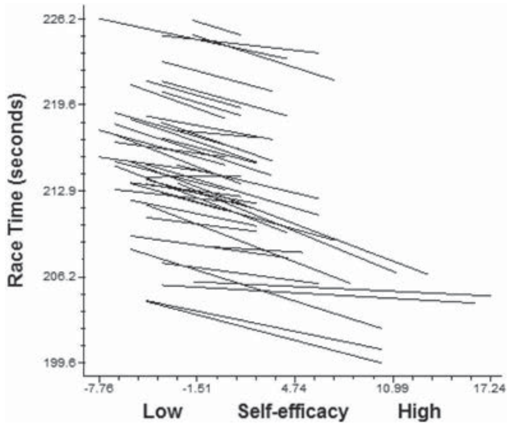

Figure 2. Individual regression slopes showing the relationship between self-efficacy and race time in Study 2.

vided participants with performance information on each of their previous trials before asking them to make self-efficacy judgments. Such a protocol is more aligned to the efficacy judgments that we make in everyday life. That is, we do not make judgments on a single previous trial, but rather on a plethora of cues and information from previous performances. By giving participants such detailed information, we hypothesized that greater well-informed self-efficacy judgments would result in greater performance (cf. Bandura & Locke, 2003).

Study 3

Method

Participants. Forty-five participants (42 men and 3 women; $M_{age} = 28.22$, $SD = 5.15$) completed the study. A golf putting task was used where all participants had either no or minimum experience of golf (i.e., played fewer then three times per year). Informed consent was obtained before testing commenced.

Measures.

Self-efficacy. We recorded self-efficacy magnitude by asking participants to indicate (*yes* or *no*) if they believed they were able to improve upon their baseline score (e.g., "I'm confident in my ability to beat my base line score by 1 point"; "I'm confident in my ability to beat my base line score by 2 points" in intervals of one point to "I'm confident in my ability to beat my base line score by 40 points." Therefore, we recorded a score of 0 to 40 for each trial. We assessed self-efficacy strength by asking participants to rate their confidence in their ability to perform at that particular level on a scale ranging from 0% to 100% (0% = *no confidence at all* and 100% = *completely confident*). Participants only responded for each score against a magnitude level answered *yes* to give a total efficacy score between 0 and 4,000. Before completing the self-efficacy measure, participants were made aware of their baseline performance score, all previous trial scores, and their current performance score.

Apparatus. We used a 12 ft × 10 ft Huxley flat putting surface green (http://www.huxleygolf.co.uk) using a standard Prosimmon KT25 putter and a standard Slazenger Raw Distance 432 dimple pattern golf balls.

Procedure. The procedure partially replicated that of Beattie et al. (2014). The experiment consisted of three practice trials and 10 experimental trials each comprising 20 putts. Putts were made from four different starting positions each 240 cm from the hole. To reduce task monotony, each set of putts (trial) were made perpendicularly to the previous set of putts at a distance of 30 cm. A scoring system involved four concentric circles that were 5 cm distant from one another that surrounded the hole. Participants gained 5 points for a successful putt. If they missed the hole by up to 5 cm (i.e., the ball stopped inside the first concentric circle from the hole 0 cm to 5 cm) then they were awarded 4 points; 3 points were awarded if the ball landed within the second concentric circle but outside the first (i.e., landed within 5 cm to 10 cm from the hole) and so on. A maximum score of 100 points (20 successful putts) could be achieved on any single trial.

We gave participants three practice trials (of 20 putts) where a baseline measure of performance was taken. After completion of the three practice trials, we used each participant's best baseline performance as the performance that they were asked to improve on over the remaining 10 performance trials. After each trial, participants' were informed of how many points they had achieved on that trial (and in all previous trials) before completing the self-efficacy questionnaire regarding their subsequent trial. To motivate participants cash prizes of £50, £30, and £20 were provided for the top three performance scores in any one trial.

Results

Self-efficacy magnitude had a significant positive correlation with performance ($r = .26$, $p < .001$). Self-efficacy strength also had a significant positive correlation with performance ($r = .26$, $p < .001$; see Table 1 for means, standard deviations and bivariate correlations). An increase in self-efficacy was correlated with an increase in putting performance. We used HLM (Version 7; Raudenbush & Bryk, 2002) in identical fashion to that of Study 1 and Study 2. The ICCs for performance, self-efficacy magnitude, and self-efficacy strength were .59, .39, and .36. Hence, 36% to 59% of the variance was accounted for across participants.

With regard to the within-person set of results, putting performance significantly increased over the 10 trials ($\gamma10 = 1.41$, $p < .001$). Self-efficacy magnitude and self-efficacy strength also significantly increased across trials ($\gamma10 = 1.68$, $p < .001$; $\gamma10 = 152$, $p < .001$). After controlling for trial and previous performance, self-efficacy magnitude ($\gamma30 = .40$, $p < .001$) and self-efficacy strength ($\gamma30 = .004$, $p < .001$) significantly predicted subsequent performance. That is, higher self-efficacy led to better putting performance (see Table 4 and Figure 3).[1]

General Discussion

There has been a long-standing controversy regarding the direction of the within-person relationship between self-efficacy and performance (e.g., Bandura & Locke, 2003; Vancouver et al., 2001, 2002). The current set of studies examined one possible moderating variable (i.e., performance feedback) that could determine whether the relationship between self-efficacy and performance is positive, null, or negative. The current set of studies goes some way in resolving it by showing that self-efficacy will have a positive relationship with performance, if participants have access to feedback regarding their previous performances. However, if feedback is withheld (i.e., if individuals cannot accurately monitor their progress across time), then according to Bandura (1997) individuals will be less able to make informed efficacy judgments. This is not something previously considered at depth in the literature. It was hypothesized (and shown) that by improving knowledge of one's actual skill level (i.e., by making knowledge of previous performance more accessible) would reduce performance ambiguity and therefore eliminate negative self-efficacy effects that has been demonstrated in tasks that are high in ambiguity (cf., Bandura & Locke, 2003; Vancouver et al., 2001, 2002).

In Study 1, the hypothesis was supported in that self-efficacy had a slight negative relationship with performance in the low-feedback condition (where performance feedback was limited), but a marginal significant positive relationship with performance in the high-feedback condition (where participants had access to baseline performance). Study 2 addressed a possible limitation where the self-efficacy measure itself may play a role in the negative effects shown in previous research. In other words, when self-efficacy is assessed as a single item (i.e., what can you do on your next trial), previous performance accomplishments are again ignored. Results revealed a stronger significant positive relationship between self-efficacy and performance, however it was not significantly stronger than the relationship shown in the high-feedback group in Study 1. The purpose of Study 3 was to apply the feedback principle to a task where negative relationship between self-efficacy and performance have been shown (i.e., golf putting; Beattie et al., 2011, 2014). By providing the participants with feedback regarding baseline performance and each subsequent performance trial, self-efficacy had a positive relationship with subsequent performance (reversing the negative trend seen in these studies).

In Study 1, a significant interaction occurred as a result of feedback condition. By providing race times for the current trial only, seemed to contribute to the nonsignificant negative self-efficacy effect shown in previous research (e.g., Sitzmann & Yeo, 2013). However, providing an additional amount of performance feedback (i.e., baseline performance time) resulted in a significant positive relationship. As stated, limiting the amount of information on which to base self-efficacy beliefs creates task ambiguity (see also Bandura & Locke, 2003). By creating ambiguity, one cannot accurately infer efficacy judgments, which have been shown to promote

[1] After the recommendation from an anonymous reviewer, we reanalyzed the data across all studies to examine for curvilinear trends. However, apart from the between person correlation of self-efficacy strength and performance in Study 1, the data were best explained as linear.

Table 4
Main Effects Between Self-Efficacy and Performance in Study 3

Step	γ	*SE*	*df*	Variance (%)
Self-efficacy magnitude as dependent variable				
Trial	1.68***	.13	44	66.95
Previous performance	.43***	.03	44	85.49
Self-efficacy strength as dependent variable				
Trial	152***	13.43	44	58.30
Previous performance	46.8***	3.96	44	80.24
Subsequent performance as dependent variable				
Trial	1.47***	.15	44	33.33
Previous performance	−.14***	.04	44	37.47
Self-efficacy magnitude	.40***	.11	44	38.64
Self-efficacy strength	.004***	.001	44	39.87

*** $p < .001$.

negative efficacy effects (e.g., Schmidt & DeShon, 2010). It seems that the positive relationship in the high-feedback condition occurred by providing participants with a minimum amount of performance feedback (baseline performance only). When feedback is provided in such a way, it will give the participants a real sense of performance progress (as they have a reference point of where they started from). In such instances, they are better equipped to monitor progress across time and make more accurate efficacy judgments.

Study 2 examined the possibility that the self-efficacy measure may also be a limiting factor when efficacy beliefs are reported. In such instances, where self-efficacy measures only improvement from an immediate previous performance trial (as opposed to a stable baseline performance), one is measuring something different at each time point (as performance changes). That is, the point of reference changes upon each trial, which makes it impossible to ascertain precisely the mechanism that might underpin the relationship between self-efficacy and performance. Further, a self-efficacy measure that assesses only what one can do only on a subsequent trial, with little or no feedback from previous trials, seems a limiting assessment, especially when one lacks task experience. Changing the self-efficacy measure to incorporate how well one could improve on a baseline performance did not significantly increase the strength of the regression coefficient, though it did produce a stronger significant coefficient value than was found in Study 2. Therefore, providing a higher amount of performance feedback before participants make a self-efficacy judgment is the major recommendation from Studies 1 and 2.

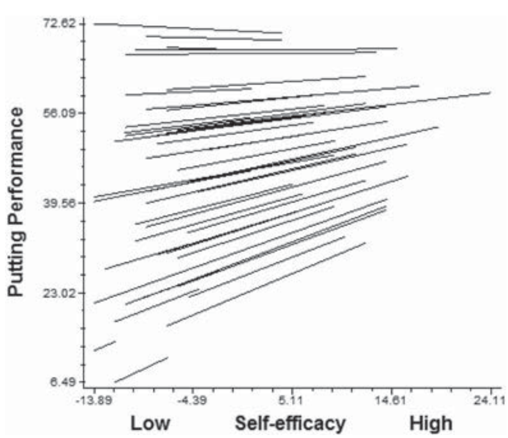

Figure 3. Individual regression slopes of the relationship between self-efficacy and putting performance in Study 3.

Study 3 extended this approach by reexamining the effect of performance feedback on a task in which self-efficacy has been shown to have a negative relationship with performance (e.g., golf putting; Beattie et al., 2011, 2014). A strong and positive self-efficacy relationship with performance occurred, reversing the trend observed by Beattie et al. (2011, 2014). Asking participants to rate their efficacy with regard to the best score they achieved in the practice trials and by providing performance feedback on every trial thereafter allowed them to observe progress and be more aware of mastery experiences over time. This added to self-efficacy beliefs building across trials, which has been absent in previous research (e.g., Beattie et al., 2011; Vancouver et al., 2001, 2002). Further, by providing participants with a wealth of previous performance information before asking them to make self-efficacy judgments also limits the risk of participants miscalibrating their self-efficacy beliefs. For example, Vancouver et al. (2001) highlighted that one of the reasons for a negative self-efficacy–performance relationship is that actual beliefs mismatch actual capacity. In such cases, negative relationships arise because of a person's miscalibration of effort required. Providing performance feedback limits this effect.

It is also worth noting that there was no significant correlation between self-efficacy magnitude and self-efficacy strength in Study 1 but that there was such an association in both Study 2 and Study 3 (see Table 1). This is likely an artifact of single-item self-efficacy measures reducing its predictive power (e.g., Lee & Bobko, 1994). A further confound is that participants are trying to make self-efficacy judgments in a void of information. This confound becomes even more apparent when the correlations are examined across feedback conditions. In the low-feedback condition, the correlation was negative ($r = -.12$, $p = .023$), and in the higher feedback condition it was positive ($r = .10$, $p = .09$). This adds further weight to Bandura's (2012) argument against the use of single-item self-efficacy scales.

The current study's manipulation of task ambiguity differs from that of previous research (e.g., Schmidt & DeShon, 2010). Schmidt and DeShon (2010) created low ambiguity by telling participants exactly how many solutions to an anagram task there were in any one trial. High ambiguity was manipulated by not telling the participants how many solutions there were. Results revealed that high task ambiguity led to a decrease in effort and a negative effect between self-efficacy and performance. However, in the present study the task and objectives were completely unambiguous (i.e., "Race around the track as quickly as you can over seven trials" or "Putt as many balls as possible over 10 trials"). What created the task ambiguity in the current set of studies, was limiting the amount of information regarding previous performances before self-efficacy judgments were made. It seems that by providing performance feedback prevents miscalibration and allows more accurate self-prediction.

At the request of an anonymous reviewer, across all studies we also examined our data using a residualized measure of past performance (e.g., Bandura, 1997; Feltz et al., 2008; Sitzmann & Yeo, 2013). In other words, we residualzed self-efficacy out of previous performance. Normally, stronger relationships between self-efficacy and subsequent performance emerge as a consequence; however, the strength of the relationship between self-efficacy and subsequent performance reduced slightly (although the significance levels remained unchanged). In the current set of studies, we use the "raw past performance" measure, as this is how authors of the studies we compared analyzed their data.

There are some limitations to the current set of studies. In Study 1, the positive effect in the high-feedback condition may have occurred through participants having prior knowledge of the race track. That is, they had three extra practice laps on the track where the experimental trials were conducted compared with those in the low-feedback condition. This was done to help build mastery experience upon which participants could base their self-efficacy beliefs. However, it is unlikely that having practice trials on the same track was a causal reason for the effects shown. First, there were no performance differences across the feedback condition. Second, Beattie et al. (2014) recently examined the moderating effects that time on task may have on the direction of the self-efficacy and performance relationship. They found that in early learning (across 10 trials) a negative self-efficacy effect occurred. However, a positive effect occurred when learning was extended (40 trials). Therefore, it is unlikely that the sole cause of the significant positive effect in Study 1 was having three extra trials. A final limitation may be noted that the effect sizes[2] reported in Tables 2, 3, and 4 between self-efficacy and performance tend to be rather small. However, this is not an unusual finding once the covariates are added to the model (i.e., trial and previous performance; Sitzmann & Yeo, 2013). They also mirror the effect sizes reported in previous

[2] Although it is not possible to obtain a true R-squared value in HLM, it is possible to obtain an estimate. Consequently, these variances should be interpreted with caution and as an estimation of total (not absolute) variance that may be explained.

research (e.g., Beattie et al., 2011, 2014; Vancouver et al., 2001, 2002).

One final interesting point that was raised by an anonymous reviewer asks, when examining the relationship across trials should one refer to the previous performance to assess efficacy beliefs or assess everything from a baseline performance? Although we think either source is viable, perhaps a baseline level of performance would be more robust against the constantly fluctuating levels of performance that are normally observed in the learning environment. However, one may also look to previous performances especially if substantial improvements have been made that were entirely in one's control. Or, perhaps one should use both sources to glean as much information as possible. To conclude, it is likely that a miscalibration of self-efficacy beliefs will occur if vital performance information regarding one's previous levels of performance accomplishments is not provided. As Bandura (1997) noted, "Like any other cognitive determinant, efficacy beliefs cannot operate as a regulative influence in an informational vacuum" (p. 66).

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