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The Moderating Effects of Performance Ambiguity on the Relationship Between Self-Efficacy and Performance

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Recent research (e.g., Vancouver & Kendall, 2006; Vancouver, Thompson, Tischner, & Putka, 2002; Vancouver, Thompson, & Williams, 2001) has challenged the conventional view of self-efficacy as a positive influence on performance, finding a negative within-person relationship between self-efficacy and performance. In the current study, performance ambiguity is examined as a potential boundary condition for this negative self-efficacy effect. As hypothesized, self-efficacy was negatively related to subsequent performance under conditions of high ambiguity but was positively related to performance when performance ambiguity was low. Additionally, the study evaluates key mediating processes underlying the relationship between self-efficacy and performance, finding support for the role of performance perceptions and effort allocation. The results of this study help to establish the scope of the phenomenon and suggest potential means of inhibiting the negative self-efficacy effects.

Keywords: self-efficacy, ambiguity, self-regulation, control theory, feedback

Self-efficacy—beliefs regarding one's capabilities for a particular task or endeavor—is among the most widely studied motivational constructs, forming the cornerstone of many contemporary theories (e.g., Bandura, 1997; Locke & Latham, 1990; Schunk, 1989). Across a broad range of tasks and contexts, self-efficacy has been shown to relate positively to a wide array of processes and outcomes, such as persistence amidst adversity, striving for high levels of accomplishment, and ultimately high levels of performance in a variety of domains (Bandura & Locke, 2003; Stajkovic & Luthans, 1998). Yet, recent research has cast doubt on the benefits of self-efficacy with regard to task performance (Vancouver & Kendall, 2006; Vancouver et al., 2002, 2001; Yeo & Neal, 2006). Specifically, when examined via within-person analyses, a negative relationship between self-efficacy and subsequent performance has been observed. That is, for any given individual, performance tended to be lower on occasions when the individual's self-efficacy was higher.

What accounts for the divergent and intriguing results observed in this recent research? Although within-person analyses appear to be essential to reveal the negative self-efficacy effect, it seems untenable to conclude that all positive effects of self-efficacy on performance observed in the vast body of existing research are little more than artifacts of between-persons methodology. As Bandura and Locke (2003) noted, the voluminous research on self-efficacy has utilized varied methodologies, including designs in which self-efficacy was experimentally altered both between persons and within persons. With few exceptions, these studies have found self-efficacy to positively relate to subsequent performance. These results, when considered along side those reported by Vancouver and colleagues (Vancouver & Kendall, 2006; Vancouver et al., 2002, 2001), highlight the variable nature of the self-efficacy and performance relationship, as both positive and negative relationships have been observed even among studies conducted at the within-person level of analysis.

Unfortunately, little is known about when or why the negative self-efficacy effect may occur. In the present study, we examine performance ambiguity as a moderator of the within-person relationship of self-efficacy and performance. We propose that, with low levels of ambiguity, self-efficacy will be positively related to subsequent performance, consistent with much of the existing research. In contrast, with high levels of ambiguity, we posit that self-efficacy will be negatively related to subsequent performance, thus replicating the findings of Vancouver and colleagues (Vancouver & Kendall, 2006; Vancouver et al., 2002, 2001). Such replication is important in light of the criticisms levied against Vancouver and colleagues' paradigm (e.g., Bandura & Locke, 2003). Below, we discuss the varying accounts of self-efficacy and its relationship with task performance, highlighting the untested assumptions concerning the role of ambiguity in the negative self-efficacy effects. Further, the role of effort allocation as an intervening variable in this process is explicitly considered. We then present an experimental study designed to test our ambiguity hypothesis.

Varying Perspectives on Self-Efficacy

Social–cognitive theory (e.g., Bandura, 1991, 1997) proposes that efficacy beliefs facilitate motivation, and countless empirical examinations have found self-efficacy to have positive effects on self-regulatory processes and outcomes such as effort, persistence, goal level, and performance (e.g., Bandura & Cervone, 1986; Cervone, Jiwani, & Wood, 1991; Gist, 1987; Stevens & Gist, 1997). With low efficacy, difficult endeavors may be seen as

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insurmountable challenges—if one's beliefs in his or her capabilities fall short of those necessary to meet the demands of the situation, then any investments in such pursuits are likely to be seen as futile. However, with sufficient efficacy, goal seekers tend to see a greater likelihood of success, thus providing a likely return on investments of time, effort, and so forth. Similarly, self-efficacy is strongly and positively related to self-set goal levels (e.g., Locke & Latham, 1990), and high self-efficacy is thought to lead individuals to increase the difficulty of their personal goals following success (Bandura, 1997; Tolli & Schmidt, 2008). Such processes can encourage greater sustained effort when self-efficacy is high, thus facilitating performance.

Yet, despite the vast body of literature suggesting that self-efficacy facilitates task performance, research indicates that this is not always the case. Some motivational scholars argue that high self-efficacy can lead to overly optimistic interpretations of one's performance, resulting in the perception that one is closer to attaining his or her goals than would be the case with lower efficacy (e.g., Powers, 1991; Vancouver et al., 2002, 2001). In turn, perceiving smaller discrepancies is argued to lead to reduced allocation of resources such as time and effort (e.g., Vancouver & Kendall, 2006; Vancouver, More, & Yoder, 2008).

The Role of Ambiguity in Negative Self-Efficacy Effects

Bandura (1997) stated that "efficacy beliefs cannot operate as a regulative influence in an informational vacuum" (p. 66), positing that a lack of timely and accurate feedback compromises the benefits of self-efficacy. Likewise, scholars pointing to a negative within-person effect of self-efficacy on performance (Powers, 1991; Vancouver et al., 2002, 2001) have suggested that ambiguity or uncertainty concerning the true status of one's performance is an essential component underlying the rationale for the negative self-efficacy effect. Yet, the role of ambiguity has not been empirically tested. As Bandura and Locke (2003) stated, "a serious test of their theory would therefore require comparing the effects of self-efficacy on performance under ambiguous versus explicit performance feedback" (p. 95). We begin that test here.

We conceptualize performance ambiguity as a lack of clear, objective information concerning one's true level of performance. In particular, we focus on ambiguity as one is actively engaged in task performance (i.e., the point at which key task decisions regarding effort and other behaviors are made), in contrast to offline performance assessments provided between performance episodes. We further distinguish performance ambiguity from role clarity (or, conversely, role ambiguity), in that role clarity pertains to knowing *what* one is expected to do (e.g., L. A. King & King, 1990), whereas performance ambiguity concerns knowing (or not knowing) *how well* one is doing. When one's true level of performance is unclear, it must be estimated or inferred if one wishes to evaluate the progress being made toward attaining one's goals. Self-efficacy beliefs are thought to be a primary source of such attempts. Estimates of performance should be greater when self-efficacy is high—individuals are more likely to believe that the effort invested in the pursuit of their goals has been effective when they have great confidence in their capabilities. In contrast, with little confidence in one's abilities, an equal investment of effort is likely to be perceived as resulting in a comparatively low level of performance. Performance perceptions influence subsequent actions taken in the pursuit of goals (e.g., Carver & Scheier, 1998; Powers, 1973, 1978; Vancouver et al., 2002, 2001). Based on this perspective, we reasoned that when a high level of ambiguity is present, self-efficacy beliefs influence perceptions of one's performance, which influence the effort that is subsequently invested (Powers, 1991; Vancouver et al., 2002, 2001).

The Current Study

In the current study, we seek to add to the existing literature in several ways. Our most central purpose is to explicitly compare the within-person relationship between self-efficacy and performance under conditions of high and low ambiguity. Further, we evaluate the presumed role of effort allocation as a mediating process underlying this relationship. If effort is indeed a mediating mechanism, the interactive effects of self-efficacy and ambiguity on effort should be similar to their expected effects on performance; further, the role of effort as an intervening variable should be borne out more formally in tests of mediation. In examining these issues, we also examine the extent to which the negative relationship between self-efficacy and performance generalizes beyond the task utilized to date by Vancouver and colleagues (2002, 2001), an important contribution in its own right given arguments that the negative effect observed by Vancouver and colleagues (2002, 2001) is a task-specific artifact (Bandura & Locke, 2003).

Figure 1 summarizes the study hypotheses. When performance is ambiguous, high self-efficacy may lead performers to more readily conclude that their efforts have resulted in a satisfactory level of performance. Thus, with high ambiguity, self-efficacy is expected to be negatively related to the amount of effort invested in the task, resulting in lower performance. In contrast, when performance is unambiguous, there is less opportunity for self-efficacy to bias performance perceptions. That is, when performance ambiguity is low, the fundamental mediator of the negative effect of self-efficacy on performance is negated, which should eliminate the negative effect. Thus, when performance ambiguity is low, self-efficacy is likely to positively influence the amount of effort allocated to the task, resulting in higher performance.

Although biased perceptions of performance are a proposed mechanism underlying the negative self-efficacy effect, directly measuring these perceptions could increase awareness and reduce the magnitude of these biases (A. King & Rosenshine, 1993). Thus, although perceived performance was examined directly in a pilot study reported below, the focal study examined this aspect of the process via a blockage model (MacKinnon, 2008; Mark, 1986). Specifically, the low-ambiguity condition was designed to reduce biases in perceived performance, thus effectively eliminating the occurrence of this proposed mediator. This, in turn, should eliminate the negative self-efficacy effect. In contrast, with high performance ambiguity, biased perceptions of performance should occur more readily, setting the stage for the negative self-efficacy effect.

> *Hypothesis 1:* The relationship between self-efficacy and performance will be moderated by performance ambiguity, such that the relationship will be negative under conditions of high ambiguity, and positive under conditions of low ambiguity.

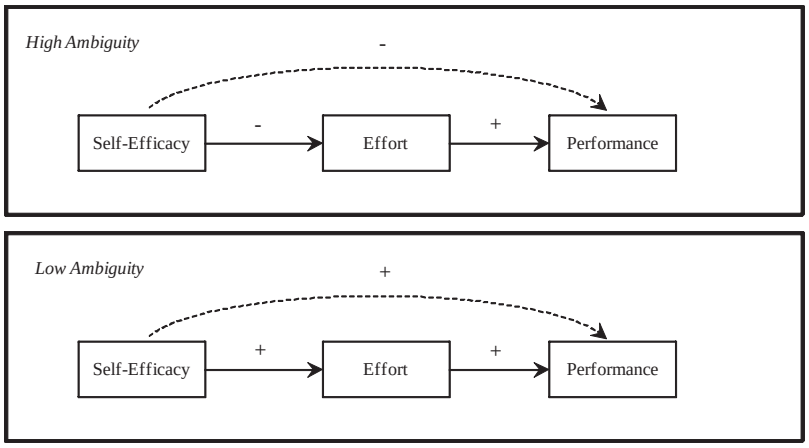

Figure 1. Predicted relationships between self-efficacy, effort, and performance within high- and low-ambiguity conditions. Dashed lines represent the resulting direct relationship (i.e., total effects) predicted between self-efficacy and performance within each ambiguity condition.

Hypothesis 2: The relationship between self-efficacy and effort will be moderated by performance ambiguity, such that the relationship will be negative under conditions of high ambiguity, and positive under conditions of low ambiguity.

Hypothesis 3: The interaction of self-efficacy and performance ambiguity on performance will be mediated by task-related effort.

Method

Overview

Seventy-three undergraduates (66% women, 78% Caucasian, M_{age} = 20.19) participated in the study in return for course credit. The study utilized a computerized anagram task, in which participants formed words from groups of five or six scrambled letters (e.g., from the letters *o*, *l*, *s*, *p*, and *o*, one could form the words *pools*, *spool*, *sloop*, or *loops*). The object was to identify the possible solutions for each anagram. Participants were told that each anagram may have (a) no solutions, (b) one solution, or (c) more than one solution. In actuality, each anagram had at least one possible solution, and as many as five possible solutions. Participants were notified that performance was determined by the percentage of possible solutions that were discovered. As described below, the potential for uncertainty regarding the number of possible solutions for each anagram was a central aspect of the performance ambiguity manipulation.

For each anagram, the scrambled letters were presented in the middle of the screen, and participants entered their solution attempts directly below. If the submitted word was a valid solution, "Correct" flashed at the top of the screen and the word was moved to a list of "Accepted Solutions" in the top right corner of the computer screen. If the submitted word was invalid, "Incorrect" was displayed at the top of the screen. After submitting a solution, participants could continue until they felt they had found as many solutions as they could for that anagram, at which point they clicked a button at the bottom of the screen to move to the next anagram. Participants completed four blocks of anagrams, with each block consisting of five anagrams.

Measures

Cognitive ability and time (block number) were utilized as control variables in all analyses. Participants reported their ACT or SAT test scores, which served as indicators of cognitive ability. Self-reported test scores have been demonstrated to correlate very highly with actual test scores (r = .94; Gully, Payne, Kiechel, & Whitman, 1999), which are considered a valid measure of general cognitive ability (e.g., F. L. Schmidt, 1988) and are highly reliable (*KR20* = .96 for the ACT composite score; American College Testing Program, 1989). Performance was operationalized as the percentage of possible solutions discovered during each block of five anagrams. This is analogous to many real-world tasks (e.g., proofreading), particularly those with a signal-detection component, where performance is a function of both targets identified and targets left unidentified. Self-efficacy was assessed prior to each block of five anagrams via self-report, consistent with Bandura's (1986) measure of self-efficacy certainty.[1] For each of 10 performance levels, ranging from 10% to 100% of possible solutions discovered, participants indicated their confidence in their ability

[1] Self-efficacy was also assessed via two additional, related measures: self-efficacy magnitude and self-efficacy composite. Self-efficacy magnitude was assessed by asking participants to respond "yes" or "no" to whether they believed they could perform at each of the 10 performance levels described above; the number of "yes" responses represents self-efficacy magnitude. A self-efficacy composite was created by following the recommendations of Lee and Bobko (1994), wherein the confidence ratings are summed only for the performance levels to which participants indicated "yes" (i.e., they believed they could attain). All three measures yielded consistent results with those reported for self-efficacy certainty. However, in comparison with the composite measure, self-efficacy certainty has the advantage of every participant's self-efficacy score being composed of an equal number of items (E. A. Locke, personal communication, March 30, 2004).

to perform at that level, on a scale from 1 to 10. Coefficient alpha was .92, .92, .90, and .92 for Blocks 1–4, respectively. Effort was operationalized via two indices: one behavioral and one self-report. The behavioral index of effort consisted of the number of solution attempts submitted during each block of five anagrams. Additionally, a four-item measure of self-reported effort was assessed following each block of five anagrams (e.g., "I worked very intensely on the previous set of 5 anagrams"). Participants responded on a Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Coefficient alpha was .94, .97, .96, and .97 for Blocks 1–4, respectively.[2]

Ambiguity Manipulation

Performance ambiguity was manipulated by varying participants' knowledge concerning the number of possible solutions for each anagram. For participants in the low-ambiguity condition, the exact number of possible solutions was prominently displayed directly below each anagram. Thus, there was no uncertainty concerning the number of solutions possible for each anagram (i.e., no ambiguity concerning errors of omission). Rather, as participants performed the anagrams, they could precisely discern when and if they had discovered all of the possible solutions for a given anagram, as well as the number of solutions that remain to be discovered (if any). In contrast, those in the high-ambiguity condition were not informed of the number of solutions for each anagram. Rather, this was a source of ambiguity, as participants could not know for certain when and if they had discovered all of the possible solutions or how many solutions (if any) remained undiscovered (i.e., errors of omission). In analyses reported below, ambiguity was coded 0 for low ambiguity and 1 for high ambiguity.

Results

Pilot Sample—Manipulation Verification

As a preliminary step, a pilot study ($n = 69$) was conducted to verify that the experimental manipulation produced the desired differences in performance ambiguity. The pilot study procedures were identical to those of the primary study, with the exception of additional questions inserted immediately following submission of each anagram. Specifically, participants were asked to indicate (a) how many solutions they believed to be possible for the anagram, (b) what percentage of possible solutions they believed they had discovered, and (c) their confidence in their performance estimates on a scale from 0 to 100, where 0 indicates *no confidence* and 100 indicates *complete certainty*.[3] These data were analyzed with multilevel modeling, implemented via the mixed procedure in SAS (see Singer, 1998, for details). Multilevel modeling was developed to examine data that were nested within higher level units, such as individuals nested within teams or, in the present case, multiple observations over time nested within individuals. In this instance, three-level models were specified, where per-anagram responses (Level 1) were nested within trials (Level 2), which were nested within individuals (Level 3). As expected, the relationship between the actual and the perceived number of possible solutions was moderated by performance ambiguity, such that the perceptions were less accurate with high ambiguity ($\gamma = -0.72$, $SE = 0.17$, $p < .001$). Likewise, the relationship between the actual and perceived percentage of solutions found was also moderated by ambiguity, with greater correspondence among participants in the low-ambiguity condition ($\gamma = -0.41$, $SE = 0.10$, $p < .001$). Finally, as expected, confidence in the accuracy of their performance estimates was significantly higher among participants in the low-ambiguity condition ($\gamma = -20.06$, $SE = 6.22$, $p < .001$).

To further examine the ambiguity manipulation, we administered a four-item Likert-based self-report measure (e.g., "I had a clear idea of how well I was performing on each anagram"; $\alpha = .86$) at the conclusion on the study. Responses were analyzed with a traditional (i.e., single-level) regression, with participants in the low-ambiguity condition indicating greater agreement with these statements ($\beta = -1.86$, $SE = 0.34$, $p < .001$). Taken together, these results indicate that the manipulation created the desired ambiguity concerning the true level of one's performance, setting the stage for the hypotheses to be tested in the primary study.

Hypothesis Tests—Within-Person Analyses

Table 1 presents means, standard deviations, and correlations at the between-persons level of analysis (i.e., averaged across trials). The hypotheses, concerning the within-person relationship between self-efficacy and performance, were tested with two-level multilevel modeling, where multiple observations over time were nested within individuals. Self-efficacy, effort, and time were Level 1 (trial-level) predictors, whereas performance ambiguity and ability were Level 2 predictors. Rosenthal and Rubin (2003) developed an effect size termed $r_{\text{equivalent}}$ and highlighted its value for computing effect sizes for random coefficient or hierarchical models. Following their approach, we computed the R^2 value for each fixed effect in Table 2 by squaring the $r_{\text{equivalent}}$ effect size estimate. All parameters reported below are incremental effects, above and beyond other variables in the same step.

Hypothesis 1. A two-step approach was followed to examine the interaction between self-efficacy and ambiguity. First, the direct effects of self-efficacy and performance ambiguity were examined, controlling for ability and time. We added the interaction term in the second step to determine whether it exhibited a significant effect above and beyond the main effects. Table 2 summarizes the results, including the average regression weight across all participants (γ), the associated standard error (*SE*), and the proportion of unique variance explained (R^2).

[2] Goals and goal commitment were also examined as contributors to the *positive* effects of self-efficacy and performance. That is, consistent with existing theory and research, self-efficacy was positively related to goals and goal commitment, which in turn were positively related to subsequent performance (although these positive effects of self-efficacy were overpowered by the negative effects in the high-ambiguity condition). Controlling for goals and goal commitment in the hypothesis tests reported below had no substantive impact on the results. Therefore, because these findings provide little contribution over the existing body of knowledge and did not influence the results reported in the present study, they are not emphasized in the present article, which is focused primarily upon enhancing our understanding of the negative self-efficacy effect.

[3] These questions were assessed in a separate sample from that used for the primary hypothesis tests due to the potential interference that such questions may have on the processes under examination. For example, such questions could lead participants to more carefully assess their performance on subsequent anagrams, negating some of the negative self-efficacy effects.

Table 1
Means, Standard Deviations, and Intercorrelations at the Between-Persons Level of Analysis

Variable	*M*	*SD*	1	2	3	4	5	6
1. Performance ambiguity	0.48	0.50	1.00					
2. Ability	0.79	0.71	−.05	1.00				
3. Self-efficacy	66.62	17.09	.02	.22	.68			
4. Effort (attempts)	2.82	0.68	−.24	.01	.37	.71		
5. Effort (self-report)	3.40	0.94	−.40	.02	.23	.23	.69	
6. Performance	56.77	19.92	−.33	.34	.49	.58	.26	.61

Note. ICC(1) values are presented on the diagonal, indicating the proportion of total variance occurring between persons. Performance ambiguity was coded 0 for low ambiguity and 1 for high ambiguity. $p < .05$ for all correlations greater than $|.23|$; $p < .10$ for all correlations greater than $|.20|$.

Both covariates, ability ($\gamma = 8.73$, $SE = 3.25$, $p < .01$, $R^2 = .09$) and time ($\gamma = 3.08$, $SE = .81$, $p < .01$, $R^2 = .07$), were positively related to task performance. A main effect was observed for ambiguity ($\gamma = –10.81$, $SE = 4.57$, $p < .05$, $R^2 = .07$)—as a whole, participants in the high-ambiguity condition discovered significantly fewer solutions than their low ambiguity counterparts. No main effect was observed for self-efficacy ($\gamma = –0.02$, $SE = 0.08$, $p > .10$, $R^2 = .00$). That is, collapsed across ambiguity conditions, self-efficacy did not have a discernable relationship with performance. However, when we examined its relationship within each condition, a very different story emerged. As expected, the relationship between self-efficacy and performance was moderated by ambiguity ($\gamma = −0.44$, $SE = 0.15$, $p < .01$, $R^2 = .04$). As displayed in Figure 2, the nature of this interaction was as

Table 2
Main Effects and Interaction Effects on Performance and Effort

Variable	γ	*SE*	*p*	R^2
Dependent variable: Performance				
Step 1				
Ability	8.73	3.25	<.01	.09
Time	3.08	0.81	<.01	.07
Performance ambiguity	−10.81	4.57	<.05	.07
Self-efficacy	−0.02	0.08	>.10	.00
Step 2				
Performance Ambiguity × Self-Efficacy	−0.44	0.15	<.01	.04
Dependent variable: Effort (attempts)				
Step 1				
Ability	0.017	0.091	>.10	.00
Time	0.041	0.018	<.05	.02
Performance ambiguity	−0.099	0.127	>.10	.01
Self-efficacy	0.002	0.002	>.10	.00
Step 2				
Performance Ambiguity × Self-Efficacy	−0.009	0.004	<.01	.03
Dependent variable: Effort (self-report)				
Step 1				
Ability	−0.080	0.140	>.10	.01
Time	−0.034	0.030	>.10	.00
Performance ambiguity	−0.574	0.197	<.01	.11
Self-efficacy	0.001	0.003	>.10	.00
Step 2				
Performance Ambiguity × Self-Efficacy	−0.015	0.006	<.01	.03
Dependent variable: Performance (controlling for effort)				
Effort operationalized as solution attempts				
Ability	6.69	2.20	<.01	.12
Time	2.78	0.78	<.01	.06
Effort (attempts)	18.22	2.14	<.01	.26
Performance Ambiguity	11.23	9.14	>.10	.02
Self-efficacy	0.19	0.09	<.05	.02
Performance Ambiguity × Self-Efficacy	−0.33	0.13	<.01	.03
Effort operationalized as self-reported effort				
Ability	9.60	3.06	<.01	.12
Time	3.58	0.74	<.01	.10
Effort (self-report)	9.53	1.44	<.01	.17
Performance ambiguity	12.91	10.44	>.10	.02
Self-efficacy	0.07	0.10	>.10	.00
Performance Ambiguity × Self-Efficacy	−0.27	0.14	.06	.02

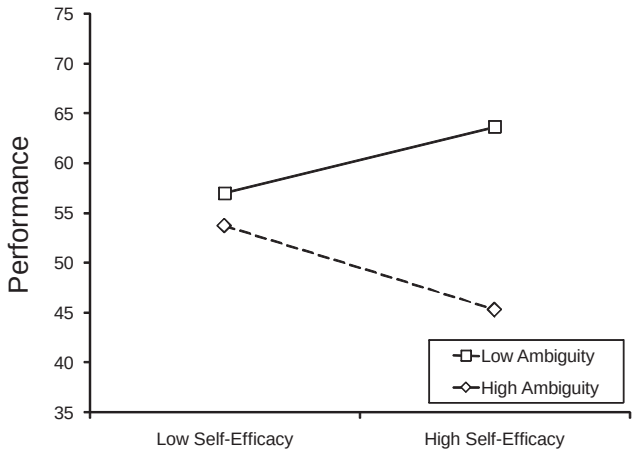

Figure 2. Interaction of self-efficacy and performance ambiguity on performance.

predicted, with self-efficacy negatively related to subsequent performance under conditions of high ambiguity but positively related to performance under low ambiguity. Thus, Hypothesis 1 was supported.

Hypothesis 2. Hypothesis 2 was tested with two sets of multilevel analyses—one for each of two measures of effort. Table 2 summarizes the results. As expected, self-efficacy and ambiguity significantly interacted in their relationships with both solution attempts ($\gamma = -0.009$, $SE = 0.004$, $p < .01$, $R^2 = .03$) and self-reported effort ($\gamma = -0.015$, $SE = 0.006$, $p < .01$, $R^2 = .03$). As displayed in Figures 3 and 4, self-efficacy positively related to effort under low ambiguity, and negatively related to effort under high ambiguity. Thus, Hypothesis 2 was supported.

Hypothesis 3. To test Hypothesis 3, we followed Krull and MacKinnon's (2001) product of coefficients procedure for testing mediation effects in multilevel analyses. This procedure provides point estimates and significance tests for mediated effects by integrating: (a) the effects of the initial variable (in this case, the interaction term for self-efficacy and ambiguity) on the mediator

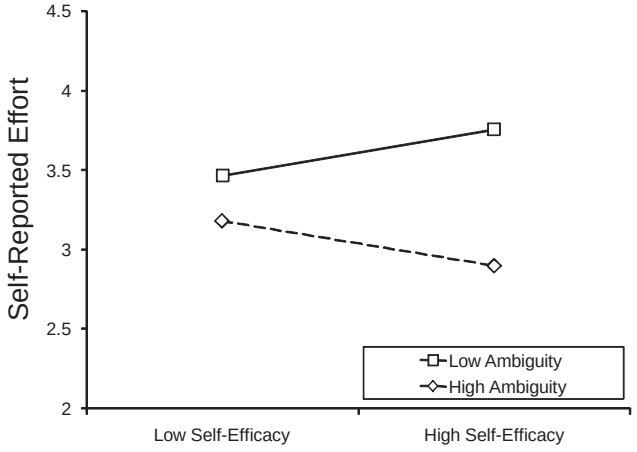

Figure 3. Interaction of self-efficacy and performance ambiguity on self-reported effort.

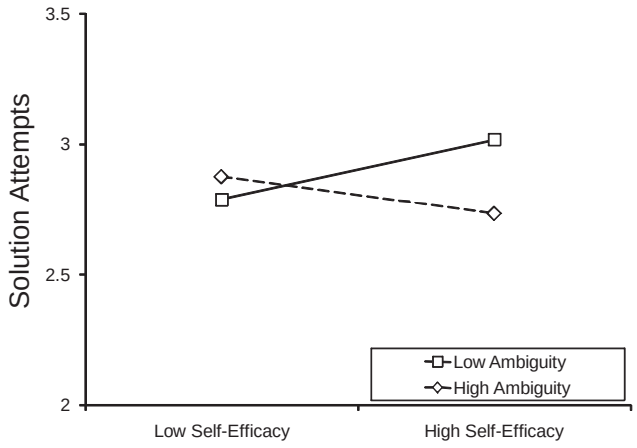

Figure 4. Interaction of self-efficacy and performance ambiguity on solution attempts.

(effort), (b) the effects of the mediator on the outcome variable (performance) after controlling for the initial variable, and (c) the associated standard errors.

Solution attempts ($\gamma = 18.22$, $SE = 2.14$, $p < .01$, $R^2 = .26$) and self-reported effort ($\gamma = 9.53$, $SE = 1.44$, $p < .01$, $R^2 = .17$) both had significant positive relationships with performance, above and beyond the interactive effects of self-efficacy and ambiguity. When we integrated these paths with the interactive effects of self-efficacy and ambiguity on effort reported above, both solution attempts (mediated effect $= -0.16$, $SE = 0.08$, $p < .05$) and self-reported effort (mediated effect $= -0.14$, $SE = 0.06$, $p < .05$) were found to have significant mediating effects. As displayed in Table 2, the interaction maintained a significant direct effect above and beyond solution attempts ($\gamma = -0.33$, $SE = 0.13$, $p < .01$, $R^2 = .03$), and the direct effect controlling for self-reported effort was nonsignificant at the .05 level but was significant at the .10 level ($\gamma = -0.27$, $SE = 0.14$, $p = .06$, $R^2 = .02$), suggesting that additional mediators may remain. Nonetheless, as a whole, these results provide support for Hypothesis 3.

Auxiliary analyses. Although our interest was on the relationship between self-efficacy and subsequent performance, we also examined the within-person relationship between past performance on subsequent self-efficacy. Consistent with prior research, a strong positive relationship was observed ($\gamma = 0.13$, $SE = 0.04$, $p < .01$), indicating that self-efficacy is shaped by one's prior performance attainments. Such strong effects of prior performance on self-efficacy raise the question of whether self-efficacy's relationship with subsequent performance is simply reflecting the relationship of past performance with subsequent performance (e.g., Heggestad & Kanfer, 2005). When we controlled for prior performance, the interaction of within-person self-efficacy and ambiguity remained ($\gamma = -0.63$, $SE = 0.20$, $p < .01$). Given that the focus of the present study is on the interaction of self-efficacy and ambiguity, one might argue the interaction of prior performance and ambiguity should be controlled for, as well. In so doing, we found no significant interaction between past performance and ambiguity ($\gamma = 0.09$, $SE = 0.13$, $p = .53$), whereas the hypothesized interaction between self-efficacy and ambiguity remained ($\gamma = -0.58$, $SE = 0.20$, $p < .01$). In short, accounting for past performance did not substantively alter the results.

Finally, to facilitate comparisons between our results and those of studies utilizing between-persons analyses, we conducted between-persons analyses by regressing each participant's average performance on their average self-efficacy. Consistent with prior research, a strong positive between-persons relationship was observed (see Table 3). Additionally, as reported in Table 3, the between-persons relationship between self-efficacy and performance was moderated by performance ambiguity. Figure 5 shows that the between-persons relationship between self-efficacy and performance was positive in both conditions, but was strongly positive with low ambiguity ($\beta = .81$, $p < .01$, $R^2 = .42$), compared to a nonsignificant positive relationship with high ambiguity ($\beta = .11$, $p = .50$, $R^2 = .01$). This suggests that, although ambiguity moderated the relationship at both between- and within-person levels of analysis, observing the *negative* relationship may require both high ambiguity and within-person analysis.

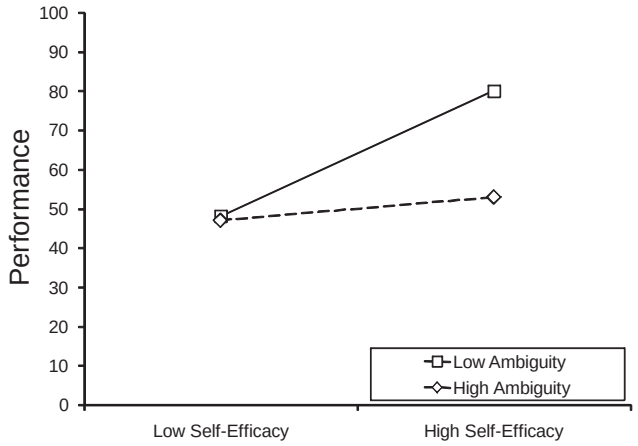

Figure 5. Between-persons interaction of self-efficacy and performance ambiguity on performance.

Discussion

Since Vancouver and colleagues (2002, 2001) reported their controversial results, a number of scholars have questioned the meaningfulness of the negative self-efficacy effect, regarding it as a unique property of the task utilized in each of the initial studies demonstrating the effect (e.g., Bandura & Locke, 2003; Eden et al., 2002). One contribution of the current study is the replication and generalization of this effect on a distinct task. However, a more substantial contribution of the current study is the identification of ambiguity as an important boundary condition. While self-efficacy was negatively related to subsequent performance under conditions of high ambiguity, it was positively related to performance when ambiguity was low. Although ambiguity has previously been implicated as an important component in the negative self-efficacy effect, this critical assumption has, until now, gone untested.

Verifying the moderating role of ambiguity has several important implications. First, recognizing the role of ambiguity helps to understand an important contingency concerning the negative self-efficacy effect. This, in turn, may help reconcile the conflicting accounts regarding the relationship of self-efficacy and performance. Many studies demonstrating the positive effects of self-efficacy on performance have utilized tasks in which one's performance can be monitored online with relatively little ambiguity. In contrast, Vancouver et al. have argued that the Mastermind[4] task utilized in their 2001 and 2002 studies possesses relatively high levels of ambiguity at a crucial point of action—that is, at the point where participants must determine how sufficiently they have considered all available information before taking action. In subsequent work, Vancouver and Kendall (2006) found a negative within-person effect of self-efficacy on college students' exam performance. Given the ambiguity associated with determining one's preparation for an exam, Vancouver and Kendall reasoned that students draw on their self-efficacy to predict their exam performance and allocate their study time accordingly, expecting higher performance and thus allocating less study time when self-efficacy was high. In other work, Yeo and Neal (2006) observed a negative within-person self-efficacy effect using an air-traffic-control task performed over 30 trials. Although feedback was provided following each trial, feedback was largely unavailable during task engagement itself (G. Yeo, personal communication, March 24, 2009), creating ambiguity concerning the decisions that were to be made during each trial. While these studies suggest that ambiguity may be a critical factor contributing to the emergence of a negative within-person effect of self-efficacy on performance, the current research is the first study to provide an empirical test of this proposition. By systematically varying ambiguity and demonstrating its moderating effects on the efficacy–performance link—negative under high ambiguity and positive under low ambiguity—we support the notion that differences in ambiguity may indeed play a large role in the conflicting results.

Identifying ambiguity as a moderator of the efficacy–performance relationship may contribute to an improved understanding of two related effects. First, Bandura (1997) asserted that self-efficacy might exert a negative effect in a preparatory context. Individuals with high efficacy may perceive themselves to be sufficiently prepared as to render further investments of time and effort into preparatory activities unnecessary. In contrast, some self-doubt can motivate individuals to increase their preparatory efforts. Empirical work has largely supported this perspective (e.g., Mann & Eland, 2005; Salomon, 1984; Vancouver & Kendall,

Table 3
Between-Persons Regression of Performance on Self-Efficacy and Performance Ambiguity

Variable	β	*SE*	*p*	R^2
Step 1				
Ability	6.50	2.67	<.05	.05
Performance ambiguity	−12.77	3.69	<.01	.10
Self-efficacy	0.52	0.11	<.01	.19
Step 2				
Performance Ambiguity × Self-Efficacy	−0.73	0.20	<.01	.10

[4] In Mastermind, participants seek to deduce a code consisting of a pattern of four "code pegs" in as few tries as possible. Each code peg can be any of six colors, resulting in 1,296 possible codes (e.g., red, green, blue, green). After each try, feedback is provided indicating (a) the number of colors correctly guessed and placed in the correct position and (b) the number of colors correctly guessed but not placed in the correct position.

2006). What is it about preparatory contexts that result in the negative self-efficacy effects? We note that preparatory activities are rife with ambiguity. For example, while preparing for an upcoming exam, students must judge the degree to which they have mastered the target material, and determine whether their level of mastery is sufficient to achieve their course goals. The difficulty of accurately assessing one's level of learning during study activities has been well documented—a strong tendency exists to overestimate one's level of comprehension and, as a result, allocate less study time than is truly necessary to meet one's goals (e.g., Bauer, Kyaw, & Kilbey, 1984; Dunlosky & Connor, 1997; Leonesio & Nelson, 1990; Mazzoni & Cornoldi, 1993). Among the more successful interventions for reducing miscalibrated perceptions are those that encourage more explicit self-evaluation of one's comprehension (e.g., A. King & Rosenshine, 1993), particularly in relation to objective, unambiguous criteria (e.g., practice tests).

Second, our results may also help explain the finding that the efficacy–performance relationship appears to be strongest for low-complexity tasks (Stajkovic & Luthans, 1998). This may be due in part to greater ambiguity present in many complex tasks (cf. Latham & Yukl, 1975; Taylor, 1987). While Stajkovic and Luthans (1998) found that the relationship varied in magnitude, but not direction, this may have been due to the use of between-persons analyses in the primary studies, whereas the negative effect is thought to be a within-person effect that occurs over time. Although we did not advance any hypotheses regarding the between-persons effects (due to its inconsistency with the underlying within-person theory being tested), the between-persons relationship between self-efficacy and performance was moderated by ambiguity in a manner consistent with Stajkovic and Luthan's complexity effects. The combination of complexity and within-person analysis may result in a similar pattern. Yet, we urge caution in generalizing from the ambiguity effects observed in the present study to task complexity, as important differences exist between the two concepts. In particular, task complexity is typically viewed as an objective aspect of a task (e.g., Campbell, 1988; Wood, 1986), whereas our notion of ambiguity represents the interaction of an individual with a task with regard to the impact of one's actions on performance. Although ambiguity may be present in many complex tasks, this is not always the case (Latham & Yukl, 1975; Taylor, 1987). Thus, although ambiguity represents one possible explanation for the moderating effects of complexity, other psychological processes may be responsible for the effect. We encourage research aimed at understanding what, if any, impact ambiguity plays in the moderating effects of complexity.

A related implication is that these results help provide a firmer picture of the underlying processes involved in the negative relationship between self-efficacy and performance. Recall that the theoretical rationale for the negative self-efficacy effect hinges on self-efficacy positively influencing perceptions of performance—higher perceptions of performance, in turn, result in reduced effort, which negatively impacts performance. The pilot study provided some support for this argument, as those experiencing high ambiguity were less accurate in their assessments of their performance. In the primary study, perceptions of performance were not directly measured, as such measurement may have fundamentally altered the occurrence of the phenomenon, just as self-questioning interventions often reduce the extent of bias in judgments of learning (e.g., A. King & Rosenshine, 1993). Rather, by systematically altering ambiguity, we alternately facilitated and inhibited the ability of this proposed mediator to take hold. With low ambiguity, self-efficacy should have little impact on one's perceptions of performance, which in turn should eliminate the negative effect, as was the case in the present study. Such an approach, sometimes referred to as a blockage model, amounts to testing mediation via moderation (MacKinnon, 2008; Mark, 1986). However, future research should seek to confirm the role of perceived performance via alternative, and ideally more direct, methods.

A more traditional approach was taken to examine the mediating effects of effort allocation. If effort is indeed a mediating mechanism, the interactive effects of self-efficacy and ambiguity on effort should be similar to their effects on performance. Indeed, this was found to be the case, with self-efficacy negatively related to effort under high ambiguity, and positively related under low ambiguity. Further, a significant mediation effect was found for each of two operationalizations of effort, thus supporting the mediating role of effort allocation in the relationship between self-efficacy and performance. Confirming the effort hypotheses with both subjective and objective measures is an additional contribution, as prior work by Vancouver and Kendall (2006) relied exclusively upon self-reported effort. However, it is important to note that additional mediators likely remain. For example, it is likely that task strategies, which have frequently been found to be positively associated with both self-efficacy and performance (e.g., Bouffard-Bouchard, 1990; Wood & Bandura, 1989), played a role in the present task as well.

However, it is likely that ambiguity alone does not account for the negative self-efficacy effect, and additional factors may facilitate or inhibit the negative self-efficacy effects. For example, recent research by A. M. Schmidt and DeShon (2009) found that the level of adversity goal seekers were experiencing—operationalized as the level of one's prior performance and the discrepancy between one's goal and one's performance—moderated the relationship between self-efficacy and performance. When facing a challenging situation, self-efficacy positively predicted performance. This is consistent with the notion that self-efficacy facilitates goal acceptance and commitment, as low efficacy may foster a belief that effort will be invested in vain. In contrast, when individuals experienced less challenge, the negative self-efficacy effect surfaced, as individuals may have concluded that they could succeed with less effort than was truly required. This finding is also consistent with the dual-process effects recently observed by Vancouver et al. (2008), such that self-efficacy was positively related to goal acceptance, but negatively related to resources that were allocated to goals if and when accepted. Relatedly, self-efficacy has been shown to facilitate upward goal revision following success (Tolli & Schmidt, 2008), providing another avenue through which self-efficacy can contribute positively to performance. In total, self-efficacy appears to contribute positively to performance through some mechanisms (e.g., goal level and goal acceptance) and negatively through others (e.g., perceptions of performance, underinvestment of effort). Additional theoretical and empirical work is needed to better understand the positive and negative causal paths through which self-efficacy influences performance, as well as the individual and situational factors that impact these paths to yield an overall positive or negative relationship between self-efficacy and performance.

Additionally, it is important to note that ambiguity can vary in degree and in form. For example, the current study provided all participants with information concerning the correctness of submitted solutions. Although those in the high-ambiguity condition were still unable to translate that information into an accurate or confident assessment of their performance, as confirmed in our pilot study, ambiguity may have been further increased by also withholding information about the correctness of individual submission attempts. We expect that further increasing ambiguity in this manner would further accentuate the negative self-efficacy effect. However, this is an empirical question, and there may be a point at which further increases in ambiguity no longer exert incremental influence on the relationship. Beyond the amount of ambiguity, we also encourage researchers to consider additional forms of ambiguity. For example, role ambiguity has been shown to moderate the relationship between self-efficacy and performance at the between-persons level (Bray & Brawley, 2002). It remains to be seen, however, whether role ambiguity plays a similar function at the within-person level of analysis.

The results of this study may also have practical implications. First, the results may help point to conditions when efficacy-bolstering interventions are most likely to prove beneficial, and when they might actually be detrimental. Additionally, by understanding when and why self-efficacy can be detrimental to performance, one can take steps to avoid these negative effects, while retaining the positive. For example, bolstering the self-efficacy of those working under ambiguous conditions may have unintended negative consequences that could outweigh other benefits associated with high self-efficacy. The results suggest that one means of reducing the potential for negative self-efficacy effects might be to minimize the ambiguity surrounding one's performance by providing specific and timely feedback. Explicit self-questioning is frequently effective in reducing overestimation in learners' judgments concerning their mastery of course material (e.g., A. King & Rosenshine, 1993). Self-questioning interventions may reduce bias in judgments of performance under ambiguous conditions.

Of course, the potential implications must be considered in light of the limitations of the current study. In particular, no single task can fully represent the broad range of contexts in which self-efficacy bears influence. The task utilized in the present study was fairly novel to participants, of short duration, and relatively simple compared to many real-world tasks. Additionally, participants may not have been as engaged and personally invested in the current task as with other real-world tasks (although participants did express a fairly high level of interest in the task [$M = 3.38$ out of 5] and indicated investing a fairly high level of effort [$M = 3.4$ out of 5]). Thus, additional work is needed to determine the generalizability of the results of the current study. Nonetheless, the present study helps foster an understanding of the impact of ambiguity on the relationship between self-efficacy and performance, and suggests potential avenues for future research and practical application.

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Correction to Bacharach et al. (2010)

In the article "Alcohol Consumption and Workplace Absenteeism: The Moderating Effect of Social Support" by Samuel B. Bacharach, Peter A. Bamberger and Michal Biron (*Journal of Applied Psychology, 95,* 334-348), the R-square estimates for models 4 and 5 of Table 2 on page 343 are incorrectly reported. The correct R-square values are .10 for both of these models (instead of .010). All the other values reported in this table are correct.

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