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# Overconfidence in Initial Self-Efficacy Judgments: Effects on Decision Processes and Performance

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## Abstract

Judgments of task-specific, expected performance (i.e., self-efficacy) can affect the activities one chooses to pursue and the extent of effort devoted to these activities. However, relatively little is known about the accuracy of self-efficacy judgments or their effects on behavior, performance, and perceptions of performance in complex cognitive tasks. The results of a pilot study and experiment indicate that initial, "first-impression" self-efficacy judgments made in cognitively complex tasks are biased towards overestimates of personal ability (i.e., "overconfidence"). The experiment manipulated performance expectations to illuminate how overestimates of initial self-efficacy affect decision processes, performance, and perceptions of performance. Inducing positive expectations produced overconfidence in choice accuracy, but did not increase effort, attention to strategy, or performance relative to mildly negative and strongly negative expectations. In contrast, inducing mildly negative expectations increased effort, attention to strategy, and performance relative to strongly negative expectations. The results suggest that the demotivational effects of initial negative expectations are more robust than the motivational effects of initial positive expectations. In addition, inducing mildly negative expectations may improve performance more than positive expectations in at least some tasks and settings.

How accurate are initial judgments of task-specific, expected performance (i.e., self-efficacy)? How does perceived self-efficacy influence effort, performance and perceptions of performance? Social cognitive theories (e.g., Bandura, 1986; Locke, 1991) have begun to explore the processes underlying the self-regulation of behavior. In contrast to theories that posit unidirectional, deterministic effects from environmental influences or internal dispositions on behavior, social cognitive theories posit "triadic reciprocal causation" (Bandura, 1986), in which behavioral, cognitive, and environmental influences interact and mutually influence one another. The shift from deterministic, unidirectional theories towards dynamic, bidirectional theories of sociocognitive functioning has increased attention to self-referent processes (Locke, 1991). More recently, social cognitive research has focused on the linkages between judgments of personal capability or "self-efficacy" and task performance. Judgments of self-efficacy are estimates of one's ability to attain a certain level of performance in a specific task (Bandura, 1977, 1986). Relatively little is known about the characteristics of self-efficacy judgments (Gist & Mitchell, 1992) or their effects on behavior, performance, and perceptions of performance in cognitively complex tasks (Cervone, in press).

While many information sources affect self-efficacy judgments (Bandura, 1977), comparisons with others are among the most important influences (Bandura, 1986; Festinger, 1954; Goethals & Darley, 1977; Suls & Miller, 1977). Such comparisons are a primary influence on self-efficacy judgments because most human activities do not provide objective, nonsocial evidence of performance (Bandura & Jourden, 1991). People therefore often gauge their expected and actual performance by comparison with that of others.

**Overconfidence and Judgments of Self-Efficacy**

Judgments of self-efficacy are made under uncertainty. As a result, they are subject to the same constraints of limited attention, information processing capacity, and memory that characterize other decisions. Research indicates that self-efficacy judgments are products of the same heuristics and subject to the same biases as other judgments under uncertainty (Cervone & Peake, 1986; Peake & Cervone, 1989; Switzer & Sniezek, 1991). While research has established that self-efficacy judgments are the product of heuristic-based processes, relatively little is known about the accuracy of self-efficacy judgments.

However, there is an extensive literature dating from the 1940s (e.g., Festinger, 1942; Frank, 1953; Irwin, 1944) that suggests a tendency towards overly positive self-evaluations. The bias towards overly positive self-evaluations extends across an impressive range of research paradigms, tasks, and participants (see Greenwald, 1980, and Taylor & Brown, 1988, for reviews). Evidence of this tendency includes recalling positive personality traits more easily than negative ones (e.g., Kuiper, Olinger, MacDonald & Shaw, 1985), evaluating one's self more positively than others (e.g., Green & Gross, 1979), unrealistic illusions of control over chance events (e.g., Langer, 1975), and unrealistic optimism about future task performance (e.g., Crandall, Solomon, & Kelleway, 1955). One recent review summarizes this literature as follows:

> Many researchers have studied biases in the processing of self-relevant information and have given their similar phenomena different names. There is, however, considerable overlap in findings, and three that consistently emerge can be labeled *unrealistically positive views of the self*, *exaggerated perceptions of personal control*, and *unrealistic optimism* (italics in original) (Taylor & Brown, 1988, p. 194).

Overly positive self-evaluations also appear to be present in evaluations of one's performance in decision tasks. Decision makers believe they perform better than objective evidence indicates in a variety of tasks, including answering almanac questions (Fischhoff, Slovic, & Lichtenstein, 1977; Koriat, Lichtenstein, & Fischhoff, 1980; Paese & Sniezek, 1991), identifying words and sounds (Clarke, 1960; Swets, Tanner, & Birdsall, 1961), predicting horse races (Fischhoff & Slovic, 1980), and diagnosing the malignancy of ulcers (Fischhoff & Slovic, 1980). "Overconfidence" occurs when decision makers' beliefs about the quality of their performance exceed their actual performance. Explanations for overconfidence include the structural characteristics of judgment tasks (Einhorn & Hogarth, 1978) and a tendency to seek confirming, but not disconfirming, evidence (Hoch, 1985; Klayman & Ha, 1987).

Overconfidence is a relatively robust phenomenon (see Keren, 1991, and Lichtenstein, Fischhoff, & Phillips, 1982, for reviews), although recent research suggests the existence of conditions in which overconfidence is lessened and even eliminated. For example, certain types of professional training and experience appear to be useful in eliminating overconfidence (e.g., weather forecasters in Murphy & Winkler, 1977; financial auditors in Tomassini, Solomon, Romney & Krogstad, 1982). Similarly, overconfidence appears to be either greatly reduced (Sniezek & Buckley, 1991) or eliminated (Gigerenzer, Hoffrage, & Kleinbolting, 1991) when decision makers evaluate their performance over a series of decisions rather than making evaluations of each decision. Sniezek and Buckley (1991) argue that this occurs because evaluations of a series of decisions result in greater weighting of self-evaluative reactions to one's performance relative to other factors (e.g., self-efficacy).

There is evidence that self-efficacy judgments, particularly those made prior to having first-hand task experience, may reflect overconfidence. For example, Cervone and Wood (1992) found that participants' self-efficacy judgments made before engaging in a complex decision making task significantly overestimated ability relative to subsequent performance. Similarly, Bandura and Schunk (1981) treated children with gross deficiencies in mathematics using four different programs of self-directed learning. Before treatment, all four groups overestimated the number of subtraction problems they could solve. After receiving treatment and extensive performance feedback, three of the four groups still significantly overestimated their capability at mathematics problems. Indeed, even the pre-treatment self-efficacy judgments of severe phobics reflect overestimates of ability (See Figure 1 in Bandura & Adams, 1977, and Figure 2 in Bandura, Adams, Hardy, & Howells, 1980).

Although there is some evidence regarding the accuracy of self-efficacy judgments, relatively little attention has been given to judgments of self-efficacy made prior to having first-hand task experience. Initial "first-impression" judgments of self-efficacy are important, since they can affect the activities people choose to pursue (Bandura, 1986), the extent of effort devoted to these activities (Cervone & Peake, 1986; Cervone & Palmer, 1990), and subsequent self-efficacy judgments (Cervone & Palmer, 1990). One procedure for measuring overconfidence in self-efficacy judgments is to use a percentile rank measure that incorporates explicit comparisons with others (e.g., "I think I will perform at the 75th percentile").[1] If there are no systematic biases towards over or underestimates of ability, percentile rank self-efficacy judgments should be at the 50th percentile. In contrast, if initial self-efficacy judgments reflect overconfidence, percentile rank self-efficacy judgments should exceed the 50th percentile. The pilot study tests the hypothesis that initial percentile rank self-efficacy judgments reflect overestimates of ability.

## Pilot Study

### Method

*Participants.* Undergraduate students enrolled in an undergraduate business course (n=47) participated for course credit and the opportunity to win a randomly distributed $20 cash prize.[2] Participants were told that the purpose of the study was to understand better how students choose colleges. They then read a case describing a student interested in choosing a college. The case described six attributes that the student had determined to be important (student quality, student/faculty ratio, distance from home, total cost, school size and percentage of faculty with Ph.D.s). Participants were told that:

> [The student] believes that, while all the factors are relevant in making the decision, some factors are more important than others. Specifically, he thinks that factors one and two are three times as important as factors five and six, while factors three and four are twice as important as factors five and six.

Participants were told that the task consisted of choosing the college that best matched these criteria from a set of eight alternatives. The experimenter then showed an example of a multiattribute choice display using a microcomputer and the *Mouselab* decision research software (Johnson, Payne, Schkade, & Bettman, 1989). Following the demonstration, participants asked clarifying questions about the task and the criteria. They then stated: (1) their expected choice accuracy percentile rank on the task in comparison with other students enrolled in the class and (2) how much they thought the hardware and software they had seen would help them in making choices. Participants stated their expected percentile rank as a number between 0 and 100 and the extent of help they expected from hardware and software on a 7 point Likert-type scale. Before asking these questions, the experimenter explained the meaning of percentile ranks and emphasized that, by definition, half of the participants should be ranked at or below the 50th percentile.

**Results and Discussion -- Pilot Study**

The mean expected percentile rank was 69.6 (standard deviation, 14.9), which is significantly higher than the 50th percentile ($t(46) = 8.92$, $p < .001$). Thirty-seven participants (78.7%) expected to perform above the 50th percentile, seven (14.9%) expected to perform at the 50th percentile, and three (6.4%) expected to perform below the 50th percentile. A sign test (Hays, 1981) indicates significantly more participants expected to perform above than below the 50th percentile ($z = 66.0$, $p < .001$). Given the impossibility of 79% of the participants performing above the 50th percentile, the results provide support for the hypothesis that initial judgments of self-efficacy in cognitively complex tasks reflect overconfidence.

**Self-Efficacy, Behavior, and Performance in Multiattribute Choice**

Social-cognitive theory posits three self-referent processes that potentially influence behavior and performance: self-set goals, self-evaluative reactions, and judgments of self-efficacy (Bandura & Cervone, 1983, 1986). Setting personal goals can influence behavior by providing a benchmark for evaluating one's performance. Self-evaluative reactions are feelings of satisfaction or dissatisfaction with one's performance. Self-evaluative reactions influence performance and behavior primarily when one both sets personal goals and receives feedback about performance (Bandura & Cervone, 1983, 1986; Cervone, in press). This suggests that the influence of self-efficacy relative to self-evaluative reactions is likely to be greatest in the absence of performance feedback and self-set goals.

Existing research has studied the effects of self-efficacy judgments on performance in a complex decision making task (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone, Jiwani, & Wood, 1991; Cervone & Wood, 1992; Jourden, 1992; Wood & Bandura, 1989). However with few exceptions (e.g., Switzer & Sniezek, 1991), research to date has studied the same task and setting, in which participants manage the employees of a simulated manufacturing business. Studying alternative tasks and settings provides important evidence on the robustness of self-efficacy effects in complex decision making (Cervone & Wood, 1992).

Choosing among alternatives is one of the most pervasive, and challenging, of cognitive activities (Hogarth, 1983; Stone & Schkade, 1991). Multiattribute choice (e.g., Payne, 1976) is a cognitively complex task that demands both effort (i.e., working hard) and the development of appropriate decision strategies (i.e., working smart). In such tasks, alternatives are frequently displayed on one dimension of a matrix and attributes of alternatives on the other. For example in Figure 1, colleges (labeled "A," "B," "C," etc.) are displayed as columns, and the attributes of the colleges (i.e., "Student Quality," "Student/fac. Ratio," etc.) as rows, in a matrix. One advantage of studying the effects of self-efficacy in multiattribute choice tasks is the existence of well-defined measures of decision processes (Klayman, 1983; Payne, 1976; Payne, Braunstein, & Carroll, 1978).

Insert Figure 1 about here

An important question related to self-efficacy is the effect of positive and negative information about one's expected performance on self-efficacy judgments (Bandura & Jourden, 1991). More specifically, how might the self-efficacy judgments of participants whose performance expectations are manipulated differ from the self-efficacy judgments of participants in the pilot study? Will the increases in self-efficacy of participants who expect better performance than the pilot study participants be larger than the corresponding decreases in self-efficacy of participants who expect worse performance than pilot study participants? There are reasons to believe that positive information about expected performance will have larger effects on self-efficacy than negative information. For example, there is evidence that people process and recall positive information about themselves more easily and efficiently than negative information (Kuiper & Derry, 1982; Kuiper & MacDonald, 1982; Kuiper et al., 1985). It may therefore be the case that positive information about one's expected performance leads to larger increases in self-efficacy than the corresponding decreases associated with negative information about expected performance.

Historically, self-efficacy theory posited that people who believed that they would perform a task well exerted more effort, persevered longer, and performed better than those who thought that they would fail (Bandura, 1977, 1982, 1986; Eden, 1990). As a result, researchers generally argued for the existence of symmetric performance effects from positive and negative self-expectations. Positive self-expectations were hypothesized to increase performance, and negative self-expectations to decrease performance, through mediating effects on effort and perseverance.

However, most of the evidence supporting a symmetric relationship between expectations and performance examined cognitively simple tasks (e.g., solving anagrams, simple addition, typing). More recent research suggests that the effects of self-referent processes in cognitively complex tasks may qualitatively differ from those found in simple tasks (Cervone, in press; Cervone & Wood, 1992). In cognitively simple tasks, immediate performance feedback confirms the existence of an unequivocal, positive relationship between effort and performance (Bandura & Jourden, 1991). As a result of this unequivocal effort/performance relationship, positive expectations induce greater effort that immediately and directly improves performance. In contrast, performance in cognitively complex tasks depends upon both working hard (i.e., greater effort) and smart (i.e., attention to strategy development). In cognitively complex tasks, working harder and smarter does not necessarily translate into immediate performance improvements. The lack of direct performance feedback may therefore change the influence of self-referent processes on decision processes and performance in cognitively complex tasks.

There is some evidence that overconfidence increases with task difficulty (Clarke, 1960; Nickerson & McGoldrick, 1965; Pitz, 1974). Overconfidence may therefore be larger in cognitively complex than simple tasks. If judgments of self-efficacy overestimate ability in complex cognitive tasks, decision makers who expect to perform well are unlikely to increase their effort or attention to strategy in tasks that lack immediate, unequivocal performance feedback . After all, why work hard if you expect superior performance and receive no feedback that contradicts this expectation (cf. Bandura & Jourden, 1991)? Providing information that induces positive performance expectations is therefore likely to increase post-decision perceptions of, but not actual, performance relative to providing information that induces mildly negative and strongly negative performance expectations. Inducing positive expectations should therefore increase overconfidence but not task performance.

Research by Sniezek and colleagues provides support for the argument that positive performance expectations may induce overconfidence without concomitant increases in effort or performance. Trafimow and Sniezek (in press) led decision makers to believe they would either perform well or poorly in answering general knowledge questions. Participants who believed they would perform well did no better at answering questions but were significantly overconfident. In contrast, participants who expected to perform poorly were neither over nor underconfident. Switzer and Sniezek (1991) provided participants engaged in a text editing task with either high or low performance expectations. Participants who received high performance anchors believed they would perform better at the task and exert more effort. However, they neither correctly transferred more sentences nor executed more keystrokes than participants who expected to perform poorly.

Information that induces mildly negative expectations (e.g., expecting only "average" performance) may increase effort, attention to strategy, and performance by increasing the perceived challenge of tasks (cf. Csikzentmihalyi, 1990; Csikzentmihalyi & LeFevre, 1989). In contrast to the overconfidence induced by positive expectations, mildly negative expectations may increase the perceived importance of exerting effort and attending to strategy development. However, strongly negative performance expectations may decrease the perceived benefits of exerting effort, since there is little benefit from working hard at a task in which one expects to perform poorly regardless of one's effort (cf. Bandura & Jourden, 1991; Sarason, 1975; Sarason, Sarason & Pierce, 1990). Mildly negative expectations should therefore improve task performance by increasing effort exerted and attention to strategy, while strongly negative expectations should decrease task performance by decreasing effort and attention to strategy.

Research suggests that inducing negative performance expectations can reduce and even eliminate overconfidence (Trafimow & Sniezek, in press). Mildly negative expectations may eliminate overconfidence because decision makers outperform their initial expectations as the result of exerting effort at the task. Strongly negative expectations may eliminate overconfidence as the result of the self-fulfilling effects of negative performance expectations on effort. More specifically, strongly negative expectations may lead to decreased effort which results in low performance that matches one's initial low expectations.

An experiment was designed to test the following hypotheses: (1) the increase in self-efficacy of participants given positive information about expected performance will be larger than the corresponding decrease in self-efficacy of participants given negative information about expected performance, (2) participants given positive expectations about their performance will have higher perceived performance than participants who are given mildly and strongly negative performance expectations, (3) participants given mildly negative performance expectations will use more effective strategies, exert more effort, and, as a result, make more accurate choices than participants given strongly negative performance expectations and, (4) participants given positive performance expectations will be overconfident (i.e., perceived will exceed actual performance), while participants given mildly and strongly negative performance expectations will be neither over nor underconfident.

## Experiment

### Method

*Procedure.* The experiment took place one week after the pilot study. Undergraduate students from the same class and semester as the pilot study (n=139) participated for course credit and the opportunity to win one of five randomly distributed $20 cash prizes. None of the participants in the experiment participated in the pilot study.

Initial procedures were identical to those described in the pilot study through the demonstration of the multiattribute choice display. Following this, participants listened to a 10 minute presentation by the author designed to manipulate their expected task performance. They then responded to the same two questions as participants in the pilot study. These questions asked: (1) their expected choice accuracy percentile rank on the task in comparison with other students enrolled in the class and (2) how much they thought the hardware and software would help them in making choices.

Subsequently, participants moved to a different room where they were greeted by a proctor who was unaware of the purpose of the experiment. This proctor seated participants at computer terminals. Participants then made 13 choices of colleges (1 practice and 12 actual) from choice sets containing 8 alternatives (i.e., colleges). Following this, participants completed a post-experimental questionnaire. Participants completed the task in groups of 8 to 13. Each session required, on average, 50 minutes.

*Design*. Participants were randomly assigned to one of three expectation conditions. In the positive expectation condition, participants were told that the software they would use to choose colleges was an advanced decision support system designed to improve the accuracy of their choices. They were told that as a result of using the software, if they worked hard, their choice accuracy would be better than 90% of previous research participants. In the mildly negative expectation condition, participants were told that some of the other participants would be using an advanced decision support system designed to improve the accuracy of their choices. However they would use software that was not designed to improve decision making, "because the advanced decision support system is not available to us today." They were also told that, by working hard, they would do better than 50% of previous research participants. In the strongly negative expectation condition, participants were told that most of the other participants would be using an advanced decision support system designed to improve the accuracy of their choices. However, they would use software that was not designed to improve decision making, "because the advanced decision support system is not available to us today." They were also told that, by working hard, they would still do better than 10% of previous research participants.

In reality, all participants used the *Mouselab* decision research software, which collects data on decision processes. The software did not provide any decision supportive capabilities. Because the experimental manipulation involved deception, participants were told, and given an opportunity to ask questions about, the true purpose of the experiment and the software at the end of the semester.

The levels of percentile ranks used for the manipulation were based upon those given by participants in the pilot study. The positive and mildly negative expectation condition levels (90th and 50th percentile) were approximately equidistant from the average self-efficacy of the pilot study participants (69.6). The strongly negative expectation condition level (10th percentile) provided a symmetric percentile rank relative to the difference between the positive and mildly negative conditions (i.e., 90 - 50 = 50 - 10).

A potential problem with manipulating performance expectations is that differing performance expectation might invoke self-evaluative reactions among participants. For example, if participants expected to perform well but received feedback that suggested they had performed poorly, then dissatisfaction with performance could influence subsequent behavior and performance. Social cognitive theory posits that both personal goals and knowledge of one's performance are necessarily to fully activate self-evaluative reactions (Bandura & Cervone, 1983, 1986; Cervone, in press). To lessen effects from self-evaluative reactions, participants were not asked to state personal performance goals and were not provided with feedback at any time during the experiment. A second procedure intended to lessen effects from self-evaluative reactions was that participants were told they could expect to do well or poorly based upon an external reason (i.e., the quality of the software that was provided to them) and not based upon their personal abilities or characteristics (e.g., intelligence, computer skills, etc.) (cf. Trafimow and Sniezek, in press).

*Data Collection.* Using *Mouselab*, alternatives are displayed as one dimension of a matrix, and their attributes on the other (see Figure 1). When a choice set first appears on the screen, the information about the alternatives is "hidden" in boxes. These boxes can be "opened" to reveal their contents by using the mouse to move the cursor into a given box. Only one box can be open at a time. Participants make choices by moving the cursor to the choice box of the desired alternative and clicking a mouse button. Figure 1 illustrates the experimental display after a box has been "opened." The data collected using *Mouselab* includes the sequence of boxes opened, the time spent in each box, and the choice made by a participant.

Two dimensions of the information display were counterbalanced: the presentation order of the twelve choice sets and the order of alternatives within a choice set. Counterbalancing was between-participants. A fractional factorial design was used to select combinations for counterbalanced factors (Hays, 1981).

*Choice Accuracy.* The alternatives in each choice set were ranked from best to worst using the criteria given in the case. For example, the best alternative in a choice set received a rank of 8, the second best a rank of 7, and the worst a rank of 1. Absolute choice accuracy was computed as the average choice quality ranking of each participant's chosen alternatives across the 12 choices. This measure was then converted to a percentile rank relative to other participants (e.g., average absolute choice accuracy of 6.5 equaled the 58th percentile). Data analysis used the percentile rank measure to permit comparisons with participants' expected and post-experimental perceived choice accuracy.

*Decision Process Measures.* Two broad indicators of decision strategies are measures of information search and measures of cognitive effort (Payne et al., 1978). Two measures of the selectively of information search are the: (1) variability in time spent per alternative and (2) variability in time spent per attribute (Klayman, 1983; Payne, 1976). The variability in time spent per alternative (attribute) measures the extent to which decision time is focused on a few alternatives (attributes) versus spread across all alternatives (attributes). It is computed as the standard deviation of the time spent per alternative (attribute) across the set of attributes (alternatives). Cognitive effort was measured as the total time required to make a choice.

*Accuracy of Self-Efficacy Judgments.* The pilot study measured the accuracy of self-efficacy judgments relative to the characteristics of percentile ranks. The experiment measured the accuracy of both pre- and post-experimental self-efficacy judgments: (1) relative to the characteristics of aggregated percentile rank measures (as in the pilot study), and (2) by comparing self-efficacy judgments with actual task performance by individuals.

*Debriefing Questionnaire.* Upon completing the experiment, participants stated: (1) their choice accuracy percentile rank on the task in comparison with other students enrolled in the class and (2) the extent to which the hardware and software they used helped their decision making.

*Analysis.* Analysis of variance (ANOVA) and two-tailed t tests were used to evaluate the data. Post-hoc comparisons were made using the Tukey HSD test (Hays, 1981).

**Results and Discussion**

*Manipulation Checks.* Significant differences exist in the expected percentile ranks of all three groups (see row 1 of Table 1). The expected percentile rank of the positive expectations group was 88.8, the mildly negative group, 56.3, and the strongly negative group, 31.3. The direction of the differences in expected percentile ranks were therefore consistent with the experimental manipulation. The expected percentile rank of participants in the positive condition was not significantly different from the percentile rank value (i.e., 90th percentile) provided in the experimental manipulation ($t(46) = -0.91$, $p = .19$). However, the expected percentile ranks of participants in the mildly ($t(44) = 2.31$, $p = .03$) and strongly negative ($t(46) = 5.85$, $p < .001$) conditions exceeded the values (i.e., 50 and 10) provided in the experimental manipulation.

Insert Table 1 about here

Significant differences also exist in participants' beliefs about how much the hardware and software would help them in the experimental task (row 2 of Table 1). Consistent with the experimental manipulation, participants in the positive expectations group believed they would receive more help than participants in the mildly and strongly negative conditions.

*Comparison of Self-Efficacy Judgments with Pilot Study.* The first hypothesis states that the increase in self-efficacy of participants given positive information about expected performance will be larger than the corresponding decrease in self-efficacy of participants given negative information about expected performance. The fact that the self-efficacy judgments of participants in the positive expectations group were equivalent to the manipulated value (i.e., 90th percentile), while the self-efficacy judgments of participants in the mildly negative expectations group exceeded the manipulated value (i.e., 50th percentile) provides some support for larger increases in the positive expectations group. To more formally test the hypothesis, 69.6 (the mean expected percentile rank for the pilot study participants) was subtracted from the expected percentile ranks of the positive and mildly negative expectation condition participants in the experiment. The sign of this measure was then reversed for participants in the mildly negative expectations condition. Positive numbers therefore indicate changes in the direction of the experimental manipulations, i.e., > 69.6 for positive expectation condition participants and < 69.6 for mildly negative expectation participants. Negative numbers indicate changes in the opposite direction from the experimental manipulations, i.e., < 69.6 for positive expectation condition participants and > 69.6 for strongly negative expectation participants.

The changes in self-efficacy of participants in the positive condition were larger than those of participants in the mildly negative condition ($t(91) = 1.98$, $p = .05$). The average change in self-efficacy in the positive expectation condition was 19.2, in the mildly negative condition it was 13.3. To better understand why the changes in self-efficacy of positive condition participants were larger, the number of participants in the positive and mildly negative conditions whose expectations were greater and less than 69.6 was computed (see Table 2). There were significantly more participants in the mildly negative condition (11/45 = 24.4%) whose expectations were greater than 69.6 than participants in the positive condition (2/47 = 4.3%) whose expectations were less than 69.6 ($X^2 = 49.1$, $p < .01$). The results therefore support the hypothesis that, relative to the expectations of participants in the pilot study, the increase in self-efficacy in the positive expectation condition exceeds the decrease in self-efficacy in the mildly negative condition.

Insert Table 2 about here

*Choice Accuracy and Cognitive Effort.* Participants in the mildly negative expectation condition made better choices and took longer to choose than participants in the strongly negative expectation condition (see rows 3 and 4 of Table 1). Positive expectation condition participants had accuracy and effort measures that were not significantly different from the other conditions. The mean accuracy percentile rank was 56.4 for mildly negative condition participants, 52.7 for positive condition participants, and 41.1 for strongly negative condition participants. Participants in the mildly negative expectations condition averaged 126.1 seconds to make choices, positive expectation participants averaged 111.5 seconds, while strongly negative expectation participants averaged 87.9 seconds.

*Information Search.* Higher variability in time spent per alternative ($r = .22$, $p < .01$) and per attribute ($r = .22$, $p < .01$) was positively correlated with choice accuracy. Greater selectivity in information search therefore was associated with higher choice accuracy. Participants in the mildly negative condition had higher variability in time spent per alternative and per attribute than participants in the strongly negative condition (see rows 5 and 6 of Table 1). As with measures of performance and effort, the variability in time spent per alternative of participants in the positive expectation condition was not significantly different from that of participants in the other conditions.[3]

*Post-experimental Measures.* Consistent with previous research demonstrating the persistence of expectations (Cervone & Palmer, 1990), post-experimental measures of perception closely followed expectations. Significant differences exist in the perceived accuracy percentile ranks of all three groups (row 7 of Table 1), with the positive expectations group perceiving the highest percentile rank (80th), the mildly strongly negative group next (55th) and the strongly negative group last (32nd). Differences consistent with expectations also exist in the amount of help participants believed they received from the hardware and software they used (row 8 of Table 1). Participants in the positive expectations group continued to believe they received more help from the hardware and software than participants in the mildly negative and strongly negative conditions.

*Accuracy of Self-Efficacy Judgments.* The mean expected and post-experimental percentile ranks across conditions were 58.8 and 55.4, respectively. Both the expected ($t(138) = 3.42$, $p < .001$) and post-experimental ($t(138) = 2.33$, $p = .02$) percentile ranks were significantly higher than the 50th percentile, indicating significant overall overconfidence in both expected and post-experimental self-efficacy judgments. There was no significant change in mean overall self-efficacy between the expected and post-experimental judgments ($t(138) = 0.12$, $p = .91$).

The expected and post-experimental perceived percentile ranks exceeded the actual percentile rank for participants in the positive expectation condition (expected vs. actual ($t(44) = 7.89$, $p < .001$), actual vs. post-experimental perceived ($t(44) = 5.91$, $p < .001$)). The data therefore support the existence of overconfidence in the positive expectation condition. In contrast, the actual percentile rank was marginally greater than the expected and post-experimental perceived percentile ranks for participants in the strongly negative condition (expected vs. actual ($t(46) = -1.82$, $p = .08$), actual vs. post-experimental perceived ($t(46) = -1.72$, $p = .10$). The data therefore provide weak evidence of underconfidence in the strongly negative expectation condition. There were no significant differences between expected and actual performance ($t(46) = -0.03$, $p = .97$) or between actual and perceived performance ($t(46) = -0.40$, $p = .66$) for participants in the mildly negative condition.

*Relationships among Expected, Actual and Perceived Performance.* Expected and perceived performance were significantly and positively correlated ($r = .82$, $p < .01$), as were, to a lesser extent, perceived and actual performance ($r = .17$, $p = .05$). In contrast, expected and actual performance were uncorrelated ($r = .09$, $p = .28$).

*Decision Processes as Mediating Variables.* To what extent do changes in cognitive effort and decision processes between the experimental groups account for the choice accuracy results? To demonstrate a mediating relationship between the expectation manipulation, cognitive processes, and decision performance, it is necessary to establish three conditions: (1) that the expectation manipulation affects processing, (2) that the effort and processing measures are correlated with accuracy, and (3) that the effect of expectations on choice accuracy is weakened or eliminated if processing measures are used as covariates (Baron & Kenney, 1986).

The previous analyses demonstrate that the expectation manipulation affects both cognitive effort and decision processes, satisfying condition 1. Measures of time to choice ($r = .36$, $p < .01$), and variability in search by alternatives ($r = .22$, $p < .01$) and by attributes ($r = .22$, $p < .01$), are correlated with choice accuracy, fulfilling condition 2. The third criterion for mediation was examined by computing ANCOVAs with processing measures as covariates. Since time to choice and the variability in search measures were highly correlated, only one processing measure was used in each of three ANCOVAs. The effect of the expectation manipulation was not significant in the presence of time to choice as a covariate ($F(2,136) = 1.3$, $p = .27$). Thus, the effect of expectations on choice accuracy is fully accounted for by the differential cognitive effort expended under differing expectation conditions. The effect of the expectation manipulation is significantly weakened in the presence of information search covariates (variability in time spent per alternative ($F(2,136) = 2.5$, $p = .08$), variability in time spent per attribute ($F(2,136) = 2.7$, $p = .07$)). The impact of expectations on decision performance therefore is partially accounted for by the differences in information search under differing expectation conditions. In summary, the results indicate that expectations affected choice accuracy through the mediating influences of cognitive effort and information search.

## General Discussion

This is the first study to demonstrate that self-referent thought can affect decision processes and performance in multiattribute choice tasks. Changes in initial self-efficacy affected the decision processes of participants, which in turn, affected decision performance. Further, the results of the mediation analysis provide evidence in a new task and context that the effects of self-efficacy on performance operate primarily through the mediating influences of cognitive effort and information search. The task, and the measures of self-efficacy and decision processes used in this research differ substantially from those used in previous research. The results therefore provide important evidence on the robustness of both self-efficacy influences on decision making, and on the role of effort and strategy in mediating the relationship between self-efficacy and performance.

The results of both the pilot study and experiment indicate that in cognitively complex tasks that lack feedback, self-efficacy judgments tend towards overconfidence. In the pilot study, the initial self-efficacy judgments of participants were overconfident relative to the defined characteristics of percentile ranks. In the experiment, both initial and post-experimental measures of self-efficacy were overconfident relative to the characteristics of percentile ranks. In addition, relative to the self-efficacy of participants in the pilot study, the increase in self-efficacy of the positive expectation condition participants in the experiment exceeded the decrease in self-efficacy of the mildly negative condition participants, which suggests greater resistance to decreases than increases in self-efficacy. However, overconfidence was eliminated relative to actual performance in the mildly and strongly negative conditions of the experiment by explicitly inducing low self-efficacy compared with participants in the pilot study.

Interestingly, although overconfidence was eliminated in both the mildly and strongly negative expectation conditions, the task performance of participants in the mildly negative condition exceeded that of participants in the strongly negative condition. One problem observed in previous manipulations intended to reduce overconfidence is that reducing overconfidence can also decrease task performance (e.g., Experiment 2 in Trafimow & Sniezek, in press). The strongly negative expectations condition replicates this result. In the strongly negative expectations condition, overconfidence, task performance, and effort decreased relative to the mildly negative expectations condition. Reducing overconfidence without simultaneously reducing task performance therefore appears to be a gentle art. More specifically, performance expectations must be decreased without inducing the sometimes accompanying self-defeating belief that effort is irrelevant to performance.

The finding of overconfidence in self-efficacy judgments provides additional evidence supporting the argument that overly positive self-evaluations are relatively common in human cognition (Taylor & Brown, 1988). Interestingly however, prior to Cervone and Wood (1992), research in self-efficacy that addressed the issue had observed that self-evaluations were relatively accurate (e.g., Bandura & Adams, 1977; Bandura et al., 1980). One reason for the finding of accurate self-efficacy judgments in early self-efficacy research may be that in the few studies that examined the accuracy of self-efficacy judgments, participants were severe phobics who judged self-efficacy in phobia-relevant tasks (i.e., snake handling). It may be the case that phobics' self-efficacy judgments in phobic-related tasks are relatively accurate, while those of nonphobics (i.e., most people) often overestimate self-capability.

In the experiment reported herein, there was no significant overall change in self-efficacy between the initial and post-experimental judgments. However, perhaps if participants had received feedback on the accuracy of their judgments, at least post-experimental overconfidence would have been eliminated. Cervone and Palmer (1990) studied the effects of feedback on the efficacy judgments of participants engaged in a problem-solving exercise in which all participants received performance feedback. The experimenters provided some participants with randomly assigned performance expectations, other participants did not receive experimenter-assigned performance expectations. Initial self-efficacy judgments predicted subsequent levels of self-efficacy for participants who received randomly assigned performance expectations. However, initial and subsequent self-efficacy judgments were uncorrelated for participants who did not receive experimenter-assigned performance expectations. Participants who did not receive experimenter-assigned expectations therefore made greater use of available feedback. While Cervone and Palmer did not explicitly study the accuracy of self-efficacy judgments, one interpretation of their findings is that feedback may be useful in improving the accuracy of self-efficacy judgments, if one has little confidence in one's initial self-efficacy judgment. If low confidence in one's self-efficacy judgment is a necessary condition for learning from feedback, then effectively using feedback to gauge one's performance may require a malleable sense of self-efficacy. While researchers have argued the benefits of consistent and unchanging self-perceptions (e.g., Wood & Bandura, 1989), self-efficacy research has given less attention to the potential for rigid self-perceptions to circumvent learning (cf. Einhorn, 1980; Einhorn & Hogarth, 1978).

It may be necessary to reinterpret some previous self-efficacy research considering the issue of overconfidence. For example, Eden and Kinnar (1991) used a special training program to increase the self-efficacy of Israeli Defense Force (IDF) draftees. The manipulation was successful in increasing the rate of volunteering for IDF special forces. However, the only dependent variable in the study was a commitment to perform a future act (i.e., serving in the special forces). Without objective measures of draftee performance, it is impossible to say whether the manipulation increased the draftees' overconfidence or induced appropriate confidence. However, the robustness of overly positive self-evaluations prior to having first-hand task experience suggests the former explanation is more likely than the latter.

This research also provides evidence that expectations of benefits from an innovation can affect self-efficacy, independent of any substantive benefits from the innovation (King, 1974; Stone, 1992). In the experiment, participants' self-efficacy changed as the result of whether they expected help from computer hardware and software. The results therefore provide support for the argument that the implementation of innovations offers the opportunity to simultaneously change self-efficacy (Eden, 1990). However, participants with mildly negative expectations performed best, which suggests that expectations of benefits from an innovation that are either unrealistically high or low may hurt task performance, at least in complex cognitive tasks. Similar results appear in field research. For example, Ginzberg (1981) found that computer system users with extreme expectations (i.e., very high or very low) of system performance used a bank computer system less and were less satisfied with the system. This suggests that realistic expectations of organizational innovations may be most effective, which contrasts with prior suggestions (e.g., Eden, 1990; King, 1974) that positive expectations of organizational innovations produce the greatest productivity gains. Given the increasing reliance on information technology in work settings, the relationship between self-efficacy and organizational innovations intended to improve productivity and decision making is an important topic for future research on self-referent processes (Stone, 1992).

While self-efficacy judgments affected performance, these effects were asymmetric for positive and negative expectations. Participants who expected to perform well did not, but believed they did. Participants who expected "average" performance outperformed those who expected to perform badly. Overconfidence biases in initial self-efficacy judgments may therefore induce complacency among those who expect to do well, but motivate those who believe they must work hard to achieve superior performance. Similar results have occurred in response to manipulations of the type of feedback given to decision makers. Bandura and Jourden (1991) gave some participants engaged in a decision making task feedback that led them to believe they had easily mastered the task. Other participants received feedback that led them to believe they had mastered the task through hard work. Participants who believed they had easily mastered the task set lower goals for themselves and performed worse than participants who believed they had worked hard to achieve mastery. The authors argue that conditions which create "complacent self-assurance" provide few incentives for exerting the effort necessary for attaining high levels of achievement. A complementary explanation for the superior performance of the mildly negative condition participants in this study is that they perceived the task to be more challenging and therefore experienced "flow" conditions (Csikzentmihalyi, 1990;

Csikzentmihalyi & LeFevre, 1989) in which both skills and task demands were perceived as high. If, as Csikzentmihalyi and colleagues argue, a balance between perceived skills and challenges often produces the highest levels of involvement and performance, the presence of overconfidence in self-efficacy may mean that moderating overly positive self-evaluations with mildly negative expectations may actually improve performance under certain conditions. It may therefore also be true that, contrary to suggestions in prior research, mildly negative self-appraisals enhance performance relative to overly positive self-appraisals under certain conditions.

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## Footnotes

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[1] There is considerable variability in the methods used to assess self-efficacy (Gist & Mitchell, 1992). Some researchers argue that multiple, sequential measures should be used to measure both the strength and magnitude of self-efficacy (e.g., Locke & Latham, 1990). However, there is some evidence that multiple, sequential measures may be redundant (e.g., Wood & Locke, 1987) and may introduce systematic biases (Peake & Cervone, 1989). Other researchers have used single, well-defined measures (e.g., Cervone & Peake, 1986) or responses to a set of Likert-type scales to assess self-efficacy (e.g., Bandura, 1977; Hill, Smith, & Mann, 1987; Schunk, 1983, 1984).

[2] A cash prize was offered to increase the rate of participation. In both the pilot study and experiment, participants were (correctly) told that cash prizes would be randomly distributed and that task performance would not affect their chances of winning.

[3] There were no significant differences due to expectation condition in the search pattern ($F = 1.4$, $p = .26$) or the percentage of information searched ($F = 2.2$, $p = .11$) (See Payne, 1976 for a description of these measures).

# Table 1
## Results of Experiment
Means and Standard Deviations by Expectation Condition

| | --------- Expectation Condition --------- | | | | |
|---|---|---|---|---|---|
| | Positive (n=47) | Mildly Negative (n=45) | Strongly Negative (n=47) | *F*(2,136) | *p* |
| **Manipulation Checks** | | | | | |
| 1. Expected Accuracy Percentile Rank | 88.8[a] (9.0) | 56.3[b] (18.3) | 31.3[c] (24.7) | 115.0 | < .01 |
| 2. Expected help from hardware and software | 5.6[a] (1.3) | 3.8[b] (1.7) | 4.0[b] (1.8) | 17.2 | < .01 |
| **Performance, Effort, and Information Search** | | | | | |
| 3. Actual Accuracy Percentile Rank | 52.7 (30.1) | 56.4[a] (28.2) | 41.1[b] (26.7) | 3.7 | .03 |
| 4. Time to Choice | 111.5 (39.5) | 126.1[a] (66.3) | 87.9[b] (39.8) | 6.8 | < .01 |
| 5. Variability in Time Spent Per Alternative | 6.0 (2.8) | 7.2[a] (4.6) | 4.6[b] (2.3) | 6.8 | < .01 |
| 6. Variability in Time Spent Per Attribute | 5.8 (2.5) | 6.3[a] (3.9) | 4.7[b] (2.3) | 3.2 | .05 |
| **Post-Experimental Measures** | | | | | |
| 7. Perceived Choice Accuracy Percentile Rank | 79.5[a] (13.5) | 54.5[b] (17.2) | 32.3[c] (25.7) | 69.1 | < .01 |
| 8. Perceived Help from Hardware and Software | 4.8[a] (1.5) | 2.8[b] (1.9) | 3.2[b] (2.0) | 15.5 | < .01 |

Standard deviations are shown in parentheses.

[a, b, c] Entries within a row with different letters are significantly different according to a Tukey Honestly Significant Difference (HSD) test ($p < .05$).

## Table 2
### Results of Experiment
Number of Participants by Actual Expectations and Expectation Condition
(Positive and Mildly Negative Conditions Only)

| | -------- Expectation Condition --------- | | |
|---|---|---|---|
| | Positive | Mildly Negative | Total |
| Actual Expectations: | | | |
| Expectation > 69.6 | 45 | 11 | 56 |
| Expectation < 69.6 | 2 | 34 | 36 |
| Total | 47 | 45 | 92 |

Figure 1
Choice Display with an "Opened" Box