

## Research Article

# MENTAL SIMULATIONS, AFFECT, AND SUBJECTIVE CONFIDENCE: Timing Is Everything

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**Abstract**—Three studies demonstrated that mental simulations and affect are related to temporal changes in subjective confidence. In Study 1, students' confidence in their midterm exam performance lessened from the first day of class (3.5 weeks before the exam) to exam day, and confidence correlated negatively with upward simulations (i.e., simulations that are better than reality) and negative affect. In Study 2, manipulated upward simulations produced low confidence and negative mood even when the exam was viewed from a distance; students who were forced to think about upward simulations 1 month prior to the exam felt no more confident than did students on exam day. In Study 3, manipulated negative moods produced low confidence and more upward simulations when students anticipated laboratory tasks, and again distal and proximal confidence did not differ. Discussion centers around reciprocal relations between mental simulations and affect, and a possibly integrative account of previous explanations.

Mental simulations are a ubiquitous aspect of people's existence and have broad theoretical and practical significance. Contemplating an imminent exam in an important college course, preparing for a business meeting with a valued client, and anticipating a tennis match against a vaunted rival are but a few examples of common situations that are likely to evoke simulations of alternative possible outcomes. It is thus not surprising that mental simulations, in one form or another, have been the subject of attention across several areas of psychology. For instance, developmental psychologists have studied children's capacity to fantasize and set goals (Dweck, 1991; Mischel & Underwood, 1974), cognitive psychologists have studied people's problem solving and planning (Einhorn & Hogarth, 1986; Hayes-Roth & Hayes-Roth, 1979), and sports psychologists have focused athletes on visualizing future successes (Cote, Salmela, & Russell, 1996; Hall & Erffmeyer, 1984). Clinical psychologists may implore clients to imagine threatening situations and to work through them (Marlatt, 1978), and social-personality psychologists have studied people's envisaged conceptions of themselves (Markus & Ruvolo, 1989) and the evocation of prefactual and counterfactual thinking (Roese & Olson, 1995b; Sanna, 1996). This article reports three studies that tested the role of mental simulations and affect in producing temporal changes in subjective confidence.

### TEMPORAL CHANGES IN SUBJECTIVE CONFIDENCE

People show a decrease in subjective confidence as they get closer to the "moment of truth." For example, Nisan (1972, 1973) performed

a series of studies in which participants were told that they would be taking an aptitude test either immediately or in 4 weeks. Among other measures, participants were asked to report how confident they were that they could correctly answer a random item from the test. Participants who anticipated taking the test immediately were less confident that they could provide a correct answer than participants who anticipated taking the test in 4 weeks. Gilovich, Kerr, and Medvec (1993) also found that participants' confidence in their performances on various tasks dropped markedly with changes in temporal perspective. For example, students were less confident that they would perform well on a midterm exam on exam day than they were on the first day of class, and similar results were obtained using a variety of laboratory tasks (e.g., memory tasks). Shepperd, Ouellette, and Fernandez (1996) reported analogous findings that students were more confident in how successful they would be on an exam when asked to provide estimates 1 month before the exam than when the exam was more proximal; in another study, college seniors were more conservative than sophomores and juniors when estimating their likely first-job salaries, presumably because the prospect of actually looking for a job was more immediate for seniors. In each case, people were demonstrably more confident when performances were viewed from a distance, but became less confident when proximity to performances increased.

### RECIPROCAL INFLUENCES BETWEEN MENTAL SIMULATIONS AND AFFECT

The present studies tested an account of changes in confidence that is based on the reciprocal relationships between mental simulations and affect (Sanna, 1998; Sanna, Meier, & Turley-Ames, 1998; Sanna, Turley-Ames, & Meier, 1999). Research on one type of simulation, counterfactual thoughts of "what might have been," has shown that affective reactions diverge depending on the direction of simulation (Markman, Gavanski, Sherman, & McMullen, 1993; Roese, 1994; Sanna, 1996). By way of a contrast mechanism (Schwarz & Bless, 1992), upward counterfactuals, simulations that are better than reality (e.g., "If only I had practiced harder, I might have made the basketball team") elicit bad moods, whereas downward counterfactuals, simulations that are worse than reality (e.g., "At least I wore my seatbelt, or I could have been more seriously injured") elicit good moods. However, via an analogous contrast mechanism, moods can also serve as antecedents to the direction of counterfactual thoughts; in the absence of other moderating variables, upward counterfactuals are elicited in bad moods, whereas downward counterfactuals are elicited in good moods (Sanna et al., 1998, 1999). Prefactual simulations (Sanna, 1998), thoughts of "what may be," can be similarly influenced; bad moods induce imagined future alternatives that are better than what is thought may actually transpire (e.g., "If only I had more study time, I could do better on tomorrow's exam"), whereas good moods induce imagined future alternatives that are worse than

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expected (e.g., "At least I bought the study guide, or my grade on tomorrow's exam might be worse").

In sum, just as research has shown that the direction of counterfactual mental simulation can influence moods, moods can also influence mental simulations (prefactuals and counterfactuals). These findings suggest a reciprocal relation between mood and mental simulations.

## PRESENT RESEARCH

That mental simulations and affect can have reciprocal influences has especially intriguing implications for understanding temporal changes in confidence. People are more confident in success when they view a performance or impending outcome from a distal perspective than when they view it from a more proximal perspective (Gilovich et al., 1993; Nisan, 1972, 1973; Savitsky, Medvec, Charlton, & Gilovich, 1998; Shepperd et al., 1996). There may be several reasons for this. First, upward simulations may increase as a performance gets proximal. Upward simulations are preparative (e.g., Markman et al., 1993), and as a performance gets closer, people would likely have more preparative thoughts. More precisely, a person may think more about everything that still requires doing, as well as things that may never get completed, as performance approaches. In either case, these thoughts about better realities may result in decreased confidence. Second, decreased confidence may result from increased negative mood or anxiety. As performances approach, people may try to buffer themselves from failure (Shepperd et al., 1996); because upward simulations allow one to think, "I knew it all along," they may increase under these circumstances (Sanna, 1996). Negative affect may result from the upward simulations (e.g., Sanna, 1996) or from anxiety over "gearing up" to perform (Savitsky et al., 1998). However, bad moods may cue upward simulations or vice versa (Sanna et al., 1998, 1999). In short, either increases in upward simulations, increases in negative affect and anxiety, or both (given the reciprocal relations between these two variables) may be responsible for temporal changes in subjective confidence.

## STUDY 1

The first study tested whether mental simulations and affect can influence temporal changes in confidence. Students estimated their midterm exam scores once on the first day of class and once on the day of the exam (Gilovich et al., 1993; Shepperd et al., 1996). It was predicted that confidence would decrease, and upward simulations and negative affect would increase, on exam day in comparison with the first day of class.

### Method

#### Participants

Participants were 36 students enrolled in an introductory psychology course. They received extra credit.<sup>1</sup>

1. There were 43 students enrolled in the course in which Study 1 was conducted, so almost the full class participated, and results are unlikely to be due to any differential attrition or participant variables. Four students did not take the exam on the day it was given because of illnesses, and 1 student simply was never further accounted for and could not be contacted. Only 2 students took the exam on the day it was given but decided not to take advantage of the extra-credit opportunity.

### Procedure

Ratings were completed on the first day of class (3.5 weeks before the exam) and on exam day (but before the exam was taken). Study 1 was run during the summer, when daily class sessions were 1 hr and 45 min long. Because the exam itself was projected to take only 50 to 60 min, students arrived at the beginning of class to complete exam-day measures, which left them plenty of time to finish the exam during the class session.<sup>2</sup>

**Confidence.** Students were told that their exam would be worth 100 points, and that traditional cutoffs would be used (e.g., 90% and above for an A). After the grading procedure was discussed, they provided numerical estimates (see Shepperd et al., 1996) of how well they thought they would do on the exam.

**Affect.** Students indicated the extent to which a series of positive and negative adjectives reflected how they felt about their forthcoming performance (cf. Sanna, 1997, 1998; Sanna et al., 1999). Positive adjectives were *happy*, *satisfied*, *pleased*, *delighted*, and *good*; negative adjectives were *gloomy*, *depressed*, *anxious*, *nervous*, and *bad*. Each adjective was rated on a 9-point scale anchored by 1 (*not at all*) and 9 (*very much*).

**Mental simulations.** Mental simulations were solicited in a manner used successfully in prior research (Sanna, 1996, 1998); an open-ended format allowed students to write about any antecedents or consequences that they could think of and to record as many mental simulations as they desired. After reading a description of "if only" and "at least" thoughts, students listed alternatives that were better or worse than they expected would actually happen and that might affect their performance. Students themselves coded simulation direction by marking a plus sign beside statements that described things that were better (upward) and a minus sign beside statements that were worse (downward) than what they expected would actually happen (Sanna, 1996, 1998; see also Roese & Olson, 1995a; Sanna & Turley, 1996).

Confidence, affect, and mental-simulation measures were presented in a randomly predetermined order for each student, and were interspersed among some filler items. During a later class, students were debriefed about the study's purpose, hypotheses, and findings, which they appeared to enjoy discussing.

## Results and Discussion

### Confidence

As predicted, students' confidence when estimating exam scores was reduced on exam day ( $M = 74.58$ ) in comparison with the first day of class ( $M = 79.36$ ), paired  $t(35) = 5.78$ ,  $p < .01$ .<sup>3</sup>

2. The students were told that they had as long as they wanted to finish the exam, even if they took beyond the scheduled class time. However, all students easily completed the exam and the measures within the regularly scheduled class time.

3. Participants' sex was included as an additional variable in supplementary analyses for each of the measures used in Study 1. Because participants' sex did not qualify any of the findings, it is not discussed in this article. The same was true for Studies 2 and 3.

### Affect

Positive-mood adjectives were reverse-scored, and the resulting scores were averaged with those of the negative-mood adjectives (Cronbach's  $\alpha = .86$ ). Also as predicted, students' feelings about their performances were worse on exam day ( $M = 6.88$ ) than on the first day of class ( $M = 5.11$ ), paired  $t(35) = 4.17, p < .01$ .<sup>4</sup>

### Mental simulations

As predicted, the number of upward mental simulations increased on exam day ( $M = 3.92$ ) in comparison with the first day of class ( $M = 2.38$ ), paired  $t(35) = 8.27, p < .01$ . In addition, the number of downward simulations exhibited a reverse pattern, decreasing from the first day of class ( $M = 1.30$ ) to the exam day ( $M = 0.86$ ), paired  $t(35) = 2.41, p < .03$ .

### Correlational analyses

Is confidence related to upward simulations and affect? Correlations are presented in Table 1. As predicted, on exam day, confidence was related to affect and upward simulations; as moods became worse and as there were more upward simulations, confidence decreased. Also, worse moods were associated with more upward simulations on exam day. A similar pattern emerged for the first day of class, although results were only marginal or approached significance.<sup>5</sup> Downward simulations were not significantly associated with confidence or affect at either time point.

### Discussion

Study 1 provides evidence that upward simulations and negative affect may increase as one gets closer to performance. These increases mirror the tendency toward decreased confidence as a performance draws near. Using students' real-life exams as the performance in question provided a degree of realism. Upward simulations and negative affect were also associated with decreased confidence, and these relationships were particularly strong on exam day. However, the usual admonitions about not inferring causality from any correlational data apply to these latter findings. Studies 2 and 3 were designed to provide

4. Analyses of an average of just the *anxious* and *nervous* variables (cf. Savitsky et al., 1998) produced an identical pattern of results. Given that the results are equivalent, only the 10-item mood measure is reported because it corresponds better to the measure used in research on which the present hypotheses are based (e.g., Sanna, 1998; Sanna et al., 1998, 1999), and because it likely has greater reliability than a 2-item measure. Similar analysis strategies were used in Studies 2 and 3.

5. Additional partial correlations were calculated for relationships among the three variables of upward mental simulations, affect, and confidence. Downward simulations were not analyzed in this way because they were not significantly associated with confidence. On exam day, the relationship between upward simulations and confidence remained significant when controlling for affect,  $r(34) = -.417, p = .013$ , but the relationship between affect and confidence was no longer significant when controlling for upward simulations,  $r(34) = -.251, p = .155$ . Although these results are only suggestive given the correlational nature of Study 1, upward simulations may be a stronger predictor of confidence than negative affect. Of course, the relationships between these variables 3.5 weeks before the exam were only marginal or approached significance, so no such analysis could be conducted appropriately for that time point. In any case, the present proposal explicitly predicts a bidirectional relationship between upward simulations and affect, so either could predict confidence, which was the focus of Studies 2 and 3.

**Table 1.** Correlations between variables in Study 1

Variables	3.5 weeks prior to exam		Exam day	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Affect-confidence	-.263	.120	-.367	.027
UMS-confidence	-.281	.097	-.487	.003
DMS-confidence	.261	.124	.030	.861
Affect-UMS	.314	.062	.329	.050
Affect-DMS	.077	.652	-.106	.499

Note. UMS = upward mental simulations; DMS = downward mental simulations.

more experimental data for the proposition that there is a bidirectional relationship between upward simulations and affect, and that either or both can influence decreases in confidence.

## STUDY 2

Mental simulations were manipulated directly in Study 2. If upward simulations decrease confidence, then forcing people to consider such thoughts should lead to low confidence, even when tasks are viewed from a distant time point.

### Method

#### Participants

Participants were 73 introductory psychology students who received extra credit in their course.

#### Procedure

Four conditions were used. Two were similar to Study 1: In the *distal-control* condition, students provided ratings 1 month before the exam, and in the *proximal* condition, they provided ratings on exam day but before the exam. However, unlike Study 1, Study 2 used a between-subjects design.

Two other distal conditions were also used; students in these conditions made distal ratings 1 month before the exam, as did students in the control condition. However, unlike in the control condition, these students were instructed to consider statements of mental simulations. In the *distal-upward* condition, a series of 10 statements described thoughts about alternatives better than what might be expected (e.g., "If only I was more prepared to take the midterm exam, I would score higher"; "There are a number of people who will do better than me on the midterm exam"). These statements were designed to lead students through the types of thoughts that may occur typically as a performance approaches. Similar statements have been used to manipulate preperformance thoughts in prior research (see Sanna, 1996). The statements were patterned after those provided by participants in earlier research (Sanna, 1997; Sanna & Turley, 1996) and by students in Study 1. Although downward simulations were unrelated to confidence in Study 1, a *distal-downward* condition was included in Study 2 for exploratory purposes. Students in this condition considered 10 statements that were parallel to those for upward simulations, but described alternatives that were worse than what might be expected.

Mental Simulations and Confidence

Each statement was presented on a separate page, and students were asked to think about each statement for 30 s; it was suggested that they repeat each statement over in their heads before moving on to the next one (Sanna, 1996).

Confidence and affect measures were identical to the measures used in Study 1. Students arrived at the laboratory in groups of 5 to 8 to make distal ratings.

**Results and Discussion**

*Confidence*

A one-way analysis of variance (ANOVA) revealed a significant effect of condition on confidence estimates,  $F(3, 69) = 7.22, p < .01$  (see Table 2). As expected, planned contrasts (Rosenthal & Rosnow, 1985) indicated that students in the proximal condition were less confident than those in the distal-control condition,  $t(69) = 3.12, p < .01$ . Most important, the primary prediction was confirmed: Students who were in a distal condition but first thought about upward simulations did not feel more confident than students in the proximal condition,  $t(69) = 0.74, p = .48$ .

Students in the distal-upward condition also felt less confident than distal-control and distal-downward students,  $t_s(69) > 2.34, p_s < .03$ . Confidence estimates were higher for distal-downward than proximal students,  $t(69) = 3.99, p < .01$ , but not distal-control students,  $t(69) = 0.97, p = .34$ .

*Affect*

The positive adjectives were reverse-scored and averaged with the scores for the negative adjectives (Cronbach's  $\alpha = .83$ ). A one-way ANOVA revealed a condition effect,  $F(3, 69) = 5.09, p < .01$  (see Table 2). Proximal students felt worse than distal-control students,  $t(69) = 2.14, p < .05$ . Distal-upward students felt just as bad as proximal students,  $t(69) = 0.12, p = .79$ .

Distal-upward students also felt worse than students in the other two distal conditions,  $t_s(69) > 2.24, p_s < .04$ . Distal-downward students felt better than proximal students,  $t(69) = 3.13, p < .01$ , but did not feel better than distal-control students,  $t(69) = 1.04, p = .31$ .

*Discussion*

Study 2 provides further evidence that upward simulations may influence confidence and affect—in this case, when those simulations were manipulated directly. In contrast to findings in previous research (Gilovich et al., 1993; Shepperd et al., 1996), even students in a distal condition had low confidence—that is, as long as they first considered upward simulations. Study 2 provides more experimental

evidence that upward simulations may produce temporal changes in confidence.

**STUDY 3**

If manipulated upward simulations can change confidence, can manipulated mood do so as well? Such a prediction follows from the proposal that mental simulations and affect can reciprocally influence each other (Sanna, 1998; Sanna et al., 1998, 1999). This possibility was tested in Study 3. It was predicted that, just as upward simulations increase negative affect, manipulated negative affect can influence upward simulations and confidence. Because downward simulations were unrelated to confidence in the first two studies, negative mood was the target of manipulation. The design of Study 3 was a 2 (mood: control vs. negative)  $\times$  2 (time: immediate vs. delayed) between-subjects factorial. The prediction was that participants in negative moods would generate more upward simulations and feel less confident than participants whose moods were not manipulated, even when performance was delayed. A new performance setting and more spontaneous measures of mental simulations were used in Study 3, to increase the generality of the research.

**Method**

*Participants*

Participants were 60 introductory psychology students who received extra credit.

*Procedure*

Participants arrived at the laboratory and were tested individually.

*Mood induction.* Negative moods were induced by having participants watch and rate a series of three films. Participants in this condition watched sad clips from *Gallipoli* and *Sophie's Choice*; these clips were preceded by a neutral car-chase scene from *Bullit*. The three clips lasted about 20 min. After each clip, participants responded to a series of surveys titled "Pilot Movie Ratings," which asked for routine ratings of the film (e.g., whether the students had seen the movie before; see Sanna, Turley, & Mark, 1996). These procedures have effectively induced moods in previous research (Martin, Ward, Achee, & Wyer, 1993; Sanna, 1998; Sanna et al., 1996, 1998). No film clips were shown in the control-mood condition. As a manipulation check, all participants responded to the mood adjectives used in the first two studies.

**Table 2.** Mean confidence and affect by condition in Study 2

Variable	Proximal condition	Distal condition		
		Control	Upward mental simulations	Downward mental simulations
Confidence	75.41	82.11	77.01	84.26
Affect	6.40	4.89	6.49	4.13

**Tasks.** Participants predicted their performances on a pair of tasks (Gilovich et al., 1993; Savitsky et al., 1998). The first task was described as a memory task, in which participants would be shown a series of 30 nonsense syllables for 5 s each and, after a 2-min retention interval, would be asked to recall as many as they could. The second task was an anagram task; participants would be given 6 min to unscramble as many of 30 anagrams as they could. In the *immediate* condition, participants were told that they would perform the tasks during the current experimental session. In the *delayed* condition, participants were told that preliminary thoughts about the tasks were being collected now, but that they would actually perform the tasks later during that semester (Gilovich et al., 1993).

**Confidence.** Participants estimated their confidence for each task by predicting their percentile standing among all students who performed the tasks (9-point scale anchored by 10% and 90%), and by estimating their performance on a 9-point scale anchored by *very poorly* and *very well*.

**Mental simulations.** Unlike in the previous two studies, participants did not read descriptions of “if only” or “at least” thoughts and were not explicitly prompted for simulations. Instead, participants were asked merely to write about their projected performances; these descriptions were recorded and later coded for spontaneous simulations. Similar techniques have been used successfully in previous research (Sanna, 1998; Sanna & Turley, 1996; Sanna et al., 1998).

## Results and Discussion

### Affect

A  $2 \times 2$  ANOVA on averaged (Cronbach's  $\alpha = .78$ ) affect revealed main effects for mood,  $F(1, 56) = 3.46, p = .061$ , and time,  $F(1, 56) = 8.57, p < .01$ , and a two-way interaction,  $F(1, 56) = 4.17, p < .05$  (see Table 3). More specifically, a focused contrast (Rosenthal & Rosnow, 1985) indicated that the control-mood, delayed condition differed from the other three conditions,  $t(56) = 3.94, p < .01$ , but the other three conditions did not differ from each other.

### Confidence

The two confidence questions were averaged ( $r[58] = .687, p < .01$ ), and scale scores were used for analyses (they were both 9-point scales). An ANOVA revealed main effects for mood,  $F(1, 56) = 12.10, p < .01$ , and time,  $F(1, 56) = 14.04, p < .01$ , and a two-way interaction,  $F(1, 56) = 4.58, p = .037$  (see Table 3).<sup>6</sup> Once again, a focused contrast indicated that the control-mood, delayed condition differed from the other three conditions,  $t(56) = 4.38, p < .01$ , which did not differ from each other.

### Upward simulations

Two judges, each unaware of the hypotheses, coded the number of upward simulations (e.g., Sanna, 1998; Sanna & Turley, 1996), with

6. Separate analyses of the memory and anagram tasks revealed identical patterns of results. Therefore, averages of the confidence ratings for the two tasks were used in the analyses reported, to avoid redundancies and for simplicity of exposition. The same was true for the upward-simulation measure, so an analogous procedure was employed.

**Table 3.** Mean affect, confidence, and number of upward simulations in Study 3

Mood condition	Time condition	
	Immediate	Delayed
Control		
Affect	7.13	5.26
Confidence	6.46	7.93
UMS	1.80	0.53
Negative		
Affect	7.06	6.73
Confidence	6.13	6.52
UMS	1.86	1.65

Note. UMS = upward mental simulations.

high reliability (interrater  $r[58] = .87, p < .01$ ). An ANOVA revealed main effects for mood,  $F(1, 56) = 5.11, p < .03$ , and time,  $F(1, 56) = 7.63, p < .01$ , and an interaction,  $F(1, 56) = 4.04, p < .05$  (see Table 3). A focused contrast indicated that the control-mood, delayed condition differed from all other conditions,  $t(56) = 4.06, p < .01$ , but there were no other differences.

### Discussion

Study 3 indicates that manipulated negative mood can result in decreased confidence and increased upward simulations, even when performances are delayed. When mood was unmanipulated, the usual lower confidence was observed when performances were immediate. A different context than Studies 1 and 2, and a more spontaneous measure of mental simulations, was employed. Manipulated negative moods did not change confidence in immediate performance or simulations, compared with when moods were unmanipulated. Perhaps this result indicates some limits on effects of manipulated mood.

## GENERAL DISCUSSION

### Mental Simulations and Explanations for Changes in Confidence

Like most psychological phenomena, temporal changes in subjective confidence are likely multiply determined. However, the present research, based on the reciprocal relations between mental simulations and affect, may begin to allow some previous hypotheses to be integrated. A number of explanations for changes in confidence have been suggested (see Gilovich et al., 1993; Shepperd et al., 1996). One candidate is that people are overly optimistic (cf. Buehler, Griffin, & Ross, 1994) in the amount of preparation they will accomplish during the intervening time. For example, at a distance, a student who anticipates an exam may plan to complete all of the readings and required assignments, scrupulously inspect the study guide, and so forth. At the time of the exam, however, many of these plans are likely to remain unrealized. The present research suggests that as performance approaches, people increase preparative upward thoughts. If plans go unrealized, upward simulations may increase even further; people imagine better alternatives because of their “best laid plans” remaining unfulfilled.

A second possible explanation is that people may try to buffer themselves from potential negative outcomes (Shepperd et al., 1996); upward simulations also do this by allowing one to think, "I knew it all along" (Sanna, 1996). That is, if failure does occur, a person has already preemptively braced himself or herself for the worst. A third possibility is that people may feel more accountable (e.g., Tetlock, 1992) when a task is proximal (e.g., facing up to actual abilities is now close at hand) than when it is distal. This may magnify attempts to brace for failure or make accessible negative thoughts in general (Gilovich et al., 1993) or upward mental simulations in particular. In each case, thoughts about better realities may result in decreased confidence.

Temporal changes in confidence appear consistent with another possible explanation, defensive pessimism (e.g., Norem & Cantor, 1986). Defensive pessimists use a strategy of adopting a negative outlook and low expectations when entering performance situations. This strategy impels them to high achievements through increased efforts to avoid imagined negative outcomes. Thus, the decreased confidence of defensive pessimists may come into play. In addition, a series of studies (Sanna, 1996, 1998) has shown that defensive pessimists' strategy involves upward (prefactual) simulations and negative moods and anxiety, a pattern consistent with the present proposals. It is unlikely that defensive pessimism alone can explain temporal changes in confidence (Gilovich et al., 1993; Shepperd et al., 1996), as defensive pessimists may account for only about 5% of most college populations. However, an analogous relationship between upward simulations and negative affect appears to be involved in temporal changes in confidence. Other individual differences, such as self-esteem, may be relevant. For example, Shepperd et al. (1996) found that individuals with low self-esteem, who may be more self-protective, lowered their performance estimates more readily than individuals with high self-esteem. Perhaps individuals with low self-esteem are more concerned with self-protection before performing (Shepperd et al., 1996), but individuals with high self-esteem are more concerned with self-enhancement after performing (Sanna et al., 1998, 1999), and mental simulations can be used in the service of both motives.

But beyond preparative thoughts, thoughts of the unaccomplished, buffering for possible failure, or individual differences, there may be additional factors that explain changes in confidence. It is here, in particular, that the reciprocal influences between mental simulations and affect may hold the key. Moods may serve as information to mental simulations (Sanna, 1998; Sanna et al., 1998, 1999). In particular, the feelings-as-information view (Schwarz, 1990; Schwarz & Clore, 1988) proposes that people ask, "How do I feel about it?" when making judgments. People in negative moods may construe current life circumstances as bad, whereas those in positive moods may construe life circumstances as good. Alternatives to poor circumstances, of course, are good alternatives, or upward simulations. Negative affect may inform people of a problem that needs to be dealt with. Upward simulations may be one cognitive response that is mobilized in reaction to such situations (Roese & Olson, 1997). Direct evidence that moods serve as information comes from research in which moods did not influence mental simulations when those moods could be externally attributed (Sanna et al., 1998). A similar misattribution (e.g., Schwarz & Clore, 1983) paradigm was used by Savitsky et al. (1998). These researchers argued that people use anxiety that is part of gearing up to perform as a cue to their confidence level; people infer they are not confident because they are anxious. However, such an effect does not occur if anxiety is externally attributed (Savitsky et al., 1998). The

feelings-as-information account may also explain why confidence can be reduced even when there is little chance for preparation or when the confidence judgments are made retrospectively (Gilovich et al., 1993): Any time there is negative affect or anxiety, for whatever reason, confidence may be decreased.

### Conclusion: Looking Ahead . . . And Back

Temporal changes in confidence are likely multiply determined, as are phenomena in most areas of psychology, and many of the proposals offered in the General Discussion also are admittedly post hoc. However, it is still possible to try to integrate existing findings and to fit the findings of the present research into broader context. It is up to future research, of course, to test these possibilities further.

An account based on the reciprocal influences between mental simulations and affect (Sanna, 1998; Sanna et al., 1998, 1999) may hold much promise. The present studies applied these notions to an area of research that is different from, but arguably related to, the area in which they were developed. Confidence changes correlated naturally with mental simulations and affect; confidence changes also occurred when mental simulations were manipulated, and when moods were manipulated. Thus, either increases in upward simulations, increases in negative affect and anxiety, or both (given the reciprocal relations between simulations and affect) may be responsible for temporal changes in confidence. Even though mental simulations and affect may be reciprocally related, however, it may be premature to discount the possibility that either alone may be the predominant driving force behind temporal changes in confidence. Nevertheless, perhaps even further integration is possible given the interdisciplinary interest in mental simulations. For example, the relation of the present results to various coping strategies (Taylor & Schneider, 1989) or to other imaginal processes (Koehler, 1991) might be particularly intriguing. Applying what is known about mental simulations and affect may further an understanding of temporal changes in confidence, but also, relating changes in confidence to mental simulations and affect may in turn lead to a greater understanding of these variables.

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### REFERENCES

- Buehler, R., Griffin, D., & Ross, L. (1994). Exploring the "planning fallacy": Why people underestimate their task completion times. *Journal of Personality and Social Psychology*, *67*, 366-381.
- Cote, J., Salmela, J.H., & Russell, S. (1996). The knowledge of high-performance gymnastic coaches: Competition and training considerations. *Sport Psychologist*, *9*, 76-95.
- Dweck, C.S. (1991). Self-theories and goals: Their role in motivation, personality, and development. In R. Dienstbier (Ed.), *Nebraska Symposium on Motivation: Vol. 38. Perspectives on motivation* (pp. 199-255). Lincoln: University of Nebraska Press.
- Einhorn, H.J., & Hogarth, R.M. (1986). Ambiguity and uncertainty in probabilistic inference. *Psychological Review*, *92*, 433-461.
- Gilovich, T., Kerr, M., & Medvec, V.H. (1993). Effect of temporal perspective on subjective confidence. *Journal of Personality and Social Psychology*, *64*, 552-560.
- Hall, E.G., & Erffmeyer, E.S. (1984). The effect of visuo-motor behavior rehearsal with videotaped modeling on free throw accuracy of intercollegiate female basketball players. *Journal of Sport Psychology*, *5*, 343-346.
- Hayes-Roth, B., & Hayes-Roth, F. (1979). A cognitive model of planning. *Cognitive Science*, *3*, 275-310.

- Koehler, D.J. (1991). Explanation, imagination, and confidence in judgment. *Psychological Bulletin*, *110*, 499–519.
- Markman, K.D., Gavanski, I., Sherman, S.J., & McMullen, M.N. (1993). The mental simulation of better and worse possible worlds. *Journal of Experimental Social Psychology*, *29*, 87–109.
- Markus, H., & Ruvolo, A. (1989). Possible selves: Personalized representations of goals. In L.A. Pervin (Ed.), *Goal concepts in personality and social psychology* (pp. 211–241). Hillsdale, NJ: Erlbaum.
- Marlatt, G.A. (1978). Craving for alcohol, loss of control, and relapse: A cognitive-behavioral analysis. In P.E. Nathan, G.A. Marlatt, & T. Loberg (Eds.), *Alcoholism: New directions in behavioral research and treatment* (pp. 271–314). New York: Plenum Press.
- Martin, L.L., Ward, W., Achee, J.W., & Wyer, R.S. (1993). Mood as input: People have to interpret the motivational implications of their moods. *Journal of Personality and Social Psychology*, *64*, 317–326.
- Mischel, W., & Underwood, B. (1974). Instrumental ideation and delay of gratification. *Child Development*, *45*, 1083–1088.
- Nisan, M. (1972). Dimension of time in relation to choice behavior and achievement orientation. *Journal of Personality and Social Psychology*, *21*, 175–182.
- Nisan, M. (1973). Perception of time in lower-class black students. *International Journal of Psychology*, *8*, 109–116.
- Norem, J.K., & Cantor, N. (1986). Defensive pessimism: Harnessing anxiety as motivation. *Journal of Personality and Social Psychology*, *51*, 1208–1217.
- Roese, N.J. (1994). The functional basis of counterfactual thinking. *Journal of Personality and Social Psychology*, *66*, 805–818.
- Roese, N.J., & Olson, J.M. (1995a). Outcome controllability and counterfactual thinking. *Personality and Social Psychology Bulletin*, *21*, 620–628.
- Roese, N.J., & Olson, J.M. (Eds.). (1995b). *What might have been: The social psychology of counterfactual thinking*. Mahwah, NJ: Erlbaum.
- Roese, N.J., & Olson, J.M. (1997). Counterfactual thinking: The intersection of affect and function. In M.P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 29, pp. 1–59). San Diego: Academic Press.
- Rosenthal, R., & Rosnow, R.L. (1985). *Contrast analysis: Focused comparisons in the analysis of variance*. New York: Cambridge University Press.
- Sanna, L.J. (1996). Defensive pessimism, optimism, and simulating alternatives: Some ups and downs of prefactual and counterfactual thinking. *Journal of Personality and Social Psychology*, *71*, 1020–1036.
- Sanna, L.J. (1997). Self-efficacy and counterfactual thinking: Up a creek with and without a paddle. *Personality and Social Psychology Bulletin*, *23*, 654–666.
- Sanna, L.J. (1998). Defensive pessimism and optimism: The bitter-sweet influence of mood on performance and prefactual and counterfactual thinking. *Cognition and Emotion*, *12*, 635–665.
- Sanna, L.J., Meier, S., & Turley-Ames, K.J. (1998). Mood, self-esteem, and counterfactuals: Externally attributed moods limit self-enhancement strategies. *Social Cognition*, *16*, 267–286.
- Sanna, L.J., & Turley, K.J. (1996). Antecedents to spontaneous counterfactual thinking: Effects of expectancy violation and outcome valence. *Personality and Social Psychology Bulletin*, *22*, 906–919.
- Sanna, L.J., Turley, K.J., & Mark, M.M. (1996). Expected evaluation, goals, and performance: Mood as input. *Personality and Social Psychology Bulletin*, *22*, 323–335.
- Sanna, L.J., Turley-Ames, K.J., & Meier, S. (1999). Mood, self-esteem, and simulated alternatives: Thought-provoking affective influences on counterfactual direction. *Journal of Personality and Social Psychology*, *76*, 543–558.
- Savitsky, K., Medvec, V.H., Charlton, A.E., & Gilovich, T. (1998). What, me worry?: Arousal, misattribution, and the effect of temporal distance on confidence. *Personality and Social Psychology Bulletin*, *24*, 529–536.
- Schwarz, N. (1990). Feelings as information: Informational and motivational functions of affective states. In E.T. Higgins & R.M. Sorrentino (Eds.), *Handbook of motivation and cognition: Vol. 2. Foundations of social behavior* (pp. 527–561). New York: Guilford Press.
- Schwarz, N., & Bless, H. (1992). Constructing reality and its alternatives: An inclusion/exclusion model of assimilation and contrast in social judgment. In L.L. Martin & A. Tesser (Eds.), *The construction of social judgments* (pp. 217–245). Hillsdale, NJ: Erlbaum.
- Schwarz, N., & Clore, G.L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology*, *45*, 513–523.
- Schwarz, N., & Clore, G.L. (1988). How do I feel about it? Informative functions of affective states. In K. Fiedler & J. Forgas (Eds.), *Affect, cognition, and social behavior* (pp. 44–62). Toronto: Hogrefe.
- Shepperd, J.A., Ouellette, J.A., & Fernandez, J.K. (1996). Abandoning unrealistic optimism: Performance estimates and the temporal proximity of self-relevant feedback. *Journal of Personality and Social Psychology*, *70*, 844–855.
- Taylor, S.E., & Schneider, S.K. (1989). Coping and the simulation of events. *Social Cognition*, *7*, 174–194.
- Tetlock, P.E. (1992). The impact of accountability on judgment and choice: Toward a social contingency model. In M.P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 25, pp. 331–376). New York: Academic Press.

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