Research Article

Integrating Temporal Biases

The Interplay of Focal Thoughts and Accessibility Experiences

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ABSTRACT—*We provide an integrative account of temporal biases (confidence changes, planning fallacy, impact bias, and hindsight bias). Students listed either 3 or 12 thoughts about success or failure before an upcoming real-life exam or immediately after learning their grades. Previous explanations had focused on how thought content alone (what comes to mind) influences temporal biases. We found, however, an interaction between thought content and accessibility experiences (how easily or difficultly thoughts come to mind). Thinking about 3 ways to succeed (success was easy to bring to mind) was equivalent to thinking about 12 ways to fail (failure was difficult to bring to mind), and conversely, thinking about 3 ways to fail was equivalent to thinking about 12 ways to succeed. In no case was thought content alone sufficient to predict the biases. These results have implications for debiasing strategies and other judgments over time.*

> Time flies over us, but leaves its shadow behind.
>
> —Hawthorne (1859/1990, p. 218)

Time pervades every aspect of people's lives, and people frequently make judgments about possible futures and alternate pasts: What will happen when Harry meets Sally? Should I bet on the Yankees to win yet again? Was that campaign failure predictable? Such judgments have received attention in diverse areas of psychology (see Karniol & Ross, 1996, for a review). There are reliable *temporal biases* in judgments over time. People become less confident as the time of performance approaches (*confidence changes*), are overly optimistic in estimating when a task will be completed (*planning fallacy*), overestimate their emotional reactions to events (*impact bias*), and view the past as inevitable (*hindsight bias*). These temporal biases have been studied independently, in separate literatures. In this article, we propose an integrative account of them by highlighting common mechanisms, emphasizing the interplay of thoughts about focal and alternative events and the ease or difficulty with which such thoughts come to mind. This interaction drives the emergence of these biases, as well as debiasing.

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TEMPORAL BIASES

Figure 1 illustrates the time course of the four temporal biases that are our focus here.

Confidence Changes

People are less confident in success when events draw near than they are at a more distant time. For example, participants taking an immediate test were less confident than those taking a test in 4 weeks (Nisan, 1972; see also Gilovich, Kerr, & Medvec, 1993). Similarly, college seniors were more muted in estimating their first-job salaries than were sophomores and juniors (Shepperd, Ouellette, & Fernandez, 1996; see also Shepperd, Findley-Klein, Kwavnick, Walker, & Perez, 2000). In each case, confidence was reduced when proximity to performance outcomes was more immediate.

Planning Fallacy

People predict that task completion will need less time than actually turns out to be the case. This underestimation of task-completion time (Buehler, Griffin, & Ross, 1994; Kahneman & Tversky, 1979) has been observed for diverse tasks ranging from household chores to school assignments. Incentives worsen the planning fallacy; for example, people expecting tax refunds or other monetary rewards for speedy completion were more optimistic than people who were not expecting refunds or rewards (Buehler, Griffin, & MacDonald, 1997; Buehler et al., 1994).

Impact Bias

People predict that emotional reactions to events will be more intense than actually turns out to be the case (Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998). For example, in one study, voters thought they would be happier after their preferred candidates won rather than lost, and students thought they would be sadder after their preferred teams lost rather than won, yet no differences in happiness between supporters of winners and losers were observed when they were asked after the outcomes were known (Wilson, Wheatley, Meyers, Gilbert, &

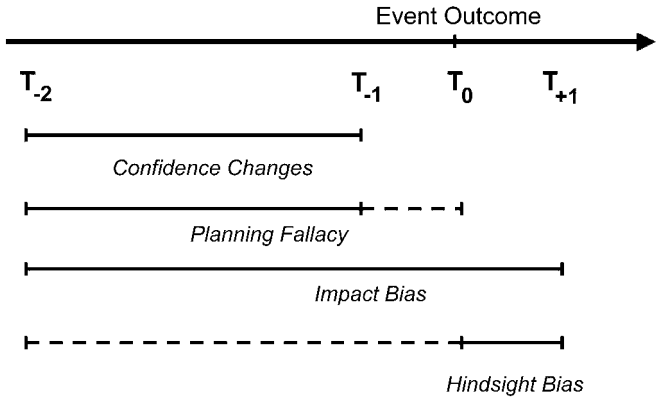

Fig. 1. Timing of measures that demonstrate temporal biases. T_0 indicates the real or expected occurrence of an event; T_{-2} and T_{-1} precede the event; T_{+1} follows the event. The dashed lines indicate that the planning fallacy can be assessed by comparing T_{-2} with T_{-1} or T_0, and that the hindsight bias can be assessed by comparing T_{+1} with T_0 or T_{-2}.

Axom, 2000). Overestimating future emotional impact is one of the most prevalent biases in affective forecasting (Wilson & Gilbert, 2003).

Hindsight Bias

Once event outcomes are known, people believe they "knew all along" what would happen, even though their preevent predictions indicate otherwise (Christensen-Szalanski & Willham, 1991; Fischhoff, 1975). This hindsight bias has been documented in varied domains, including political events, medical diagnoses, and labor disputes (see Hawkins & Hastie, 1990, for a review). Moreover, the past may be viewed as particularly inevitable after successes compared with failures (Louie, 1999; Mark & Mellor, 1991).

ACCESSIBILITY EXPERIENCES AND FOCAL OR ALTERNATIVE EVENTS

Previous theoretical accounts of temporal biases focused solely on what people think about, assigning a key role to thoughts about focal and alternative events. However, an emphasis on thought content alone—*accessible content*—misses the critical role of people's *accessibility experiences*—how easily or difficultly thoughts come to mind (for reviews, see Schwarz, 1998, and Schwarz & Vaughn, 2002). For example, in one study, participants who recalled 6 assertive behaviors (easy to bring them to mind) judged themselves as more assertive than participants who recalled 12 assertive behaviors (difficult to bring them to mind), even though the latter group thought of twice as many examples (Schwarz et al., 1991). These results are consistent with Tversky and Kahneman's (1973) availability heuristic in that participants concluded from the difficulty of bringing 12 examples to mind that they did not behave assertively very often.

We propose that the interaction of thought content and accessibility experiences renders generating many success (failure) thoughts functionally equivalent to generating few failure (success) thoughts. That is, thinking about 3 ways to succeed (success is easy to bring to mind) is equivalent to thinking about 12 ways to fail (failure is difficult to bring to mind), and conversely, thinking about 3 ways to fail is equivalent to thinking about 12 ways to succeed. In short, people's temporal judgments will be consistent with what comes to mind only when it comes to mind easily; difficulty of recall or thought generation will result in conclusions opposite to the implications of thought content (Sanna, Schwarz, & Stocker, 2002).

We tested this proposal in the experiment reported here. Students made judgments about real-life exam outcomes at one of three time points: 28 days before the exam (T_{-2}), a few minutes before the exam (T_{-1}), or right after learning their grade (T_{+1}). The latter group (T_{+1}) was further divided on the basis of actual exam scores, resulting in T_{+1}-success and T_{+1}-failure conditions. Each person was also assigned to one of five thought conditions: no thoughts (control), thoughts implying success (either 3 success or 12 failure thoughts), or thoughts implying failure (either 3 failure or 12 success thoughts). Students predicted their likelihood of success, study completion time, and affective responses.

METHOD

Participants

Participants were 227 introductory psychology students who received extra credit and were randomly assigned to conditions.

Procedure

We used a between-participants design (Buehler et al., 1997; Christensen-Szalanski & Willham, 1991; Gilbert et al., 1998; Shepperd et al., 1996).[1] Participants performed the thoughts-listing task (except for those in the control condition, who were not given this task) and then judged their first-exam outcomes on the dependent measures (described later). All judgments were made before regular class meetings in a room down the hallway from the students' classroom.

Thoughts Listing and Subjective Difficulty

The thoughts-listing task was modeled after prior research (see Schwarz, 1998, for a review) and was administered before participants completed the dependent measures. In the *control* condition, participants did not list any thoughts. The remaining four conditions were labeled *3-success*, *3-failure*, *12-success*, and *12-failure*.[2] Participants who listed thoughts at T_{-2} and T_{-1} were asked to "please list 3[12] things that may lead you to do well[poorly] on the exam." Participants who listed thoughts at T_{+1} similarly listed either 3 or 12 thoughts, but with regard to what "may have led" them to succeed or fail on the exam.

Participants who listed thoughts used 11-point scales to rate the experienced ease (*not at all easy* to *very easy*) and difficulty (*not at all difficult* to *very difficult*) of thought generation.

Subjective Performance

Participants who listed thoughts at T_{+1} reported if they viewed their grades as a success or failure by circling whether they *did well* or *did poorly*, and we classified them on this basis.[3]

[1]Temporal biases have been found using between- and within-participants designs. We ran an additional control condition ($n = 16$) identical to the one reported in the text, except that measures were within participants. Results did not differ significantly from those for the control condition reported in the text.

[2]Pilot testing ($n = 26$) indicated that generating 3 success or failure thoughts was easy, and generating 12 success or failure thoughts was difficult.

[3]Students' self-reported exam success or failure corresponded with their actual grades. Those in the T_{+1}-success condition had a mean grade of 85%, or a B. Those in the T_{+1}-failure condition had a mean grade of 70%, or a C-.

Dependent Measures

Dependent measures were modeled after those used in previous research.

Likelihood of Success. Students were told that the exams were worth 100 points and had traditional grade cutoffs (90% for an A, etc.). Students in the T_{-2} and T_{-1} conditions predicted their percentile performance using an 11-point scale ranging from 0 to 100% (Shepperd et al., 1996). They also used 11-point scales to answer two questions assessing their likely (*not likely* to *very likely*) and probable (*not probable* to *very probable*) success. Students in the T_{+1} condition answered these questions on the basis of what they "would have predicted" before knowing grades.

Study Completion Time. Students in the T_{-2} condition predicted when, relative to exam time, their studying would be completed (Buehler et al., 1997) and how much time they would spend studying; responses were open ended. Students in the T_{-1} condition answered similar questions about when they actually completed their studying and how much time they actually spent studying. Students in the T_{+1} condition indicated retrospectively what they would have said their completion time and amount of study time were before they knew their grades.

Affective Response for Success and Failure. In the T_{-2} and T_{-1} conditions, students estimated on two 11-point scales how they would feel after "doing well" and if they were to "succeed" (1 = *not good*, 11 = *very good*); they also estimated how they would feel after "doing poorly" and if they were to "fail" (1 = *very bad*, 11 = *not bad*). Students in the T_{+1} condition answered similar questions asking the degree to which they felt good (*not good* to *very good*) and bad (*not bad* to *very bad*) about their obtained exam scores.

PREDICTIONS AND RESULTS

Number of Thoughts and Subjective Difficulty

Manipulation checks were subjected to 2 (3 thoughts, 12 thoughts) × 2 (success, failure) × 3 (T_{-2}, T_{-1}, T_{+1}) analyses of variance (ANOVAs).[4] Participants listed more thoughts in the 12-thoughts condition ($M = 9.9$) than in the 3-thoughts condition ($M = 3.0$), $F(1, 169) = 21.33$, $p < .01$. Examples of thoughts recorded are "I may not study enough" and "The instructor has given clear lectures." The responses to the subjective-difficulty questions were significantly correlated, $r(179) = .78$, $p < .01$ (responses to the question on experienced ease were reverse-scored). Analysis of averaged subjective difficulty revealed that participants found it more difficult to list thoughts in the 12-thoughts condition ($M = 9.1$) than in the 3-thoughts condition ($M = 4.0$), $F(1, 169) = 18.80$, $p < .01$. Thus, our thoughts-listing manipulations were effective.

Confidence Changes

Research on confidence change indicates that people focus on success at a distance, but are more likely to consider other outcomes (e.g., possible failure; Sanna, 1999; Sanna & Meier, 2000) as performance draws closer; this change in focus results in confidence shifts. We had three predictions regarding confidence changes: First, participants who did not list thoughts (control condition) would show declining confidence in success as the test drew nearer (confidence at T_{-2} > confidence at T_{-1}). Second, the confidence of participants who generated thoughts implying success (3-success and 12-failure conditions) at T_{-1} would be as high as the confidence of control participants at T_{-2}; that is, generating thoughts implying success would eliminate proximal pessimism. Third, the confidence of participants who generated thoughts implying failure (3-failure and 12-success conditions) at T_{-2} would be as low as the confidence of control participants at T_{-1}; that is, generating thoughts implying failure would eliminate distal optimism.

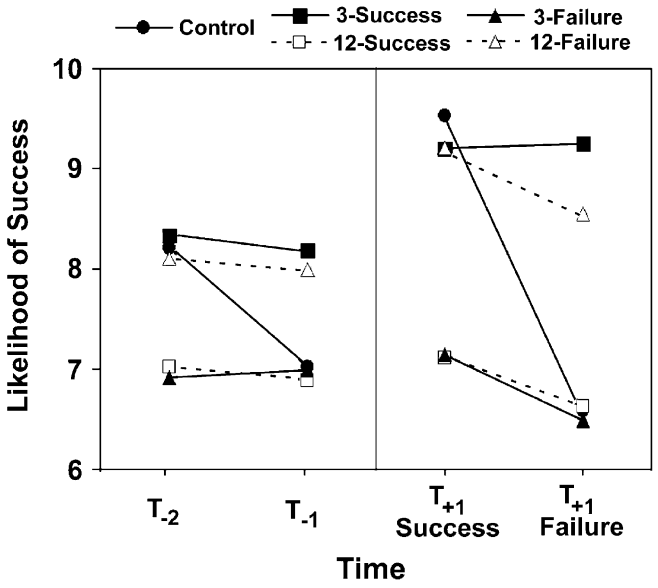

Fig. 2. Mean rating of the likelihood of success as a function of thoughts-listing condition and time (relevant for confidence changes and hindsight bias). The thoughts-listing conditions were as follows: control = no thoughts listing; 3-success = generate 3 success thoughts; 3-failure = generate 3 failure thoughts; 12-success = generate 12 success thoughts; 12-failure = generate 12 failure thoughts. T_{-2} = 28 days before the exam; T_{-1} = a few minutes before the exam; T_{+1} = right after learning grades. The T_{+1} groups were divided according to whether they viewed their grade as a success or a failure.

Confidence change was assessed through reported likelihood of success. The data are shown in Figure 2. Because our hypotheses involved specific comparisons across and within time, we employed theoretically derived planned contrasts using mean square errors from ANOVAs (Rosenthal, Rosnow, & Rubin, 2000).[5] Results are presented in Table 1.

Responses to questions measuring likely success were averaged (Cronbach's αs = .77 and .81 for T_{-2} and T_{-1}, respectively). As predicted, participants in the control condition, who did not list thoughts, reported higher confidence in success at T_{-2} than at T_{-1}.

[4]ANOVAs including the T_{+1}-success and T_{+1}-failure conditions separately showed the same pattern of results.

[5]Rosenthal et al. (2000) argued that significant omnibus *F*s are not required before contrasts. In any event, ANOVAs also revealed Condition × Time interactions for likelihood of success, $F(12, 207) = 2.03$, $p < .05$ (Fig. 2); predicted study completion, $F(12, 207) = 5.06$, $p < .05$ (Fig. 3); and affective responses for predicted and experienced success, $F(8, 169) = 2.27$, $p < .05$, and predicted and experienced failure, $F(8, 152) = 2.17$, $p < .05$ (Fig. 4).

TABLE 1
Results of Planned Contrasts Testing the Predictions

Measure and prediction	Relevant conditions and means	Significance of planned contrast
	Confidence changes	
Likelihood of success		
Without thoughts listing, confidence declines with performance proximity (confidence changes)	T_{-2} control: 8.2; T_{-1} control: 7.0	$t(207) = 2.14$*
Thoughts implying success at T_{-1} eliminate proximal pessimism	T_{-2} control: 8.2; T_{-1} 3-success: 8.2; T_{-1} 12-failure: 8.0	$t(207) = 0.26$
Thoughts implying failure at T_{-2} eliminate distal optimism	T_{-1} control: 7.0; T_{-2} 3-failure: 6.9; T_{-2} 12-success: 7.0	$t(207) = 0.12$
	Planning fallacy	
Predicted study completion		
Without thoughts listing, study completion time is underestimated at T_{-2} (planning fallacy)	T_{-2} control: 4.4; T_{-1} control: 0.3	$t(207) = 8.38$**
Thoughts implying success at T_{-2} leave the planning fallacy intact	T_{-1} control: 0.3; T_{-2} 3-success: 4.7; T_{-2} 12-failure: 4.5	$t(207) = 12.18$**
Thoughts implying failure at T_{-2} reduce the planning fallacy	T_{-1} control: 0.3; T_{-2} 3-failure: 1.1; T_{-2} 12-success: 1.4	$t(207) = 2.50$*
	Impact bias	
Affective response to success		
Without thoughts listing, predicted response to success exceeds actual impact of success (impact bias)	T_{-2} control: 9.2; T_{+1}-success control: 7.3	$t(169) = 3.33$**
Thoughts implying success at T_{-2} foster impact bias for success	T_{+1}-success control: 7.3; T_{-2} 3-success: 9.5; T_{-2} 12-failure: 9.4	$t(169) = 5.17$**
Thoughts implying failure at T_{-2} attenuate impact bias for success	T_{+1}-success control: 7.3; T_{-2} 3-failure: 7.1; T_{-1} 12-success: 7.6	$t(169) = 0.17$
Affective response to failure		
Without thoughts listing, predicted response to failure exceeds actual impact of failure	T_{-2} control: 5.0; T_{+1}-failure control: 6.4	$t(152) = 2.45$*
Thoughts implying failure at T_{-2} foster impact bias for failure	T_{+1}-failure control: 6.4; T_{-2} 3-failure: 4.8; T_{-2} 12-success: 5.0	$t(152) = 3.69$**
Thoughts implying success at T_{-2} attenuate impact bias for failure	T_{+1}-failure control: 6.4; T_{-2} 3-success: 6.5; T_{-2} 12-failure: 6.4	$t(152) = 0.23$
	Hindsight bias	
Likelihood of success		
Without thoughts listing, obtained grades appear more inevitable than predicted grades suggest	T_{-2} control: 8.2; T_{+1}-success control: 9.5; T_{+1}-failure control: 6.6	$t(207) = 4.83$**
Thoughts implying success at T_{+1} produce hindsight bias for successful students	T_{-2} control: 8.2; T_{+1}-success 3-success: 9.2; T_{+1}-success 12-failure: 9.2	$t(207) = 2.08$*
Thoughts implying failure at T_{+1} produce hindsight bias for failing students	T_{-2} control: 8.2; T_{+1}-failure 3-failure: 4.2; T_{+1}-failure 12-success: 5.0	$t(207) = 3.25$**
Thoughts implying failure at T_{+1} attenuate hindsight bias for successful students	T_{-2} control: 8.2; T_{+1}-success 3-failure: 6.7; T_{+1}-success 12-success: 7.4	$t(207) = 2.28$*
Thoughts implying success at T_{+1} attenuate hindsight bias for failing students	T_{-2} control: 8.2; T_{+1}-failure 3-success: 6.7; T_{+1}-failure 12-failure: 6.6	$t(207) = 1.38$

Note. $MSE = 1.90$ for likelihood of success, 1.52 for predicted study completion, 2.20 for affective response to success, and 1.61 for affective response to failure. Where three means are listed, the contrast within each row represents a comparison between the control condition (on the left) and the other two conditions. The thoughts-listing conditions were as follows: control = no thoughts listing; 3-success = generate 3 success thoughts; 3-failure = generate 3 failure thoughts; 12-success = generate 12 success thoughts; 12-failure = generate 12 failure thoughts. T_{-2} = 28 days before the exam; T_{-1} = a few minutes before the exam; T_{+1} = right after learning grades. The T_{+1} groups were divided according to whether they viewed their grade as a success or a failure.
*$p < .05$. **$p < .01$.

These results are consistent with those of prior research (Shepperd et al., 1996).[6]

More important, the thoughts-listing manipulations eliminated the confidence shift observed in the control condition. Our second prediction was supported: Participants who listed 3 success or 12 failure thoughts right before the exam (T_{-1}) were as confident as control participants had been 28 days earlier (T_{-2}). Our third prediction was also supported: Participants who listed 3 failure or 12 success thoughts at T_{-2} reported confidence as low as that of control participants at T_{-1}.

Planning Fallacy

Research on the planning fallacy indicates that people adopt an optimistic "narrow focus on successful future plans" and this leads them to be overly optimistic in estimating completion times (Buehler et al., 1997, p. 239). Considering alternatives (e.g., possible failures) may sometimes lessen the bias (Newby-Clark, Ross, Buehler, Koehler, & Griffin, 2000). We had three predictions regarding the planning fallacy: First, students who did not list their thoughts (control condition) would underestimate study completion time relative to actual time needed as reported by peers right before the exam (T_{-1}). Second, participants who generated thoughts implying success (3 success thoughts, 12 failure thoughts) at T_{-2} would also underestimate their study completion time relative to the T_{-1} control condition. Third, thoughts implying failure (3 failure thoughts, 12 success thoughts) at T_{-2} would reduce the planning fallacy, resulting in estimated study completion times that approximated actual completion times reported by peers in the T_{-1} control condition.

The planning fallacy was assessed by comparing predicted with actual completion time, between participants (Buehler et al., 1997; Kahneman & Tversky, 1979). The data are summarized in Figure 3. Answers to the questions on when study would be completed and how much time would be spent studying (in days) were averaged, $r(62) = .70$ and $r(58) = .72$, $ps < .05$, for T_{-2} and T_{-1}, respectively. Participants in the control condition, who did not list their thoughts, were overly optimistic about study completion at T_{-2} relative to peers' reports of study completion at T_{-1}. This result supports our first prediction and replicates prior research (Kahneman & Tversky, 1979).

Our second prediction was also supported, as the planning fallacy was also observed at T_{-2} among students who generated thoughts implying success (3-success and 12-failure conditions); the planning fallacy was not more pronounced among these students than among the T_{-2} control students, a result consistent with the notion that distal success thoughts produce this fallacy (Buehler et al., 1994). Thoughts implying failure (3-failure and 12-success conditions) at T_{-2} attenuated the planning fallacy relative to thoughts implying success at T_{-2}, $z = 4.61$, $p < .05$, but did not completely eliminate the fallacy relative to the T_{-1} control condition, providing limited support for our third prediction. Listing thoughts did not affect reports within the T_{-1} condition.

Including T_{+1} ratings enabled us to explore whether the fallacy also occurs retrospectively. It does. After the exam (T_{+1}), the control, 3-success, and 12-failure conditions (combined $M = 4.4$) provided overly optimistic estimates relative to peer reports in the T_{-1} control condition, $t(207) = 15.89$, $p < .05$. Participants who listed 3 failure or 12 success thoughts also provided overly optimistic estimates (combined $M = 1.6$) relative to reports in the T_{-1} control condition, $t(207) = 4.30$, $p < .05$. But the fallacy was significantly reduced in the latter compared with the former conditions, $z = 3.68$, $p < .05$. Actual success (T_{+1}-success condition) or failure (T_{+1}-failure condition) did not influence study estimates after the exam.

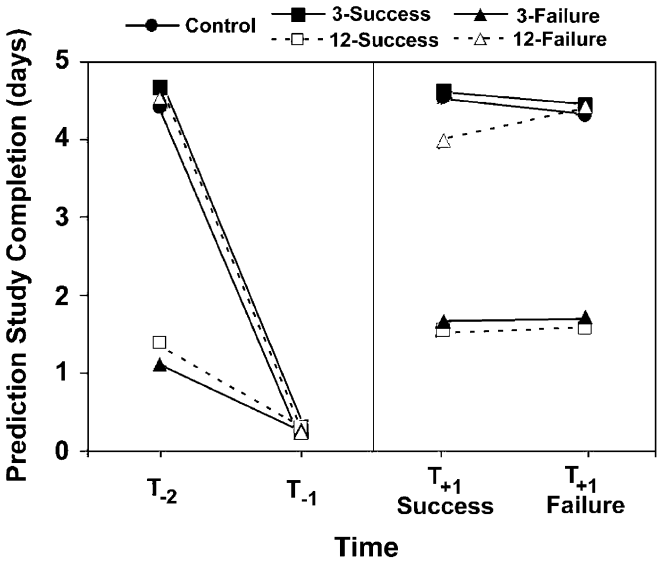

Fig. 3. Mean prediction of study completion (in days) as a function of thoughts-listing condition and time (relevant for planning fallacy). The thoughts-listing conditions were as follows: control = no thoughts listing; 3-success = generate 3 success thoughts; 3-failure = generate 3 failure thoughts; 12-success = generate 12 success thoughts; 12-failure = generate 12 failure thoughts. T_{-2} = 28 days before the exam; T_{-1} = a few minutes before the exam; T_{+1} = right after learning grades. The T_{+1} groups were divided according to whether they viewed their grade as a success or a failure.

Impact Bias

Research on the impact bias suggests that "people think too much about the focal event and fail to consider the consequences of other events" (Wilson et al., 2000, p. 833), and as a result overestimate their emotional reactions when making affective forecasts. Our predictions regarding the impact bias were as follows: First, in the control condition (i.e., among participants who did not list thoughts), positive and negative affective impact of grades as predicted at T_{-2} would exceed the impact after actual success and failure at T_{+1}. Second, thoughts implying success (3-success and 12-failure conditions) at T_{-2} would foster overestimation of positive emotions upon success (comparison with the T_{+1}-success condition), and thoughts implying failure (3-failure and 12-success conditions) at T_{-2} would foster overestimation of negative emotions upon failure (comparison with the T_{+1}-failure condition). Third, in contrast, thoughts implying failure at T_{-2} would attenuate the bias when predicting success reactions (comparison with the T_{+1}-success condition) and thoughts implying success at T_{-2} would attenuate the bias when predicting failure reactions (comparison with the T_{+1}-failure condition).

Impact bias was assessed by comparing predicted with actually experienced feelings, between participants (Wilson & Gilbert, 2003; Wilson et al., 2000). The data are shown in Figure 4. For the T_{-2}

[6]Grades did not vary between students who responded at T_{-2} and those who responded at T_{-1} (overall M = 77%, C+); differences in dependent measures at these times thus were independent of eventual exam scores.

condition, responses to the two questions asking students to predict how they would feel after success were averaged, $r(62) = .75$, $p < .05$; responses to the two questions asking students to predict how they would feel after failure were similarly averaged, $r(62) = .80$, $p < .05$. For the T_{+1} condition, ratings of actually experienced feelings about grades—responses to feeling "bad" were reverse-scored—were similarly averaged, $r(101) = .76$, $p < .05$.

Participants in the control condition at T_{-2} predicted more positive feelings after success than were experienced by successful peers after receiving grades (T_{+1}-success control condition) and predicted more negative feelings after failure than were experienced by peers in the failure condition (T_{+1}-failure control condition). This result supports our first prediction and replicates prior research (Gilbert et al., 1998).

Results also supported our second prediction: T_{-2} thoughts implying success (3-success and 12-failure conditions) fostered the overestimation of positive reactions to success, relative to the experience of successful peers (T_{+1}-success control condition), and T_{-2} thoughts implying failure (3-failure and 12-success conditions) fostered the overestimation of negative reactions to failure, relative to the experience of peers in the failure condition (T_{+1}-failure control condition). The results also supported our third prediction: T_{-2} thoughts implying failure (3-failure and 12-success conditions) eliminated the impact bias for reactions to success, resulting in predictions that did not differ from the responses in the T_{+1}-success control condition; T_{-2} thoughts implying success (3-success and 12-failure conditions) eliminated the impact bias for reactions to failure, resulting in predictions that did not differ from responses in the T_{+1}-failure control condition.

Including two predictive measures (at T_{-2} and T_{-1}) enabled explorations of whether the impact bias also varies predictively. It does not. Affective responses did not vary between T_{-2} and T_{-1} (and T_{-1} vs. T_{+1} comparisons were similar to the T_{-2} vs. T_{+1} comparisons reported).

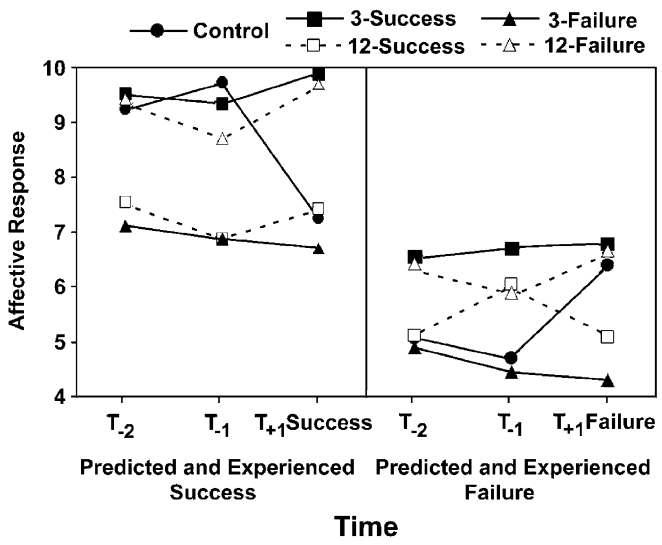

Fig. 4. Mean rating of affective response for predicted and experienced success and failure as a function of thoughts-listing condition and time (relevant for impact bias). The thoughts-listing conditions were as follows: control = no thoughts listing; 3-success = generate 3 success thoughts; 3-failure = generate 3 failure thoughts; 12-success = generate 12 success thoughts; 12-failure = generate 12 failure thoughts. T_{-2} = 28 days before the exam; T_{-1} = a few minutes before the exam; T_{+1} = right after learning grades. The T_{+1} groups were divided according to whether they viewed their grade as a success or a failure.

Hindsight Bias

After an outcome is known, people believe it was inevitable and they "knew it all along." Thinking about alternative outcomes may attenuate this hindsight bias (Fischhoff, 1982), although debiasing is not always successful (Sanna, Schwarz, & Stocker, 2002). Our predictions regarding the hindsight bias were as follows: First, participants who did not list thoughts (i.e., control condition) would view obtained grades at T_{+1} as more inevitable than predicted grades at T_{-2} suggested. Second, comparisons with the T_{-2} control condition would show that thoughts implying success (3-success and 12-failure conditions) at T_{+1} would produce hindsight bias for successful participants (T_{+1}-success condition) and that thoughts implying failure (3-failure and 12-success conditions) at T_{+1} would produce hindsight bias for participants who felt they failed (T_{+1}-failure condition). Third, in contrast, thoughts implying failure in the T_{+1}-success condition and thoughts implying success in the T_{+1}-failure condition would attenuate the bias (comparisons with the T_{-2} control condition).

Hindsight bias was assessed through reported likelihood of success (Fig. 2). Answers to T_{+1} questions on the likelihood of success were averaged (Cronbach's $\alpha = .70$). Control participants in the T_{+1}-success condition viewed success as more likely than control participants in the T_{-2} condition, and control participants in the T_{+1}-failure condition viewed failure as more likely than control participants in the T_{-2} condition.[7] This result supports our first prediction and replicates prior research (Louie, 1999).

The results also supported our second prediction: Comparison with the T_{-2} control condition demonstrated a hindsight bias for successful participants (T_{+1}-success condition) after thoughts implying success (3-success and 12-failure conditions) and for participants who felt they failed (T_{+1}-failure condition) after thoughts implying failure (3-failure and 12-success conditions). The results also supported our third prediction: Thoughts implying failure attenuated—and in fact reversed (see also Sanna, Schwarz, & Stocker, 2002)—the hindsight bias for successful participants, relative to the T_{-2} control condition; thoughts implying success eliminated the hindsight bias for participants who felt they failed, relative to the same control.[8]

Additionally, within the T_{+1}-success condition, thoughts implying success did not increase the hindsight bias, relative to the control condition, $t(207) = 0.66$, n.s., whereas thoughts implying failure attenuated the bias, $t(207) = 4.87$, $p < .05$. Within the T_{+1}-failure

[7]Internal analyses using the T_{-2} control condition bolster this finding. The average grade among T_{-2} participants was C+, but some students did well ($n = 6$; $M = 86\%$, B) and others did poorly ($n = 4$; 71%, C-). These grades matched the grades of students in the T_{+1} control condition—excluding 3 students whose grades were exactly C+ (76 or 77%). Success was viewed more likely by T_{+1}-success control students ($M = 9.5$) than by T_{-2} control students ($M = 8.2$) who were matched on grades, $t(17) = 2.22$, $p < .05$; failure was viewed more likely by T_{+1}-failure control students ($M = 6.6$) than by T_{-2} control students ($M = 8.2$) who were matched on grades, $t(12) = 2.27$, $p < .05$. Note that the mean likelihood of success predicted by T_{-2} control students who eventually did well and who eventually did poorly was identical (8.2).

[8]Internal analyses using the T_{-2} control condition (as described in footnote 7) bolster this finding. Participants listing 3 success or 12 failure thoughts viewed failure as less likely than did T_{-2} control participants who eventually did poorly, $t(20) = 1.76$, $p < .10$; participants listing 3 failure or 12 success thoughts viewed success as less likely than T_{-2} control participants who eventually did well, $t(30) = 2.08$, $p < .05$.

condition, thoughts implying failure did not increase the hindsight bias relative to the control condition, $t(207) = 0.06$, n.s., whereas thoughts implying success attenuated the bias, $t(207) = 5.02$, $p < .05$.

DISCUSSION

Our findings provide an integrative account of temporal biases (confidence changes, planning fallacy, impact bias, and hindsight bias) by highlighting the interplay of accessible content and accessibility experiences in the emergence of the biases, as well as in debiasing.

Accessibility Experiences and Temporal Biases

As suggested by focalism (Schkade & Kahneman, 1998; Wilson et al., 2000), what participants thought about did make a difference. But in no case did we observe the main effect of thought content predicted by simple focalism accounts. Instead, accessibility experiences rendered generating few thoughts about success (failure) functionally equivalent to generating many thoughts about failure (success). Specifically, thinking about 3 ways to succeed (success was easy to bring to mind) was equivalent to thinking about 12 ways to fail (failure was difficult to bring to mind), and conversely, thinking about 3 ways to fail was equivalent to thinking about 12 ways to succeed. The interaction between thought content and accessibility experiences is necessary to predict the production and reduction of temporal biases.

Prior theorizing about temporal biases, which focused on thought content alone, cannot account for our observed patterns. In contrast to the expectation that thinking about alternatives attenuates temporal biases, our research indicates that debiasing may fail when people try to generate more alternatives than they can easily accomplish (see also Sanna, Schwarz, & Stocker, 2002). Ironically, the more people attempt to avoid a temporal bias in this way, the more they may fall prey to it.

The interaction of thought content and accessibility experiences provides a common integrative mechanism for temporal biases. Right before the exam (T_{-1}), thoughts implying success eliminated the otherwise observed low confidence for proximal outcomes (Gilovich et al., 1993; Shepperd et al., 1996); 28 days before the exam (T_{-2}), thoughts implying failure eliminated the otherwise observed high confidence for distal outcomes. Listing thoughts implying success 28 days before the exam (T_{-2}) did not increase the planning fallacy (Buehler et al., 1994; Kahneman & Tversky, 1979), whereas listing thoughts implying failure at the same time significantly reduced, but did not fully eliminate, this fallacy. Our research also provides the first demonstration that the planning fallacy can occur retrospectively (at T_{+1}), perhaps further supporting the idea that optimism is restored after past failures (Buehler et al., 1997).

Forecasts of positive affect after success were less biased before the exam (T_{-2}) when thoughts implied failure than when thoughts implied success, whereas forecasts of negative affect after failure were less biased when thoughts implied success than when thoughts implied failure. Wilson et al. (2000) argued that "people are often content to focus on what comes to mind easily" (p. 822). Our results support this notion, but with an addendum: Temporal biases are attenuated when thinking about focal events is difficult or when thinking about alternative events is easy. Similarly, thoughts implying failure eliminated the otherwise observed hindsight bias (Louie, 1999; Mark & Mellor, 1991) for participants experiencing success (T_{+1}-success condition), whereas thoughts implying success eliminated the hindsight bias for participants experiencing failure (T_{+1}-failure condition). The impact of easily generating thoughts about failure even reversed the hindsight bias after success relative to the T_{-2} control condition (see also Sanna, Schwarz, & Small, 2002; Sanna, Schwarz, & Stocker, 2002).

Other Judgments Over Time

Future research may profit from exploring the role of accessibility experiences in other temporal judgments. People may construe distant futures in more abstract terms than near futures (Trope & Liberman, 2003), reconstruct the past (Ross, 1989) in self-serving ways (Ross & Wilson, 2002), discount event impact as time passes (Loewenstein & Schkade, 1999; Mischel, Shoda, & Rodriguez, 1989), and misattribute affect (Levine & Safer, 2002) over time. Although each of these variables may contribute to temporal biases, the prior focus on what comes to mind misses the fact that thoughts are accompanied by subjective experiences, such as ease of recall or generation (Schwarz, 1998), perceptual and conceptual fluency (Jacoby, Kelley, & Dywan, 1989), and bodily feedback (Stepper & Strack, 1993). The impact of thought content cannot be predicted without also considering accompanying subjective experiences. Because almost all phenomena take place in a temporal context, it is surprising that time is such an underresearched variable (Karniol & Ross, 1996; Sanna, Stocker, & Clarke, 2003). A full understanding of subjective accessibility experiences and metacognitive processes is critical. Our research thus provides another important piece of the puzzle in an integrative account of how people's judgments are influenced by time.

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