Exploring the "Planning Fallacy": Why People Underestimate Their Task Completion Times

Roger Buehler, Dale Griffin, and Michael Ross

This study tested 3 main hypotheses concerning people's predictions of task completion times: (a) People underestimate their own but not others' completion times, (b) people focus on plan-based scenarios rather than on relevant past experiences while generating their predictions, and (c) people's attributions diminish the relevance of past experiences. Results supported each hypothesis. Ss' predictions of their completion times were too optimistic for a variety of academic and nonacademic tasks. Think-aloud procedures revealed that Ss focused primarily on future scenarios when predicting their completion times. In Study 4, the optimistic bias was eliminated for Ss instructed to connect relevant past experiences with their predictions. In Studies 3 and 4, Ss attributed their past prediction failures to relatively external, transient, and specific factors. In Study 5, observer Ss overestimated others' completion times and made greater use of relevant past experiences.

In 1871, the colony of British Columbia agreed to join the new country of Canada on the condition that a transcontinental railway reach the west coast by 1881. In fact, because of the intervention of an economic depression and political changes, the last spike was not driven until 1885, 4 years after the predicted date of completion. Nearly 100 years later, in 1969, the mayor of Montreal proudly announced that the 1976 Olympics would feature a state-of-the-art coliseum covered by the first retractable roof ever built on a stadium. According to mayor Jean Drapeau, the entire Olympic venture would cost $120 million and "can no more have a deficit than a man can have a baby" (Colombo, 1987, p. 269). Because of economic problems, strikes, and other construction delays, the stadium roof was not in place until 1989, 13 years after the predicted date of completion—and cost $120 million by itself! Many people consider the Sydney Opera House to be the champion of all planning disasters. According to original estimates in 1957, the opera house would be completed early in 1963 for $7 million. A scaled-down version of the opera house finally opened in 1973 at a cost of $102 million (Hall, 1980).

The history of grand construction projects is rife with opti-

mistic, even unrealistic, predictions (Hall, 1980). Yet current planners seem to be unaffected by this bleak history: The builders of the Channel tunnel connecting Britain and France predicted that the first trains would run between London and Paris in June 1993, after an expenditure of 4.9 billion pounds. The real cost is expected to be at least 10 billion pounds, and at this point the projected opening date is May 1994. The tendency to hold a confident belief that one's own project will proceed as planned, even while knowing that the vast majority of similar projects have run late, has been termed the *planning fallacy* (Kahneman & Tversky, 1979).

Great construction projects are often undertaken by governments. Proponents of these schemes may deliberately provide overly optimistic assessments of cost and time to win political approval for the projects. In addition, some of these projects involve the adoption of new technologies that turn out to be much more complex and expensive than their advocates envisioned (Hall, 1980).

This phenomenon is not limited to commercial mega-projects, however, and its occurrence does not depend on deliberate deceit or untested technologies. From a psychological perspective, the planning fallacy can perhaps be studied most profitably at the level of daily activities. Consider one familiar example: Academics who carry home a stuffed briefcase full of work on Fridays, fully intending to complete every task, are often aware that they have never gone beyond the first one or two jobs on any previous weekend. The intriguing aspect of this phenomenon is the ability of people to hold two seemingly contradictory beliefs: Although aware that most of their previous predictions were overly optimistic, they believe that their current forecasts are realistic. It seems that people can know the past and yet still be doomed to repeat it. The phenomenon, we propose, is not peculiar to academics. In a classroom survey we conducted, students reported having finished about two thirds of their previous projects ($M = 68\%$) later than they expected.

The planning fallacy is an important topic of study for both applied and theoretical reasons. Inaccurate completion estimates can have economic, social, and personal costs. Surpris-

Roger Buehler, Department of Psychology, Simon Fraser University, Burnaby, British Columbia, Canada; Dale Griffin and Michael Ross, Department of Psychology, University of Waterloo, Waterloo, Ontario, Canada.

Correspondence concerning this article should be addressed to Roger Buehler, Department of Psychology, Simon Fraser University, Burnaby, British Columbia, Canada, V5A 1S6. Electronic mail may be sent to roger_buehler@sfu.ca.

ingly, however, we were able to locate little research on this phenomenon in the psychological literature. In one relevant study, professional engineers were found to underestimate consistently when equipment overhauls in electricity-generating stations would be finished (Kidd, 1970). An important feature of the study distinguishes it from the present investigation, however: The repair projects involved teams of technicians, and the engineers' predictions reflected group judgments, which are often more extreme than those made by individuals (Janis, 1982; Myers & Lamm, 1976). Researchers have also examined how people make plans to accomplish tasks assigned to them in the laboratory, such as carrying out a sequence of errands in a hypothetical town (Hayes-Roth, 1981; Hayes-Roth & Hayes-Roth, 1979). Subjects typically overestimate how much they can accomplish in a given time period and continue to do so in the face of repeated negative feedback. The present study extends these previous investigations by documenting the prevalence and magnitude of overly optimistic personal predictions for real-world tasks.

A second purpose of our study was to explore the psychological mechanisms that underlie these forecasts. We focus, in particular, on the mechanisms by which people segregate their general theories about their predictions (i.e., that they are usually unrealistic) from their specific expectations for an upcoming task. Unlike the optimistic or self-enhancing biases documented by many researchers (e.g., Taylor & Brown, 1988; Weinstein, 1980), the planning fallacy features the combination of relatively pessimistic general theories with optimistic specific judgments.

Our research also differs in several ways from most studies on biases in predictive judgment (for summaries, see Dawes, 1988; Kahneman, Slovic, & Tversky, 1982; Rehm & Gadenne, 1990; Yates, 1990). The current experiments involve time estimates rather than the occurrence or nonoccurrence of predicted events and real tasks varying in familiarity instead of hypothetical and unfamiliar activities. We examine the everyday processes by which people maintain their optimistic outlooks in the face of pessimistic past experience. We do not search for individual differences in motivational constructs, such as optimism or self-enhancement, that might moderate the level of optimistic prediction; we seek out common processes that lead to optimistic predictions in most people.

Processes Underlying Task Prediction

In their theoretical analysis of the planning fallacy, Kahneman and Tversky (1979) suggested that people can use singular and distributional information when predicting task completion. Singular information relates to aspects of the specific target task that might lead to longer or shorter completion times. Distributional information concerns how long it took to complete other, similar tasks. In the present studies, where individuals make predictions about everyday activities, the distributional information could either be their own past experiences (personal base rates) or the experiences of others (population base rates). Kahneman and Tversky (1979) suggested that people who focus on case-based or singular information adopt an internal perspective: They concentrate on working out how they will complete the target task. In contrast, people who primarily

consider distributional information embrace an external perspective: They compare the present task with past projects. Thus, the two general approaches to prediction differ primarily in whether individuals treat the target task as a unique case or as an instance of an ensemble of similar problems.

In most cases, people should derive their predictions from both case-based and distributional information. However, the existence of the planning fallacy implies that people typically adopt an internal perspective when predicting their own completion times; they seemingly fail to consider such relevant distributional information as their previous experiences with similar tasks.

Obstacles to Using Past Experiences

When individuals make their time estimates, they may focus on the problem at hand, constructing a story about how they will complete the task. A number of theorists have offered related views of the prediction process, emphasizing people's tendency to construct scenarios or narratives as they generate inferences and forecasts (Dawes, 1988; Griffin, Dunning, & Ross, 1990; Johnson & Sherman, 1990; Jungermann & Thuring, 1987; Kahneman & Lovallo, 1991; Kahneman & Tversky, 1982a; Klayman & Schoemaker, 1993; Read, 1987; Zukier, 1986). Zukier suggested that for many judgments and predictions, people adopt a "narrative mode" of thinking concerned with sequential relationships among events, action-related structuring, and the integration of available information into a connected narrative. Once individuals are in the planning or narrative mode, there are a number of obstacles that prevent them from incorporating their past experiences into their story. We consider three particular impediments: (a) the forward nature of prediction, (b) the elusive definition of "similar" experiences, and (c) attributional processes that diminish the relevance of the past to the present.

The act of prediction, by its very nature, elicits a focus on the future rather than on the past; a future orientation may prevent individuals from looking backward in time. However, a failure to use personal base rates need not always result from neglect of the past. People may sometimes attend to their past experiences but nevertheless fail to incorporate this information into their predictions. The connection between past experiences and a specific prediction task is not straightforward. The person must first select an appropriate standard for comparison, a past experience or class of experiences similar in important ways to the one under consideration. Often it may be difficult to detect the appropriate set of past experiences; the various instances seem so different from each other that individuals cannot compare them meaningfully (Kahneman & Tversky, 1979).

Even if people are able to identify a distribution of similar experiences, they may not apply this information to the current prediction. Considerable research suggests that people tend to neglect background data (e.g., base rates) when they possess case-based information on which to form their judgments (for reviews see Bar-Hillel, 1983; Kahneman et al., 1982). People appear to make use of base-rate information only if they can connect it to the judgment at hand (Bar-Hillel, 1980; Borgida & Brekke, 1981), such as when they incorporate base rates into their intuitive theories of causation (Ajzen, 1977). Thus, people

may use their previous experiences as a basis for prediction primarily when they can draw a causal connection between the past and the present (e.g., the earlier tasks took longer than I expected because I tend to procrastinate).

Furthermore, people might actively process information about the past in a manner that reduces its pertinence to the current prediction. The meaning and relevance of any past behavior depends largely on an individual's explanation of why it occurred (Jones & Davis, 1965; Kelley, 1967; Weiner, 1985). Certain types of attributions will have the effect of linking a past event to the present and future; other attributions will serve to isolate the past. To the extent that people perceive a previous episode to be caused by external, unstable, and specific factors, they need not connect its outcome to future occasions. For example, an optimistic academic may attribute her or his inability to complete past weekend tasks to visits by her or his in-laws. Thus, the academic may generalize the previous failures only to weekends when that external and specific factor is present. Knowing that the in-laws are away this weekend, the academic may suppose that she or he can readily attain her or his objectives.

We suggest that people often make attributions that diminish the relevance of past experiences to their current task. People are probably most inclined to deny the significance of their personal history when they dislike its apparent implications (e.g., that a project will take longer than they hope). If they are reminded of a past episode that could challenge their optimistic plans, they may invoke attributions that render the experience uninformative for the present forecast. This analysis is consistent with the view that individuals are inclined to explain away negative personal outcomes (for reviews see Snyder & Higgins, 1988; Taylor & Brown, 1988).

Actor–Observer Differences in Prediction

There are contexts, however, in which people do use distributional information in the service of their predictions. In particular, individuals may rely on distributional information when they make predictions for others rather than for themselves. Anecdotally, it seems that the planning fallacy vanishes when individuals forecast other people's task completions. We are not surprised when our colleagues' journal reviews are late or when their house renovations take twice the time that they predicted. Even without the benefit of hindsight, we would have anticipated these outcomes.

An actor–observer difference in prediction may be partly due to differing attributions for past behaviors. Because they are not explaining their own inability to meet predictions, observers may be less motivated than actors to discount previous prediction failures by attributing them to external, transitory, or unstable causes. Also, observers tend to ascribe actors' behaviors to characteristics of those individuals; conversely, the actors, themselves, are disposed to attribute their behaviors to external circumstances (Jones & Nisbett, 1972). When explaining failures to meet previous predictions, observers may see actors as procrastinators or as dilatory, but actors see themselves as the victims of circumstances. There is another possible basis for actor–observer differences in predictions. In comparison with actors, observers may be relatively unaware of the actors' future activities and commitments. Consequently, it may be difficult for observers to develop plans of how and when another individual will complete a task. If observers cannot construct future scenarios with confidence, they may rely on available sources of distributional information, including the other individual's previous performance.

Deadlines

We examined one additional factor that may influence people's predicted and actual completion times. Anecdotally, it appears that although people fail to meet their predictions, they do typically meet important deadlines. As teachers, we notice that most students turn their assignments in on time, but few submit them early. In our classroom survey, students indicated that they finish approximately three quarters of their projects ($M = 73\%$) on the same day as the deadline. We suspect that deadlines may sometimes exert a greater impact on behavior than on predictions. Although people are aware that they have completed previous tasks only shortly before a deadline, they remain optimistic that they will finish the current assignment with plenty of time to spare. Actors may fail to apply their past experiences with deadlines to their current predictions for the same reasons that they generally fail to base their forecasts on their past experiences.

In addition, we anticipated an actor–observer difference in the impact of deadlines on predictions. Relative to observers, actors are more motivated to deny the relevance of episodes that have unpleasant implications for the present or future as well as more able to generate scenarios of how they would like the future to unfold. Therefore, we expect actors to depend less on deadlines when generating their predictions than would observers.

Overview of the Present Studies

We tested implications of the above analysis in a series of five studies. In the first study, we examined whether university students' time estimates for an important academic task were overly optimistic. In Study 2, we assessed the accuracy of participants' time estimates for a variety of academic and nonacademic tasks that they intended to complete in the following week. In the third study, we recorded the on-line narratives of participants as they predicted their completion times for various academic tasks, some of which had deadlines. We analyzed these narratives for evidence that people focus on plan-based scenarios for the task at hand rather than on distributional information, such as their previous experiences. In Study 4, we manipulated the focus of the predictors' thoughts and the immediacy of their deadlines to test experimentally the hypotheses developed in our narrative analyses. In Studies 3 and 4, we also examined participants' explanations for past performances, anticipating that their attributions would diminish the relevance of past failures to meet optimistic goals. In the final study, we asked observers to predict when another individual would finish a target task. Each observer was yoked to a participant in Study 4, and we manipulated the type of information the observer possessed about the actor (e.g., distributional or case-based infor-

mation). This experiment allowed us to test our suppositions concerning actor–observer differences in prediction.

Study 1

Our initial study was designed to provide evidence that people's task completion estimates tend to be optimistically biased. To provide a relatively stringent test of the hypothesis, we selected individuals engaged in a project of considerable importance, assessed their predictions when the projects were near completion, and obtained an objective measure of completion times.

Method

Subjects and procedure. Thirty-seven psychology students (27 women and 10 men) enrolled in the final semester of the Honors Thesis course at the University of Waterloo, Waterloo, Ontario, Canada, were contacted for a brief telephone survey concerning their ongoing thesis. The interviewer asked respondents to predict as accurately as possible when they would submit their finished thesis. In addition, the interviewer asked respondents to forecast when they would complete the thesis "if everything went as well as it possibly could" and "if everything went as poorly as it possibly could." The order of the optimistic and pessimistic predictions was counterbalanced across participants. The coordinator of the thesis course recorded the date on which each thesis was submitted.

Results and Discussion

Predicted and actual completion times were recorded as the number of days from the date of the survey. The results are summarized in Table 1. When asked for their best estimate, respondents predicted, on average, that they would finish in 33.9 days, but they actually took 55.5 days, $t(32) = 3.43$, $p < .002$.[1] An additional 4 respondents were not included in this analysis because they had not completed their thesis when our records were discontinued two semesters after the survey. Fewer than one third of the respondents (29.7%) finished in the time they reported as their most accurate prediction.

Despite the optimistic bias, respondents' best estimates were by no means devoid of information: The predicted completion times were highly correlated with actual completion times ($r = .77$, $p < .001$). Compared with others in the sample, respon-

dents who predicted that they would take more time to finish actually did take more time. Predictions can be informative even in the presence of a marked prediction bias.

We also examined respondents' optimistic and pessimistic predictions. When they assumed that "everything went as well as it possibly could," students offered predictions that were almost 30 days earlier than the actual completion times ($M = 27.4$ days vs. 55.5 days), $t(32) = 4.11$, $p < .001$; only 10.8% of the respondents finished their theses by the optimistic date. Interestingly, fewer than half of the respondents (48.7%) finished by the time they had predicted assuming that "everything went as poorly as it possibly could." Although the difference was not significant, respondents tended to underestimate their actual completion times even when they made pessimistic predictions ($M = 48.6$ days vs. 55.5 days), $t(32) = 1.03$, *ns*. Respondents' optimistic and pessimistic predictions were both strongly correlated with their actual completion times ($rs = .73$ and .72, respectively; $ps < .01$).

In terms of absolute accuracy, respondents' pessimistic predictions fared no better than their best estimates. The absolute difference between predicted and actual completion times was equivalent whether respondents were instructed to make pessimistic predictions or accurate predictions ($Ms = 23.2$ days and 22.6 days, respectively), $t(32) < 1$.[2] Similarly, respondents' pessimistic predictions were no more informative than their best estimates at the correlational level (see Table 1). Although the instructions to make a pessimistic prediction decreased the optimistic bias in prediction, it did not increase the accuracy of respondents' forecasts.

Study 2

One aim of the second study was to replicate the pattern of results obtained in the initial study. We also instituted several changes to the procedure to address some alternative interpretations of the optimistic bias revealed in Study 1. One possibility was that the optimistic bias was due to some atypical aspects of the target task. The Honors Thesis course, although very similar to many school projects, was novel because of its

Table 1

Predicted and Actual Completion Times by Prediction Instruction: Study 1

| | Prediction instruction | | |
Measure	Best	Optimistic	Pessimistic
Predicted days	33.9	27.4	48.6
Actual days	55.5	55.5	55.5
Difference	−21.6	−28.1	−6.9
Absolute difference	22.6	28.2	23.2
Subjects completed in predicted time (%)	29.7	10.8	48.7
R: Predicted and actual days	.77	.73	.72

Note. Means are based on 33 subjects.

[1] In each of the studies reported, there were no significant sex differences in the relation between predicted and actual completion times. The analyses are collapsed across sex.

[2] Note that if the distributions of both sets of difference scores (best guesses minus actual completion times and worst-case predictions minus actual completion times) were symmetrical around their means (e.g., in perfectly normal or rectangular distributions) then the mean of the absolute difference scores would necessarily be smaller for the predictions that had the smaller signed difference. However, the distribution of difference scores from the best-guess predictions were markedly skewed, with a long tail on the optimistic side of zero, a cluster of scores within 5 or 10 days of zero, and virtually no scores on the pessimistic side of zero. In contrast, the differences from the worst-case predictions were noticeably more symmetric around zero, with the number of markedly pessimistic predictions balancing the number of extremely optimistic predictions. These differences in shape imply that the deviation of pessimistic predictions from actual completion times should have greater variance than the deviation of best-guess predictions from actual completion times. Although this pattern was observed, the difference in variances was far from significant.

magnitude and lack of external deadlines. In Study 2, partici-pants made predictions about familiar everyday activities, in-cluding school assignments and tasks around the home. Antici-pating that there would be external deadlines for many of the academic assignments, we sought to examine the relations among deadlines, predictions, and actual performance.

A second possibility was that participants in Study 1 offered optimistic completion times out of a desire to present them-selves in a positive light. In the present study, we assessed the possibility of a self-presentation bias by varying the information participants received about the purpose of their predictions. If participants are fully aware that the researcher will assess the validity of their predictions, then experimental demands should be for accurate rather than optimistic predictions. Thus, we ex-plicitly informed some participants that researchers would compare subjects' predicted and actual completion times. The remaining participants were simply told that researchers were interested in the activities of university students. As in Study 1, these latter subjects were not informed that the researchers would evaluate the accuracy of the predictions. If the optimistic bias in Study 1 was due to self-presentation, then subjects should exhibit less optimism when they are aware that the ac-curacy of their predictions will be assessed.

A related possibility was that, despite instructions to the con-trary, participants in Study 1 merely reported a time by which they hoped to be done. Participants may have suspected that they were unlikely to finish by the time of their best estimates. Note that one finding suggests otherwise: Even when partici-pants were instructed to furnish their most pessimistic judg-ments, many continued to underestimate their completion times. In Study 2, a measure of participants' subjective confi-dence in their predictions provided a more direct assessment of their beliefs regarding the accuracy of their forecasts.

The present study differed from Study 1 in another important way. In the first study, we obtained an objective measure of com-pletion time; in the second study, we examined participants' forecasts for everyday tasks and thus had to rely on self-reported completion times. We took a number of precautions to mini-mize the likelihood that subjects would report erroneous com-pletion times: We obtained participants' completion times after a relatively short interval and emphasized their confidentiality as well as the importance of accurate recall. Although these pro-cedures cannot guarantee accurate reporting, we believed that the increase in external validity achieved by sampling a wide range of familiar activities outweighed the risks.

Method

Subjects and procedure. Subjects were 104 undergraduate psychol-ogy students (54 men and 50 women) who received course credit for their participation. Recruited by telephone for a study of the activities of university students, subjects participated individually or in small groups in two questionnaire sessions scheduled 1 week apart. At the initial session, the experimenter provided verbal instructions that were varied to create two information conditions. Subjects assigned to the complete information condition were informed that the primary pur-pose of the study was to assess the accuracy of people's predictions. They were told that they would predict completion times for projects in the first session and report their actual completion times in the second session. Subjects in the partial information condition were told only that

the researchers were studying the activities that university students were engaged in throughout the year.

Following the verbal instructions, subjects received a questionnaire containing the measures of prediction and confidence. Subjects were asked to describe two tasks or projects that they intended to complete in the next week, one that was school related and one that was not. The order of the two project descriptions was counterbalanced across subjects. Subjects offered their predictions and judgments for each proj-ect immediately after they described it. They predicted the date and time they would finish the project. They also indicated how certain they were that they would finish by the predicted time on a percentage scale ranging from 0% (*not at all certain*) to 100% (*completely certain*).

Subjects returned for a second session 1 week later. They indicated whether they had finished the projects and, if so, the date and time of completion. Subjects also reported whether there was an external dead-line for completing the academic project and when the deadline was. Almost half of the projects remained unfinished at the time of the sec-ond session, even though subjects were instructed to choose tasks that they intended to complete within the week. At the end of the semester, we telephoned subjects whose projects were incomplete at the second session; we asked these subjects whether they eventually finished the tasks, and if so, when.

Results

Predicted versus reported completion times. Because we were unable to contact 3 subjects for the follow-up interview, the analyses are based on 101 subjects. Of these subjects, 97 were able to report an academic project that they intended to complete in the next week (e.g., essays, computer assignments, and laboratory reports) and 78 were able to report a nonaca-demic project (e.g., "fix my bicycle," "clean my apartment," and "write a letter to my friend"). Their predicted and reported completion times for the projects were rounded to the nearest half hour, converted to number of days from the initial session, and subjected to mixed model analyses of variance (ANOVAs). The within-subjects factor was predicted versus reported com-pletion time; the between-subjects factors were the information (partial vs. complete) subjects received and the order (academic first vs. nonacademic first) in which they reported the projects. The ANOVAs were based on the 91 academic projects and 62 nonacademic projects that were finished by the time of the fol-low-up interview. Means are presented in Table 2. For both types of projects, subjects took longer to finish than they pre-

Table 2
Predicted and Actual Completion Times by Type of Task: Study 2

Measure	Task	
	Academic	Nonacademic
Predicted days	5.8	5.0
Actual days	10.7	9.2
Difference	−4.9	−4.2
Absolute difference	5.6	5.8
Subjects completed in predicted time (%)	37.1	42.5
R: Predicted and actual days	.36	.48

Note. Means are based on the 91 academic projects and 62 nonaca-demic projects that were finished before the follow-up interview.

dicted: for academic projects $M = 10.7$ vs. 5.8 days, $F(1, 87) = 20.00$, $p < .001$; for nonacademic projects $M = 9.2$ vs. 5.0 days, $F(1, 58) = 6.65$, $p < .02$. The prediction bias was not moderated by the between-subjects factors. Subjects' predictions were equivalently biased regardless of whether they had received complete information about the purpose of the study and had answered questions about their academic or nonacademic project first (all interaction Fs < 1). Subjects finished 37.1% of the academic projects and 42.5% of the nonacademic projects within the predicted time.[3]

Note, again, that the optimistic bias in prediction does not indicate that subjects' predictions were unrelated to their reported completion times. Predicted and reported completion times were significantly correlated for both academic and nonacademic projects (rs $= .36$ and $.48$, respectively; $p < .01$). Subjects who predicted they would finish early, in comparison with the other participants, reported that they had finished relatively early. However, the bias at the mean level does indicate that subjects' prediction errors were systematic. Subjects tended to underestimate rather than overestimate their completion times.

Confidence. On average, subjects reported feeling 74.1% certain that they would meet their forecasts for academic projects and 69.9% certain for nonacademic tasks. Subjects' certainty ratings were related to whether they finished the projects within the predicted time. Point-biserial correlations indicated that subjects who reported higher certainty ratings were more likely to fulfill their predictions ($r = .29$, $p < .01$, for academic projects; $r = .23$, $p < .06$, for nonacademic projects).

The role of deadlines. A subset of the subjects ($n = 62$) reported having external deadlines for their academic projects; a majority of these subjects (80.6%) finished the projects in time to meet their deadlines. On average, the projects were due in 12.9, days and subjects reported finishing them in 11.0 days. Nevertheless, even subjects with deadlines typically exceeded their predicted completion times. They predicted that they would finish in only 5.9 days, on average, well in advance of both the deadline and the reported completion time; only 38.7% of these subjects finished in the predicted time. Apparently, subjects underestimated the importance of deadlines in determining when they would finish their projects. Correlational analyses support this interpretation: Although subjects' predictions were only weakly associated with the deadlines ($r = .23$, $p < .09$), their reported completion times were strongly associated with the deadlines ($r = .82$, $p < .001$).

Discussion

The results replicate the prediction bias obtained in Study 1 and extend the phenomenon to more familiar, everyday tasks. The bias in people's predictions does not appear to be a byproduct of experimental demand or of subjects' concerns about self-presentation. Participants reported equally optimistic predictions regardless of whether they had been informed of the researcher's intention to examine the accuracy of their predictions. In addition, a measure of subjective confidence revealed that subjects were quite confident that they would meet their predictions. Subjects expressed a degree of certainty in their predictions that was much closer to the scale's highest point of *completely certain* than to the lowest point of *not at all certain.*

By reporting relatively high levels of confidence, subjects indicated that they saw their predictions as realistic, not merely as wishful thinking.

Study 3

In the next study, we included a think-aloud procedure to explore the cognitive processes underlying the seemingly pervasive optimism in task completion predictions. Participants were instructed to say aloud every thought that came to mind as they formulated their predictions for when they would complete an upcoming school assignment. We hypothesized that participants would refer primarily to their plans for the target task as they thought aloud. We examined their protocols to assess the extent to which participants also considered their own previous experiences, the experiences of others, their own personal dispositions, and the deadline for the assignment. Similar information categories have been used in previous research on self-prediction (Osberg & Shrauger, 1986). Because of the seemingly recurrent nature of the prediction bias, we were particularly interested in participants' use of past experiences.

One reason people may neglect the past is that they are motivated to discount negative prior experiences. To assess the attributions people make for past completion times, we instructed subjects in the present study to recall one occasion when they had failed to complete a task by the time they originally predicted. They then recalled a similar prediction failure experienced by a friend or acquaintance. Subjects explained why each of the two tasks was not finished by the expected time. Subjects' attributions for a friend's performance served as a baseline against which we could evaluate their attributions for their own performance. Judges evaluated subjects' explanations on three dimensions: the extent to which the cause implicated other people and circumstances or the subjects, themselves, (external vs. internal), was temporary or persistent (transitory vs. stable), and was specific to the particular project or relevant to many different activities (specific vs. global).

The following hypotheses were tested in the present study. First, participants will underestimate their completion times. Second, participants will focus primarily on future scenarios for the task at hand and neglect their past experiences while formulating their predictions. Finally, participants will attribute their own prior prediction failures to causes that are relatively external, transitory, and specific.

Method

Subjects and procedure. Subjects for the study were 78 undergraduate psychology students (34 men and 44 women) who participated individually and received course credit or a nominal payment. Subjects were recruited to participate in a study concerning the activities of university

---

[3] Because the mean completion time includes only those projects that were finished at the follow-up interview, we provide a conservative estimate of the magnitude of the prediction bias. Importantly, the frequency of incomplete projects did not differ significantly between the partial information condition (3 academic tasks and 6 nonacademic tasks) and the complete information condition (3 academic tasks and 10 nonacademic tasks). The incomplete projects were included in calculating the percentage of projects finished by the predicted time.

students. On arrival, subjects were seated at a desk containing a tape recorder and microphone. They were told that the researchers were interested in the thoughts of students as they made their responses. Subjects were given a questionnaire and asked to "think aloud" as they completed it: "Read each question aloud and then continue by saying every thought that enters your mind as you think about a question, decide on your answer, and even as you write down your answer." The experimenter started the tape recorder and left the subject alone to complete the questionnaire. Subjects first described a school project that they planned to complete in the next 2 weeks and indicated when the project was due (i.e., its deadline). Next, subjects predicted as accurately as possible the date and time that they would finish the project. Subjects then indicated how certain they were that they would finish by the predicted time on a percentage scale.

After reporting their judgments for the target project, subjects were asked to recall an occasion when they failed to complete a similar project by the time they had expected and to explain why the prediction error had occurred. Subjects also described and explained an occasion when a friend had not completed a similar project by the time he or she had anticipated. The order of recall was counterbalanced across subjects. All responses were recorded on audiotape and later transcribed verbatim.

Finally, the experimenter requested permission to contact subjects for a brief telephone interview. The follow-up interviews took place 1 week after the reported deadline for the project (except for 2 subjects who had no deadline and were interviewed 1 week after the predicted completion time). The interviewer asked subjects when they had completed their projects.

Results

Predicted versus reported completion times. Only 43.6% of the subjects finished their projects within the predicted time. The remaining subjects reported finishing later than predicted (46.2%) or were not finished at the time of the telephone interview (10.3%). Moreover, the 70 subjects who did finish their projects had expected to finish in 6.0 days but reported finishing in 7.1 days, $t(69) = 2.68, p < .01$. Once again, however, the predicted completion times were strongly correlated with actual completion times ($r = .81, p < .001$).

Confidence. As in Study 2, subjects were quite confident in the accuracy of their predictions. On average, subjects reported they were 83.5% certain that they would complete the project in the predicted time. In this study, subjects' certainty ratings were not significantly correlated with whether they finished in the predicted time.

The role of deadlines. The majority of subjects (75.0%) finished before the deadline. On average, subjects completed in 6.7 days projects that were due in 8.2 days. Moreover, subjects' completion times were strongly correlated with their deadlines ($r = .91, p < .001$). Their predicted completion times were also strongly correlated with the deadlines ($r = .87, p < .001$), suggesting that, unlike in Study 2, subjects were sensitive to the implications of the deadlines for their future behavior. One important difference between the studies is that subjects in the present experiment reported their deadlines before making their predictions; in contrast, subjects in the earlier study reported their deadlines after making their predictions.

Verbal protocols. On the basis of a priori theoretical considerations, we developed a seven-category system to characterize the content of subjects' verbal protocols as they generated their

predictions. These categories and sample responses are depicted in Table 3. Two types of thoughts about the future were distinguished. One category included subjects' plans for completing a project and thoughts about its likely progression (future plans). A second category included subjects' references to potential impediments (future problems). Two categories of past experiences were also distinguished, one for references to projects that were completed as anticipated (past success) and one for references to problems or impediments encountered in the past (past problems). Three additional categories were included for references to other people's experiences (others' experiences), the subjects' personal characteristics (disposition), and the deadline (deadline). A research assistant familiar with the seven information categories partitioned the transcripts into response units and assigned each response to one category. To assess the reliability of the category assignment, a second assistant classified the same responses independently; the two raters agreed on 85.6% of their classifications. The raters resolved their disagreements through discussion; all analyses were conducted on the final set of classifications. Both raters were naive with respect to the hypotheses.

As subjects generated their predictions, they expressed a total of 247 responses, on average 3.69 responses per subject.[4] For each subject, we calculated the proportion of responses assigned to each category. Proportionally more responses concerned future scenarios ($M = .74$) than relevant past experiences ($M = .07$), $t(66) = 13.80, p < .001$. Furthermore, a much higher proportion of subjects' thoughts involved planning for a project and imagining its likely progress ($M = .71$) rather than considering potential impediments ($M = .03$), $t(66) = 18.03, p < .001$. Subjects rarely mentioned others' experiences, their own personal attributes, or the deadlines for the target task. The mean proportion of thoughts assigned to each of these categories did not exceed .15.

In further analyses, we failed to find evidence of a relation between the informational content of subjects' thoughts and the accuracy of their predictions. Most important, subjects who finished in the predicted time were no more likely to mention their past experiences ($M = .12$) than were subjects who did not finish in the predicted time ($M = .05$), $t(65) < 1$. Similarly, thoughts about personal dispositions, others' experiences, and deadlines were rare and unrelated to whether subjects finished in the predicted time. Finally, note that although subjects' predicted completion times were strongly correlated with deadlines, subjects rarely referred to deadlines in their verbal protocols.

Attributions. Subjects described and explained two previous occasions when projects were not completed as anticipated, one for themselves and one for a close acquaintance. Four research assistants independently rated, on 7-point scales, the extent to which the attributions were external, transitory, and specific. Reliability among the four raters was high (Cronbach's alpha ranged from .83 to .90); we analyzed the raters' mean ratings on each scale.[5] In comparison with the explanations they

---

[4] Responses to the think-aloud procedure were inaudible for 11 subjects, and the mean proportions are based on the remaining 67 subjects.

[5] Responses to the attribution questions were inaudible for 11 subjects. An additional 8 subjects claimed that they were unable to recall

Table 3
Mean Proportion and Examples of Responses Coded Into Each Information Category: Study 3

Category	Proportion	Examples
Future plans	.71	"I plan to go up to my parents' place and use their personal computer to type it up today." "I'll start it Tuesday, get as much done as I can and finish up what I don't have done on Wednesday." "Let's see, I have the morning off, I have classes in the afternoon, I have to do some fieldwork in the late afternoon, so it will probably be done about 7:00."
Future problems	.03	"I don't know. It might take a bit longer because I'm not quite caught up in this." "There's a chance that because of unexpected circumstances, or just laziness, I won't get done by Wednesday." "But there will probably be some question I won't get, so I might have to get it off of someone else."
Past success	.06	"Because I have always finished my projects by the expected date." "I'll put about five hours, that's about my average for all of the assignments."
Past problems	.01	"I never have completed something when I really wanted to." "It took me days and days and days to do a term paper last year for Social Work." "Seeing as how I have handed every other paper for this class in late, I would like to get this one in on time."
Others' experience	.01	"I will finish it about 11:30, like all of my friends." "I think it's more time than most people are spending on it, but I have to weigh all of the information given to me in this project."
Disposition	.02	"I tend to be a little bit of a procrastinator at times." "I'm very slow and I'm a perfectionist, especially as far as art is concerned."
Deadline	.15	"I'll finish it on Sunday because it's due on Monday at four o'clock." "Well, the due date is July 12 at five o'clock. I'll probably finish the project half an hour before it's due."

Note. Mean proportions are based on 67 subjects with audible responses.

offered for others, subjects' explanations for their own prediction failures were somewhat more external (*M*s = 2.92 and 3.40), $t(59) = 1.84$, $p < .07$; more transitory (*M*s = 3.81 and 4.71), $t(59) = 4.07$, $p < .001$; and more specific (*M*s = 3.61 and 4.22), $t(59) = 2.67$, $p < .01$.

Discussion

In formulating their task completion estimates, participants focused overwhelmingly on their plans for the current project, describing scenarios in which they finished the task without impediments; their verbal protocols indicated a neglect of other kinds of information, including past experiences with similar projects. Correlational analyses did not reveal evidence of the hypothesized relation between the content of individuals' thoughts and the validity of their completion estimates. We anticipated that subjects who used the past as a basis for prediction would generate more realistic predictions. The study was unable to provide an adequate evaluation of this hypothesis, how-

an occasion when they did not finish a project by the anticipated time. Analyses of the attribution data are based on the remaining 60 subjects.

ever, as only 7% of the subjects' responses involved references to the past.

Perhaps the most puzzling aspect of the verbal protocols is subjects' general failure to refer to their deadlines. The deadlines for the tasks were presumably highly salient; subjects recorded their deadlines shortly before generating their predictions. Moreover, subjects' predictions were highly correlated with their deadlines. Of course, this correlation does not necessarily imply that subjects' thoughts about their deadlines guided their predictions. To clarify these issues, we manipulated deadlines in the fourth study and observed their impact on subjects' thought listings and predictions.

Although participants did not report focusing on past experiences while generating their predictions, most were able to remember instances when they failed to complete an assignment by the time they anticipated. The reasons participants reported for their own lateness were more external, transitory, and specific than the reasons they provided for similar tardiness by close acquaintances. Because comparable data were not obtained for tasks completed in the predicted time, we cannot determine the extent to which these actor–observer differences are specific to tasks completed late. Nevertheless, the finding is consistent with the idea that attributional processes may diminish the relevance of previous negative experiences.

Study 4

In Study 4, we examined the impact that asking subjects to focus on memories of relevant past experiences would have on predictions. Subjects were each given a standard computer assignment to complete and were asked to predict when they would finish it. We attempted to vary the focus of subjects' thoughts as they formulated their predictions. In the recall condition, subjects remembered and described their previous experiences with similar assignments just before making their predictions. In the recall-relevant condition, subjects described their past experiences with similar assignments and then answered additional questions that were designed to lead subjects to link these experiences to the present computer assignment. In the control condition, we made no attempt to direct the focus of subjects' thoughts.

If simply remembering past episodes leads people to make use of the experiences, then individuals' predictions in both the recall and the recall-relevant condition should be closer to the deadline than their predictions in the control condition. We have argued, however, that individuals may consider past episodes but judge them as irrelevant. Unless people forge a direct connection between past episodes and the task at hand, they will not use their experiences to guide their predictions. Subjects in the recall-relevant condition were required to construct scenarios that would illuminate the relevance of their previous experiences to the current prediction problem. These subjects should be most likely to use their previous experiences while generating their forecasts; hence, their predicted completion times should be more realistic than those of subjects in the other two conditions.

Subjects' deadline for completing the assignment constituted a second independent variable. Half of the subjects were given a deadline of 1 week; the remaining participants received a deadline of 2 weeks. Varying the deadline allowed us to examine its impact on predicted and actual completion times and to generalize the results of the thought-focus manipulation to forecasts of different lengths.

Although the computer assignment afforded an objective measure of completion times, subjects also returned for a second questionnaire session. They reported when they had finished the assignment and explained why they did or did not complete it by the time they anticipated. According to our attributional hypothesis, participants who finished later than they expected should offer more external, transitory, and specific explanations for their performance than participants who completed the assignment on time.

Method

Subjects and procedure. Subjects were 123 undergraduate psychology students (46 men and 77 women) who received course credit for participating in research on a new computer tutorial program for psychology. Subjects were informed that they would be required to attend two questionnaire sessions scheduled 1 or 2 weeks apart and to complete a computer assignment in the interval between sessions. On arrival at the initial questionnaire session, subjects received instructions for completing the computer assignment. The assignment involved working through three sections of an interactive computer tutorial program for psychology available on the student computer network and required ap-

proximately 1 hr to complete. To prevent subjects from treating the assignment as merely an extension of the initial session, rather than as an assignment in itself, subjects were asked not to begin the assignment on the same day as their initial session. Otherwise, they were free to do the assignment at any time. Subjects were also given a handout indicating the time of their second session, either 1 week or 2 weeks later. To receive credit for participation, subjects needed to finish the assignment by that time. Thus, two different deadline conditions were created. Unbeknownst to subjects, the computer was programmed to record the date and time that they completed the project.

After receiving their instructions, subjects filled out a short questionnaire containing the measures of previous completion times and current predictions. Subjects predicted as accurately as possible when, including the time of day, they would finish the assignment. We asked subjects to write all of the relevant thoughts that went through their heads, "whether about the past, present, or future," while they were trying to predict when they would complete the assignment. At different points in the procedure according to condition, subjects reported their past experiences with school assignments similar to the present one (i.e., short assignments with specific deadlines). They estimated the proportion of the previous projects that they had finished 4 days or more before the deadline, 3 days before the deadline, 2 days before the deadline, and so on up to 4 days or more after the deadline. They then summarized the distribution they reported by indicating how far before the deadlines they had typically finished their assignments.

Thought-focus manipulation. To manipulate the focus of subjects' thoughts as they generated their predictions, we varied the questions subjects answered immediately before their predictions. Subjects in the recall condition answered questions about their past experiences immediately before making their predictions. Moreover, the instructions for the prediction question asked these subjects to keep their past experiences in mind. Subjects in the recall-relevant condition also reported their past experiences before generating their predictions. In addition, these subjects answered two more questions that required them to forge a connection between the past experiences and the computer assignment. First, they indicated the date and time they would finish the computer assignment if they completed it as far before its deadline as they typically completed assignments. Second, they described a plausible scenario—based on their past experiences—that would result in their completing the computer assignment at their typical time. After writing the hypothetical scenario, they reported their predictions for the computer assignment. In the control condition, we made no attempt to direct the focus of subjects' thoughts. Control subjects were not asked to recall their past experiences until after they had reported their predictions. The three thought-focus conditions were crossed with the two deadlines to create six experimental conditions. Individuals were assigned randomly to experimental treatments, and the experimenter was unaware of each subject's condition.

At the second session, subjects first indicated whether they had finished the assignment before, after, or at the same time as predicted. They then offered an explanation for their success or failure in meeting their prediction. Next, subjects rated their own causal explanation on three dimensions. Using 7-point scales, they indicated the extent to which the cause implicated other people and circumstances or themselves (external vs. internal), was temporary or would be present for similar assignments in the future (transitory vs. stable), and was specific to this type of assignment or would influence other types of assignments as well (specific vs. global).

Results

Recall of past experiences. Subjects remembered finishing the majority of their previous projects very close to deadline. When asked to estimate their "typical completion time," they

Table 4
Predicted and Actual Completion Times by Thought Focus Condition: Study 4

Measure	Thought focus		
	Control	Recall	Relevant
Predicted days	5.5	5.3	7.0
Actual days	6.8	6.3	7.0
Difference	−1.3	−1.0	−0.1
Absolute difference	1.8	2.0	1.9
Subjects completed in predicted time (%)	29.3	38.1	60.0
Subjects refer to past experience (%)	2.4	11.9	12.5
R: Predicted and actual days	.60	.62	.75

Note. n = 41, 42, and 40 in the control, recall, and recall-relevant conditions, respectively.

reported that they finished projects approximately 1 day before deadline ($M = 1.3$ days). A 2 (deadline) × 3 (thought focus) ANOVA conducted on these typical completion times indicated no significant differences among the experimental conditions.

Predicted versus actual completion times. We hypothesized that subjects in the recall-relevant condition would generate completion estimates that were closer to the deadlines and less optimistically biased than subjects in the other two conditions. To test this hypothesis, we performed a series of 2 (deadline) × 3 (thought focus) ANOVAs. Means for each thought-focus condition are depicted in Table 4. The analysis of subjects' predictions revealed a significant main effect for thought focus, $F(2, 117) = 4.64$, $p < .02$. Subsequent comparisons revealed that subjects in the recall-relevant condition predicted they would finish the assignment later than subjects in either the recall condition, $t(79) = 1.99$, $p < .05$, or the control condition, $t(80) = 2.14$, $p < .04$, which did not differ significantly from each other, $t(81) < 1$. The impact of the thought-focus manipulation was not moderated by the deadline variable (interaction $F < 1$). Across all conditions, subjects with a 2-week deadline predicted that they would finish later than those with a 1-week deadline ($Ms = 7.9$ and 3.9 days, respectively), $F(1, 117) = 68.64$, $p < .001$.

The actual completion times recorded by the computer did not differ among the three thought-focus conditions (means ranged from 6.3 days in the recall condition to 7.0 days in the recall-relevant condition), $F(2, 117) < 1$, and there was no significant Deadline × Thought Focus interaction, $F(2, 117) < 1$. Although the thought-focus manipulation affected subjects' predictions, it did not influence when they finished the assignment. In contrast, deadlines did affect behavior. Subjects finished the assignment later when their deadline was in 2 weeks rather than 1 week ($Ms = 9.1$ and 4.3 days, respectively), $F(1, 117) = 67.26$, $p < .001$.

Further analyses were performed on the difference between subjects' predicted and actual completion times. Subjects underestimated their completion times significantly in the control ($M = −1.3$ days), $t(40) = 3.03$, $p < .01$, and recall conditions ($M = −1.0$ day), $t(41) = 2.10$, $p < .05$, but not in the recall-relevant condition ($M = −0.1$ days), $t(39) < 1$. Moreover, a higher per-

centage of subjects finished the assignments in the predicted time in the recall-relevant condition (60.0%) than in the recall and control conditions (38.1% and 29.3%, respectively), $\chi^2(1, N = 123) = 7.63$, $p < .01$. The latter two conditions did not differ significantly from each other.

Accuracy of prediction. A 2 (deadline) × 3 (thought focus) ANOVA on absolute difference scores yielded no significant effects of thought focus. Predictions were no more accurate in the recall-relevant condition than in the other conditions. There was a main effect for deadline: The absolute difference between predicted and actual completion times was greater for subjects with a 2-week deadline than for subjects with a 1-week deadline ($Ms = 2.7$ and 1.1 days, respectively), $F(1, 117) = 11.82$, $p < .001$. We also computed correlations, within each condition, between estimated completion times and actual completion times. The mean within-cell correlation was significant ($r = .66$, $p < .01$); the correlation was no stronger in the recall-relevant condition than in the other two conditions. Thus, predictions in the recall-relevant condition were less biased but no more accurate than predictions in the other two conditions.

Mediating process. Subjects' typical completion times were not significantly correlated with their predictions in any of the conditions, and the mean within-cell correlation was nonsignificant. Apparently, subjects did not incorporate their own past experiences directly into their predictions. In contrast, subjects' typical completion times were related, albeit weakly, to their actual completion times. The mean within-cell correlation was significant ($r = .19$, $p < .05$, one-tailed); subjects who reported that they usually finished assignments closer to deadlines tended to finish the computer assignment relatively close to its deadline.

We also examined the thoughts listed by subjects' as they generated their predictions. Two raters, unaware of experimental condition, categorized the open-ended responses using the same seven-category system used in Study 3. The raters agreed on 90% of their initial classifications and resolved disagreements through discussion. Because subjects in the present study provided a relatively small number of responses ($M = 1.2$), we examined the percentage of subjects who referred to each of the seven types of information rather than mean category frequencies. Almost all subjects (93.5%) reported considering future plans and scenarios for the computer assignment. Most of these future plans concerned how subjects would successfully complete the project. Only 9.8% of the subjects mentioned future impediments, and there were no significant differences among the conditions. In addition, very few subjects (8.9%) reported thinking about their past experiences. Even within the recall-relevant condition, only 12.5% of the subjects mentioned their past experiences. Note, however, that of the 12 subjects who mentioned past experiences, 11 were in either the recall or recall-relevant condition. Few subjects referred to either the deadline for the assignment (4.1%) or their dispositions (4.9%); no subjects mentioned the experiences of others. Although the present study incorporated a written thought-listing procedure and Study 3 used a verbal think-aloud measure, the results are very similar.

Despite the dearth of references to past experience, we conducted an internal analysis to examine whether the reported use of past experiences was associated with the degree of optimistic

prediction bias. This did not appear to be the case: The mean optimistic bias did not differ between subjects who referred to past experiences (M = 1.4 days) and those who did not (M = 0.7 days), $t(121) < 1$. Internal analyses revealed a similar lack of association for each of the other types of information.

Attributions. Subjects' ratings of their explanations for finishing by or after the predicted time were submitted to 2 (deadline) × 3 (thought focus) × 2 (reported outcome: late vs. on time) ANOVAs. The attributional data are consistent with the hypothesis that people diminish the relevance of prediction failures for subsequent predictions. Subjects who finished late rated the reasons that they provided for the completion time as significantly more transitory (Ms = 4.5 and 3.0), $F(1, 110)$ = 30.68, $p < .001$, and specific than did individuals who finished on time (Ms = 4.2 and 3.1), $F(1, 110)$ = 9.73, $p < .01$. Subjects did not judge the reasons for finishing late to be significantly more external than the reasons for finishing on time (Ms = 3.5 and 3.2), $F(1, 110)$ = 1.41, *ns.* Neither deadline nor thought focus produced a significant effect on subjects' attributions.

Discussion

The findings suggest that people make more realistic completion estimates when they use their past experiences to inform their predictions. However, leading people to remember past experiences did not, in itself, reduce the optimistic bias. The bias was attenuated only when subjects were induced both to consider their past experiences and to relate the experiences to the task at hand.

The absence of an effect in the recall condition is rather remarkable. In this condition, subjects first described their past performance with projects similar to the computer assignment and acknowledged that they typically finish only 1 day before deadlines. Following a suggestion to "keep in mind previous experiences with assignments," they then predicted when they would finish the computer assignment. Despite this seemingly powerful manipulation, subjects continued to make overly optimistic forecasts. Apparently, subjects were able to acknowledge their past experiences but disassociate those episodes from their present predictions.

In contrast, the impact of the recall-relevant procedure was sufficiently robust to eliminate the optimistic bias in both deadline conditions. It is important to distinguish the logical demands that subjects in the recall-relevant condition faced from possible demand characteristics that might have yielded similar results. Our instructions asked subjects to put considerable thought into how they might incorporate their past experiences into their future plans. A demand characteristic account of the findings implies that subjects mindlessly modified their predictions in accordance with pressures existing in the experimental situation. Such demands should have led subjects to translate their typical past completion times directly into their current predictions. This did not occur: The correlation between typical times and current predictions was nonsignificant, and although the typical past completion time was about 1 day before the deadline, the average prediction for the computer task was about 4 days before the deadline. Both of these results indicate that a considerable amount of processing intervened between the demand for subjects to consider the past and the production

of their current prediction. Note, as well, that this degree of processing seems warranted. If subjects had simply based their predictions on their typical completion times, they would have been far too pessimistic, on average. Therefore, subjects were justified in being more optimistic than their history seemed to imply. They overshot the mark, however, evidencing even more optimism than their subsequent performance justified.

Interestingly, although the completion estimates were less biased in the recall-relevant condition than in the other conditions, they were not more strongly correlated with actual completion times, nor was the absolute prediction error any smaller. The optimistic bias was eliminated in the recall-relevant condition because subjects' predictions were as likely to be too long as they were to be too short. The effects of this manipulation mirror those obtained with the instruction to provide pessimistic predictions in the first study: When students predicted the completion date for their honor's thesis on the assumption that "everything went as poorly as it possibly could" they produced unbiased but no more accurate predictions than when they made their "best guesses."

We included a thought-listing procedure in an attempt to assess the cognitive processes mediating the experimental effects. As in Study 3, subjects' reported thinking about future scenarios to the exclusion of almost anything else. In Study 3, we found that subjects mentioned deadlines only rarely in their verbal protocols even though their predictions were correlated with their deadlines. In Study 4, we manipulated deadlines and obtained a large impact of this variable on predictions. Again, however, subjects virtually ignored deadlines while listing the thoughts that went through their heads as they made their forecasts. Moreover, subjects in Study 4 made little reference to their past even in the recall-relevant condition, in which they had been prompted to draw a connection between the past and their forecast just before they made their prediction. The lack of a correlation between typical completion times and predictions provides further evidence that subjects in all conditions largely ignored their histories.

How does the recall-relevant manipulation exert its impact if it does not cause people to derive their current prediction directly from their personal history? One possibility is that although subjects refused to extrapolate from their past experiences, the procedure led many subjects to appreciate the wisdom of more conservative predictions. They may not have believed that the past was likely to repeat itself. Nevertheless, they may have abstracted a more profound conclusion from the experiences. Perhaps they acknowledged, at least at a "theoretical" level, that there was a good chance that the route from plan to completion might contain some unforeseen—and perhaps unforeseeable—impediments. At the time they made their predictions, they may not have known the precise roadblocks that would arise, but they may have realized that some unplanned detours were likely to slow their progress. Accordingly, they adjusted their predictions in a more conservative direction. Note that this interpretation is speculative: The thought-listing results do not provide evidence of such reasoning. An alternative possibility is that the recall-relevant manipulation induced subjects to add a correction factor to their forecasts but did not inspire any particular insight into the prediction process.

Questions also remain about the importance of reviewing

past experience. It is possible that the recall-relevant manipulation achieved something other than its intended effect of making subjects more aware of the relevance of the past to the present. Conceivably, the manipulation exerted its effects through asking people to construct a hypothetical future scenario that was more pessimistic than their original plans. Researchers have successfully used similar "alternative scenario" manipulations to reduce overconfidence (Griffin et al., 1990; Hoch, 1985; Koriat, Lichtenstein, & Fischhoff, 1980) as well as other judgment biases (Arkes, Faust, Guilmette, & Hart, 1988; Lord, Lepper, & Preston, 1984). Because our study did not include a condition in which subjects were instructed merely to construct a hypothetical scenario, without reference to the past, we cannot rule out this possibility. We can, however, note two ways in which our manipulation explicitly focused people on their past: (a) Subjects derived the target date for their narratives directly from their own summary of past experiences, and (b) the potential impediments included in the narratives were to be based on problems they had encountered previously. We cannot say which of these two components produced the greater degree of realism exhibited by these subjects. Our decision to use a double-barrelled manipulation stemmed from our expectation that it would be difficult to overcome people's ahistorical prediction style. The manipulation achieved its primary purpose of demonstrating that, under some circumstances, leading people to consider their past can result in unbiased predictions. Further research is required to identify the conditions that make people more attentive to the implications of their previous performance.

Study 5

Our final study extended the investigation into the realm of social prediction. The primary goal of the study was to examine, again, the impact of different information—specifically, past experiences versus future scenarios—on people's predictions. In a social prediction study, participants forecast when another individual will complete a task. The advantage of this paradigm is that it allows us to exercise considerable control over the type of information available to the forecaster.

We speculated earlier that people's predictions of task completion times tend to be less optimistic for others than for themselves, in part because observers rely on distributional information more than actors do and in part because observers are more sensitive to the role of deadlines. In the present study, observer subjects attempted to predict when another individual—a participant in Study 4—would finish the upcoming computer assignment. To explore the impact of different types of information on prediction, we varied the nature of the information available to observer subjects. Some observers received the thoughts and plans that the target individuals reported thinking while generating their self-predictions; other observers received the target individuals' reported memories of their previous completion times. Observers who receive information about the individuals' past experiences should offer less optimistic predictions than observers who need to rely on the individuals' self-generated future scenarios.

Method

Subjects and procedure. Subjects were 123 undergraduate psychology students (87 women and 36 men) who were offered course credit to participate in a study of social judgment. Subjects received a brief written description of the previous study (Study 4) in which participants were asked to predict when they would finish an upcoming computer assignment. Subjects were informed that they would obtain information about one of the participants and would make judgments and predictions concerning that individual.

Subjects in the present study served as observers and were each yoked to a subject (actor) of the same sex from the control condition of Study 4. Observers received the following items of information concerning their target actor: demographic information provided by the actor (sex, age, and academic major), the instructions the actor received for completing the computer assignment, the actor's deadline for the assignment (1 or 2 weeks), and the actor's self-predicted completion time. Two additional sources of information that had been potentially available to the actors at the time of prediction were their thoughts about completing the assignment and their memories of relevant previous experiences. The control actors had written their thoughts while generating their predictions, and they reported their previous completion times for similar projects immediately after making their predictions. We varied which of the two sources of actor-generated information observers received. Subjects were randomly assigned to one of three information conditions. In one condition (thoughts), subjects received the thoughts and plans reported by the actor subject as he or she generated a completion estimate. In a second condition (memories), subjects received the actor's reports of previous completion times. In a third condition (thoughts and memories combined), subjects received both sources of information in counterbalanced order. Thus, each subject from the control condition of Study 4 served as the target actor for three observers (i.e., one observer from each condition). After reviewing the information, subjects predicted as accurately as possible when the target actor would finish the assignment and wrote their thoughts as they arrived at their predictions.

Results

Analyses are reported in two stages. First, we compare the predictions of actors and observers, regardless of condition, and then we examine differences among the observer conditions. Means for each observer condition are presented in Table 5.

Self versus social prediction. To compare predictions made by the observers and actors, we performed a 2 (deadline: 1 vs. 2 weeks) × 2 (status: actor vs. observer) ANOVA. The analysis yielded significant main effects for deadline, $F(1, 39) = 108.43$, $p < .001$, and actor versus observer status, $F(1, 39) = 70.19$, $p < .001$. The main effect for status indicated that observers offered more conservative predictions ($M = 8.5$ days) than actors ($M = 5.5$ days). In addition, the analysis yielded a significant Deadline × Status interaction, $F(1, 39) = 15.94$, $p < .001$. The interaction revealed that observers were more sensitive to the deadline manipulation than were actors. For the 1-week deadline, observers' predictions were about 1 and a half days longer than were the actors' ($Ms = 5.1$ days vs. 3.6 days); for the 2-week deadline, observers' predictions were more than 4 days longer than were the actors' ($Ms = 11.7$ days vs. 7.4 days). Although the observers' predictions were more conservative, they were no more accurate than the actors' predictions. The two groups of subjects tended to err in opposite directions. The actors' optimistic bias ($M = -1.3$ days), $t(40) = 3.03$, $p < .01$, was matched by the observers' pessimistic bias ($M = 1.7$ days), $t(122) = 5.08$, $p <$

Table 5
Predictions, Completion Times, and Thought Listing by Information Condition: Study 5

Measure	Actors	Observer information		
		Thoughts	Memories	Combined
Predicted days	5.5	8.0	8.8	8.7
Actual days	6.8	6.8	6.8	6.8
Difference	−1.3	1.2	2.0	1.9
Absolute difference	1.8	2.8	2.7	2.6
Subjects completed in predicted time (%)	29.3	65.9	68.3	70.7
R: Predicted and actual days	.60	.51	.64	.59
Subjects using information category in thought listing (%)				
Future plans	92.7	36.6	17.1	34.1
Future problems	9.8	58.5	34.1	36.6
Past success	2.4	2.4	36.6	36.6
Past problems	0.0	2.4	39.0	36.6
Others' experience	0.0	14.6	9.8	7.3
Disposition	0.0	26.8	24.4	22.2
Deadline	0.0	9.8	7.3	12.2

Note. $n = 41$ in each condition.

.001. An ANOVA on absolute difference scores indicated that the actors and observers did not differ in absolute accuracy (*M*s = 1.8 and 2.7 days, respectively), $F(1, 39) = 2.68, p > .10$.[6]

Informational bases of predictions. To assess the effects of varying the type of information made available to the observers, we performed additional comparisons among the three observer conditions. First, we computed the intraclass correlation (Shrout & Fleiss, 1979) among the predictions of the three types of observers to determine the appropriate method of analysis (i.e., dependent vs. independent tests). The intraclass correlation, which indicates the similarity or agreement of the three observers yoked to a single actor, was virtually zero ($r = -.05$, *ns*), indicating that between-subjects comparisons among the three observer conditions were appropriate. An a priori contrast revealed that observers' predictions were somewhat more optimistic in the thoughts condition ($M = 8.0$ days) than in the memories and combined conditions (*M*s = 8.8 and 8.7 days, respectively), $t(117) = 1.64, p < .05$, one-tailed. The difference between the thoughts and memories conditions was marginally significant, $t(80) = 1.56, p < .10$, one-tailed. Apparently, exposure to actors' plans led observers to make slightly less conservative predictions. However, the absolute difference between predicted and actual completion times did not differ among the thoughts, memories, and combined conditions (*M*s = 2.8, 2.7, and 2.6 days, respectively).

Correlational analyses also helped to reveal the informational bases of observers' predictions. Observers' predictions were moderately correlated with the actors' reports of their typical completion times in both the memories and combined conditions (*r*s = .29 and .27, respectively, both *p*s < .05). In the thoughts condition, subjects were not provided with the actors' typical completion times; not surprisingly, then, their predictions were not significantly correlated with these times ($r = .10$, *ns*). In all three conditions, observers' predictions were correlated with the actors' predictions (*r*s ranged from .57 to .65, *p* < .01, in each case). Similarly, the correlation between observers' predictions and actual completion times was strong in each con-

dition (*r*s ranged from .51 to .64, *p* < .01), a level of association that is comparable to the prediction–behavior correlation for actors ($r = .60, p < .01$).

Thought listing. Two raters, unaware of experimental condition, categorized the thoughts listed by observers during prediction into the seven categories used in the previous studies. The raters agreed on 84% of their initial classifications and resolved disagreements through discussion. As in Study 4, we examined the percentage of subjects who referred to each type of information. Our analyses focused on observers' use of the actors' past experiences. Consistent with the hypotheses, the actors' previous history was mentioned by more of the observers (48.0%) than by the actors themselves (2.4%), $\chi^2(1, N = 164) = 48.78, p < .001$. The number of references to the past differed among the three observer conditions as well. More observers referred to the past in the memories and the combined conditions (73.2% and 65.9%, respectively) than in the thoughts condition (4.8%), $\chi^2(1, N = 123) = 45.75, p < .001$.

Note that control actors did not provide information about their past experiences until after they made their predictions; in contrast, observers in the memories and combined conditions had this information available before they made their predictions. Perhaps this procedural difference accounts for the greater tendency of observers to mention distributional information in their thought listing. One argument against this interpretation is that actors who had distributional information readily available to them before they made their predictions (subjects in the recall and recall-relevant conditions in Study 4) typically failed to mention this information in their thought listing. Unlike the actors, then, observers who were provided with both singular and distributional information appeared to use the distributional information as a basis for prediction. Fur-

---

[6] In the present study, we do not report analyses for prediction bias (i.e., signed difference scores). Because actual completion times were the same for actors and observers, the analysis of prediction bias is redundant with the analysis of predicted completion times.

thermore, as Table 5 indicates, observers were about four times more likely to refer to potential future problems than were the actors.

Discussion

Observers anticipated that a project would be finished considerably later than the time predicted by the individuals performing it. Although the conservatism displayed by observers could reflect a variety of processes, there was support for our suggestion that people make greater use of previous experience for social than for self-predictions. While generating their forecasts, observers were much more likely than actors to refer to the target actors' past experience. Even when observers obtained both past completion times and future scenarios they seemed to make use of the distributional information. In contrast, actors involved in the project—who had access to the same two sources of information—appeared to rely more heavily on their own plans as a basis for self-prediction.

The results were also consistent with our hypotheses about the effects of information on prediction, as revealed by comparisons among the observer conditions. Observers who were offered only the actors' future scenarios generated more optimistic predictions than observers who were provided with the actors' reports of their typical past performances. Note, however, that the effects of varying the information available to observers were relatively small. At a mean level, judgments in the three observer conditions were more similar to one another than to the actors' own estimates. Even when they obtained only information about the actors' plans for the project, observers made more conservative predictions than actors. Therefore, the conservatism displayed by observers was not due entirely to their greater use of past experience. The thought listings reveal another important difference between actors and observers. Whereas actors focused almost single-mindedly on how they would successfully finish the task by the predicted time, observers also considered factors that might obstruct the actors' task completion. This difference in focus may well reflect the discrepant objectives of actors and observers. While generating their predictions, actors were absorbed with planning how they would complete the task. The observers had a somewhat different goal. They assessed the credibility of the actors' predictions in light of the available evidence and generated their own forecasts. A focus on evaluation and credibility may lead observers to consider possible obstacles to the actors' finishing the project within their predicted time.

General Discussion

People anticipate that they will finish their own tasks earlier than they actually do. This optimistic bias in self-prediction was replicated in four prospective studies in which we varied characteristics of the target tasks, the procedure for eliciting predictions, and the criterion measures. In each case, fewer than one half of the participants finished their tasks in the amount of time they originally predicted. The magnitude of the prediction bias—which ranged from an average of approximately 1 day in Studies 3 and 4 to several weeks in Study 1—is sufficiently large to have an impact on people's lives. The findings extend previ-

ous literature on forecasting and planning (Hall, 1980; Hayes-Roth, 1981; Kidd, 1970) to include personal estimates of completion times for everyday tasks and activities.

Our assessments of participants' thoughts as they produced their forecasts yielded results consistent with the hypotheses. Participants appeared to construct narratives of how the future would unfold, scenarios that often included detailed plans for completing the target task as well as descriptions of related future activities. Participants rarely considered their own past experiences with similar tasks. When they did describe the past, they usually focused on previous occasions that justified their optimism; they almost never spontaneously mentioned episodes when they had encountered problems or failed to finish tasks as anticipated. Participants also rarely referred to such potentially useful information as their personal characteristics, others' experiences, and deadlines associated with tasks. In sum, their introspective reports were consistent with the planning fallacy: Apparently, people's natural inclination is to generate forecasts by focusing on details of a specific case rather than on distributional information about a related set of cases (Kahneman & Lovallo, 1991; Kahneman & Tversky, 1979; Kahneman & Tversky, 1982b).

A large majority of participants failed to mention some variables in their thought listing that exerted a strong influence on their predictions. In particular, both actors and observers largely ignored deadlines. We suspect that, if asked directly, subjects would affirm the significance of deadlines. Participants in our experiments always predicted they would finish before their deadline; this suggests that deadlines serve as a framework or background within which people construct their plans and predictions. Conceivably, participants felt little need to mention deadlines explicitly because the experimenter was clearly aware of them (Grice, 1975). Although the thought-listing data are informative, we doubt that they provide a complete or fully accurate rendering of cognitive process.

As hypothesized, participants appeared to interpret their past prediction failures in a manner that diminished their relevance to the present prediction. In Study 3, raters judged the explanations participants offered for their own previous failures to be more external, transitory, and specific than the reasons they offered for similar tardiness by a close acquaintance. In Study 4, participants explained why their estimates for completing the computer assignment were accurate or not and then rated their own explanations on the external, transitory, and specific dimensions. Those who finished later than anticipated offered explanations that made the experiences seem relatively unique and unlikely to recur.

Although the attribution data are consistent with the view that people explain away previous prediction failures, the findings are open to alternative interpretation. In Study 3, individuals selected the experiences that they explained. Conceivably, they did not interpret their past experience in a manner that exaggerated its uniqueness, but rather they selected experiences that were truly exceptional. In Study 4, we avoided this ambiguity by specifying the event to be explained. This procedure may have introduced a different self-selection problem, however. Because participants were not randomly assigned to their prediction outcomes, discrepancies in the attributions may reflect existing differences between the individuals who finished

later than expected and those who finished on time. Conceivably, people who live in more stable environments finish their tasks on time; they would then be correct in attributing their outcomes to relatively stable factors.

We theorized that individuals will generate more realistic and accurate predictions if they take past completion times into account. This improvement in prediction should only occur, however, if participants' recollections are valid and if their present task is comparable with the projects that they recall. We do not know why subjects in Study 4 completed the computer task much earlier than they claimed to complete previous similar activities; we do know that subjects would have generated estimates that were too pessimistic if they had relied heavily on their memories of past projects. On the basis of the present studies, we do not yet have compelling evidence that individuals can use their recollections of their own past performances to improve the accuracy of their time estimates.

The discrepancy in Study 4 between participants' reported completion times for previous projects and their completion times for the current task may help explain the actor–observer difference that we obtained in Study 5. As hypothesized, observers seemed more attuned to the actors' base rates than did the actors themselves. Observers spontaneously used the past as a basis for predicting actors' task completion times and produced estimates that were later than both the actors' estimates and their completion times. In general, we expect observers' predictions to be relatively sensitive to base rates. Consequently, we do not anticipate that observers' predictions will always be too conservative. Indeed, observers should underestimate actors' completion times when the actors finish their current task later than they have completed past projects.

One of the most consistent findings throughout our investigation was that manipulations that reduced the directional (optimistic) bias in completion estimates were ineffective in increasing absolute accuracy. This implies that our manipulations did not give subjects any greater insight into the particular predictions they were making, nor did they cause all subjects to become more pessimistic (see Footnote 2), but instead caused enough subjects to become overly pessimistic to counterbalance the subjects who remained overly optimistic. It remains for future research to identify those factors that lead people to make more accurate, as well as unbiased, predictions. In the real world, absolute accuracy is sometimes not as important as (a) the proportion of times that the task is completed by the "best-guess" date and (b) the proportion of dramatically optimistic, and therefore memorable, prediction failures. By both of these criteria, factors that decrease the optimistic bias "improve" the quality of intuitive prediction. In many circumstances, however, absolute accuracy does matter. There can be costs for finishing earlier than one expected. For example, expert forecasters will not maintain their reputation as experts (and the client list that accompanies this reputation) if their predictions are as likely to be wildly pessimistic as they are to be wildly optimistic.

More generally, the most appropriate prediction strategy depends on the relative costs associated with the two types of prediction error—underestimation and overestimation. For instance, participants in Study 4 may have had little to lose by offering optimistic predictions. Did it really matter if they finished a little later than they anticipated, as long as they met their

deadlines? The potential affective and motivational benefits of optimism may well have outweighed whatever minor costs they might have incurred by missing their estimates. Similarly, ever-optimistic academics who routinely carry home too much weekend work may have more to gain than lose from an optimistic outlook. On the other hand, the costs of underestimating completion times may have been quite severe for some of our research participants (e.g., submitting an honor's thesis months late can result in the loss of job opportunities).

In keeping with the above analysis, we are currently conducting research to explore two central issues: the role of motivation in the prediction process and the consequences of optimistic time estimates. To explore further the motivational determinants of prediction we are conducting experiments that vary independently people's incentives for making accurate time estimates and their incentives for finishing tasks as early as possible. The relative strength of the accuracy goal versus the directional goal (Kunda, 1990) may affect people's predictions by influencing the cognitive strategies they adopt. Specifically, individuals with a strong desire to make accurate forecasts may be more likely to adopt an external approach to prediction, incorporating relevant distributional information; in contrast, people with a strong desire to finish tasks promptly may maintain an internal approach, focusing exclusively on their future plans. In addition, we are exploring the consequences of people's optimistic time estimates. People's time estimates may have a variety of functions and consequences. An intriguing possibility suggested by previous research is that optimistic forecasts may be associated with enhanced motivation and performance (for a review, see Taylor & Brown, 1988). Predictions are sometimes self-fulfilling (Johnson & Sherman, 1990; Sherman, 1980; Shrauger, 1990): Optimistic time estimates may prompt individuals to finish tasks—if not by the predicted time—earlier than they would have otherwise.

People's completion estimates for everyday tasks provide a rich context for the study of prediction processes. Continued research will yield further insight into the relations among people's representations of the past, their hopes and expectations for the future, and their actual attainments.

References

Ajzen, I. (1977). Intuitive theories of events and the effects of base rate information on prediction. *Journal of Personality and Social Psychology, 35,* 303–314.

Arkes, H. R., Faust, D., Guilmette, T. J., & Hart, K. (1988). Eliminating the hindsight bias. *Journal of Applied Psychology, 73,* 305–307.

Bar-Hillel, M. (1980). The base-rate fallacy in probability judgments. *Acta Psychologica, 44,* 211–233.

Bar-Hillel, M. (1983). The base-rate fallacy controversy. In R. W. Scholtz (Ed.), *Decision making under uncertainty* (pp. 36–91). Amsterdam: Elsevier Science.

Borgida, E., & Brekke, N. (1981). The base rate fallacy in attribution and prediction. In J. H. Harvey, W. Ickes, & R. F. Kidd (Eds.), *New directions in attribution research* (pp. 63–96). Hillsdale, NJ: Erlbaum.

Colombo, J. R. (1987). *New Canadian quotations.* Edmonton, Canada: Hurtig Publishers.

Dawes, R. M. (1988). *Rational choice in an uncertain world.* San Diego, CA: Harcourt Brace Jovanovich.

Grice, H. P. (1975). Logic and conversation. In P. Cole & J. L. Morgan

(Eds.), *Syntax and semantics: Speech acts* (Vol. 3, pp. 41-58). San Diego, CA: Academic Press.

Griffin, D. W., Dunning, D., & Ross, L. (1990). The role of construal processes in overconfident predictions about the self and others. *Journal of Personality and Social Psychology, 59,* 1128-1139.

Hall, P. (1980). *Great planning disasters.* London: Weidenfeld & Nicolson.

Hayes-Roth, B. (1981). *A cognitive science approach to improving planning.* Proceedings of the Third Annual Conference of the Cognitive Science Society. Berkeley, CA: Cognitive Science Society.

Hayes-Roth, B., & Hayes-Roth, F. (1979). A cognitive model of planning. *Cognitive Science, 3,* 275-310.

Hoch, S. J. (1985). Counterfactual reasoning and accuracy in predicting personal events. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 11,* 719-731.

Janis, I. L. (1982). *Groupthink: Psychological studies of policy decisions and fiascoes* (2nd ed.). Boston: Houghton Mifflin.

Johnson, M. K., & Sherman, S. J. (1990). Constructing and reconstructing the past and the future in the present. In E. T. Higgins & R. M. Sorrentino (Eds.), *Handbook of motivation and social cognition: Foundations of social behavior* (pp. 482-526). New York: Guilford Press.

Jones, E. E., & Davis, K. E. (1965). From acts to dispositions: The attribution process in person perception. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 2, pp. 220-266). San Diego, CA: Academic Press.

Jones, E. E., & Nisbett, R. E. (1972). The actor and the observer: Divergent perceptions of the causes of behavior. In E. E. Jones, D. E. Kanouse, H. H. Kelley, R. E. Nisbett, S. Valins, & B. Weiner (Eds.), *Attribution: Perceiving the causes of behavior.* Morristown, NJ: General Learning Press.

Jungermann, H., & Thuring, M. (1987). The use of mental models for generating scenarios. In G. Wright & P. Ayton (Eds.), *Judgmental forecasting.* New York: Wiley.

Kahneman, D., & Lovallo, D. (1991). Bold forecasting and timid decisions: A cognitive perspective on risk taking. In R. Rumelt, P. Schendel, & D. Teece (Eds.), *Fundamental issues in strategy.* Cambridge, England: Cambridge University Press.

Kahneman, D., Slovic, P., & Tversky, A. (1982). *Judgment under uncertainty: Heuristics and biases.* Cambridge, England: Cambridge University Press.

Kahneman, D., & Tversky, A. (1979). Intuitive prediction: Biases and corrective procedures. *TIMS Studies in Management Science, 12,* 313-327.

Kahneman, D., & Tversky, A. (1982a). The simulation heuristic. In D. Kahneman, P. Slovic, & A. Tversky (Eds.), *Judgment under uncertainty: Heuristics and biases* (pp. 201-208). Cambridge, England: Cambridge University Press.

Kahneman, D., & Tversky, A. (1982b). Variants of uncertainty. In D. Kahneman, P. Slovic, & A. Tversky (Eds.), *Judgment under uncertainty: Heuristics and biases* (pp. 509-520). Cambridge, England: Cambridge University Press.

Kelley, H. H. (1967). Attribution theory in social psychology. In D. Levine (Ed.), *Nebraska Symposium on Motivation* (Vol. 15, pp. 192-240). Lincoln: University of Nebraska Press.

Kidd, J. B. (1970). The utilization of subjective probabilities in production planning. *Acta Psychologica, 34,* 338-347.

Klayman, J., & Schoemaker, P. J. H. (1993). Thinking about the future: A cognitive perspective. *Journal of Forecasting, 12,* 161-168.

Koriat, A., Lichtenstein, S., & Fischhoff, B. (1980). Reasons for confidence. *Journal of Experimental Psychology: Human Learning and Memory, 6,* 107-108.

Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin, 108,* 480-498.

Lord, C. G., Lepper, M., & Preston, E. (1984). Considering the opposite: A corrective strategy for social judgment. *Journal of Personality and Social Psychology, 47,* 1231-1243.

Myers, D. G., & Lamm, H. (1976). Group-induced polarization in simulated juries. *Personality and Social Psychology Bulletin, 2,* 63-66.

Osberg, T. M., & Shrauger, J. S. (1986). Self-prediction: Exploring the parameters of accuracy. *Journal of Personality and Social Psychology, 51,* 1044-1057.

Read, S. J. (1987). Constructing causal scenarios: A knowledge structure approach to causal reasoning. *Journal of Personality and Social Psychology, 52,* 288-302.

Rehm, J. T., & Gadenne, V. (1990). *Intuitive predictions and professional forecasts: Cognitive processes and social consequences.* New York: Pergamon Press.

Sherman, S. J. (1980). On the self-erasing nature of errors of prediction. *Journal of Personality and Social Psychology, 39,* 211-221.

Shrauger, J. S. (1990, October). *Some virtues of self-prediction.* Paper presented at the annual meeting of the Society for Experimental Social Psychology, Buffalo, New York.

Shrout, P. E., & Fleiss, J. L. (1979). Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin, 86,* 420-428.

Snyder, C. R., & Higgins, R. L. (1988). Excuses: Their effective role in the negotiation of reality. *Psychological Bulletin, 104,* 23-35.

Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin, 103,* 193-210.

Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review, 92,* 548-573.

Weinstein, N. D. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology, 39,* 806-820.

Yates, J. F. (1990). *Judgment and decision making.* Englewood Cliffs, NJ: Prentice Hall.

Zukier, H. (1986). The paradigmatic and narrative modes in goal-guided inference. In R. M. Sorrentino & E. T. Higgins (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (pp. 465-502). New York: Guilford Press.