



National Library
of Canada

Bibliothèque nationale
du Canada

Acquisitions and
Bibliographic Services Branch

Direction des acquisitions et
des services bibliographiques

395 Wellington Street
Ottawa, Ontario
K1A 0N4

395, rue Wellington
Ottawa (Ontario)
K1A 0N4

Your file *Votre référence*

Our file *Notre référence*

NOTICE

AVIS

The quality of this microform is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

La qualité de cette microforme dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

If pages are missing, contact the university which granted the degree.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us an inferior photocopy.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de qualité inférieure.

Reproduction in full or in part of this microform is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30, and subsequent amendments.

La reproduction, même partielle, de cette microforme est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30, et ses amendements subséquents.

Canada

THE EFFECT OF ACCURACY MOTIVATION AND DIRECTIONAL MOTIVATION
ON THE OPTIMISTIC BIAS IN PREDICTION
OF TASK COMPLETION TIME

by

Heather MacDonald

B.A. (Hons.), Algoma University College

Laurentian University, 1993

THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS
in the Department of Psychology

© Heather MacDonald 1995

SIMON FRASER UNIVERSITY

February 1995

All rights reserved. This work may not be reproduced in whole or in part, by
photocopy or other means, without written permission of the author.



National Library
of Canada

Bibliothèque nationale
du Canada

Acquisitions and
Bibliographic Services Branch

Direction des acquisitions et
des services bibliographiques

395 Wellington Street
Ottawa, Ontario
K1A 0N4

395, rue Wellington
Ottawa (Ontario)
K1A 0N4

Your file *Votre référence*

Our file *Notre référence*

THE AUTHOR HAS GRANTED AN IRREVOCABLE NON-EXCLUSIVE LICENCE ALLOWING THE NATIONAL LIBRARY OF CANADA TO REPRODUCE, LOAN, DISTRIBUTE OR SELL COPIES OF HIS/HER THESIS BY ANY MEANS AND IN ANY FORM OR FORMAT, MAKING THIS THESIS AVAILABLE TO INTERESTED PERSONS.

L'AUTEUR A ACCORDE UNE LICENCE IRREVOCABLE ET NON EXCLUSIVE PERMETTANT A LA BIBLIOTHEQUE NATIONALE DU CANADA DE REPRODUIRE, PRETER, DISTRIBUER OU VENDRE DES COPIES DE SA THESE DE QUELQUE MANIERE ET SOUS QUELQUE FORME QUE CE SOIT POUR METTRE DES EXEMPLAIRES DE CETTE THESE A LA DISPOSITION DES PERSONNE INTERESSEES.

THE AUTHOR RETAINS OWNERSHIP OF THE COPYRIGHT IN HIS/HER THESIS. NEITHER THE THESIS NOR SUBSTANTIAL EXTRACTS FROM IT MAY BE PRINTED OR OTHERWISE REPRODUCED WITHOUT HIS/HER PERMISSION.

L'AUTEUR CONSERVE LA PROPRIETE DU DROIT D'AUTEUR QUI PROTEGE SA THESE. NI LA THESE NI DES EXTRAITS SUBSTANTIELS DE CELLE-CI NE DOIVENT ETRE IMPRIMES OU AUTREMENT REPRODUITS SANS SON AUTORISATION.

ISBN 0-612-06719-X

Canada

APPROVAL

Name Heather MacDonald
Degree Master of Arts
Title of Thesis The Effect of Accuracy Motivation and Directional Motivation on the Optimistic Bias in Prediction of Task Completion Time

Examining Committee:

Chair Richard Wright

Roger Buehler
Senior Supervisor

Cathy McFarland

Rebecca Collins
External Examiner
Psychology Department
University of British Columbia

Date Approved: Mar 10 / 95

PARTIAL COPYRIGHT LICENSE

I hereby grant to Simon Fraser University the right to lend my thesis, project or extended essay (the title of which is shown below) to users of the Simon Fraser University Library, and to make partial or single copies only for such users or in response to a request from the library of any other university, or other educational institution, on its own behalf or for one of its users. I further agree that permission for multiple copying of this work for scholarly purposes may be granted by me or the Dean of Graduate Studies. It is understood that copying or publication of this work for financial gain shall not be allowed without my written permission.

Title of Thesis/Project/Extended Essay

The Effect of Accuracy Motivation and Directional Motivation

on the Optimistic Bias in Prediction of Task Completion Time

Author:

(signature)

Heather MacDonald

(name)

Mar 17/95

(date)

ABSTRACT

Two studies were conducted to examine the role of motivation in the optimistic bias in people's predictions of completion times. It was hypothesized that a strong desire to finish tasks quickly (directional goal) would increase the optimistic bias and that a strong desire to make accurate predictions would attenuate the bias. After completing two timed anagram trials, subjects predicted, under varying incentive conditions, how long the third trial would take. High accuracy subjects were offered a monetary prize for making an accurate prediction, whereas high directional subjects were offered a monetary prize for finishing quickly. These two motivational factors were crossed in a factorial design. In addition, in Study 2, half of the subjects were informed of their pre-trial times while the other half were not. Subjects' predicted and actual completion times were only partially consistent with the hypotheses. In Study 1, the accuracy goal actually increased the optimistic bias in prediction, largely because it increased actual completion times; however, this finding was not obtained in the second study. In Study 2, the directional goal led subjects to predict shorter completion times and also to finish more quickly. Additional thought listing measures revealed that high accuracy subjects were more likely to base predictions on a calculated average past completion time whereas high directional subjects were more likely to discount their past performance and anticipate improvement.

ACKNOWLEDGMENTS

I would like to like to express my gratitude to the members of my committee for their support throughout this research. I would especially like to thank Dr. Roger Buehler for his commitment and interest in helping me carry out this study.

Thanks also to Laura MacKay and Stacy Ashton for their brilliant insights and dynamic sense of timing in running subjects (hey to all the lab-rats in 3117).

Lastly, thanks to my family (you know who you are).

TABLE OF CONTENTS

Title Page.....	i
Approval Page.....	ii
Abstract.....	iii
Acknowledgments.....	iv
Table of Contents.....	v
List of Tables.....	vii
Introduction.....	1
Cognitive Explanations of the Optimistic Bias.....	2
Motivational Explanations of the Optimistic Bias.....	5
Motivational Influences on Prediction of Completion Times.....	7
Directional Motivation.....	7
Accuracy Motivation.....	12
Interaction of Different Types of Motivations.....	16
Outcome Dependency Studies.....	16
The Current Research.....	19
Experiment 1.....	20
Method.....	21
Subjects.....	21
Procedure.....	22
Manipulation of Motivation.....	23
Results.....	25
Manipulation Checks.....	25
Motivational Influences on the Optimistic Bias.....	25
Correlations.....	28
Think-Aloud Questions.....	28
Discussion.....	30
Experiment 2.....	31
Method.....	33
Subjects.....	33
Procedure.....	33
Results.....	35
Manipulation Checks.....	35

TABLE OF CONTENTS (cont.)

Predictions Compared to Average Past Times	36
Predictions Compared to Actual Completion Times.....	37
Predicted Completion Times.....	38
Actual Completion Times	39
Additional Measures of Optimism in the Uninformed Condition	39
Accuracy of Prediction	40
Correlations.....	41
Reasons Given for Predicted Completion Time.....	41
Discussion.....	43
General Discussion.....	44
Footnotes	50
References.....	51

LIST OF TABLES

Table 1	Ratings of the importance of finishing quickly and making accurate predictions as a function of accuracy and directional motivation.....	57
Table 2	Measure of predicted and actual completion time (in minutes) as a function of accuracy and directional motivation.....	58
Table 3	Thoughts expressed by subjects while making their predictions (reported in percentage of total thoughts mentioned by subjects).....	59
Table 4	Ratings of the importance of finishing quickly and making accurate predictions as a function of accuracy and directional motivations.....	60
Table 5	Measures of predicted and actual completion time (in minutes) as a function of accuracy and directional motivation.....	61
Table 6	Thoughts expressed by subjects in the Informed Condition while making their predictions (reported in percentage of total thoughts mentioned by subjects).....	62
Table 7	Thoughts expressed by subjects in the Uninformed Condition while making their predictions (reported in percentage of total thoughts mentioned by subjects).....	63

Picture this scenario: A friend calls you at work and invites you to have lunch at a new restaurant downtown. You promise to be there in half an hour, fully intending to meet that commitment. Unfortunately, you did not anticipate the telephone call you received right after talking with your friend, the union picket line you encountered, the incredible number of seemingly new traffic lights the city has installed, and the impenetrable lunch hour traffic. When you eventually reach the restaurant, you are more than twenty minutes late. Scenarios like this occur regularly, yet most of us still don't take into account the myriad of events that could come between us and successful meeting of our predictions. Instead, many people continue to underestimate consistently the amount of time they will require to complete various tasks.

That people give overly optimistic predictions concerning how long various tasks will take has been noted by a number of authors. In the book Great Planning Disasters, Hall (1980) described a number of major construction projects that took much longer to complete than expected, at a much greater cost. For example, San Francisco's Bay Area Rapid Transit (BART) system was begun in 1962 and was expected to be finished by January 1971 at a cost of no more than \$130,000,000. However, BART actually did not begin operating until October of 1974 at a final cost of 1.6 billion dollars. Kidd (1970) also reported the tendency for professionals to underestimate how long a project will take. Kidd found that subjective probabilities given by teams of technicians and engineers were overly optimistic about the amount of time that planned overhauls would take to complete. In fact, even the conservative end of the engineers' 95% confidence intervals were too optimistic compared to actual completion times.

More recently, Buehler, Griffin and Ross (1994) examined whether individuals, rather than groups, were overly optimistic in predicting when they would finish everyday projects such as school assignments and tasks around the home. Again,

they found that people were likely to underestimate how long it would take to complete these tasks. Similarly, Byram (1993) found that people underestimated how long it would take to complete a variety of tasks including putting together a computer stand and constructing origami figures. In sum, there is both anecdotal and empirical evidence that people systematically underestimate the time that it will take to complete a task.

Cognitive Explanations of the Optimistic Bias

Given that the optimistic bias does exist, it next becomes of interest to examine the possible causes of this bias. Most researchers have concentrated on the cognitive aspects of the optimistic bias (Buehler et al., 1994; Byram, 1993; Kahneman & Tversky, 1979). For instance, Kahneman and Tversky (1979) describe the planning fallacy as "a consequence of the tendency to neglect distributional data and to adopt what may be termed an internal approach to prediction, in which one focuses on the constituents of the specific problem rather than on the distribution of outcomes in similar cases" (p. 415). Adopting an internal perspective involves concentrating on the specific task at hand, and estimating how long this specific task should take to complete.

A potential problem with the internal approach is that people may be ignoring important distributional information. In regard to the prediction of events in general, relevant distributional information could include personal base rates (one's own past performance), or population base rates (the performance of a reference group). In regard to the prediction of completion times, personal base rates involve one's own past performance in finishing tasks of this nature. In general, researchers have found that people underuse distributional information when it is less salient than the specific criteria of the particular task at hand (e.g., Bar-Hillel, 1990). Researchers in the area of time prediction have suggested that because time

prediction normally involves a very salient, specific task, distributional information might fade into the background.

Based on their cognitive account of its causes, Kahneman and Tversky have also suggested means to lessen the planning fallacy. They suggest that relating the current task to distributional information of completion times will result in more accurate predictions. Specifically, they suggest a five-step procedure to improve the accuracy of predictions: (1) select the appropriate reference class (e.g., past completion times on a similar task) (2) assess the distribution for the reference class (e.g., most times, I've gotten an assignment done 2 days before the deadline), (3) evaluate the information that distinguishes this case from other such cases, (4) assess the extent to which the information available in this case allows an accurate prediction, and (5) correct intuitive estimates (e.g., a first guess of when one will get finished) toward the average of the reference class. This proposed strategy reflects the emphasis placed on cognitive mechanisms thought to be responsible for the planning fallacy.

Buehler, Griffin, and Ross (1994) also concentrated on cognitive explanations of the optimistic bias in the context of prediction of completion times. Following Kahneman and Tversky, they concentrated on people's tendency to use singular rather than distributional information. They discerned several obstacles to using past experiences including people's tendency to construct narratives concerning their future performance as they make predictions. This "narrative mode" of thinking involves sequential ordering of events, action-related structuring, and connecting various pieces of information in order to construct a narrative (Zukier, 1986). According to this account, once a person is in the narrative mode, a number of factors can impede the utilization of distributional information in the current prediction task: (1) the forward nature of prediction (2) the difficulty in assessing which events are similar enough to be considered, and (3) uncertainty concerning

the extent to which the past relates to the future. For these reasons, people might tend to focus on future plans and ignore distributional information.

Other cognitive mechanisms may contribute to the optimistic bias. Buehler et al. found that people made attributions that diminished the relevance of past performance to the task at hand. Their subjects attributed past failures to transitory, specific factors that were not generalizable to the current situation. Such attributions might serve to diminish the relevance of personal base rates. Presumably, base rates will only be utilized if people can draw a direct connection between past experiences and the current prediction problem. Consistent with this account, Buehler et al. found that when subjects were required to draw a logical connection between their past experiences and the current task, the level of optimistic bias in their prediction decreased.

Byram (1993) also examined cognitive processes involved in people's optimistic time estimates. She attempted to lessen the level of optimistic bias by getting subjects to participate in a number of cognitive exercises designed to counter cognitive mechanisms thought to occur in the optimistic bias. Byram examined three major cognitive explanations for time underestimation: inadequate consideration given to unexpected obstacles, the inability to calculate proper probabilities, and the planning fallacy. In her first study, Byram asked subjects to estimate how long it would take to construct a computer stand, without asking them to actually complete the task. Contrary to her hypothesis, she found that asking subjects to list surprises, estimate each component before estimating how long the task as a whole would take, and making a distribution of estimates (optimistic, best guess, and pessimistic) did not have a significant effect on predictions. Her findings, then, indicate that the optimistic bias cannot be easily overcome by suggesting a number of cognitive strategies designed to lessen the optimistic bias.

Although research has concentrated on cognitive mechanisms that produce the optimistic bias, these cognitive explanations do not appear to give a complete account. Byram's attempts to lessen the optimistic bias using strategies suggested by cognitive explanations of the optimistic bias were not successful. In addition, Buehler et al. were only able to lessen the level of optimistic bias by using a strong manipulation in which subjects were compelled to write an account explaining how their past performance might be directly related to the task at hand, and as a result might lead to a later completion time than they originally thought. Based on these findings, it appears that other explanations of the optimistic bias might be needed to account fully for the phenomenon. In the present research, I sought to extend the previous work by examining the role of motivational factors in the optimistic bias.

Motivational Explanations of the Optimistic Bias

Some previous research has examined the impact of motivation on people's predictions. As a result of the failure of cognitive strategies to reduce the optimistic bias, Byram (1993), attempted to clarify the role that motivation might play in the optimistic bias with regard to time prediction. Byram suggested that people's tendency to underestimate completion times might be due to motivational factors. In one study, Byram found that people who were required to come into the lab and make a second time estimate (after having made an initial time estimate for a task without knowing whether they would have to complete the task), actually further underestimated their completion time compared to their first estimate. Byram suggested that people who were faced with finishing a long, rather tedious task were more motivated than other subjects to believe they could finish the task quickly. Apparently, due to a greater desire to finish early, their predictions were more optimistic. This result suggests that there is a motivational component to the optimistic bias in completion time estimates.

An additional study conducted by Byram offered further support for this motivational interpretation. Byram offered subjects monetary incentives to finish a task early. She found that those given an incentive to finish early gave significantly shorter predictions but finished no sooner than controls.

The finding that the degree of optimistic bias was influenced by people's desire to complete a task early is perhaps not surprising. Many of our daily predictions seem to involve wishful thinking and not simply an earnest desire to predict how long a task will actually take us. However, while it appears that motivational factors influence the optimistic bias, the exact role that motivation plays is unclear. A desire to finish early is not the only motivational factor that can play a role in prediction. There are many times, for example, when it is important for us to make an accurate time prediction. Consider again the scenario described at the beginning of this paper. What would be your response if, instead of a friendly lunch-date, the scenario involved the somewhat more important commitment of a job interview. How might this influence your prediction of how long it would take you to get downtown? Presumably you would give a more conservative estimate. In addition, you might be more likely to push yourself harder to arrive in time.

In summary, people's predictions may be guided by various types of motivations, including the desire to finish tasks quickly and the desire to make accurate predictions. In recent years several theorists have drawn a similar distinction between accuracy and directional motivation (Kunda, 1990). Accuracy motivation refers to the desire to make a correct decision (in this case, a correct prediction). Directional motivation refers to the desire to reach a particular, desired conclusion (in this case, people may hope that they will finish early).

In order to clarify the role that these two type of motivations--the desire to finish early and the desire to make an accurate prediction--might play in the prediction of task completion, it is useful to review the literature on these two type of

motivations. It will also be useful to consider how these two types of motivations might influence not only time prediction, but also subsequent completion times. It is possible that people motivated to finish early might also finish earlier than they would have without the incentive.

Motivational Influences on Prediction of Completion Times

Directional Motivation

As mentioned above, intuitively, our predictions seem to be influenced by a desire to finish early. Often we are motivated to finish an assignment in order to move on to more enjoyable things. For example, graduate students are motivated to finish their theses so that they can move on to professional life. In addition, we often need to make accurate predictions in order to budget time wisely. Finally, in many situations there may be simultaneous demands to make early, yet accurate predictions.

The desire to finish tasks quickly can be described as a type of directional motivation (the desire to arrive at a particular conclusion). On the surface, it seems likely that this directional motivation may play an important role in the prediction of task completion times. Our hopes that we will get a task done faster than ever before may influence our predictions about how long the task actually will take us.

Consistent with this proposal, research suggests that people do at times use cognitive strategies selectively to convince themselves that a desired outcome is reasonable. There is a plethora of studies which indicate that desirable outcomes are believed to be more likely than other outcomes (Cantril, 1938; Irwin, 1944; Kunda & Sanitioso, 1989; Lund, 1975; McGuire, 1960; Pruitt & Hoge, 1965; Sherman, 1980; Weinstein, 1980). People's desire to reach a particular conclusion has been found to influence their memory, information processing, and other cognitive processes. For example, Gilovich (1983) studied the perceived effect of a fluke event on the

outcome of an athletic game by the fans of a winning and losing team. Predictably, the winning team fans felt that they weren't affected by the fluke; the losing team fans felt that the fluke played an important role, and that if the two teams were to play again, the losing team would clearly win. Similarly, Tesser (1986) found that when similar peers outperformed a person on an activity (threatening his or her self-esteem), the person downplayed the importance of the activity in question. Apparently, to admit that another person possessed more ability was too threatening to subjects, and they became motivated to believe that the task did not reflect anything important.

In addition to directionally motivated interpretations of outside events, people often distort recollections of their own personal history in order to make themselves feel better. For example, when subjects were led to believe that a characteristic such as extroversion or introversion was predictive of academic success, they perceived themselves as possessing more of the desirable characteristic (Kunda & Sanitioso, 1989). Similarly, subjects who were told that caffeine consumption was detrimental to their health recalled themselves as consuming less caffeine (Sherman & Kunda, 1989). Apparently, people sometimes distort their personal histories in an attempt to meet their current goals.

In a recent review of motivated inference processes, Kunda (1990) argues that people do not completely ignore reality in these distortions, but that they will only espouse the distorted conclusion if they can muster enough evidence to support such a conclusion. According to this view, directionally motivated decision makers are still rational, but their motivation influences which cognitive rules are chosen and applied. Along these same lines, Kruglanski (1980) has noted that directional goals influence which of the many pieces of information and which of the many potential cognitive rules are accessed and used in decision-making. For example, although people normally ignore base rate information, when subjects were acting

as a lawyer for one side in a dispute, they exploited base-rate information when it was to their advantage (Ginossar & Trope, 1987).

A number of studies are more directly pertinent to prediction. These studies have shown that people predict that events are more likely to occur when those events are seen as desirable. For example, when drawing a picture card from a stack was seen as positive, children (Marks, 1951) and adults (Irwin, 1953) were both more likely to predict that they would draw a picture card. In addition, Weinstein (1980) found that the desirability of events influenced the level of optimism shown by subjects when predicting the likelihood that future events would occur to them. Subjects reported that positive events were more likely to occur to them than to others, and similarly, negative events were less likely to occur to them than to others. Weinstein showed that this optimistic bias was a result of subjects concentrating on factors that would improve the chances of positive events occurring to them, while ignoring many of the factors that would improve others' chances.

Other studies have looked at the effect of directional motivation on the actual *performance* for which the prediction is made. Henry and Snizek (1993) offered monetary incentives designed to increase directional motivation with regard to a task that involved looking up facts in an almanac. They found that monetary incentives contingent on high task performance resulted in judgments of improved future performance, but did not in fact affect their actual subsequent performance.

Studies concerning the effect of stated goals on subsequent performance are also clearly of relevance to the present research. Goals differ somewhat from predictions in that they represent a performance level to strive for rather than an attempt to accurately predict future performance. Nevertheless, goals may operate much like predictions. In fact, in cases where people are motivated to finish a task early, predictions about future performance will likely resemble goals very closely.

Consistent with this view, it has been found that when contingent incentives for a high level of performance were introduced, prediction questions were interpreted as goal questions (Henry, 1994). As a result, it appears that when people hope that they will perform well, subsequent predictions resemble goals because predictions are influenced by people's level of aspiration. If prediction questions can be seen as similar to goal questions in cases where directional motivation is strong, then research on goals is directly relevant to time predictions.

What effects do goals have on performance? Subjects who were given specific, challenging goals (e.g., listing a specific number of uses of a household object) reported engaging in more planning on a list-use task than did subjects with "do your best" goals (Earley & Perry, 1987). This result suggests that subjects who were more motivated to do well were more likely to engage in planning strategies in order to improve their ability to complete those tasks. This strategy seems to be effective; subjects who had received training consistent with the task and who had harder goals performed better than subjects who had "do your best" goals. In addition, another study found that after having received training in bargaining strategies, subjects with hard goals performed better than subjects with other goals (Neale, Northcraft & Earley, 1987). In an extensive review of research on goals, Locke and Latham (1990) summarize why challenging goals increase performance in many cases: challenging goals require higher performance in order for the individual to feel satisfied, involve less uncertainty about what constitutes good performance, lead to more expended effort, direct attention better, and motivate suitable task strategies that enhance performance.

Other authors have concurred with this explanation as to why people with specific challenging goals perform better than people without such goals. Gollwitzer (1993) argued that implementation plans aid successful completion of a project because once an implementation plan is salient, opportunities to fulfill the steps

involved in the project are recognized quickly and responded to. In addition, information that does not pertain to the task is seen quickly as irrelevant and dismissed (Gollwitzer, 1993). This type of outlook has also been characterized as seeking closure (Kruglanski, 1989). This means that when a person is motivated to seek a specific conclusion, evidence will continue to be weighted until that conclusion is reached, after which new evidence will be resisted. This type of closure-seeking may cause people to search for evidence to suggest that they will get done faster than ever before and resist evidence that suggests difficulties might delay them.

In a related analysis, Taylor and Schneider have argued that mental simulations, or "imitative representation[s] of the functioning process of some event or series of events" (1989, p. 174) can enhance the probability of that event's occurrence. This can happen because simulations create a link (i.e., a plan) from thought to action. Simulations may involve mental practice, which has been found to improve performance (Feltz & Landers, 1983; Suinn, 1972; Richardson, 1967). This research together suggests why directional motivation accompanied by planning might improve performance.

The literature reviewed above suggests that concentrating heavily on planning might result in overly optimistic predictions, but might also prove beneficial by increasing performance. However, the finding that directional motivation resulted in more planning and improved performance is not unanimous. Recall that Henry and Snizek (1993) found that performance did not substantially improve when subjects were given incentives for a high level of performance compared to other subjects. In addition, Byram (1993) found that incentives increased the optimism of predictions, without improving performance.

In summary, it appears very likely that directional motivation might play an important role in the optimistic bias. Directional motivation appears likely to result

in optimistic predictions. However, it is also possible that people with a desire to finish early might also complete the task much sooner than they would have without such directional motivation. As a result, it is unclear whether directional motivation will result in predictions that are too optimistic compared to actual performance.

Accuracy Motivation

A second type of motivation, accuracy motivation, is the desire to reach the correct conclusion. Researchers have used a number of different techniques to manipulate accuracy motivation. Sometimes subjects are offered money contingent on an accurate decision (Snyder & Swann, 1978; Tversky & Kahneman, 1973). Other researchers have used accountability manipulations. These manipulations have included (1) telling subjects that they would have to communicate their opinion to others, (2) emphasizing the importance of subjects' decisions, (3) increasing personal involvement or investment in the decision, and (4) telling subjects that they would have to *defend* their decision.

The effects of manipulating accuracy motivation have been somewhat mixed. On the one hand, accuracy motivation has been found to eliminate or reduce a variety of judgmental biases (Freund & Kruglanski, 1985; Kassin & Hochreich, 1977; Pittman & D'Agostino, 1985). For example, Kruglanski and Freund (1982) found that when subjects believed their judgments would be evaluated, primacy effects, ethnic stereotyping, and anchoring phenomena all significantly decreased. In addition, primacy effects in impression formation were less pronounced when subjects believed their judgments would be evaluated by the experimenter (Freund and Kruglanski, 1985). Tetlock also found that accuracy motivation decreased primacy effects. For example, information presented early in a description of a defendant normally exerts undue influence on a subject's judgment of guilt or

innocence. However, subjects who were told that they would have to justify their impressions before seeing the evidence did not show this primacy effect (Tetlock, 1983). In addition, the over attribution effect, or the tendency of people to make dispositional judgments about a person who wrote an essay under low choice, did not occur when subjects were told that they would have to justify their judgment to an experimenter (Tetlock, 1992).

On the other hand, other researchers have found that accuracy motivation did not lessen biased thinking (Dawes, 1976; Fischhoff, 1977; Kahneman & Tversky, 1972; Lichtenstein & Fischhoff, 1977). For example, Tversky and Kahneman (1982) found that exhorting subjects to be accurate and offering a bonus of one dollar did not eliminate the availability heuristic. In addition, an incentive of twenty five dollars did not reduce subjects' tendency to use confirmatory hypothesis testing rather than disconfirming strategies (Snyder & Swann, 1978). Further, in a study of attributions, subjects who were given accountability instructions made stronger dispositional attributions about others compared to controls (Harvy, Harkins, & Kagehiro, 1976). Manipulating accountability by increasing the importance of a decision has been found to result in overconfidence in one's decision (Siebert, 1974). Lastly, encouraging personal involvement seems to increase the frequency of dominant cognitive responses, and again does not necessarily result in better decision makers. For example, Petty & Cacioppo (1986) reported that people who were personally involved were more likely to reject counter-attitudinal, but not pro-attitudinal arguments. This is because counter-attitudinal issues were contrasted (seen as further away from the person's opinion than they really were, and therefore objectionable), but pro-attitudinal arguments were assimilated (seen as more similar to the person's opinion, and thus acceptable).

It is even possible that the increased attention and effort invested in an evaluation might sometimes lead to more biased rather than less biased decisions.

This intriguing hypothesis has been raised by Kunda (1990), who argued that increased effort invested in biased processes might actually cause more biased judgments. In fact, a few studies have shown that subjects who were motivated to process information accurately actually showed increased bias in their thinking (Simonson, 1989; Tetlock & Boettger, 1989; Tetlock & Boettger, 1991). Tetlock and Boettger (1989) studied the effect of accountability on the dilution effect, or the tendency to allow irrelevant information to lessen the extremity of judgments based on relevant information. They found that accountability worsened the dilution effect, suggesting that accountability operates by encouraging subjects to process information in more "integratively complex ways" (p. 376). This integrative complexity refers to a type of thinking that is multi-dimensional, self-critical and cognizant of positive and negative features of different alternatives. These complex ways of thinking, however, may not always be appropriate.

Along these same lines, accuracy motivation has been shown to worsen the status quo bias. Theoretically, people should only take into account preference relevant information when making a decision. However, the status quo bias refers to people's predilection, when faced with a number of alternatives, to favor the alternative that involves doing nothing, or maintaining a past decision. Accountable subjects were just as likely as unaccountable subjects to risk lives when a medical drug was already on the market. However, accountable subjects were less willing than unaccountable subjects to risk the same number of lives in order to provide an as yet unmarketed drug to the public. In other words, accountable subjects were just as willing as unaccountable subjects to risk lives, as long as their decision represented the status-quo, regardless of the fact that the same number of lives were at risk as in the unmarketed drug scenario (Tetlock & Boettger, 1991). This study suggests that accountable subjects may sometimes be led more astray by irrelevant information, and may in situations of ambiguity, be less likely to take a

position that would leave them vulnerable to criticism.

In yet another study, Simonson (1989) showed that holding subjects accountable for their choices led to an increased attraction effect. The attraction effect refers to the finding that people find it easier to make a difficult trade-off between two options that have off-setting strengths and weaknesses when a logically irrelevant third option is introduced. Again, the fact that accountability manipulations increase this bias suggest that subjects may be more easily led astray by logically irrelevant information. Therefore, it is not clear whether accuracy motivation always lessens biased thinking; it may actually increase bias in some situations.

There is also some question as to whether accuracy goals will simply prompt conservative estimates. In other words, subjects who are motivated to be accurate may volunteer safe, "middle of the road" estimates that seem less biased, but actually reflect biased thinking that has simply been moderated to appear less extreme. Interestingly, however, a number of studies suggest that this is not likely to occur. Berscheid, Graziano, Monson and Dermer (1976) found that high outcome dependency was associated with increased attention to the target, better memory of the other's behavior, and more *extreme* and confident trait descriptions and evaluation. In addition, Tetlock (1983) found that expectations of evaluation led to lessened primacy effects, but only when subjects were told that they would be evaluated before they had received the information relevant to their decision. This finding suggests that expectation of evaluation did not simply result in more conservative estimates. If it had, subjects who were told that they would be evaluated *after* they had seen the case evidence should have also shown a reduced primacy effect. Instead, these results indicate that accuracy manipulations actually prompted deeper processing of information.

With regard to time predictions, the research discussed above does not imply that deeper processing will necessarily result in *better* (less biased) predictions. In fact, it

seems possible that people who are motivated to be accurate will give more optimistic predictions than people who aren't given extra incentives to be accurate. This would occur if subjects are led astray by complex strategies and planning concerning the particular details of the task, and neglect more diagnostic information such as past completion times. For example, more detailed scenario thinking might lead subjects to think of even more reasons why they should be capable of improving their performance.

With regard to actual completion times, the motivation to make accurate predictions could have a variety of effects on performance. It is possible that people who give conservative (or longer) predictions will feel less time pressure, and as a result, take more time to complete the final word task. On the other hand, it is possible that people who give very challenging estimates with the belief that they can complete the task by this time, might feel time pressure similar to people with a desire to finish early. In other words, it is possible that people with a desire to finish early and people with a desire to make an accurate prediction will perform similarly. This would result in a comparable degree of optimism in people with high accuracy motivation and those with high directional motivation.

Thus, it is not entirely clear how directional and accuracy motivation would affect the optimistic bias in prediction of completion times. It is even more uncertain how these two motivations would interact if subjects were motivated both to finish early and to make an accurate prediction.

Interaction of Different Types of Motivations

Outcome Dependency Studies

Perhaps the most interesting and relatively unexplored aspect of the distinction between accuracy motivation and directional motivation is the question of how these two goals interact. In daily life, people often find themselves influenced by a

number of competing motivations. For example, scientists who have a stake in the success of a methodology are also compelled to be accurate, because the long-term success of the favored procedure will be determined by its real-world validity. Similarly, although we all want to believe that we are healthy, we also feel compelled to visit the physician regularly in order to find out the truth, whatever that may be.

A number of researchers interested in impression formation have examined the combined effect of accuracy and directional goals on judgment by manipulating outcome dependency (Neuberg & Fiske, 1987; Berscheid, Graziano, Monson & Dermer, 1976). Outcome dependency is characterized by subjects' reliance on a target person or partner for some desired outcome. In some of these studies, the subject expected to date the target; in others, subjects expected the reward they received for their performance to depend on the performance of the other person. The dependent measure in such studies is normally the impression that subjects form of the target person.

Presumably, these situations prompt both accuracy and directional goals; on one hand, subjects are motivated to understand what the target is like so that they can interact competently, but they are also motivated to view the target positively because they will benefit from a pleasant interaction. In Berscheid et al.'s (1976) study, the researchers found that subjects who expected to date the target person rated the target significantly more positively than did subjects who did not expect to interact with the person later. In addition, outcome dependent subjects spent more time processing relevant information about the target than control subjects. These studies suggest that people with both strong directional and accuracy goals were more likely than control subjects to seek an accurate evaluation.

Unfortunately, such outcome dependency studies suffer from ambiguities with regard to what extent the two motivational goals operate on people's cognitions and

evaluations. The two motivations are confounded. Because there is a high degree of directional motivation in addition to high accuracy motivation, it is impossible to determine the extent to which each type of motivation influenced subjects' judgments.

Neuberg and Fiske's (1987) study has also been cited as an attempt to examine the competing influences of accuracy and directional motivation (Kunda, 1990). In this study, subjects were told that they were participating in a program to reintegrate hospital patients into the community. Subjects were told that they would be interacting with Frank, a schizophrenic, by working together to design creative games with wind-up toys. Outcome dependent subjects in the first and second study were told that a prize of \$20 would be given to each member of the student-patient teams that designed the most creative games. This incentive presumably prompted directional motivation, or the desire to view Frank positively so that the award would be seen as more likely. Again, however, assessing Frank accurately would provide a reliable basis on which to predict his behavior. A more accurate perception of Frank would lead to a smoother interaction. As before, this type of manipulation confounds the two types of motivation.

In their first two experiments, Neuberg and Fiske found that outcome dependent subjects spent more time reading the profile of Frank than did non-outcome dependent subjects. Subjects who were motivated to form an accurate impression of Frank also spent more time than non-outcome dependent subjects to form an impression. On the basis of these findings, the authors argued that outcome dependent subjects seemed to show deeper processing of information about Frank and formed a more carefully considered impression. Unfortunately, due to the measures taken, it is difficult to determine clearly what the effects were of pitting the two types of motivations against each other. The Neuberg and Fiske experiments showed that outcome dependent subjects took more time to arrive at a likeability

rating of the targets. However, it is impossible to determine whether outcome dependent subjects' dispositional judgments were also more accurate.

In summary, the outcome dependency studies do not resolve the question of how motivational and accuracy goals interact to affect the accuracy of people's judgments. Indeed, after reviewing the relevant literature, Kunda (1990) concluded that "there has been no serious attempt to address this question empirically" (p. 487). To do this, an investigation would need to separate the influence of accuracy and directional motivations on people's judgments and behavior. The present research sought to do this in the domain of people's task completion predictions.

The Current Research

The above review suggests a number of hypotheses concerning the role that motivation may play in influencing people's prediction of completion times. First, it is hypothesized that directional motivation will result in earlier predictions than past performance would suggest is reasonable. Consistent with Buehler et al.'s (1994) research, I expect that directional motivation may lead to an increased focus on planning and a decreased focus on past performance (distributional information). It is also possible that directional motivation will improve subsequent performance. If high directional subjects do improve their performance, it is possible that their predictions will turn out to be just as accurate as subjects who are not as highly motivated to finish quickly (when predictions are compared to performance). However, I suspect that people with a desire to finish early will not perform as well as they expect and, as a result, their predictions will be more optimistically biased than the predictions of other people. In short, it is hypothesized that despite possible changes in behavior, people with directional motivation will be more optimistically biased than subjects without such directional motivation because their predictions reflect wishful thinking

With regard to accuracy motivation, it is expected that motivating people to make accurate predictions will lessen the optimistic bias. In addition, it is expected that people motivated to be accurate will focus more on their past performances and less on scenario thinking in making time predictions than people not motivated to be accurate. Of course, it is possible that encouraging people to be accurate will instead exacerbate the planning fallacy. More effort in a prediction task may simply mean more narrative thinking, leading people to think of a dozen more reasons why they should be able to get the task done faster than ever before. In this case, the optimistic bias would be worsened as a result of accuracy motivation.

Lastly, it is expected that directional motivation will interact with accuracy motivation. It is predicted that accuracy motivation will moderate the optimism that would have been shown if people were merely concerned with the desire to finish early.

The present research was conducted to test these hypotheses. By independently varying directional and accuracy motivations, I sought to clarify the role that these two motivations (alone and in combination) play in the optimistic bias. This is clearly of interest given the lack of research concerning how these two goals interact.

Experiment 1

The first study examined the effects of different types of motivation on people's predictions of task completion times. The task chosen for this experiment was a short word task designed to be completed in approximately 5 to 10 minutes. A laboratory-based study was used in order to examine the effect of different types of motivation in a controlled setting.

The present experiment involved predictions about a word task with which subjects were somewhat familiar due to two practice trials. This design has the advantage of giving the researchers access to actual past performance on the task,

with which to compare subjects' predictions. This information will be used to create a measure of optimism: the degree to which subjects predict that they will complete the final word task more quickly than is suggested by their past performance.

A number of other characteristics make the current setting an ideal one in which to study the combined influences of different motivation. Because subjects do not know exactly how difficult the third task will be before they make their prediction, an argument could be made that the most realistic prediction would involve simply taking an average of the past two trials. Subjects can't assume that their completion time on the final trial will be faster than it was on the past two trials, due to the uncertain difficulty level of the third task. Thus, a prediction that is earlier than past trials would indicate that a subject is being optimistic. In addition, subjects' predictions were compared with actual completion times, in order to gain another measure of optimism.

The primary purpose of the study was to examine the effects of accuracy and directional motivation on prediction. Both types of motivation were varied independently. Accuracy motivation was manipulated by offering a monetary incentive for an accurate prediction. Directional motivation was manipulated by offering a monetary incentive to finish early. I examined the effect of these different types of motivation on people's predictions and on the cognitive processes accessed when making these predictions.

Method

Subjects

Subjects were 60 undergraduates attending Simon Fraser University who were either given course credit in a Psychology class or paid five dollars for participating in the study.

Procedure

Subjects were recruited for this experiment, described as a study on decision-making. People were told that they would be asked to complete a series of word anagrams and then make a number of decisions concerning the tasks. Upon arrival, subjects were taken individually to a lab room and given instructions concerning the word task. The task was a simple, yet challenging anagram-like exercise. For each trial, a subject was given a list of five long words (e.g., histogram, roustabout, cosmopolitan, comparison, noviciate) and underneath each word there were five blank lines. From any three of those five long words, subjects were required to find five smaller words using the letters in the root word. For example, one set of smaller words using the letters in "histogram" could include gram, trim, grit, toga and mist. Subjects were given a list of rules which stated that (a) the solution words must be found in an English dictionary (b) the solution words were to be four letters long or longer, (c) each letter in the root word was only be used once in each solution word and (d) the solution words could not rhyme. Subjects were informed that they would complete a practice trial and then three trials for the study. In addition, subjects were told that different word lists would be used for each trial and that the lists would vary in difficulty, but that there was no pattern to the varying level of difficulty (in other words, the difficulty was randomly determined). Pre-testing indicated that each task took approximately four to seven minutes to complete. The order of the word lists was counterbalanced across the three experimental trials. In addition, subjects were told that some strategies might allow them to finish the word tasks faster and that perhaps they might want to be alert to the possibility of using different strategies. All subjects were told that the purpose of the task was to complete the anagrams as quickly as possible.

To allow subjects to become comfortable with the word task, they were given the practice word trial, on which they were timed, but not informed of how long it took

to complete. Then subjects were given the three main word tasks and were timed by the experimenter with a stopwatch.

After they finished each of the first two trials, they were told how long it took them to complete the task. Then subjects were asked to predict how long the third and final word task would take. They were told that this word task would have the same format as did the previous two tasks, but would have different words. Before subjects predicted how long the word task would take to complete, the motivational manipulation was introduced.

Manipulation of Motivation

Accuracy and directional motivation were the two independent variables. Subjects in the high accuracy condition were told that the three participants who made the most accurate predictions would be awarded \$25. Subjects in the low accuracy condition were not offered a monetary incentive for accuracy but were instructed to make as accurate a prediction as possible. Subjects in the high directional condition were told that the three participants who finished earliest would be awarded \$25. Subjects in the low directional condition were not offered an award for speedy completion. They were simply instructed to finish the word task as quickly as possible.

The two motivational variables were crossed in a 2 (directional motivation) x 2 (accuracy motivation) factorial design. Note that this design provided a condition that included both high directional and high accuracy motivation. In this condition, subjects were told that the three participants with the most accurate predictions would be awarded \$25, and also that the three people who finished earliest would also win \$25. In effect, subjects in this combined condition had a chance to win \$50; \$25 for finishing early, and \$25 for making an accurate prediction. Although offering these subjects two incentives means that they had more chances of

winning, this manipulation was an attempt to induce a comparable incentive for accurate predictions and early completions as those in conditions where accuracy and directional motivations were manipulated alone.¹

After receiving information about the monetary incentives, subjects were asked to predict how long it would take them to complete the task. As subjects were making their predictions, they were asked to "think aloud". They were instructed to "say every thought that comes to mind as you are thinking about the question, deciding on an answer and as you are writing down the prediction". In addition, subjects were asked to continue thinking out loud for one to two minutes after the prediction, until they had reported everything that they were thinking of while answering the question. The "think-aloud" responses were recorded on tape and later transcribed. Subjects then completed the third task.

After completing the third task, subjects completed two measures that served as manipulation checks. Subjects rated how important it was to them to finish early on a scale from 1 (not important at all) to 10 (very important). They also rated how important it was to them to make an accurate prediction on a scale from 1 (not important at all) to 10 (very important). Subjects were asked to think aloud as they completed these measures.

The dependent variables were subjects' predictions of how long it will take to complete the task, their thoughts when making the prediction, and their actual completion time. Based on these measures, the degree of optimistic bias was assessed in two ways. One indicator of optimism was the difference between subject's predicted completion time and their average completion time for the first two word tasks. If subjects volunteered a completion time earlier than their past performance, then they were considered optimistic. A second indicator of optimistic bias was the difference between subjects' predicted completion time for the third trial and their actual completion time. If subjects predicted that they

would get done earlier than they actually did, then this also shows an optimistic bias. As explained earlier, I felt that both comparisons should be used as measures of optimism.

Results

Manipulation Checks

To assess the effectiveness of the two motivational manipulations, subjects' responses to the manipulation checks were submitted to a 2 (directional motivation) x 2 (accuracy motivation) analysis of variance (ANOVA). Means for the analyses are displayed in Table 1. First I examined subjects' ratings of how important it was to finish promptly. The analysis showed subjects in the high directional conditions did not report significantly higher levels of directional motivation ($M = 7.63$) than did subjects in conditions who were not offered a monetary award to finish early ($M = 7.04$). There was not a significant interaction of accuracy and directional motivations. The accuracy manipulation was more effective. Subjects who were offered \$25 to predict accurately rated it significantly more important to predict accurately ($M = 7.25$) than did those subjects who were not offered an incentive for accuracy ($M = 5.75$), $F(1, 44) = 4.63$, $p < .05$. There was not a significant interaction of directional and accuracy motivation. Although the manipulation of directional motivation did not appear to affect subjects' desire to finish early, then, the manipulation of accuracy motivation appeared to be effective.

Motivational Influences on the Optimistic Bias

The primary purpose of this study was to examine the effect that different types of motivations have on the degree of optimistic bias in prediction. Two indices of optimistic bias were considered. One way to measure the extent of optimistic bias is to compare the difference between predicted and actual completion times. Thus for

each subject I computed a difference score by subtracting the actual completion time from the predicted completion time. These (signed) difference scores were submitted to a 2 (directional motivation) \times 2 (accuracy motivation) ANOVA. Table 2 displays the means for each of the dependent variables by condition. I hypothesized that subjects in the high directional condition would be more biased than subjects in the low directional condition. This did not appear to be the case. There were no significant effects of directional motivation. Instead, the only significant effect to emerge from the analysis was a main effect of accuracy motivation which indicated that subjects in the high accuracy condition underestimated their actual completion times by a greater degree ($M = 1.96$ minutes) than did subjects in the low accuracy conditions ($M = -0.13$ minutes), $F(1,44) = 6.94$, $p < .03$.

This measure of optimism was also analyzed using a two-way t-test. Across all groups, the difference between completion time and prediction was significant, $t(59) = -2.31$, $p < .03$. In addition, when the four motivational conditions were examined separately, there was a significant difference between completion time and prediction only in the high accuracy group, $t(11) = -2.65$, $p < .03$. There were no significant differences in any of the other conditions.

As a second index of optimistic bias, I examined the difference between subjects' average completion time for the first two trials and their prediction for the third trial. These difference scores were submitted to a 2 (directional motivation) \times 2 (accuracy motivation) ANOVA. Once again there was no significant effect of directional motivation. Furthermore, unlike the previous analysis, this analysis did not reveal a main effect of accuracy motivation.

This measure of optimism was then analyzed using a two-way t-test. Across all groups, there was a significant difference between average past performance and prediction, $t(59) = -3.62$, $p < .002$. When the four motivational conditions were

analyzed separately, this measure of optimism was significant in the high accuracy condition, $t(11) = -2.57$, $p < .03$, and marginally significant in the combined motivation condition, $t(11) = -1.95$, $p < .08$. This difference was not significant in the control or high directional groups.

In sum, both measures of optimistic bias failed to reveal the hypothesized effects of directional motivation. However, the accuracy manipulation appeared to affect the amount of optimistic bias obtained. Subjects in the high accuracy condition generated more optimistic predictions than subjects in the low accuracy condition.

In addition to these analyses of the two indices of optimistic bias, a separate 2 (directional motivation) \times 2 (accuracy motivation) ANOVA was conducted for each of the following measures: (a) completion times on the first two trials, (b) predicted completion times, and (c) actual completion times. First, I examined subjects' completion times on the first two trials. Because these trials preceded the experimental manipulations, there should not have been differences across conditions. The analysis confirmed that there were no significant differences. Next, subjects' predicted completion times were examined. The analysis revealed that subjects' predictions did not differ significantly across the experimental conditions. There was not a significant main effect of directional motivation or accuracy motivation; nor was there a significant interaction. In contrast, subjects' actual completion times for the third trial did differ across the conditions. A significant main effect of accuracy motivation indicated that performance on the third trial was significantly slower for high accuracy groups ($M = 7.85$) than for low accuracy groups ($M = 5.58$), $F(1, 44) = 4.71$, $p < .05$. Based on this last result, it seems that the high accuracy group showed more optimistic bias in large part because of their slower completion times.

Correlations

That subjects used past times when making their predictions is suggested by the high correlation between subjects' first two completion times and their actual prediction. The correlation between subjects' first trial completion time and their prediction was significant, ($r = .51, p < .01$), and the correlation between their second trial time and the prediction was even higher ($r = .93, p < .01$). The correlations between predicted time and the past two times did not differ greatly among the motivational conditions. These correlations, suggest that subjects were relying on their past times, especially their most recent time, to make the present prediction. The correlation of the actual completion time on the third trial and prediction was .67, suggesting that subjects were moderately accurate with regard to their predictions.

Think-Aloud Questions

As they were making their predictions, subjects were asked to say out loud any thought they had while making the prediction. These responses were transcribed, then examined and clustered into eight categories. The categories were chosen on the basis of theoretical explanations of the optimistic bias. As noted earlier, Kahneman and Tversky (1979) suggest that people adopt an internal focus (involving future planning) in forecasting instead of relying on distributional information. Accordingly, one of our categories (future planning) involved the extent to which people used future planning. This category involved any type of strategizing, scenario thinking, or future planning statements (e.g., "I think that the words will be easier this time" or "Next time I'll look for e's"). A second category (future impediments) also involved future thinking, but involved finding reasons why the next task would take longer than expected (e.g., the next set of words might be more difficult). The third category (past experience) involved the use of personal

distributional information. In this case, use of distributional information could involve any consideration of their past performances at all. The fourth category (average of past experience) involves a prediction that was based on a rough calculation of the average of the past two times. Lastly, based on previous research on the effects of accuracy motivation, it seemed possible that subjects might adjust their predictions to be conservative. The fifth category (conservative adjustment) refers to an attempt to give a conservative or long estimate in order to make a "safe" estimate. This category differs from the future impediments category, in that adjusting to be conservative would not necessarily involve imagining specific scenarios. Instead, adjusting to be conservative simply involves subjects lengthening their predictions, so that they have a margin of safety in which to complete the task. Here subjects seemed to be concerned about taking longer than their prediction.

In addition to categories derived from theory, one of the categories was empirically derived from an examination of the think-aloud transcripts. This category (discounting the past) refers to subjects explaining away the past in order to come to the conclusion that they would be faster at the task this time. It includes, for example, taking the average and subtracting a few minutes because "I think I have the hang of it now". These six categories formed the basis of the qualitative analysis: future planning, use of past completion times, calculation of average completion time, adjustment to be conservative, future impediments, and discounting the past.

Two raters who were blind to the subjects' experimental condition independently categorized the responses into the six categories. The inter-rater agreement rate was 87%. I computed the proportion of a subject's total number of responses that were assigned to each category (see Table 3). For example, if a subject dwelt entirely on past performance in order to make a prediction, the proportion for that category

equaled 100%. Likewise, if a subject mentioned an adjustment to be conservative and also tried to gauge how long it had taken to finish the past trials, then each of these categories would have a proportion of 50%.

The proportions for each category were submitted to a 2 (directional motivation) x 2 (accuracy motivation) ANOVA. There were no significant differences between motivational groups in the explanations mentioned by subjects. Thus there did not appear to be any systematic effect of the motivational manipulation on the thoughts expressed by subjects while making a prediction. In general, there appeared to be a high proportion of subjects mentioning past times as a basis on which to make their prediction ($M = 20.7\%$), as well as those subjects who specifically calculated an average of their past times ($M = 29.3\%$).

It might seem surprising that I found a consistent optimistic bias if people were concentrating on their past times, since distributional information is thought to lessen the optimistic bias. However, how this information was used would likely have affected whether people were more or less optimistic. Fully 43.1% of people discounted the effect that past performance would have on future performance. In other words they explained why their past performance would not be indicative of how they would perform this time. This finding suggests that attending to distributional information will not by itself lessen the optimistic bias.

Discussion

The current study did not reveal the hypothesized main effect of directional motivation on the optimistic bias. The finding that high directional groups did not show a significantly greater optimistic bias than low directional groups is likely attributable to the small impact of the manipulation. Subjects in the high directional condition did not report a stronger desire to finish the task quickly than did subjects in the low directional condition.

One explanation for the small effect of the directional manipulation is that there was a ceiling effect on subjects' desire to finish the task early. That is, subjects in both conditions appeared to have a strong desire to finish early. An experimenter sitting beside subjects with a stop-watch might have caused a high level of directional motivation in all conditions. In fact, a number of control subjects stated their desire to get the task done quickly, because they felt that was the main purpose of the task. Indeed, subjects in all conditions reported a strong desire to finish the task early.

Although there was no main effect of directional motivation, there was a main effect of the accuracy manipulation on the optimistic bias. Subjects motivated to make accurate predictions actually showed the highest level of optimistic bias. For the most part, the difference found in the high accuracy group with regard to the optimistic bias is attributable to their slower completion time on the third word task, which resulted in a completion time that was longer than the prediction. The high accuracy group might have felt less pressure to complete the task quickly and as a result finished later than they had expected.

Experiment 2

Due to the unexpected result that the high accuracy group ended up being most optimistic in their predictions (mainly due to their poor performance on the final task) and due to the ineffectiveness of the directional motivation manipulation, a second study was conducted. Several changes were made. First, I attempted to increase the effectiveness of the directional manipulation. As noted above, one element that might have weakened the effect of the directional motivation manipulation is a potential ceiling effect for directional motivation. Subjects in the previous study were told that the sole purpose of the word task was to finish quickly. In the present study, subjects were told that they were being asked to

complete the word tasks as a pretest for a later study. They were also informed that the experimenter was interested in learning a number of things from the pretest such as how hard subjects thought the word task was, how enjoyable, and how much concentration it required. This information was intended to lessen the sense that speed was the only performance element of interest.

In addition, the monetary incentive in the first study may not have been great enough to interest subjects. The possibility of winning \$25 may not have been sufficient motivation for those subjects who were either not competitive or felt they did not have a good chance of winning. A different, more individual incentive was used in the second experiment to try to strengthen the manipulation. High directional subjects only had to improve on their own previous performance to win an award. Likewise, high accuracy subjects only had to predict their completion within a specified amount of time (30 or 45 seconds) in order to win the high accuracy award.

Lastly, because past trials were so salient in the first experiment, this may have lessened subjects' tendency to use future thinking in making their predictions. This lessened future thinking might have weakened the effect that directional motivation had on optimism. In order to solve this potential problem, the second experiment manipulated the accessibility of past trials by not telling half of the subjects what their completion times were on the pre-trials. Not informing subjects how long their pre-trials took to complete should decrease the accessibility of subjects' past experience with the task, and make this information less disruptive of planning/future thinking. This "uninformed" condition is also quite similar to many real-world situations, in which people are often not aware of exactly how long various tasks have taken them to complete. It was thought that high directional subjects who were not told how long their previous completion times were might show an exacerbated optimistic bias.

As in Experiment 1, the two main measures of optimism were a) the difference between subjects' predictions and actual completion times, and b) the difference between subjects' predictions and an average of their past performance. In addition, I was interested in whether the motivational manipulation affected how quickly subjects actually finished the word task. However, in this experiment, subjects were not asked as they are making their predictions to think out loud, due to the possibility that this procedure might have made people feel accountable for what they say, and thus, indirectly, might have motivated all subjects to be accurate. Instead, subjects were asked to recall what factors were important to them in making a prediction only after they had finished the third word task. Although these retrospective reports may not be as informative as concurrent reports, they provided a measure of the thoughts people had while making their prediction (e.g., whether they focused on future scenarios or on past information).

Method

Subjects

One hundred and twenty undergraduate psychology students were subjects in this study. Thirty subjects were given course credit and 90 subjects were paid \$5 for participating.

Procedure

The procedures were very similar to those in the first experiment. As in the first experiment, subjects were given one practice trial, and two pre-trials with the word task before making their prediction. In the present experiment the availability of information concerning previous completion times was varied. There were two information conditions. In one condition (informed), subjects were told their actual completion times. In the other condition (uninformed) subjects finished the tasks

but were not told how long it took them to complete these trials. Then subjects received the motivational manipulation and were asked to make a prediction for the third trial.

The motivational manipulations were altered slightly to strengthen their impact. After completing the pre-trials, subjects were asked how long it would take them to complete the next word task. Subjects were told that the next word task could be harder or easier. Then the manipulations of directional and accuracy motivation took place. Subjects in the high directional conditions were told that the researchers were interested in people's ability to learn to finish word tasks quickly. Accordingly, those subjects who managed to finish by a time two minutes less than their original time would win \$4 and subjects who took one minute less than their original time would win \$2; otherwise, subjects would not win a prize. Subjects in the low directional condition were simply reminded to finish as quickly as they could. Subjects in the high accuracy condition were told that the researchers were very interested in people's abilities to make accurate judgments. They were informed that subjects who managed to finish within 30 seconds of their predicted time would win \$4 and that subjects who finished within 45 seconds of their predicted time would win \$2; otherwise, subjects would not win a prize. In addition, to further increase the motivation to make accurate predictions, high accuracy subjects were told that they would be expected to justify their decision to the experimenter after the third word task was finished. To ensure that all subjects would be working toward the same goal, subjects in the low accuracy conditions were also reminded to make their prediction as accurate as possible. It was hoped that all subjects would attempt to complete the word task in good time, and that all subjects would make conscientious predictions. The motivational manipulations were intended only to vary the strength of subjects' desire to accomplish these goals.

After receiving their instructions, subjects were asked to predict how long the

third word task would take. After completing the final task, subjects were asked to describe, in writing, their thoughts while making the prediction. In addition, subjects were asked to rate how important it was for them to finish the task early and how important it was for them to make an accurate prediction. These two questions served as manipulation checks. Finally, subjects estimated how long they had taken on previous tasks. In the uninformed condition, subjects estimated how long they had taken on each of the three tasks, and in the informed condition, subjects estimated how long they had taken on the final task. Subjects' estimates provided a measure of their accuracy in judging the speed of their performance. Conceivably, differences could result between the high and low information conditions because of systematic biases in subjects' estimates of previous performance.

Results

Manipulation Checks

As anticipated, there was a main effect of the directional manipulation on subjects' desire to be done early. Subjects in the high directional condition rated it significantly more important to finish early ($M = 7.17$) than did subjects in the low directional condition ($M = 6.07$), $F(1, 116) = 6.76$, $p < .01$. In addition, subjects in the high accuracy condition rated it more important to try to be accurate in their predictions ($M = 6.70$) than did subjects in the low accuracy condition ($M = 5.58$), $F(1, 116) = 6.64$, $p < .01$. Table 4 displays the ratings of importance to finish early and ratings of importance to make an accurate prediction for each condition. These findings suggest that both of the motivational manipulations achieved their intended purpose.

Predictions Compared to Average Past Times

To examine the effect of the motivational manipulations on the optimistic bias, a 2 (directional motivation) by 2 (accuracy motivation) x 2 (information) analysis was conducted for each measure of interest. Table 5 displays the results for the informed and uninformed conditions. I was interested in the effect that directional and accuracy motivation would have on the extent of optimistic bias in time prediction. In particular, it was hypothesized that subjects with a high level of directional motivation would be more optimistic than their counterparts. As an initial test of this hypothesis, the difference between subjects' average past performance and their predictions was examined. Consistent with the hypothesis, the difference was greater for high directional subjects ($\underline{M} = 1.56$ minutes) than for low directional subjects ($\underline{M} = 0.49$ minutes), $\underline{F}(1, 112) = 4.15, p < .05$. This main effect indicates that subjects motivated to finish early believed they would improve on their previous performance more than subjects in the low directional condition. In contrast, high accuracy subjects were not significantly more optimistic ($\underline{M} = .86$ minutes) than low accuracy subjects ($\underline{M} = 1.19$) minutes on this measure of the optimistic bias. There were no significant interactions of information with either directional motivation or accuracy motivation.

Although the motivational manipulations did not interact significantly with the information variable, further exploratory analyses were conducted to examine the impact of motivation within each information condition. A 2 (directional motivation) x 2 (accuracy motivation) ANOVA was performed separately for each information condition. In the informed condition, the hypothesized effect of directional motivation was found. Subjects with high directional motivation expected to improve on their average past time by a greater amount ($\underline{M} = 1.54$ minutes) than did subjects with low directional motivation ($\underline{M} = -.09$), $\underline{F}(1, 56) = 9.34, p < .003$. In the informed condition, there was also a marginal effect of accuracy motivation on the difference between average past time and prediction, $\underline{F}(1, 56) =$

3.12, $p < .08$. Unlike Experiment one, where high accuracy subjects were more optimistic than subjects in the low accuracy condition, it appeared that high accuracy subjects predicted that they would improve on their past time by a lesser amount ($M = .25$ minutes) than did low accuracy subjects ($M = 1.20$ minutes). There was no significant interaction between accuracy and direction motivation.

The uninformed condition showed a much different pattern of results than did the informed condition. There were no significant main effects or interactions of directional and accuracy motivation on the difference between average past time and prediction (all F 's < 1).

This measure of optimism was also analyzed using a two-way t-test. Across all conditions, there was a significant difference between the average past completion time and prediction, $t(119) = -3.89$, $p < .001$. There was also a marginally significant difference between past performance and prediction in the control group, $t(29) = -1.75$, $p < .10$. This difference was significant in the high directional group as well, $t(29) = -3.10$, $p < .005$. However, there was not a significant difference between past performance and prediction in the high accuracy condition or in the combined motivation group.

Predictions Compared to Actual Completion Times

The second measure of optimistic bias was the difference between subjects' actual completion times and their predictions. Again, I expected that high directional subjects would be more optimistic than subjects in low directional conditions. Contrary to this hypothesis, there were no significant main effects of either directional or accuracy motivation manipulation on this measure. There was a marginally significant interaction between accuracy motivation and information, $F(1, 112) = 3.35$, $p < .08$. However, contrasts done between high and low accuracy subjects separately in the two information conditions revealed no significant

differences in the predictions of high accuracy subjects compared to low accuracy subjects.

There was not a significant three-way interaction between the two motivational conditions and the information condition. In spite of this, further exploratory analyses were conducted. There was not an effect of directional motivation in either the informed condition or in the uninformed condition. As well, there was not a significant interaction of directional and accuracy motivation in either information condition.

The difference between actual completion time and prediction was also analyzed using a two-way t-test. Across all groups, this difference was not significant. Indeed, none of the four conditions showed a significant bias with regard to the difference between actual completion time and prediction.

Predicted Completion Times

A 2 (directional motivation) x 2 (accuracy motivation) x 2 (information condition) ANOVA was conducted on subjects' predictions. There was no main effect of directional motivation, accuracy motivation, or information condition. However, there was a significant interaction between directional motivation and information condition, $F(1, 112) = 8.62, p < .005$. In the informed condition, high directional subjects volunteered predictions that were shorter ($M = 4.95$ minutes) than those volunteered by low directional subjects, ($M = 7.69$ minutes), $t(112) = -2.95, p < .005$. In contrast, there was no significant effect of directional motivation in the low information condition.

In addition, there was also a significant interaction between accuracy motivation and information condition, $F(1, 112) = 3.7, p < .05$. In the informed condition, the high accuracy subjects gave somewhat longer predictions ($M = 7.24$) than the low accuracy subjects ($M = 5.4$ minutes), $t(112) = 1.98, p < .06$. In the uninformed

condition, however, there was no effect of accuracy motivation.

Although there was not a significant three-way interaction between the motivational variables and the information condition, further exploratory analyses were conducted for each information condition separately. The analyses failed to reveal a significant interaction of accuracy motivation and directional motivation in either the informed or the uninformed conditions.

Actual Completion Times

Analyses were also conducted on the time the final word task actually took subjects to complete. There was no significant main effects of directional motivation or accuracy motivation, (all F 's < 1). However, there was a significant interaction between directional motivation and information condition, $F(1, 112) = 4.24, p < .05$. In the informed condition, high directional subjects finished faster ($M = 5.48$ minutes) than did low directional subjects ($M = 7.27$ minutes), $t(112) = 2.10, p < .04$. In contrast, there was not a significant effect of directional motivation in the low information condition.

Although the three-way interaction was not significant, further exploratory analyses were conducted for each information condition separately. However, there was not a significant interaction of accuracy and directional motivation in either the informed or the uninformed conditions.

Additional Measures of Optimism in the Uninformed Condition

Because the uninformed subjects did not know how long the first two word tasks had taken to complete, they made their prediction based on considerably less information than did the informed subjects. It is possible, then, that uninformed subjects based their predictions to some extent on a subjective estimate of how long the previous tasks had taken. In order to examine the relationship of such estimates

to the prediction, a difference score was computed between subjects' estimated average completion time for the first two trials and the actual average time on those trials. This score indicates how accurate subjects' perceptions of their performance on the first two trials were. It appeared that high directional subjects overestimated slightly the time it took them to complete the first two word tasks ($\underline{M} = -0.2$ minutes), whereas low directional subjects underestimated ($\underline{M} = .27$ minutes). However, this result did not approach significance. Even though this finding was not significant, another analysis was conducted to control for subjects' perceptions of their time on the first two tasks. To do this, a third indicator of optimism was computed: the difference between subjects' prediction and their *perceived* average completion time. Interestingly, when the relatively "pessimistic" perceptions of the high directional subjects were controlled for, there was a marginally significant greater optimistic bias in the high directional conditions ($\underline{M} = 1.85$ minutes) than in low directional conditions ($\underline{M} = 0.88$ minutes), $\underline{F}(1, 56) = 3.56, p < .08$.

Accuracy of Prediction

In addition to the measures of optimistic bias, I also examined the absolute difference between subjects' predictions and their actual completion time. The absolute difference score provides a measure of the accuracy of prediction. There was no significant main effect of either directional or accuracy motivation manipulation on these absolute difference scores. There was a main effect of information condition, $\underline{F}(1, 112) = 7.33, p < .009$. Not surprisingly, the uninformed condition (not having access to their past performance times) had higher absolute difference scores ($\underline{M} = 3.15$ minutes) than the informed conditions ($\underline{M} = 1.94$ minutes). What was not expected, however, was that the high accuracy subjects were not more accurate than low accuracy subjects in terms of absolute differences from their actual completion time. In neither the informed or uninformed

conditions were the high accuracy subjects significantly more accurate than the low accuracy subjects.

Correlations

Correlational analyses revealed no differences in the degree to which any of the motivational conditions utilized their past performance in making predictions. Collapsed across information groups, the correlation of predicted time with average past time was similar in high directional subjects ($r = .64$) and in low directional groups, ($r = .71$). Likewise, the high accuracy group volunteered predictions that showed a similar degree of correlation with their average past times ($r = .71$) compared to the low accuracy group ($r = .60$).

The two information conditions showed different patterns with regard to the correlation of predicted times with past performances. The predictions of informed subjects were more highly correlated with their past two trials ($r = .66$ and $r = .76$) than were the predictions of uninformed subjects ($r = .44$ and $r = .48$). In addition, the correlation between predictions and actual completion times was higher for informed subjects ($r = .71$) compared to uninformed subjects ($r = .26$). This difference is understandable given the lack of distributional information available to uninformed subjects.

Reasons Given for Predicted Completion Time

Subjects were asked to explain, in detail, what they were thinking about when they made their predictions and their responses were clustered into seven categories similar to those used in Experiment 1: (1) Future Planning, (2) Future Impediments, (3) Adjustment to be Conservative, (4) Past, (5) Average, (6) Discounting Past, and (7) Time Estimates. The last category is new; it refers specifically to the uninformed conditions where subjects would have to estimate

how long their past performances took them.

Again, two raters blind to experimental condition independently categorized responses into the above categories. The inter-rater agreement rate was 91%. Table 6 and 7 display the mean proportion of subjects' explanations that referred to each category. Analyses focused primarily on the extent to which subjects referred to future planning and to their past experiences.

First, the extent to which subjects engaged in future planning was examined. I expected that people in the high directional conditions would be more likely to use future planning in their predictions, since a focus on future planning is thought to be the cause of the optimistic bias. However, there was not a significant effect of directional motivation on future planning. Instead, there was a main effect of accuracy. High accuracy subjects focused less on future planning ($M = 6.78\%$) than did low accuracy groups ($M = 13.94\%$), $F(1, 109) = 3.92, p < .05$. This finding suggests that future thinking is used by individuals who were not given any incentive at all (one might consider this a baseline), whereas accuracy motivation makes people less likely to engage in future planning.

Also important was the extent to which people used their past performance in making predictions. I expected that people in the high accuracy conditions might be more likely to concentrate on this type of distributional information. Contrary to this expectation, past performance was used fairly heavily in both high accuracy ($M = 24.58\%$) and low accuracy conditions ($M = 27.44\%$) collapsed across both information conditions. There was no significant main effect of either directional motivation or accuracy motivation. However, there was a main effect of information, $F(1, 109) = 3.66, p < .06$. Subjects in the uninformed condition were more likely to focus on their past experiences ($M = 32.47\%$) than subjects in the informed condition ($M = 19.63\%$), likely in an attempt to decide how long their past performance had taken. In the high information condition, exploratory analyses

revealed that instead of high accuracy subjects using past information more than low accuracy subjects (as expected), the high directional groups used this distributional information less ($M = 15.56\%$) compared to the low directional condition ($M = 23.85\%$), $F(1, 109) = 6.46$, $p < .02$. Thus the groups motivated to finish early were most likely to ignore important distributional information.

Even more interesting than which groups mentioned their past performances were differences between groups in how they used that information. High accuracy groups were more likely to calculate an average on which to base their prediction ($M = 19.77\%$) compared to low accuracy groups ($M = 8.33\%$), $F(1, 109) = 5.25$, $p < .03$. In contrast, the high directional groups were more likely to discount their past times in an attempt to explain why their performance would be better next time ($M = 29.38\%$) compared to low directional groups ($M = 12.64\%$), $F(1, 109) = 8.38$, $p < .006$. The high directional groups were also less likely to think of future impediments to their performance ($M = 2.82\%$) compared to low directional groups ($M = 6.9\%$), $F(1, 109) = 3.12$, $p < .08$. These results are reported for all subjects, collapsed across informed and uninformed conditions.

Discussion

The results suggested that motivation plays a role in the optimistic bias. I expected that directional motivation would lead to more optimistic predictions compared to past performance, and the results supported this hypothesis. However, directional motivation also resulted in improved performance, so that high directional subjects were not significantly more optimistic than low directional subjects when compared to actual performance. This finding is consistent with research that has found that challenging goals result in improved performance. It is very possible that optimistic predictions could serve as goals, with the implication that being optimistic in our predictions helps us to finish tasks more quickly. This

interpretation is consistent with the thoughts that high directional subjects mentioned as influencing their prediction. Although they were aware of their past performance, they found ways to discount its importance. They were also less likely to think of future impediments to their performance. This type of thinking may have aided them to complete the task more quickly.

The high accuracy group showed an interesting range of responses to the incentive. For example, in the informed condition, it seemed that the high accuracy subjects volunteered overly conservative estimates which resulted in predictions that were no more accurate than other subjects. In the uninformed conditions, the high accuracy subjects gave predictions comparable to predictions given in other conditions, but then seemed to feel less time pressure in completing the task. The high accuracy group was the only condition that actually took longer to complete the final task than it had taken on average to complete the first two tasks. This finding may be the result of these subjects' misperception of the passage of time. This suggests that at least part of the optimistic bias is a cognitive fallacy concerning how long tasks should take. Having underestimated the time that it would take to complete the task, it may have been that high accuracy subjects proceeded to complete the task, thinking they had plenty of time to meet their prediction.

General Discussion

The preceding two experiments examined the effect of motivational influences on people's time predictions. It appeared that directional motivation (desire to finish a task early) caused people to volunteer an early prediction of when they would finish a task. These people also finished the task early, but not as early as their prediction. In the second study, high directional subjects were more optimistic than low directional subjects when their predictions were compared to past

performance. However, directional motivation also seemed to improve performance; high directional subjects did indeed finish the final word task faster than they had completed the first two tasks on average.

The high accuracy group showed a range of responses to the monetary incentive. In the first study, high accuracy subjects were just as optimistic as the other groups in making predictions compared to their average past times. However, unlike the other groups, the high accuracy group took much longer to complete the final word task (perhaps because they felt less time pressure) and as a result this group was the most optimistic compared to their actual completion time. This finding appears to be consistent with Kunda's (1990) hypothesis that in some cases, accuracy motivation may actually lead to more biased judgments. A similar pattern of results was also somewhat evident in the uninformed condition of Study 2. High accuracy subjects gave equally optimistic predictions compared to other subjects, but then were the only subjects whose final performance did not improve. This set of results suggests that accuracy motivation may not always have the intended effect, and may at times simply prompt behavior that is not as sensitive to time pressure.

Only in the second study, where informed subjects were told how long their past trials had taken and were offered an incentive (as well as being told that they would have to justify their prediction to the experimenter) did high accuracy subjects make very cautious predictions. Given these conditions, subjects mentioned future impediments more frequently and gave conservative (lengthy) estimates of their future completion time. However, this conservatism did not result in more accurate predictions, but simply in predictions that were too long, instead of too short. This result points to the resiliency of the optimistic bias. Along these same lines, in Buehler et al.'s (1994) original study, the importance of an accurate prediction was repeatedly emphasized, yet subjects were consistently optimistic.

Certainly, in neither of the two present studies was there evidence that the high

accuracy group made noticeably better predictions than the low accuracy group. In neither study was there a significant difference between high and low accuracy groups with regard to the absolute difference between predictions and actual completion time. This finding is inconsistent with Tetlock's (1992) work on accountability. Although only in the second study were subjects in the high accuracy group accountable to the experimenter for their decision, this accountability did not appear to improve the accuracy of subjects' predictions. It appears that giving people incentives to make accurate predictions has limited usefulness (at least in a laboratory setting).

It is important to note that subjects on the whole were somewhat (albeit not remarkably) accurate. Subjects, on average, predicted a completion time that was within two and a half minutes of their actual completion time. In addition, correlations between predicted and actual time were fairly high.

What do people think about when making their time predictions? Thought listing measures in the second study indicated that high directional subjects did indeed make use of their past performances. However, they appeared to mention past performance mainly in order to discount its importance, to describe why it did not apply in this situation, and to describe why past delays would not affect them this time. Instead, they used future scenarios to plan how they could improve on their performance and on the whole concentrated on task specific plans. These findings are consistent with Kahneman and Tversky's (1979) theorizing on the planning fallacy, as well as with empirical research conducted by Buehler et al. (1994). The high accuracy groups, on the other hand, appeared to use past performance mainly to calculate an average past time on which to base their prediction. The high accuracy group was also more likely to think of future impediments that might slow them down.

Clearly, research should be done to examine in more detail the effects of

motivation on the optimistic bias. Given the different effects of accuracy motivation found across the two studies, it would be interesting to explore under what conditions accuracy motivation will reduce and under what conditions worsen the optimistic bias. Does accountability (along with access to information about past performances) prompt people to give conservative estimates? Do high accuracy subjects end up being less accurate because they take longer to complete the task (and thus ironically, being more optimistic). Finally, given a lack of information, do many people choose an early prediction in an attempt to be accurate and then struggle to fulfill such an early prediction? All these questions could be explored further. In addition, accuracy and directional motivation might be combined in field research as well as in laboratory studies. The interesting results from the present experiments suggest that further research should be completed concerning the effect of accuracy and directional motivations alone, and in combination.

Such future studies are important, because although the choice to conduct the present experiments in a laboratory setting allowed a greater degree of experimental control, it is not clear that the findings of a laboratory-based study would predict the findings of a similar field study. For instance, the task used in these studies was specifically chosen so that subjects' control over their performance was somewhat limited. Subjects did not know whether the words included in the next anagram task would be easier or harder to solve. As a result, in some cases, although subjects wished to finish the task more quickly than they had previously, the difficulty of the task resulted in a performance that was actually worse than previous levels. A field experiment might allow subjects more control over task completion times. As a result, the desire to finish early might then result in earlier predictions which can subsequently be met. On the other hand, it is possible that predictions which are influenced by directional motivation might result in completion times that are

earlier than they would have been without the incentive, but not as early as their predictions indicated.

Just as it is possible that directional motivation might have a different effect on real-world behavior than was indicated by this research, the finding that accuracy motivation did not noticeably affect predictions might not reflect the working of accuracy goals outside the laboratory. For example, offering employees an incentive to finish a project by a predicted deadline might have a noticeably positive effect. As mentioned above, real-world tasks often involve more personal control over the completion time than was true of the laboratory task chosen for the present study. A work deadline might be easier to meet than a prediction made in a laboratory. For example, an employee who is motivated to make an accurate prediction might simply decide to devote more hours to the project within a certain period, so that the project would be completed by the self-set deadline. It is not clear that the results obtained from this study reflect how people behave outside of the laboratory.

This study also does not resolve the issue of whether making earlier predictions results in improved performance. It is possible that an optimistic prediction operates like a self-fulfilling prophecy, and that once having made the prediction, subjects then propelled themselves into the task of completing the task within the predicted time. However, it is also possible that the same directional motivation that prompted subjects to volunteer optimistic predictions, also prompted them to complete the task more quickly than similar word tasks had taken them in the past.

Future studies can address these questions. The possibility of self-fulfilling prophecies which might result from giving early predictions can be studied by experimentally varying how early a prediction subjects give, and then measuring their subsequent performance. This can be done by introducing an anchoring manipulation, in which half of the subjects are given a high anchor, while the other half are given a low anchor (Buehler, MacDonald, & Griffin, 1994).

Other studies might address the question of whether the results detailed in the present research are applicable to real-world tasks by taking advantage of existing incentives to finish tasks. For example, people who have yet to finish a degree are likely to be highly motivated to complete the task. Lastly, researchers may wish to differentiate between negative and positive incentives. For example, some tasks involve positive incentives (perhaps involving a reward) for timely completion of such tasks. Tax returns for those people who are lucky enough to expect a monetary refund presents a positive type of motivation. On the other hand, term papers and other disagreeable chores may involve a high degree of motivation to complete the task early, but for a different reason. People that have to complete such undesirable tasks may look forward to the incentive that the sooner the project is started, the sooner it will be over. However, this type of negative incentive might not motivate people to actually start or complete the task sooner, perhaps unlike the more positive type of incentive.

The present research, then, suggests a number of interesting directions for future research involving predictions of completion time and subsequent performance. Continued research will present a more complete picture of people's optimistic bias, and what factors lead to its attenuation.

Footnotes

¹For exploratory purposes an additional condition was included in which the two motivations were combined in a different manner. In this alternative combined condition, subjects were told that the three participants with the earliest *predictions* would be awarded \$25, with the provision that they must be able to complete the task within their predicted completion times. If the earliest predictor could not complete the task by the estimated time, then the subject with the next earliest prediction would win the \$25 if he or she could complete the task by his or her predicted completion time. If he or she could not complete the task in the estimated time, again the next earliest predictor would be given a chance to win the award, and so on until three subjects won the \$25. This alternative condition should create high levels of both accuracy and directional motivations. Subjects would want to underbid other subjects, yet the stipulation that they would be required to complete the task by their predicted time would likely constrain how optimistic a bid they submitted. Results in this exploratory condition did not differ substantially from those in the condition in which subjects were offered two incentives and are not discussed further.

References

- Bar-Hillel, M. (1983). The base rate fallacy controversy. In R. W. Scholtz (Ed.), Decision Making Under Uncertainty (pp. 36-91). Amsterdam: Elsevier Science.
- Berscheid, E., Graziano, W., Monson, T., & Dermer, M. (1976). Outcome dependency: Attention, attribution, and attraction. Journal of Personality and Social Psychology, *34*, 978-989.
- Buehler, R. Griffin, D. & Ross, M. (1994). Exploring the "planning fallacy": Why people underestimate their task completion times. Journal of Personality and Social Psychology, *67*, 366-381.
- Buehler, R., MacDonald, H. & Griffin, D. (1994, July). The impact of optimistic predictions on task completion times. Paper presented at the Annual Conference of the Canadian Psychological Association, Penticton, British Columbia.
- Byram, S. (1993). Underlying processes of time estimation. Unpublished manuscript. Carnegie-Mellon University, Pittsburgh, Pennsylvania.
- Cantril, H. (1938). The prediction of social events. Journal of Abnormal and Social Psychology, *33*, 364-389.
- Dawes, R. M. (1976). Shallow psychology. In J. Carroll & J. Payne (Eds.), Cognition and Social Behavior (pp. 3-12). Hillsdale, NJ: Erlbaum.
- Earley, P. C. & Northcraft, G. B. (1990). Impact of process and outcome feedback on the relation of goal setting to task performance. Academy of Management Journal, *33*, 87-105.

- Earley, P. C., & Perry, B. C. (1987). Work plan availability and performance: An assessment of task strategy priming on subsequent task completion. Organizational Behavior and Human Decision Processes, 39, 279-302.
- Feltz, D. L., & Landers, D. M. (1983). The effects of mental practice on motor skill learning and performance: A meta-analysis. Journal of Sport Psychology, 5, 25-57.
- Fischhoff, B. (1977). Perceived informativeness of facts. Journal of Experimental Psychology: Human Perception and Performance, 3, 349-358.
- Freund, T. & Kruglanski, A. W. (1985). The freezing and unfreezing of impressional primacy: Effects of the need for structure and the fear of invalidity. Personality and Social Psychology Bulletin, 11 479-487.
- Gilovich, T. (1983). Biased evaluation and persistence in gambling. Journal of Personality and Social Psychology, 44, 1110-1126.
- Ginossar, Z., & Trope, Y. (1987). Problem solving in judgment under uncertainty. Journal of Personality and Social Psychology, 52, 464-474.
- Gollwitzer, P. M. (1993). Goal Achievement: The role of intentions. European Review of Social Psychology, 4, 141-185.
- Hall, P. (1981). Great Planning Disasters, Los Angeles, California: Penguin Books.
- Harvey, J. H., Harkins, S. G., & Kagehiro, D. K. (1976). Cognitive tuning and the attribution of causality. Journal of Personality and Social Psychology, 34, 708-715.
- Henry, R. A. (1994). The effects of choice and incentives on the overestimation of future performance. Organizational Behavior and Human Decision Processes, 57, 210-225.

- Henry, R. A., & Sniezek, J. A. (1993). Situational factors affecting judgments of future performance. Organizational Behavior and Human Decision Processes, 54, 104-132.
- Irwin, R. W. (1944). The realism of expectations. Psychological Review, 51, 120-126.
- Irwin, R.W. (1953). Stated expectations as functions of probability and desirability of outcomes. Journal of Personality, 21, 329-335.
- Kahneman, D., & Tversky, A. (1972). Subjective probability: A judgment of representativeness. Cognitive Psychology, 3, 430-454.
- Kahneman, D., & Tversky, A. (1979). Intuitive prediction: Biases and corrective procedures. TIMS Studies in Management Science, 12, 313-327.
- Kassin S. M., & Hochreich, D. J. (1977). Instructional set: A neglected variable in attribution research? Personality and Social Psychology Bulletin, 3, 620-623.
- Kidd, J. B. (1970). The utilization of subjective probabilities in production planning. Acta Psychologica, 34, 338-347.
- Kruglanski, A. W. (1980). Lay epistemology process and contents. Psychological Review, 87, 70-87.
- Kruglanski, A. W. (1989). Lay Epistemics and Human Knowledge. New York: Plenum.
- Kruglanski, A. W. & Freund, T. (1983). The freezing and unfreezing of lay-inferences: Effects on impressional primacy, ethnic stereotyping, and numerical anchoring. Journal of Experimental Social Psychology, 19, 448-468.

- Kunda, Z. (1987). Motivation and inference: Self-serving generation and evaluation of evidence. Journal of Personality and Social Psychology, 53, 636-547.
- Kunda, Z. (1990). The case for motivated reasoning. Psychological Bulletin, 108, 480-498.
- Kunda, Z., & Sanitioso, R. (1989). Motivated changes in the self-concept. Journal of Experimental Social Psychology, 25, 272-285.
- Lichtenstein, S., & Fischhoff, B. (1977). Do those who know more also know more about how much they know? The calibration of probability judgments. Organizational Behavior and Human Performance, 20, 159-183.
- Lund, F. H. (1975). The psychology of belief: A study of its emotional and volitional determinants. Journal of Abnormal and Social Psychology, 20, 63-81.
- Locke, E. A. & Latham, G. P. (1990). A Theory of Goal Setting and Task Performance. Englewood Cliffs, NJ: Prentice Hall.
- Marks, R.W. (1951). The effect of probability, desirability, and "privilege" on the stated expectations of children. Journal of Personality, 19, 332-351.
- McGuire, W. (1960). A syllogistic analysis of cognitive relationships. In M. Resenber, C. Hovland, W. McGuire, R. Abelson, & J. Brehm (Eds.), Attitude organization and change (pp. 65-111). New Haven, CT: Yale University Press.
- Neuberg, S. L. & Fiske, S. T. (1987). Motivational influences on impression formation: Dependency, accuracy-driven attention, and individuating information. Journal of Personality and Social Psychology, 53, 431-444.

- Petty, R. E. & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. In L. Berkowitz (Ed.), Advances in experimental social psychology (Vol. 19, pp. 123-205). Orlando, FL: Academic Press.
- Pittman, T. S., & D'Agostino, P. R. (1985). Motivation and attribution: The effects of control deprivation on subsequent information processing. In G. Weary & Harvey (Eds.), Attribution: Basic issues and applications (pp. 117-141). New York: Academic Press.
- Pruitt, D. G., & Hoge, R. D. (1965). Strength of the relationship between the value of an event and its subjective probability as a function of method of measurement. Journal of Experimental Psychology, *5*, 483-489.
- Richardson, A. (1967). Mental practice: A review and discussion: Part 1. The Research Quarterly, *38*, 95-107.
- Sherman, S. J. (1980). On the self-erasing nature of error of prediction. Journal of Personality and Social Psychology, *39*, 211-221.
- Sherman, S. J., & Kunda, Z. (1989, June). Motivated evaluation of scientific evidence. Paper presented at the American Psychological Society convention, Arlington.
- Siebert, J. E. (1974). Effects of decision importance on ability to generate warranted subjective uncertainty. Journal of Personality and Social Psychology. *30*, 688-694.
- Simonson, J. (1989). Choice based on reasons: The case of attraction and compromise effects. Journal of Consumer Research, *16*, 158-174.
- Snyder, M., & Swann, W. B. (1978). Hypothesis-testing processes in social interaction. Journal of Personality and Social Psychology, *36*, 1202-1212.

- Suinn, R. (1972). Behavior research training for ski racers. Behavior Therapy, 3, 519.
- Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. Psychological Bulletin, 103, 193-210.
- Tesser, A. (1986). Some effects of self-evaluation maintenance on cognition and action. In R. M. Sorrentino & E. T. Higgins (Eds.), The handbook of motivation and cognition: Foundations of social behavior (pp. 435-464). New York: Guilford Press.
- Tetlock, P. E. (1983). Accountability and the perseverance of first impressions. Social Psychology Quarterly, 46, 285-292.
- Tetlock, P. E. (1992). The impact of accountability on judgment and choice: Toward a social contingency model. Advances in Experimental Social Psychology, 25, 331-376.
- Tetlock, P. E., & Boettger, R. (1989). Accountability: A social magnifier of the dilution effect. Journal of Personality and Social Psychology, 57, 388-398.
- Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. Cognitive Psychology, 5, 207-232.
- Weinstein, N. D. (1980). Unrealistic optimism about future life events. Journal of Personality and Social Psychology, 39, 806-820.
- 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.

Table 1

Ratings of the importance of finishing quickly and making accurate predictions as a function of accuracy and directional motivation.

	Low Accuracy		High Accuracy	
	Low	High	Low	High
	Directional	Directional	Directional	Directional
Importance of speed	7.50	7.25	6.58	8.00
Importance of accuracy	5.83	5.67	7.23	7.17

Note: There were 15 subjects in each condition. Ratings were made on a scale ranging from 1 (not at all important) to 10 (extremely important).

Table 2

Measure of predicted and actual completion time (in minutes) as a function of accuracy and directional motivation.

	Low Accuracy		High Accuracy	
	Low	High	Low	High
	Directional	Directional	Directional	Directional
Actual - Prediction	-0.67	0.41	2.29	1.62
Average of Past Trials - Prediction	0.24	0.41	0.98	0.64
Average of Past Trials Prediction	5.56	6.51	6.98	6.44
Actual Completion time	4.66	6.51	8.29	7.42

Table 3

Thoughts expressed by subjects while making their predictions (reported in percentage of total thoughts mentioned by subjects).

Category	Low Accuracy		High Accuracy	
	Low Directional	High Directional	Low Directional	High Directional
Future Planning	2.78	11.36	6.94	19.44
Potential Impediments	13.19	14.39	15.28	15.28
Adjustment to be				
Conservative	20.83	3.03	8.33	0.00
Past	27.78	9.85	4.17	11.11
Average	10.42	18.18	29.17	23.61
Discounting Past				
Experiences	25.0	34.09	36.11	30.56

Table 4

Ratings of the importance of finishing quickly and making accurate predictions as a function of accuracy and directional motivations.

	Low Accuracy		High Accuracy	
	Low	High	Low	High
	Directional	Directional	Directional	Directional
Importance of speed	5.90	7.30	6.23	7.03
Importance of accuracy	5.47	5.7	6.83	6.57

Note: There were 30 subjects in each condition. Ratings were made on a scale from 1 (not at all important) to 10 (extremely important).

Table 5

Measures of predicted and actual completion time (in minutes) as a function of accuracy and directional motivation.

	Low Accuracy		High Accuracy	
	Low Directional	High Directional	Low Directional	High Directional
<u>INFORMED CONDITION</u>				
Actual - Prediction	0.27	1.36	-1.11	-0.30
Average of Past Trials - Prediction	0.55	1.84	-0.74	1.25
Average of Past Trials	7.29	5.91	7.90	7.08
Prediction	6.74	4.07	8.64	5.84
Actual Completion time	7.01	5.43	7.53	5.54
Improvement on Third Trial	0.29	0.48	0.37	1.55
<u>UNINFORMED CONDITION</u>				
Actual - Prediction	0.19	0.34	1.63	0.70
Average of Past Trials - Prediction	2.08	3.23	2.81	2.91
Average of Past Trials	6.62	8.44	6.41	7.83
Prediction	5.77	6.91	5.10	6.20
Actual Completion time	5.96	7.25	6.73	6.82
Improvement on Third Trial	0.65	1.19	-0.32	1.01

Table 6

Thoughts expressed by subjects in the Informed Condition while making their predictions (reported in percentage of total thoughts mentioned by subjects).

Category	Low Accuracy		High Accuracy	
	Low	High	Low	High
	Directional	Directional	Directional	Directional
Future Planning	22.02	23.33	2.22	13.33
Potential Impediments	7.14	0.00	15.55	5.56
Adjustment to be				
Conservative	4.76	3.33	10.0	5.56
Past	32.74	15.56	27.78	3.33
Average	9.52	12.22	33.33	38.89
Discounting Past				
Experiences	20.24	43.33	4.44	33.33

Table 7

Thoughts expressed by subjects in the Uninformed Condition while making their predictions (reported in percentage of total thoughts mentioned by subjects).

Category	Low Accuracy		High Accuracy	
	Low	High	Low	High
	Directional	Directional	Directional	Directional
Future Planning	3.57	6.67	5.56	5.95
Potential Impediments	2.38	5.56	2.22	0.00
Adjustment to be				
Conservative	2.38	8.89	12.22	0.00
Past	32.14	30.0	28.89	39.29
Average	9.52	2.22	0.00	5.95
Discounting Past				
Experiences	14.29	6.67	12.22	34.52
Time Estimates for first				
two trials	10.71	26.67	28.89	7.14