HOW GOALS AFFECT PERFORMANCE: TASK COMPLEXITY AS A MODERATOR ON THE COGNITIVE PROCESSES OF GOAL SETTING

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(Abstract)

Current goal setting studies are working in two directions. The first direction is to identify the cognitive processes of goal setting and the second direction is to examine the moderating effect of task complexity on the goal-performance relationship. The objective of this paper is to integrate the two current directions by examining the moderating effects of two types of task complexity, component complexity and coordinative complexity, on the cognitive processes of goal setting. Two hundred and sixty-seven undergraduates who were taking upper level management courses participated in the study and 226 subjects were included in the final analysis. Subjects performed a stock prices prediction task on computer. Goals were assigned after the subjects have finished the pretest and the subjects were asked to answer questions on their specific self-efficacy and performance valence perceptions. Subjects were also asked to set personal goals before performing the test. The cognitive processes models of goal setting for different task groups were compared with the multi-sample analysis of LISREL VII. It was found that subjects who performed the task with low component - low coordinative complexity used a simple motivation mechanism. They motivated their behaviors directly

with specific self-efficacy. On the other hand, subjects who performed the more complex tasks used a more rational motivation mechanism that required more cognitive processing. The subjects set personal goals by considering performance valence and specific self-efficacy, and they used personal goals to motivate their behaviors. Unlike the simple task for which specific self-efficacy directly affected performance, personal goals were found to mediate the effect of specific self-efficacy on performance for the complex tasks.

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Table of Contents

List of Figures

List of Tables

Introduction

The objective of this study is to integrate the two current trends of goal setting studies. More specifically, this study examines the moderating effects of task complexity on the cognitive processes of goal setting. Currently, goal setting studies are conducted in two directions. The first direction is to examine the cognitive processes of goal setting by integrating the social cognitive theory (Bandura, 1977; 1986; Wood & Bandura, 1989) and the expectancy theory (Vroom, 1964) with the goal setting theory (Locke, 1968). This line of goal setting research was started when Dachler and Mobley (1973) tried to integrate expectancy theory and goal setting theory. After twenty years of vigorous research and modifications on the constructs, Locke and Latham (1990) recently summarized the research findings on goal setting and constructed a cognitive processes model of goal setting. Specific self-efficacy, which is a key construct of the social cognitive theory, and performance valence, which was developed by Garland (1985) from the valence construct of the expectancy theory, are proposed to mediate the effects of assigned goals on personal goal choice and performance. Various portions of the model have been examined in many recent studies and all results showed positive support on the model (Earley & Lituchy, 1991; Klein, 1991; Mento, Locke & Klein, 1992; Meyer & Gellatly, 1988).

The second direction of current goal setting studies is to look for boundary conditions or moderators for the goal setting effects. After more than two decades of empirical research on goal setting theory, the basic argument that specific, difficult goals improve performance has been well supported (Locke & Latham, 1990). Recent goal setting studies have been moved into a new arena to identify the moderators that would affect the goal setting effects. One of the moderators for goal effects that have been identified is task complexity. In a meta-analysis on studies of the effects of goals on performance, Wood, Mento, and Locke (1987) concluded that goal setting effects were strongest for easy tasks and weakest for more complicated tasks. They concluded their paper with a call for further studies to explain the underlying processes by which goals affect performance on different types of tasks.

The moderating effect of task complexity on goal difficulty-performance relationship is most frequently explained by the strategies employed in performing the task (e.g., Chesney & Locke, 1991; Earley, Northcraft, Lee & Lituchy, 1990b). Wood and Locke (1990) posited that the importance of the quality of strategy employed increases as the task becomes more complex. There is plentiful evidence that the selection of appropriate strategy significantly affects performance for a complex task (e.g., Chesney & Locke, 1991; Earley, Connolly, & Ekegren, 1989; Huber, 1985). In addition, there are extensive supports for the premise that goal setting increases planning activities, strategy development and search processes (e.g., Campbell, 1984; 1988; Earley et al., 1989; Earley & Perry, 1987; Earley, Lee, & Hanson, 1990a; Earley, Wojnaroski, & Prest, 1987; Huber, 1985; Smith, Locke, & Barry, 1990). There is also evidence that setting challenging goals is associated with the selection of effective strategies in a complex task (Chesney & Locke, 1991; Earley, Hanson, & Lee, 1986). In summary, the smaller goal effect for complex tasks has been explained by the increased number of possible strategies in performing the task. Since some individuals may employ a suboptimal strategy in performing the task, the effect of goal difficulty becomes smaller when compared with subjects performing a simple task where all subjects utilize the same strategy.

Although there are many studies working in the two current directions of goal setting studies, there has not been any attempt to integrate them. As concluded by Wood et al. (1987), task complexity may affect the cognitive processes of goal setting in addition to its effect on task strategies. Studying the cognitive processes of goal setting without specifying the moderating effects of task complexity obviously limits the predictability of the theory. Hence, the first purpose of this paper is to examine the moderating effect of task complexity on the cognitive processes of goal setting.

Furthermore, although there have been many studies examining the effects of task complexity on the goal-performance relationship, few of them has defined task complexity. An exception is the work by Wood (1986) who defined three types of task complexity: component complexity, coordinative complexity, and dynamic complexity. Wood proposed that the three types of task complexity were caused by different elements of a task and each type of task complexity would affect the requirement for task performance differently. However, as the task complexity-goal setting studies did not systematically control or manipulate task complexity, the effects of different types of task complexity on the goal setting effects remain unclear. In addition, without a systematic control or manipulation of task complexity, results of previous studies are difficult to be generalized beyond the tasks used in those studies. Thus, the second purpose of this paper is to examine both the independent effects of component complexity and coordinative complexity and their interaction effects on the cognitive processes of goal setting.

In terms of the contributions of this research, it will be the only known study to specifically compare the motivation models for tasks with different complexity. Although some previous studies have examined the cognitive processes of goal setting for tasks with different complexity (e.g., Earley and Lituchy, 1991), there was no direct comparison between the cognitive processes of goal setting for tasks with different complexity. There are two reasons for the existence of this research gap. First, task complexity has not been systematically controlled in previous studies. Without controlling task complexity systematically, a comparison of the cognitive processes of goal setting for tasks with different complexity will not be meaningful since the results cannot be generalized beyond the tasks used. Second, there is no previous study in the business management area that statistically test the difference of path models across groups. In this study, the comparison of path models across groups was performed by a multi-sample analysis of LISREL VII. This method was only discussed in a few studies in sociology and in statistics. Hence, the second contribution of this study is to demonstrate how to compare path models across groups by using the multi-sample analysis of LISREL VII.

Overview of the Study

This chapter has summarized the two current directions of goal setting studies and has indicated that there was no direct comparison of the cognitive processes of goal setting for tasks with different complexity. Chapter two reviews the literature pertaining to the cognitive processes of goal setting and task complexity, and presents the study's hypotheses. Chapter three describes the methodology used in this study. It includes a description of the tasks employed and the measures used. Chapter four presents the statistical techniques employed and the results of the analyses of the study's hypotheses. Chapter five discusses the inferences of the results of statistical analyses reported in chapter four. Chapter six concludes the study and discusses the limitations of the study and implications of the study for future research.

The Theoretical Framework

After more than twenty years of empirical research on goal setting theory, the basic argument that specific, difficult goals improve performance has been well supported. Locke and Latham (1990: 30) have summarized the results of five meta-analyses on studies comparing the effects of specific, difficult goals with "do your best" goal or no goal on performance (Chidester & Grigsby, 1984; Hunter & Schmidt, 1983; Mento, Steel, & Karren, 1987; Tubbs, 1986; Wood et al., 1987). They reported that there have been a total of 201 studies on this hypothesis, 91% of them demonstrated either significant or contingent significant effects, and the mean effect sizes ranged from .42 to .80. In addition, they reported that with the above supportive evidence concerning the basic argument of the goal setting theory, these studies have moved into a new arena to identify the cognitive processes of goal setting.

This line of goal setting research was started when Dachler and Mobley (1973) tried to integrate expectancy theory and goal setting theory. However, early studies have suffered problems in measuring the expectancy theory constructs in goal setting research (Klein, 1991). After two decades of studies, there have been many modifications on the constructs in the integrated model and improvements in measurement of the constructs. Recently, Locke and Latham (1990: 72) proposed a cognitive processes model of goal setting, which is shown in Figure 1, by integrating the social cognitive theory (Bandura,

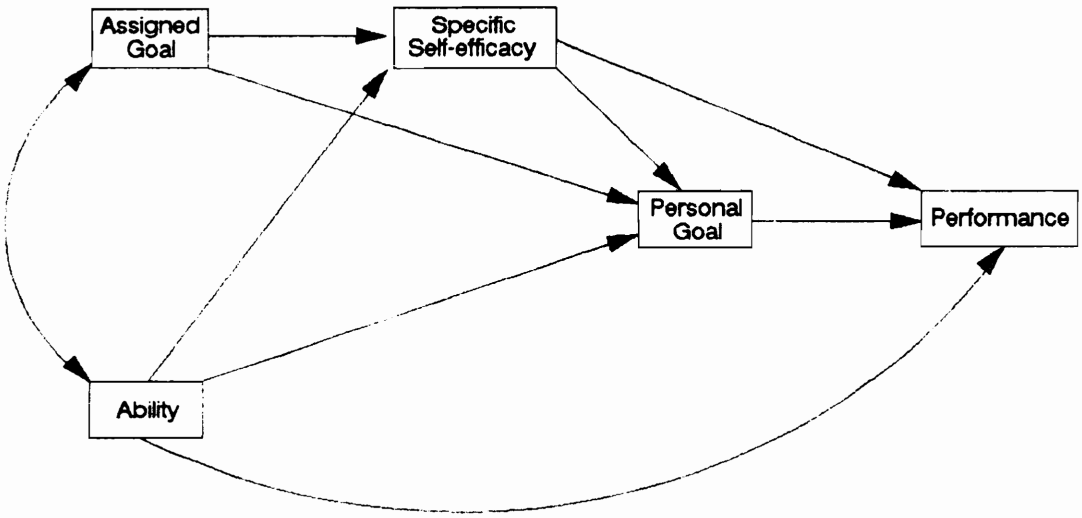


Figure 1
Locke and Latham's (1990: 72) cognitive processes model of goal setting[1]

1977; 1986; Wood & Bandura, 1989) and the goal setting theory[1]. The model posits that specific self-efficacy, which is the principal construct in the social cognitive theory, mediates the effects of assigned goals on personal goals and task performance. In addition, according to the social cognitive theory, specific self-efficacy affects task performance both in a direct way and through its effect on personal goals.

After reviewing some recent studies on the cognitive processes of goal setting, Mento et al. (1992) proposed that performance valence also has negative effects on personal goal choice. The cognitive processes model for goal setting was therefore modified to include the effects of performance valence and is presented in Figure 2. In addition, Eden (1988) proposed that specific self-efficacy was influenced by both general self-efficacy and situational factors such as task difficulty, quality of supervision, and adequacy of resources. Therefore, the effect of general self-efficacy on specific self-efficacy was included in the present model. Various forms of this model have been examined in some recent studies and all results showed positive support on the model (Earley & Lituchy, 1991; Klein, 1991; Mento et al., 1992; Meyer & Gellatly, 1988).

Note: 1. The model presented in Figure 1 is based on the model tested in Earley and Lituchy (1991: 82). The original model presented in Locke and Latham (1990: 72) did not include ability as an element. The paths including ability were included in Earley and Lituchy (1991) and were constructed on the basis of a personal conversation between P. C. Earley and E. A. Locke (May 12, 1989).

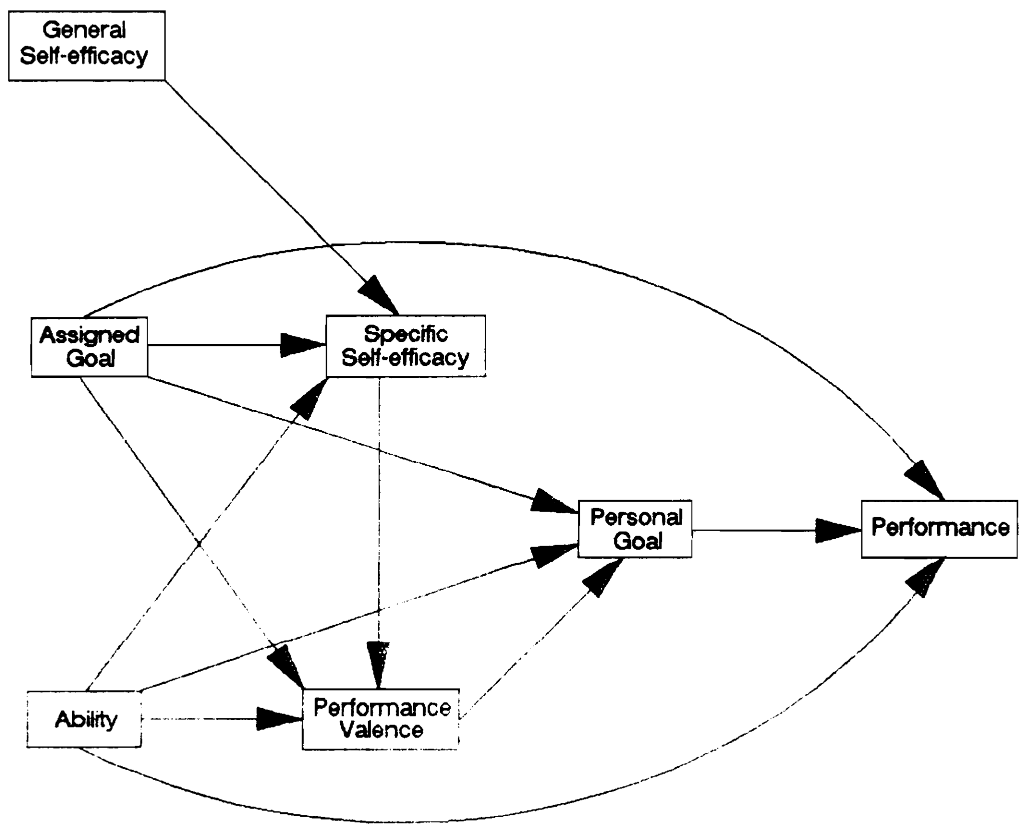


Figure 2
Cognitive processes model of goal setting

Specific Self-Efficacy

Construct Definition Issues

Self-efficacy is a key construct in Bandura's social learning theory or social cognitive theory (Bandura, 1977; 1986), which posits that behavior, cognition, and the environment influence each other in a dynamic fashion. Bandura (1982: 122) defined self-efficacy as one's judgement of "how well one can execute courses of action required to deal with prospective situations." Wood and Bandura (1989: 408) elaborated this definition of self-efficacy by stating that "self-efficacy refers to beliefs in one's capabilities to mobilize the motivation, cognitive resources, and courses of action needed to meet given situational demands." More specifically, Gist and Mitchell (1992: 184) stated that "self-efficacy is a comprehensive summary or judgement of perceived capability for performing a specific task."

Related Constructs

There are three constructs that are very similar to the specific self-efficacy construct. The first one is the effort-performance expectancy of the expectancy theory (Vroom, 1964). Vroom defined expectancy as the perceived probability that a given act will be followed by a specific outcome. In other words, expectancy is the probability of attaining a specific performance level.

The second similar construct is general self-efficacy. According to Bandura (1977), there are three dimensions for the construct self-efficacy. The first dimension is magnitude, or the level of task difficulty a person believes he or she can master. The second dimension is strength, whether the belief in ability is easily extinguished by disconfirming information. The third dimension is generalizability, whether the belief in ability is task specific or extends across a variety of situation. However, later studies on self-efficacy normally refer the concept "self-efficacy" to a task specific situation. In this study, the term "specific self-efficacy" is used to refer to a task specific self-efficacy to distinguish the concept from general self-efficacy.

White (1959) proposed the concept of competence to refer to a person's capacity to master and deal effectively with the surroundings. The terms trait expectancy, generalized self-efficacy and self-competence seem identical. Eden used the term "trait expectancy" to refer to a cognition about perceived self-competence in achievement situations that is based on an individual's previous successes and failures at many different types of tasks (Eden, 1988: 642). He recommended to use the general self-efficacy scale developed by Sherer et al. (1982) to measure trait efficacy. As stated by Earley et al. (1991: 85), "Eden's construct of trait expectancy really appears to be a form of generalized efficacy."

In summary, specific self-efficacy refers to one's belief in his/her ability in performing a specific task and general self-efficacy refers to one's belief in his/her ability to perform many different types of tasks. As stated by Deci and Ryan (1985: 27), "In the broad, biological sense, competence refers to the capacity for effective interactions with the environment that ensure the organism's maintenance."

Hence, all three constructs, specific self-efficacy, expectancy, and general self-efficacy, refer to the cognition about an individual's capacity. However, the three constructs are different in the level of the capacity to which they refer. Expectancy is the most specific level capacity perception which refers to the cognition of capacity to attain a specific performance level when performing a specific task. Specific self-efficacy is the moderate level capacity perception which refers to the cognition of capacity to perform a specific task. General self-efficacy or self-competence is the most generalized level capacity perception which refers to the cognition of capacity to perform many different types of tasks.

Another construct that is similar to the specific self-efficacy construct is self-confidence. The construct self-confidence is defined as "an appraisal of one's competence, skill, or ability, either in general or in a specific domain (Crocker, & Major, 1989). When self-confidence is used to refer to a person in general, it represents a cognitive and affective evaluation of positive and negative aspects of oneself (Bryant, 1989). According to Boyatzis (1982: 101), "self-confidence is a competency often called decisiveness or presence. People with self-confidence feel that they know what they are doing. They also feel that they are doing it well." Some authors (e.g., Brockner, 1988; Taylor, 1987) did not distinguish self-confidence in a specific domain from specific self-efficacy and used both terms to refer to individuals' beliefs that they can execute successfully the behaviors required to produce desired outcomes in a given situation. However, some authors used self-confidence in a specific domain to represent the assessment of the probability that a statement is true (Griffin & Tversky, 1992; Koriat, Lichtenstein, & Fischhoff, 1980). In this context, self-confidence represents the strength of the belief that one can achieve a specific performance level. It is different from the specific self-efficacy construct in two ways. First, there is a magnitude dimension for specific self-efficacy. While self-confidence represents the strength of a belief, the magnitude of specific self-efficacy is a belief that represents the performance level that an individual thinks he or she can master. Second, self-confidence refers to a specific performance level but the strength dimension of specific self-efficacy refers to multiple performance levels. Therefore, strength of specific self-efficacy is usually operationalized as the summation or average of self-confidence ratings for various performance levels.

Operationalization of Specific Self-efficacy in Goal Setting Studies

Specific self-efficacy is the construct that has been used most frequently to explain the cognitive processes of goal setting and operationalization of the specific self-efficacy construct in goal setting studies have gone through some major modifications since it was first measured in the goal setting study by Yulk and Latham (1978). During the early 1980s, studies used the effort-performance expectancy construct of the expectancy theory to explain the cognitive processes of goal setting and expectancy was operationalized as the expectancy (probability) of goal attainment. Correlations between expectancy of goal attainment and performance reported in previous studies are summarized in Table 1. Since the insignificant correlations between expectancy and performance found in goal setting studies (Garland, 1982; 1983; Matsui, Okada, & Mizuguchi, 1981; Mento, Carledge, & Locke, 1980) were inconsistent with the results of expectancy theory studies, which have found a strong expectancy effect on performance (Mitchell, 1974, 1982), Garland (1984) proposed that expectancy should be measured at multiple performance levels instead of measured at the goal level only.

Table 1

Correlations Between Expectancy of Goal Attainment and Performance

Study (Year)		N	EX-P
Bandura & Cervone (1983)		90	.57
Bandura & Cervone (1986)		88	.50
Garland (1982)		86	-.12
Garland (1983)		58	.14
Locke et al. (1984a)	- 1	231	-.19
	- 2	231	-.04
Locke & Shaw (1984)		212	-.01
Matsui et al. (1987)		100	.11
Mento et al. (1980)		196	-.15
Mento et al. (1980)		406	.06
Meyer et al. (1988)		69	.27
Yulk & Latham (1978)		41	-.17

EX = Expectancy of goal attainment; P = Performance

Although Bandura and Cervone (1983) measured specific self-efficacy across performance levels, they operationalized specific self-efficacy as the strength of subjects' perceived efficacy that they could attain the goal (40% performance increase in their study). Locke, Frederick, Lee, and Bobko (1984b) modified the measurement of specific self-efficacy in Bandura and Cervone's (1983) study and developed a scale that measures both the magnitude and strength of specific self-efficacy. Because of the smaller variance in specific self-efficacy magnitude, specific self-efficacy strength consistently related more highly to goals and performance than specific self-efficacy magnitude (Locke et al., 1984b). Therefore, later studies simplified the scale by measuring the strength of specific self-efficacy only, and specific self-efficacy is operationalized as the average or summation of certainties of attaining various performance levels. Later studies also operationalized specific self-efficacy as the average or summation of probabilities of attaining various performance levels or as the average or summation of expectancies of attaining various performance levels. Goal setting studies measuring expectancy or specific self-efficacy across performance levels are summarized in Table 2.

During the first few years after Locke et al.'s (1984b) study, both expectancy of goal attainment and specific self-efficacy across performance levels have been used in goal setting studies. However, goal setting studies in recent years have used specific self-efficacy across performance levels exclusively due to the findings on the relationship between expectancy of goal attainment and performance are inconsistent with the expectancy theory postulates.

The following discussion on expectancy and specific self-efficacy in goal setting

Table 2

Correlations Between Assigned Goals, Personal Goals, Specific Self-efficacy, and Performance

Study (Year)	N	AG-PG	AG-SSE	SSE-PG	SSE-P	PG-P
Bandura & Cervone (1986)	88			.43	.50	.69
Earley & Lituchy (1991) - 1	100	.72	.73	.68	.87	.75
- 2	100	.45	-.03	.19	.26	.51
- 3	127			.38	.24	.51
Garland (1985)	176			.58	.74	.55
Klein (1991)	310			.50	.43	.58
Locke et al. (1984b)	181			.54	.61	.57
Mento et al. (1992) - 1	114	.53	.19	.51	.42	.64
- 8	356			.61	.30	.42
Meyer & Gellatly (1988) - 1	56	.59	.33	.62	.73	.83
- 2	60	.29	.13	.48	.71	.62
Podsakoff & Farh (1989)	90			.69	.63	.73
Taylor et al. (1984)	169			.20	.38	.25
Wood & Locke (1987) - 2	194			.25	.28	.39
- 3	212			.32	.22	.45
- 4	111			.29	.37	.40

AG = Assigned Goals; PG = Personal Goals; SSE = Specific self-efficacy; P = Performance studies will be divided into four sub-sections: a) a review of the studies that employed the expectancy construct to explain goal setting effects; b) a review of the studies that employed the specific self-efficacy construct to explain goal setting effects; c) the effects of assigned goals on specific self-efficacy; d) the effect of ability on self-efficacy, and e) the effect of general self-efficacy on specific self-efficacy. In this section, specific self-efficacy will be treated as the first endogenous variable in the goal setting model proposed in Figure 2 and the discussion will be restricted to the effects of the exogenous variables on specific self-efficacy. The effects of specific self-efficacy on other endogenous variables will be discussed in subsequent sections.

Effort-performance Expectancy in Goal Setting Studies

Table 1 (page 13) presents a summary of studies that empirically examined the role of expectancy in goal setting effects. Early efforts have tried to integrate the expectancy theory and goal setting theory by measuring the subjects' expectancies of goal attainment. The correlation between the expectancy measure and performance was then compared with the correlation between goal levels and performance. Although the studies showed a consistent positive relationship between goal levels and performance, the consistent finding of an insignificant relationship between expectancy and performance disturbed the researchers very much because it did not support the expectancy theory postulates.

As indicated by Garland (1984: 79), the "expectancy models predict that, all things being equal, performance will increase as effort-performance expectancy increases." He then proposed that the inconsistency between expectancy theory postulates and the findings in goal setting studies was due to the fact that researchers have failed to distinguish between expectancy-performance correlations within, as compared to between, goal groups. Since the goal attainment expectancies are referring to different performance levels when subjects have different goal levels, the expectancy-performance correlation will be close to zero while computed across goal groups and remain positive while computed within goal groups. Detailed discussion on this argument can be found in Klein (1991) and Locke and Latham (1990). Garland suggested that later studies addressing the issue of effort-performance expectancy in goal setting should measure expectancy at a variety of performance levels for individuals assigned to different goal conditions. This suggestion has received empirical supports in studies by Garland (1984) and Locke et al. (1984b), which initialized a dramatic change in both the conceptualization and operationalization of expectancy in later goal setting studies.

Before moving to the discussion of goal setting studies that utilized the new conceptualization and operationalization of the expectancy construct, two other arguments that attempt to explain the inconsistency between expectancy theory postulates and findings in early expectancy-goal setting studies will be examined. The first argument seems very similar to the between and within goal groups argument proposed by Garland (1984) but the following discussion will show that they are two very different arguments. Some researchers argued that the expectancy construct in the goal setting studies should be tested with a within-subject design instead of a between-subject design (e.g., Klein, 1991) since the expectancy theory is a within-subject theory instead of a between-subject theory (Mitchell, 1974, 1982). However, the researchers mistakenly considered the within-group design proposed by Garland (1984) as a within-subject design.

Mitchell (1982: 305) explained a within-subject design as one in which "people were seen as having different ΣEVs (the Force Model) for different behaviors and were predicted to choose that alternative with the highest ΣEV (maximization)." He also explained that a between-subject design is one in which "a ΣEV would be generated for each subject for one behavior such as working hard and the score would be correlated across subjects with a criterion, usually self-rated effort." For both the within-group design suggested by Garland (1984) and the summated expectancies across goal levels used in later studies (Klein, 1991), only one expectancy or a summated expectancy measure has been generated for each subject and the score is correlated with performance either across all subjects or across subjects with the same goal level. Thus, both designs are in fact between-subject designs. Therefore, the cognitive process within an individual (select the behavior with maximum force) postulated by the expectancy theory has not been tested or captured by the expectancy-goal setting studies.

There is another possible explanation for the inconsistency between expectancy theory postulates and findings in the expectancy-goal setting studies, although this argument has received very little attention. While most of the expectancy-goal setting studies claimed as integrations of the expectancy and goal setting theories, only the expectancy theory constructs were measured in those studies; the relationships between the constructs proposed by the theory have been ignored. Although all versions of the expectancy theory proposed an interaction between expectancy and valence in predicting efforts or performance, only very few expectancy-goal setting studies have considered this interaction in predicting performance (Dachler & Mobley, 1973; Klein, 1991; Riedel, Nebeker, & Cooper, 1988).

In most of the early expectancy-goal setting studies, only expectancy was measured while leaving valence uncontrolled. Even in later studies where both expectancy and valence have been measured, most of the discussions were restricted to the results of zero-order correlations. Since zero-order correlations between expectancy and performance do not control for the suppressor effects of valence on the relationship between expectancy and performance, it is not unusual to find that the zero-order correlation between expectancy and performance is null.

In summary, the early expectancy-goal setting studies have suffered from both methodological problems (within- and between-goal group design; within- and between-subject design) and conceptual problems (relationships posited by the expectancy theory). Hence, while adopting an operationalization of the expectancy construct proposed by Garland (1984) to handle the within- and between-goal group design problem, Locke et al. (1984b) suggested that the summated expectancies across various performance levels represented the specific self-efficacy construct of the social cognitive theory rather than the expectancy construct of the expectancy theory. This conceptualization of expectancy initialized a major change in subsequent studies in explaining the cognitive processes of goal setting from an integration of expectancy theory with goal setting theory to an integration of social cognitive theory with goal setting theory.

Specific Self-efficacy in Goal Setting Studies

The examination of specific self-efficacy in goal setting studies was originated from the social learning theory (Bandura, 1977) and was operationalized as the expectancy of goal attainment (Bandura & Cervone, 1983). Specific self-efficacy is defined as a perception of "how well one can execute courses of action required to deal with prospective situations" (Bandura, 1982: 122). It was proposed that the goal effects on performance operate in part through specific self-efficacy. Because of the between and within goal group problem, specific self-efficacy was later operationalized as the summated expectancy (confidence) scores across various performance levels (Locke et al., 1984b). Table 2 summarizes studies that empirically examined the relationship between specific self-efficacy and goal setting effects.

Since the inclusion of specific self-efficacy in goal setting studies was originated by an attempt to solve a methodological problem rather than a conceptual problem, early specific self-efficacy - goal setting studies have spent insufficient efforts in explaining the role of specific self-efficacy in goal setting effects. The specific self-efficacy concept was only elaborated later in the social cognitive theory (Bandura, 1986; 1988; Wood & Bandura, 1989). Wood and Bandura (1989) proposed that people's beliefs about their efficacy can be instilled and strengthened by mastery experiences, modeling, social persuasion, and physiological states.

Mastery experiences refer to previous successes or failures in performing the same or similar tasks. Previous successes enhance the perception of specific self-efficacy whereas previous failures weaken the specific self-efficacy perception. Modeling refers to the observation of success or failure by similar others which raises or lowers the observer's perceptions of specific self-efficacy. Social persuasion can influence a person's specific self-efficacy perception in two ways. A social norm provides a person with the standard that an average people can perform, which affects his/her specific self-efficacy perception through an indirect modeling. A person may also consider expectations from other people as their perceptions of his/her capability, which may serve as references when a person develops perception of his/her own capability. Strengthening a person's specific self-efficacy through physiological states refer to the fact that people would consider their physical status and stress levels when determining specific self-efficacy.

Relationship Between Assigned Goal and Specific Self-efficacy

According to Wood and Bandura's social cognitive theory (1989), specific self-efficacy can be instilled and strengthened by social persuasion. One of the functions of an assigned goal is to serve as a standard for comparison with future performance. An assigned goal as a standard conveys an external expectation to the individual who is assigned the goal. This expectation will be interpreted as others' perceptions of the individual's capability, which then affect the individual's own specific self-efficacy perception.

An assigned goal also conveys normative information to the individual and affects the specific self-efficacy perception through modeling. Wood and Bandura (1989) proposed that people partly assess their capabilities through a social comparison process.

Meyer, Schacht-Cole, and Gellatly (1988: 403) derived from the social information processing theory (Salancik & Pfeffer, 1978), hypothesized that "in the absence of information to the contrary, individual perceived an assigned goal as the norm for performance." Gellatly and Meyer (1986) also found a positive relationship between goal difficulty and the "average performance of similar others." In a later study Meyer and Gellatly (1988) found that assigned goal only indirectly affect specific self-efficacy through perceived norm. In their second experiment when perceived norm was manipulated independently from the assigned goal, assigned goal was found to have no effect on specific self-efficacy. Therefore, in the absence of contradictory normative information, assigned goal difficulty is proposed to have a positive effect on specific self-efficacy perception.

Relationship Between Ability and Specific Self-efficacy

Bandura's social cognitive theory posits that the most effective way to enhance specific self-efficacy perception is by mastery experiences (Wood & Bandura, 1989). In most of the goal setting studies, ability has been operationalized as performance in the pretest or practice trial. This measure of ability provides the subjects with fresh experiences in performing the task, thus a strong direct relationship between ability and specific self-efficacy is expected.

Relationship Between General Self-efficacy and Specific Self-efficacy

Eden (1988: 642) defined general self-efficacy as "beliefs about self-competence in achievement situations in general" and suggested that general self-efficacy is a stable trait which is relatively invariant across situations. He also proposed that a person high on general self-efficacy would expect to perform better than a person low on general self-efficacy regardless of task difficulty. Earley et al. (1991: 85) further explained the relationship between general self-efficacy and specific self-efficacy by suggesting that "as individuals successfully perform in increasingly diverse task settings, they develop a general sense of efficacy that is positively related to subsequent task challenges."

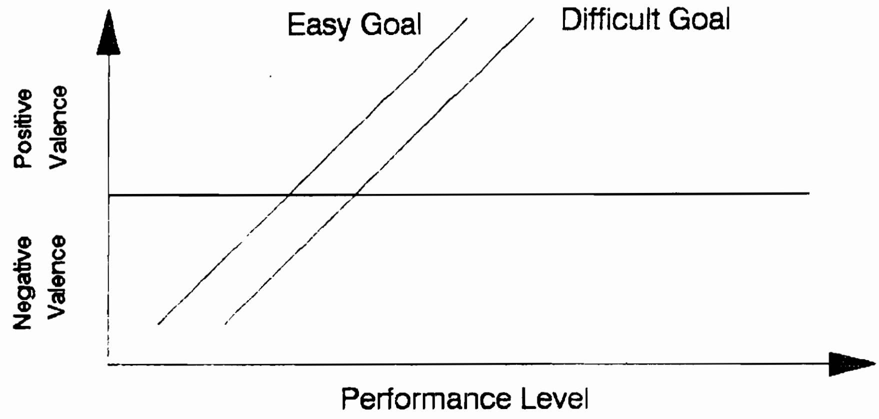
Performance Valence

Construct Definition Issues

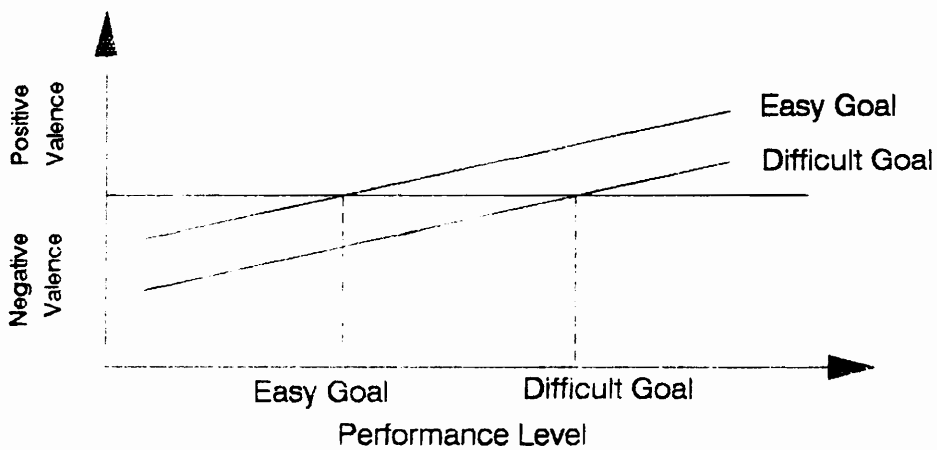
Unlike specific self-efficacy or expectancy, performance valence has received significantly less attention in goal setting studies. There were a few studies in the early 1980s that studied the role of valence of expectancy theory (Vroom, 1964) in the goal setting effects (Locke & Shaw, 1984; Mento et al., 1980). However, measuring valence of goal attainment in those studies also suffered the between and within goal group problem as examining goal attainment expectancy. Similar to his recommended solution to the problem in measuring expectancy, Garland (1985) proposed to measure valence across various performance levels. This modification in measurement not only changes the measurement itself but also changes the construct. Garland (1985: 349) referred the new construct as "performance valence" and defined it as "a composite of those satisfactions an individual anticipates will be gained by producing each a number of different performance levels over a range of performances that might be considered." However, this definition is more an operational definition (i.e., measurement) of the construct than a theoretical definition of the construct. Alternatively, Klein (1991: 238) proposed that performance valence may "represent an individual's general affective orientation toward the task or the capacity of task performance to provide satisfaction."

To avoid confusion in subsequent discussions, valence will be used to refer to the anticipated satisfaction from attaining a specific performance level whereas performance valence will be used to refer to the anticipated satisfaction from general task performance. The relationship between valence and performance valence is diagrammed in Figure 3A. Figure 3A shows the valence-performance functions of two individuals with different goal levels. Any point on the valence-performance function refers to the relationship between performance level and valence at a specific performance level. The positive slope of the valence-performance function shows that the higher the performance, the higher the valence. In Figure 3A, performance valence is represented by the area under the valence-performance function. The closer the valence-performance function is to the left, the greater the area under the valence-performance function, and the higher the performance valence for that individual. Hence, Figure 3A shows that an individual with a difficult goal is supposed to have a lower performance valence than an individual with an easy goal.

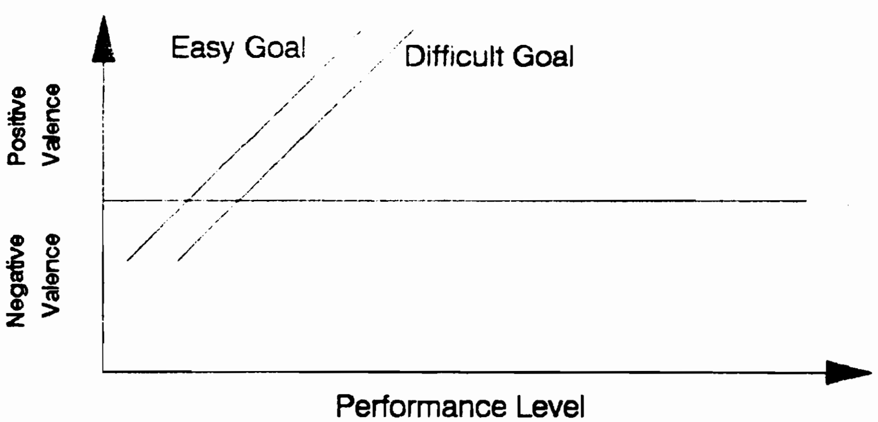
Unfortunately, performance valence has not received comparable attention as in the case for self-efficacy. Only until recently, goal setting studies began to examine the role of performance valence in the goal setting processes because of the consistent finding



3A. Overall valence from performing a task



3B. Valence from performance deviation from the goal



3C. Valence from performance level

Figure 3
Relationship between valence, performance, and goal level

of a significant negative relationship between performance valence and personal goals (Earley & Lituchy, 1991; Klein, 1991; Mento et al., 1992; Meyer & Gellatly, 1988). However, discussions on the performance valence construct are very limited, which contribute to the fact that we know more about the consequences of performance valence than the construct itself.

Relationship between Assigned Goal and Performance Valence

There is a common understanding that an assigned goal affects performance valence by conveying evaluation standards to people (Locke & Latham, 1990; Naylor & Ilgen, 1984; Tubbs & Ekeberg, 1991). Locke and Latham (1990: 77) stated that "a goal is at the same time a target to aim for and a standard by which to evaluate the adequacy of one's performance." Accordingly, valence (anticipated satisfaction) of attaining a specific performance level is proposed to be obtained from two sources.

First, valence can be obtained from the deviation of the anticipated performance level from the goal level (norm performance or external standard). That is, regardless of the anticipated performance level itself, the difference between the anticipated performance level and goal level determines valence. When anticipated performance level exceeds goal level, an individual will expect satisfaction, whereas an individual will expect dissatisfaction when the anticipated performance level is lower than the goal level. This valence-performance relationship is diagrammed in Figure 3B. The diagram shows that if two individuals with different goal levels attain the same performance level that is above the easy goal and below the difficult goal, the individual with an easy goal will expect satisfaction from exceeding the goal whereas the individual with the difficult goal will expect dissatisfaction from the failure to achieve the goal. Hence, individuals with difficult goals must have a higher performance level to obtain satisfaction from achieving the standard than individuals with easier goals (Mento et al., 1992: 398).

However, valence from the anticipated difference between performance level and goal level cannot explain why people expect more satisfaction from achieving a difficult goal than an easy goal. The diagram presented in Mento et al. (1992: 398) shows that an individual expects more satisfaction from achieving a difficult goal than an easy goal, which suggests that in addition to the valence from the anticipated difference between performance level and goal level, there is a second source of performance valence.

The second source of valence is the level of performance itself. After controlling for the valence from goal attainment, each individual is expected to have a different valence-performance function which is determined by specific self-efficacy and experiences. This relationship is diagrammed in Figure 3C. One way to partial out the valence from goal attainment is to compare the valence of goal attainment across subjects with different goal levels. Klein (1991) found that there was a strong positive relationship ($r = .62$) between goal level and valence of goal attainment. Since valences of goal attainment were measured, the valence from deviation of anticipated performance level from the goal level is partialled out. Thus, the positive correlation between goal level and valence should come from the performance level itself, which indicated that the higher the performance level, the higher the expected satisfaction from the performance level itself. These valence-performance functions are closer to the left than the valence-performance function for goal attainment. It means that a person may anticipate satisfaction for the performance level itself even if he or she expects to be unable to achieve the goal, while the valence-performance function for goal attainment indicates that he or she will anticipate dissatisfaction because of inability to achieve the goal.

When combining the two sources of satisfaction, the relationship between performance level and valence would look like Figure 3A. The relationships between anticipated satisfaction (performance valence), goal levels, and performance levels found in Mento et al. (1992) were very similar to those demonstrated in Figure 3A. They found that subjects with difficult goals have a lower performance valence than subjects with easy goals. In addition, the closeness of the valence-performance functions showed that anticipated satisfaction from performance level itself is more important than the anticipated satisfaction from goal attainment in determining the valence-performance function.

Relationship Between Specific Self-efficacy and Performance Valence

Correlations between specific self-efficacy and performance valence reported in previous studies are summarized in Table 3. Previous studies showed that there is a consistent negative relationship between specific self-efficacy and performance valence and the mean correlation is -.40. Garland (1985: 352) explained this negative relationship by suggesting that "individuals learn, in the course of their lives, that performances that are easy to achieve are less satisfying than those that are more difficult to achieve." As a result, an individual with a high specific self-efficacy perception

Table 3

Correlations Between Specific Self-efficacy and Performance Valence

Study (Year)	N	SSE-PV
Earley & Lituchy (1991) - 1	100	-.13
- 2	100	-.28
- 3	127	-.23
Garland (1985)	176	-.49
Mento et al. (1992) - 1	114	-.42
- 8	356	-.45
Meyer & Gellatly (1988) - 1	56	-.76
- 2	60	-.55

SSE = Specific self-efficacy; PV = Performance Valence anticipates less satisfaction from task performance.

Personal Goals

Relationship between Assigned Goal and Personal Goal

The effect of assigned goal on personal goal is straight forward. An assigned goal provides a reference for an individual to determine the target he or she will strike for (personal goal). In many cases, people simply accept and internalize assign goals as personal goals because of habitual responses, or because of the authority and power of the person assigning the goal (Earley & Lituchy, 1991). Especially in laboratory experiments, the correlation between assigned goal and personal goal is normally very high due to the habitual responses of the subjects to accept the goals assigned by the experimenter. For example, the correlations between assigned goal and personal goal are 0.72 for study 1 and 0.45 for study 2 in Earley and Lituchy (1991), 0.53 for study 1 in Mento et al. (1992). However, in many other cases, people do not simply accept assigned goals as personal goals, but use assigned goals as anchors and determine personal goals after evaluation of other factors such as self-efficacy and performance valence.

Relationship between Ability and Personal Goals

There are numerous studies which have found a significant correlation between ability and personal goal (Earley & Lituchy, 1991; Garland & Adkinson, 1987; Garland, Weinberg, Bruya, & Jackson, 1988; Hall & Foster, 1977; Klein, 1991; Locke et al., 1984a; Locke et al., 1984b; Mento et al., 1992; Meyer & Gellatly, 1988; Wood & Bandura, 1989; Wood & Locke, 1987). Ability provides information on how well one has done on the same or a similar task in the past. In most studies, ability is measured by the performance of the task before the introduction of treatment (goal setting). There are two ways ability can affect an individual's goal choice. First, ability is operationalized as the past performance in most goal setting studies. Individuals may simply use the past performance or a slight improvement over past performance as the personal goal for future performance. Second, ability can affect personal goal through the perception of specific self-efficacy. Both the direct effect of ability on personal goals and the indirect effect of ability on personal goals through specific self-efficacy have been demonstrated in many previous studies (Earley & Lituchy, 1991; Klein, 1991; Meyer & Gellatly, 1988; Wood & Bandura, 1989). It has been discussed above that ability is a major factor in determining specific self-efficacy perception. The following section will explain how specific self-efficacy affects personal goals.

Relationship between Specific Self-efficacy and Personal goals

Locke and Latham (1990: 115) have summarized the results of studies which have measured the relationship between specific self-efficacy and personal goals. The mean correlation between specific self-efficacy and personal goal was 0.38. There are six studies which have reported correlation between specific self-efficacy and personal goals after Locke and Latham's review. Except for the second study in Earley and Lituchy

(1991), all other studies reported a higher correlation than the one reported in Locke and Latham (1990).

There are two ways through which specific self-efficacy can directly affect personal goals. First, Bandura (1977) suggested that people will engage in behaviors only if they have expectations that they can do the behaviors efficaciously. Thus, there is a direct effect of specific self-efficacy on personal goals where people will set modest goals to avoid negative self-evaluation when the personal goal cannot be achieved. Second, Hunt (1965) proposed that people are intrinsically motivated by a need to encounter stimulus events that are moderately discrepant from their accustomed stimulation. Hence, people have a tendency to set difficult goals for a certain amount of challenges (which is affected by specific self-efficacy) for intrinsic motivation to perform the task.

Relationship between Performance Valence and Personal Goal

There are also consistent findings on the negative effect of performance valence on personal goal choice (Klein, 1991; Mento et al., 1992; Meyer & Gellatly, 1988). By assuming that self-satisfaction is a meta-goal desired by most people (Mento et al., 1992), people with low performance valence must accomplish more to satisfy themselves than people with high performance valence. Thus, people with low performance valence set higher personal goals.

However, the negative direct effect from performance valence to personal goal should be interpreted with great caution. It is suggested that this negative direct effect exists only under two conditions. The first condition is that the individual does not have a choice on task. That is, the task of concern is the only task the individual can perform and from which satisfaction is achieved. In all previous studies which found a negative relationship between performance valence and personal goal, the subjects did not have a choice on whether to perform the task or not. In all laboratory experiments subjects were exposed to only one task and were asked to perform only that task. Although in all classroom experiments (e.g., Klein, 1991) students have a choice on whether to stay in the class or not, all of the subjects in the final analysis have in fact chosen to stay in the class. Thus, in all cases the only choice for the subjects is the level of effort to spend or the personal goal in performing the task. If the subjects are exposed to more than one task, they are expected to choose the task with higher overall valence rather than choosing a task with lower overall valence and set a higher personal goal.

The second condition is that the level of performance valence must not be too low. As stated by Garland (1985: 351), "... in situations where individuals do not feel bound to the task or committed to their task goals, it is possible to use a more standard expectancy approach to predict a shift in tasks if anticipated satisfaction with performance is too low." When performance valence is moderate to high, a direct effect from performance valence on personal goal is expected. However, if the level of performance valence is low, the individual may choose not to perform the task because he/she does not expect any significant reward from performing the task. If the individual is engaged into the task, that is, there is no choice on whether perform the task or not, personal goal will be determined by other factors such as specific self-efficacy.

Performance

Relationship between Assigned Goal and Performance

The direct effect of assigned goals to performance is not included in all previous goal setting models. However, results of the hierarchical regression analyses on performance for the studies by Earley and Lituchy (1991: 88, 91) showed that adding assigned goals to the equation significantly increased the R^2 after ability, personal goals, self-efficacy, and performance valence have been entered into the equation. These results demonstrated that assigned goals have a direct effect on performance in addition to the indirect effects through self-efficacy and personal goals. In all previous studies, subjects were asked to set a personal goal before performing the task. However, it is only an assumption that individuals aim at a personal goal when performing a task. Even though the subjects have chosen a personal goal before performing the task, they might have worked toward the assigned goals instead of the personal goals, especially when they perceived that the assigned goals were important. Moreover, individuals might work toward an internal standard (personal goal) and an external standard (assigned goal) simultaneously.

Relationship between Ability and Performance

Earley and Lituchy (1991: 83) stated that "the direct influence of an individual's ability on performance reflects the inherent limitations of an individual's self-assessments." However, it is widely recognized that motivation affects performance only when the individual has the ability to perform the task. Many previous studies found that there was a positive direct effect from ability to performance (e.g., Earley & Lituchy, 1991; Garland, 1983; 1985; Garland & Adkinson, 1987; Garland et al., 1988; Klein, 1991; Locke et al., 1984a; Locke et al., 1984b; Mento et al., 1992; Meyer & Gellatly, 1988; Wood & Locke, 1987). As stated by Locke and Latham (1990: 206), "... it is axiomatic that people cannot perform in accordance with their goals if they do not have the ability to reach them." This is the reason for which direct effect from ability to performance was found in many previous goal setting studies.

Relationship between Specific Self-efficacy and Performance

Results of previous studies on the relationship between specific self-efficacy and performance are also summarized in Table 2. Specific self-efficacy can directly affect performance in two ways. First, people's specific self-efficacy perceptions determine their level of motivation, which is reflected in the effort they will exert and the persistence in task performance (Bandura, 1988; Wood & Bandura, 1989). As it was defined by Wood and Bandura (1989), one of the aspects of specific self-efficacy perception is people's belief in their capabilities to mobilize motivation. Unlike performance valence, which can be affected by both intrinsic rewards and extrinsic rewards, specific self-efficacy perception is an internal belief. Therefore the motivation affected by specific self-efficacy is believed to be mainly intrinsic motivation. Second, Earley and Lituchy (1991: 83) proposed that "highly efficacious individuals are more likely than inefficacious individuals to attribute failure to internal causes, so they are more likely to proactively engage their subsequent performance by redoubling their efforts, searching for new strategies, and so forth."

Relationship between Personal Goals and Performance

The direct effect of personal goals on performance has been thoroughly reviewed by Locke and Latham (1990). In short, personal goals have direct positive effect on performance through effort, persistence, directed attention, and strategy development.

Summary

The model presented in Figure 2 summarizes the above review on goal setting process. Previous studies suggested that assigned goals affect performance in three ways. First, assigned goals have a direct positive effect on performance since people treat assigned goals as external standards to strive for. Second, assigned goals affect performance through specific self-efficacy (Wood & Bandura, 1989). Assigned goals have a positive effect on specific self-efficacy perceptions, which in turn have a positive effect on performance through intrinsic motivation. That is, the higher the assigned goals, the higher the specific self-efficacy perceptions. Moreover, higher specific self-efficacy perceptions leads to higher intrinsic motivation, which increases performance. Third, assigned goals affect performance through personal goal choice (Locke & Latham, 1990). Assigned goals provide anchors for people to set personal goals, which people consider as internal standards at which to aim. Similar to the effect of assigned goals to performance, the higher the personal goals, the higher will be the performance.

Task Complexity

Task Complexity as a Moderator of Goal Effects

In addition to the examination of the cognitive processes of goal setting, another trend of current goal setting studies works toward the identification of moderators of the goal setting effects. One of those moderators of goal effects that have been studied is task complexity. Wood et al., (1987) have conducted a meta-analysis on studies of the effects of goals on performance and concluded that goal-setting effects were strongest for easy tasks and weakest for more complicated tasks. They concluded their paper with a call for further studies to explain the underlying processes by which goals affect performance on different types of tasks.

Task Complexity and Strategies

The moderating effect of task complexity on goal difficulty-performance relationship is most frequently explained by the strategies employed in performing the task (e.g., Chesney & Locke, 1991; Earley et al., 1990b). Wood and Locke (1990) posited that the importance of the quality of strategy employed increases as the task becomes more complex. There is plentiful evidence that selection of appropriate strategy significantly improves performance for a complex task (e.g., Chesney & Locke, 1991; Earley et al., 1989; Huber, 1985). In addition, there is extensive support for the premise that goal setting increases planning activities, strategy development and search processes (e.g., Campbell, 1984; 1988; Earley et al., 1989; Earley & Perry, 1987; Earley et al., 1990a; Earley et al., 1987; Huber, 1985; Smith et al., 1990). For example, in both a laboratory study and a field study, Earley et al. (1987) found that a specific goal not only led an individual to plan and organize more than a general goal, but also increased an individual's energy expended (effort and persistence).

Although people with difficult goals may engage in more strategy development activities, they may not always find the best strategy. As reported by Chesney and Locke (1991), subjects with difficult personal goals tended to use the most successful strategy and reject the least successful strategy. On the other hand, Huber (1985) found that when performing a difficult task, subjects with difficult goals used a less effective strategy more frequently than subjects with easy goals. Earley et al. (1989) proposed a three-level hierarchy of tasks to explain the moderating effect of task complexity on the goal setting effect on performance. The first level consists of simple tasks. At this level, increased effort, diligence, and energy normally lead to improved performance. There are ample supports that goal setting is effective for these tasks. The second level includes tasks with relatively few alternative strategies. Since there are only a few strategies available, the selection of the best strategy is possible and not very expensive. As setting difficult goals increases the strategy search activities, people with hard goals have a greater chance to employ the best strategy than people with easy goals. The third level involves tasks with a large number of possible strategies. Earley et al. (1989: 25) have proposed four characteristics for tasks at this level: (a) performance is primarily a function of strategy rather than of task effort; (b) there are many available strategies; (c) the optimal strategy is neither obvious nor readily identified; and (d) little opportunity to test hypotheses retrospectively exists (go back and retry a strategy). It is at this level of tasks that the relation between goal difficulty and performance becomes problematic. Since there is a large number of possible strategies, merely searching through them offers little hope of finding the best strategy. As a result, although people with difficult goals engage in more strategy search activities, that does not mean that a good strategy will be developed. Instead, the strategy search activities may hinder rather than help task performance.

In summary, the smaller goal effect for complex task has been explained by the increased number of possible strategies in performing the task. Earley et al. (1989) found that subjects with difficult goals spent more effort in strategy development activities than did subjects with a "do your best" goal. Since there were an indefinitely large number of different strategies for the task they employed, the additional search was dysfunctional and subjects with difficult goals performed poorer than the subjects with "do your best" goals.

However, this explanation is not very satisfactory because previous studies have found that subjects with difficult goals employed more effective strategies than subjects with easy goals even in very complex tasks. Chesney & Locke (1991) found that goal difficulty was positively related to task strategies, and both goals and strategies had significant effects on performance in their experiment, where subjects were performing a complex, strategic management, computer simulation task. Similarly, Wood and Bandura (1989) found that personal goals had a positive effect on analytic strategies, which in turn had a positive effect on performance for a complex simulated managerial task. In addition, their study showed that both personal goals and specific self-efficacy have direct effects on performance in addition to the indirect effects through analytic strategies. In fact, the direct effect of specific self-efficacy on performance is much stronger than the indirect effect through strategies, which suggests that the effects of direct motivation mechanisms may be stronger than the effects of indirect motivation mechanisms. Thus, the strategy argument does not explain the moderating effect of task complexity on goal effects very well.

Construct Definition Issues

Despite the frequent use of task complexity as a moderator of the relationship between goals and performance and as an explanatory variable of performance in goal setting studies, task complexity is seldom defined. One exception is the work by Wood (1986) who defined three types of task complexity: component, coordinative, and dynamic.

Component Complexity

Component complexity of a task is defined as "a direct function of the number of distinct acts that need to be executed in the performance of the task and the number of distinct information cues that must be processed in the performance of those acts" (Wood, 1986: 66). The number of acts refers to the number of activities and events that an individual needs to perform, which determines the amount of information and skills required to perform a task. In addition, the number of information cues determines the perceptual and information processing requirements for performing the task. Hence, the greater the component complexity, the more information and skills are required to be able to perform the task, and the more perceptual and information processing activities will be carried out when performing the task.

Coordinative Complexity

Coordinative complexity is defined as "the form and strength of the relationships between information cues, acts, and products, as well as the sequencing of inputs" (Wood, 1986: 68). The form of the relationships refers to the interactions between various components (acts) of the task. The higher the interaction between the components, the more information and skills are required to be able to perform the task. The strength of the relationships between the inputs and product of a task refer to the magnitude of random effects when performing the task. This can be conceptualized as the correlation between the inputs and the product. As the coordinative complexity increases, the correlation between the inputs and product lowers, i.e., the error term increases. Hence, the product becomes less predictable.

Dynamic Complexity

The third type of task complexity defined by Wood (1986: 71) is dynamic complexity. Dynamic complexity refers to the changes in the relationships between task inputs and products. As the state of the world is continuously changing, the relationship between task inputs and products may change overtime. In addition, the number of acts and information cues in performing a task may also change from time to time. Thus, when the dynamic complexity is low, there will only be a few system states during the performance of the task, where each system state represents an unique set of component complexity and coordinative complexity. When the dynamic complexity increases, the number of system states also increases. Therefore, more information processing activities are required to discover the component complexity and coordinative complexity for the increased system states.

Total Complexity

As stated by Wood (1986), the exact form of the relationship between the three types of complexity and total task complexity cannot be specified yet. Hence, we should study different types of task complexity independently. However, no previous study has attempted to distinguish the effects of different types of complexity on the goal setting process. Since the three types of task complexity may have different effects on the number of strategies available for a task, it will be worthwhile to study their effect independently. In the current study, the effects of component complexity and coordinative complexity on the goal setting process will be examined independently, while controlling the effect of dynamic complexity.

Task Complexity and the Cognitive Process of Goal Setting

Although discussions on the effect of task complexity on goal setting have been limited to the strategy argument, there are some clues that task complexity may also affect the cognitive process of goal setting. The first sign of the influence of task complexity on the cognitive processes of goal setting is that previous studies have generated different cognitive processing models of goal setting. Most of the models tested before 1990 and the model proposed by Locke and Latham (1990) did not include performance valence as a component in the cognitive model. However, when Klein (1991), Mento et al. (1992), and Meyer and Gellatly (1988) include performance valence in the cognitive model, all of them found significant direct effects of performance valence on personal goals.

In addition, Kernan and Lord (1990) found that valence and expectancies had a different role in multiple as compared with single goal environments. Although they were not directly testing a cognitive model of goal setting, they found that both valence and expectancy have little effect on subsequent motivation in a single goal condition. They explained that "a simple cybernetic model of motivation, which emphasizes discrepancies and more automatic responses, would be capable of predicting performance results much better than more cognitively demanding motivational models like expectancy-valence theory" (Kernan & Lord, 1990: 200). On the other hand, they found that both valence and expectancy had strong effects on motivation in the multiple goal environment and they proposed that a more rational motivational model may be applicable to multiple goal conditions. These results imply that the cognitive process of motivation may be different under different task conditions.

Finally, there has not been a study which directly compares the cognitive model of goal setting under different task conditions. Although Early and Lituchy (1991) have tested the model in both a simple task condition (mathematics problem) and a complex task condition (game simulation), they did not compare the models generated for the two tasks even though they were very different. Therefore, the objective of the current study is to compare the cognitive process of goal setting for tasks with different complexity levels.

Direct Effect of Specific Self-efficacy on Performance

As presented in Table 2, there are consistent findings of a significant correlation between specific self-efficacy and performance. On the other hand, Table 2 also shows that the magnitude of the correlation varies from .24 (Wood & Locke, 1987) to .74 (Garland, 1985). This variation in the effect sizes for the relationship between specific self-efficacy and performance may be partially caused by task complexity in two ways.

First, task complexity affects the number of strategies available in performing the task, where the number of strategies has been found to moderate the relationship between self-efficacy and performance (Wood and Bandura, 1989). Increased task complexity hinders the relationship between specific self-efficacy and performance because more effort is required to search for the best strategy. The moderating effect for component complexity and coordinative complexity may also be different. A task with high component complexity means that the number of distinct acts or information cues for performing the task are large, which also has a large number of possible strategies. Therefore people will engage in more strategy searching activities in the early stages of task performance, when the effect of specific self-efficacy on performance may be lower. After the tasks has been performed for a period of time, people performing a task with high component complexity may have found the best strategy to perform the task. If people performing a task with low component complexity and people performing a task with high component complexity are both using the best strategy available, the effect of specific self-efficacy on performance will be the same on both tasks. In fact, if people with high specific self-efficacy can find a better strategy than those used by people with low specific self-efficacy when performing a task with high component complexity (that have been found by Wood and Bandura, 1989), the effect of specific self-efficacy on performance may be stronger in the later stages of task performance.

On the other hand, a task with high coordinative complexity means that a best strategy is less available because the relationship between the inputs and products is weak. Thus, the strategy searching activities may go on throughout the task performing process. Therefore, increases in coordinative complexity may hinder the effect of specific self-efficacy on performance throughout the performance process.

Second, an increase in task complexity may lower people's perceived control of performance, which has been proposed to be a key component in intrinsic motivation (Deci, 1975; 1980; Deci, & Ryan, 1980; Fisher, 1978). Since specific self-efficacy influences performance through mobilization of intrinsic motivation, people's perceived control of performance may moderate the effect of specific self-efficacy on performance. When the perceived control on performance is low, people feel that their effort-performance relationship is weak, i.e., their effort will not affect their performance.

Therefore, they may not exert the amount of effort that they would like to apply in performing the task. Although component complexity may affect people's perceived control of performance, the effect of coordinative complexity on people's perception of control is expected to be higher.

When combining both effects of task complexity on the relationship between specific self-efficacy and performance, the following hypotheses are proposed.

> Hypothesis 1A: The positive direct effect of specific self-efficacy on performance for a task with high component complexity is smaller than that for a task with low component complexity.
>
> Hypothesis 1B: The positive direct effect of specific self-efficacy on performance for a task with high coordinative complexity is smaller than that for a task with low coordinative complexity.
>
> Hypothesis 1C: The moderating effect of coordinative complexity on the positive direct effect of specific self-efficacy on performance is stronger than that of component complexity.

Direct Effect of Personal Goals on Performance

Task complexity is proposed to affect the relationship between personal goals and performance in two different ways. The first one is that similar to the moderating effect of task complexity on the relationship between specific self-efficacy and performance. In addition, task complexity also affect the relationship between personal goals and performance because of the number of strategies available in performing the task. Hence, the relationship between personal goals and performance for a task with high component complexity is weaker than that for a task with low component complexity during the early stages of task performance because of the increased strategies search activities. After a period of time, this moderating effect may level off or even be reversed. For a task with high component complexity, people with difficult goals have a greater chance of using a better strategy than people with easy goals because of their higher efforts exert in the strategy searching process. For a task with high coordinative complexity, the relationship between personal goals and performance is weaker than that for a task with low coordinative complexity throughout the performance process since people with difficult goals do not have a better chance of finding a better strategy than people with easy goals although they spend more effort in the strategy searching activities.

On the other hand, as found by Kernan and Lord (1990), people employed a more rational motivational model when performing a complex task. People may perceive higher costs (or efforts) for a complex task and therefore go through a more thorough cognitive process before performing the task. If people choose their personal goals by more rational decision making and have gone through more cognitive mechanisms, it is reasonable to expect that they will be more committed to their personal goals. As a result, the direct effect of personal goals on performance will be higher when task complexity increases. In addition, as the direct effect of specific self-efficacy on performance is hindered by increase task complexity, people will look for alternative motivation mechanisms for performing the task. Thus, the importance of personal goals will increase. When combining the strategy effect and motivational effect of task complexity on the direct effect of personal goals on performance, the following hypotheses are proposed:

Hypothesis 2A: The positive direct effect of personal goals on performance for a task with high component complexity is stronger than that for a task with low component complexity.

Hypothesis 2B: The positive direct effect of personal goals on performance for a task with high coordinative complexity is stronger than that for a task with low coordinative complexity.

Hypothesis 2C: The moderating effect of coordinative complexity on the direct effect of personal goals on performance is stronger than that of component complexity.

Direct Effects of Specific Self-efficacy and Personal Goals on Performance

Hypothesis 1 proposes that the direct effect of specific self-efficacy on performance decreases when task complexity increases while hypothesis 2 proposes that the direct effect of personal goals on performance increases when task complexity increases. These hypotheses suggest that people employ a simple motivational model (specific self-efficacy) in performing a task with low complexity and employ a more rational motivational model (personal goal setting) when performing a task with high complexity. This argument is parallel to the results in Kernan and Lord (1990) who found that subjects used a simple cybernetic model of motivation in the single goal situation (low component complexity) and a more rational model of motivation in the multiple goals situation (high component complexity).

Hypothesis 3A: Direct effect of specific self-efficacy on performance is stronger than direct effect of personal goals on performance when task complexity is low.

Hypothesis 3B: Direct effect of specific self-efficacy on performance is weaker than direct effect of personal goals on performance when task complexity is high.

Direct Effect of Specific Self-efficacy on Personal Goals

As stated above, people will employ a simple motivational mechanism when performing a simple task and a more rational motivational mechanism when performing a complex task. Hence, when people choose their personal goals for a simple task, the major influence may come from their past performance and the assigned goals, which represent the external standard or norm performance of the task. On the other hand, when people are performing a complex task, they may consider their perceived capabilities more when choosing their personal goals. In addition, when their perceived specific self-efficacy is high in a simple task condition, they may not bother to choose personal goals before they perform the task. The subjects select personal goals only because they are asked by the experimenter. Salancik and Pfeffer (1977: 449) referred this as "priming", which means that "the interviewer orients the respondent's attention to particular information."

Hypothesis 4: Direct positive effect of specific self-efficacy on personal goals is stronger for a task with high complexity than that for a task with low complexity.

Direct Effect of Performance Valence on Personal Goals

Similar to the direct effect of specific self-efficacy on personal goals, people will consider performance valence for selection of personal goals when they need a more rational motivational mechanism for a complex task. When people perceive that performance valence is low, they set higher personal goals because they recognize that they need a higher performance to achieve satisfaction. However, people may perceive the performance valence for a simple task as too low and will not consider it in the selection of personal goals (Garland, 1985).

Hypothesis 5: Direct negative effect of performance valence on personal goals is stronger for a task with high complexity than that for a task with low complexity.

Effect of Task Complexity on Perceived Control over Performance

When component complexity increases, people perceive less control over performance because the number of strategies available increases. When coordinative complexity increases, people perceive less control over performance because the relationship between people's inputs and task performance decreases. Since the problem of increased number of strategies can be solved after practices or training while the problem of weaker relationship between inputs and task performance cannot be solved easily, the effect of coordinative complexity on perceived control over performance is expected to be larger than that for component complexity.

Hypothesis 6A: People's perceived control over performance is higher for a task with low component complexity than for a task with high component complexity.

Hypothesis 6B: People's perceived control over performance is higher for a task with low coordinative complexity than for a task with high coordinative complexity.

Hypothesis 6C: The effect of coordinative complexity on people's perceived control over performance is stronger than the effect of component complexity on people's perceived control over performance.

Effect of Task complexity on Strategy Search Activities

Although previous studies have examined the effects of task complexity on strategy search activities and goal setting effects, none has tried to differentiate the effects of component complexity from the effects of coordinative complexity. Since component complexity and coordinative complexity are caused by different elements of a task, their effects on the task strategies are believed to be different. Increases in component complexity are expected to increase the number of strategies available for performing a task. As a result, strategy search activities will be increased and people with difficult goals will expend more effort than people with easy goals in strategy searching activities. Hence, the performance will be worse for people with difficult goals. However, as suggested by Wood et al. (1987: 420), "it is possible that differences in goal effects between complex and simple tasks may disappear over repeated performance of a task, as individuals develop effective strategies for the performance of complex tasks." This argument was supported in the studies by Shaw (1984) and Smith et al. (1990) who found that specific, difficult goals lead to higher performance only in later trials for complex tasks.

On the other hand, a task with high coordinative complexity means that an effective strategy for performing the task is not readily available. Thus, although people with difficult goals spend more efforts in strategy searches than people with easy goals, they have very little chance to find an effective strategy for performing the task. As a result, the performance for people with easy goals will be higher than the performance for people with difficult goals throughout the process of performing the task.

Hypothesis 7A: People with difficult goals will spend more efforts in strategy-search activities than people with easy goals.

Hypothesis 7B: The goal effects on strategy development will be stronger for tasks with high component complexity than that for tasks with low component complexity.

Hypothesis 7C: The goal effects on strategy development will be stronger for tasks with high coordinative complexity than that for tasks with low coordinative complexity.

Hypothesis 7D: The initial performance for people with difficult goals will be lower than that for people with easy goals for a task with high component complexity.

Hypothesis 7E: After some practice, the performance for people with difficult goals will be higher than that for people with easy goals for a task with high component complexity.

Hypothesis 7F: For a task with high coordinative complexity, the performance of people with difficult goals will be lower than that of people with easy goals.

Method

Subjects

Three hundred and thirty-nine undergraduates who were taking upper level management courses participated in the study. The subjects participated on their own time and all of them were entered into a drawing for a prize of $100 cash. Some subjects received extra credit toward the partial fulfillment of a course requirement in addition to the chance of winning the cash prize. Seventy-two subjects participated in the pilot study to set assigned goal levels for the four tasks. Two hundred and sixty-seven subjects participated in the study. Forty-one subjects were removed from the final analysis for the following reasons: a) performance data for one subject was lost due to mechanical problem, b) 14 subjects were unable to recall their personal goals, and c) 26 subjects were unable to recall their assigned goals. There were 226 subjects included in the final analysis and the number of subjects in each treatment group is presented in Table 4. Demographic data for the 226 subjects in the final analysis is presented in Table 5A to Table 5E.

Tasks

The task used in Earley et al. (1989) was modified and employed in this study. Subjects were asked to predict stock prices for a company from the performance of the divisions of the company. This task was a multiple cue probability learning (MCPL) task which required the subjects to determine how to use the proximal cues (performance

Table 4

Number of Subjects in Each Treatment Group

	Assigned Goal			
Task	Easy	Moderate	Difficult	Total
L-L	19	19	19	57
L-H	18	19	18	55
H-L	19	19	19	57
H-H	19	19	19	57
Total	75	76	75	226

L-L = Low component - Low coordinative

L-H = Low component - High coordinative

H-L = High component - Low coordinative

H-H = High component - High coordinative

Table 5A

Demographic Data for Subjects in Final Analysis: Gender

Gender	Frequency	Percent
Male	131	58.0
Female	95	42.0
	-------	-------
Total	226	100.0

Table 5B

Demographic Data for Subjects in Final Analysis: College

College	Frequency	Percent
Agriculture & Life Sciences	3	1.3
Architecture & Urban Studies	3	1.3
Arts & Sciences	4	1.8
Business	186	82.3
Education	4	1.8
Engineering	2	.9
Human Resources	24	10.6
	-------	-------
Total	226	100.0

Table 5C

Demographic Data for Subjects in Final Analysis: Year

Year	Frequency	Percent
Junior	63	27.9
Senior	163	72.1
	-------	-------
Total	226	100.0

Table 5D

Demographic Data for Subjects in Final Analysis: Age

Age	Frequency	Percent
19	2	.9
20	50	22.1
21	102	45.1
22	54	23.9
23	7	3.1
24	3	1.3
25	2	.9
Older than 25	6	2.7
	-------	-------
Total	226	100.0

Table 5E

Demographic Data for Subjects in Final Analysis: QCA

QCA	Frequency	Percent
Lower than 1.4	1	.4
1.7 - 1.9	7	3.1
2.0 - 2.2	27	11.9
2.3 - 2.5	42	18.6
2.6 - 2.8	50	22.1
2.9 - 3.1	47	20.8
3.2 - 3.4	33	14.6
3.5 - 3.7	13	5.8
3.8 - 4.0	6	2.7
	-------	-------
Total	226	100.0

of the divisions) to predict the distal event (stock prices). A MCPL task was used for two reasons. First, both the component complexity and coordinative complexity can be manipulated independently in a MCPL task. Second, by using Brunswik's lens model (Brunswik, 1956; Hursch, Hammond, & Hursch, 1964), performance can de decomposed into statistically independent components, which allows an estimate of the quality of the strategy used by a particular subject and the consistency with which the strategy was used.

Subjects performed the stock prices prediction task on computers. At the beginning of each trial, performance of the divisions of the company was displayed on the computer. An example for the display on computer for the high component complexity task was given in Figure 4. The following three pieces of information: (a) the performance of division A, (b) the performance of division B, and (c) the performance of division C relative to their own division goals were given. The cues were presented in percentages and the predictions were made in dollars. In Earley et al.'s (1989) study, the three divisions were named as marketing, research and development, and production. As noticed by Earley et al., it may be argued that the subjects are merely testing the preexisting belief that production division (or marketing) is always the most important division within a company. Therefore, division A, division B, and division C were used in the current study and the subjects were told that the three divisions represented three different product lines within the company.

The subjects were told that the stock price of the company for a given trial was independent of the stock price for other trials and that the stock prices would range

This is Trial # 2

Performance of the Divisions are as following:

Division A	Division B	Division C
80	50	100

Please enter your prediction of stock value and hit <ENTER>

Figure 4

Display for task with high component - high coordinative complexity on computer between \$10 and \$150. The subjects had 15 seconds to enter the prediction for each trial. A time limit was given so that the subjects did not have enough time to attempt multiple strategies on any given trial. After the performance cues had been displayed for 15 seconds, the computer made a "beep" sound and displayed a warning message to alert the subjects that 15 seconds have been past. However, since the estimates of performance and quality of strategies used required predictions for all trials, the subjects were allowed to enter their predictions even when the time limit was past. The average time for subjects in the pilot study to enter a prediction was 6 seconds and 99% of the predictions were made within 15 seconds. After the subjects have recorded their predictions for each trial, the actual stock price was displayed for 5 seconds to provide immediate feedback.

The value of the criterion, Y (actual market value of the stock), was generated using the formula,

$$Y = A X_1 + B X_2 + C X_3 + \text{error},$$

where X_1 = division A performance, X_2 = division B performance, and X_3 = division C performance. The three cue values (X_1, X_2, and X_3) were randomly drawn from uniform distributions with a mean of 80% and range of 10% to 150%. Different cue values were drawn for the stock price for each of the 60 trials. The importance of each division (A, B, and C) was determined before the experiments. The error term was randomly drawn from a uniform distribution with mean of \$0 and the range of -\$7 to +\$7 for low coordinative complexity group and mean of \$0 and the range of -\$15 to +\$15 for high coordinative complexity group. Cue values were rounded to the nearest 10% to ease arithmetic manipulation by the subjects. Hence, for each company, there were an importance score for each division, a set of cue values and the corresponding stock prices for 60 trials. Subjects in the same task complexity group predicted stock prices of the same company. There were information cues for two companies for each task complexity group, one for measuring ability of the subjects in the pretest and a second company for the measurement of treatment effects.

Manipulations

Task complexity. Two levels of component complexity and two levels of coordinative complexity were manipulated in the current study. As stated by Wood (1986), "for judgement tasks in which an individual utilizes configurations of cues to draw inferences the level of component complexity will depend upon the number of distinct information cues in the configuration being utilized." Therefore the companies for low component complexity tasks in the current study have two divisions whereas companies for high component complexity tasks have three divisions.

One of the major elements of coordinative complexity is the relationship between the information cues and the objective criterion, which can be reflected by the correlation between the cues and the criterion. Therefore, coordinative complexity was manipulated through the error term of the equation generating the stock prices. Low coordinative complexity task involves an error term range from -$7 to +$7 whereas a high coordinative complexity task involves an error term range from -$15 to +$15.

Thus, there are four task groups in the current study and the following eight equations were used in the experiments:

A) Equations for companies before treatment:

A1) Low component - low coordinative complexity

$Y = .55\ X_1 + .45\ X_2 + error$ (error range from -\$7 to +\$7)

A2) Low component - high coordinative complexity

$Y = .55\ X_1 + .45\ X_2 + error$ (error range from -\$15 to +\$15)

A3) High component - low coordinative complexity

$Y = .15\ X_1 + .45\ X_2 + .40\ X_3 + error$ (error range from -\$7 to +\$7)

A4) High component - high coordinative complexity

$Y = .15\ X_1 + .45\ X_2 + .40\ X_3 + error$ (error range from -\$15 to +\$15)

B) Equations for companies after treatment:

B1) Low component - low coordinative complexity

$Y = .35\ X_1 + .65\ X_2 + error$ (error range from -\$7 to +\$7)

B2) Low component - high coordinative complexity

$Y = .35\ X_1 + .65\ X_2 + error$ (error range from -\$15 to +\$15)

B3) High component - low coordinative complexity

$Y = .35\ X_1 + .30\ X_2 + .35\ X_3 + error$ (error range from -\$7 to +\$7)

B4) High component - high coordinative complexity

$Y = .35\ X_1 + .30\ X_2 + .35\ X_3 + error$ (error range from -\$15 to +\$15)

Assigned goals. The study consisted of three assigned goal levels, easy, moderate, and difficult goals. The goal levels were set in terms of mean absolute error (MAE), the mean of absolute amounts of the difference between the subject's prediction and the actual stock price. A different set of goal levels were set for each task complexity group since a difficult goal level for the high component - high coordinative complexity task may be easy for the low component - low coordinative complexity group. The assigned goal levels were determined in a pilot study with 18 subjects in each task complexity group. The assigned goal levels were set at performance levels where 10%, 50%, and 90% of the subjects reached in the pilot study. Locke and Latham (1990: 349) recommended these three assigned goal levels to get substantial performance differences. The goal levels for each task complexity group are presented in Table 6.

Procedure

The study was conducted in sessions with four to 20 subjects in a computer laboratory. Multiple task complexity groups and multiple goal levels were involved in each session. This procedure was used to keep cell sizes as close as possible and to minimize the contamination of a particular session on a given treatment group. Each subject was seated in front of a computer. After being seated, the subjects were given a page of general description of the study, and a form to get their consent for voluntary participation in the study. Then the subjects were asked to answer the questions on the general efficacy scale presented in Appendix A.

The experimenter informed all of the subjects that although the task was a simulation of a stock market, they should not necessarily assume that the market would perform according to their experiences or what they might have learned in other classes. They were told that they should approach the predictions with a "clean slate" and not

Table 6

Assigned Goal Levels for Each Task Group

Task	Assigned Goal Easy	Moderate	Difficult
L-L	$13	$ 8	$ 6
L-H	$15	$13	$10
H-L	$15	$13	$10
H-H	$17	$14	$12

L-L = Low component - Low coordinative

L-H = Low component - High coordinative

H-L = High component - Low coordinative

H-H = High component - High coordinative

Note: Assigned goals were set in terms of mean absolute error (MAE), the mean of absolute amount of the difference between the predictions and the actual stock prices.

make any assumptions about the simulation or predictions prior to starting the task. Then the experimenter answered all questions, presented a trial set of cues by using an overhead projector, and demonstrated to the subjects how to enter their predictions.

Afterwards, the subjects were asked to read the instructions for performing the task on the computer and asked questions if they have any problem. After all questions have been answered, the subjects worked on five practice trials to get familiar with the task and the keyboard. They could choose to rerun the practice trials if they felt it was necessary after the practice trials. Then they worked on the first company for 60 pretest trials.

After completing the 60 pretest trials, MAE for the pretest was displayed on the computer to provide immediate feedback to the subjects. The assigned goal for upcoming trials for each subject was also displayed on the computer. The subjects were then asked to complete a questionnaire that includes items assessing their specific self-efficacy, performance valence, and personal goals (Appendix B). After completion of the questionnaire, the subjects worked on the second company for another 60 trials to measure the treatment effects.

After all experimental trials, the subjects were asked to complete a postexperimental questionnaire that included a manipulation check, self-report items concerning strategy used, and ratings of perceived usefulness of the cues (Appendix C). After completion of the questionnaire the subjects were debriefed.

Measures

Performance. Two performance measures were employed in Earley et al.'s (1989) study to assess overall performance: (a) mean absolute error (MAE); and (b) the achievement correlation, r_a, the simple correlation between predicted and actual prices. In the current study, since performance feedback after the pretest, the assigned goals and personal goals were all measured or set in terms of MAE, MAE would be used as the basis for performance measure. To be consistent with previous studies where better performance was indicated by a higher performance measure, the performance in this study was measured by -1 times MAE. Besides the measures of overall performance, each subject's stock predictions were grouped into four blocks of 15 trials each to allow for analysis of possible learning effects. Performance was assessed again within each block.

Ability. Performance in the 60 pretest trials was used as the ability measure. Similar to the performance measure for the test, in addition to the overall performance, performance for each block of 15 trials were also computed for testing the learning effect.

Strategy. A MCPL task can be analyzed by Brunswik's (1956) lens model presented in Figure 5 to decompose r_a into components to examine various factors that constitute performance. Using the lens model, Hursch et al. (1964) decomposed r_a into four components by the following equation:

$$r_a = (R^2e + R^2s - D)/2 + C[(1 - R^2e)(1 - R^2s)]^{1/2},$$

where

r_a = Simple correlation between predicted and actual prices

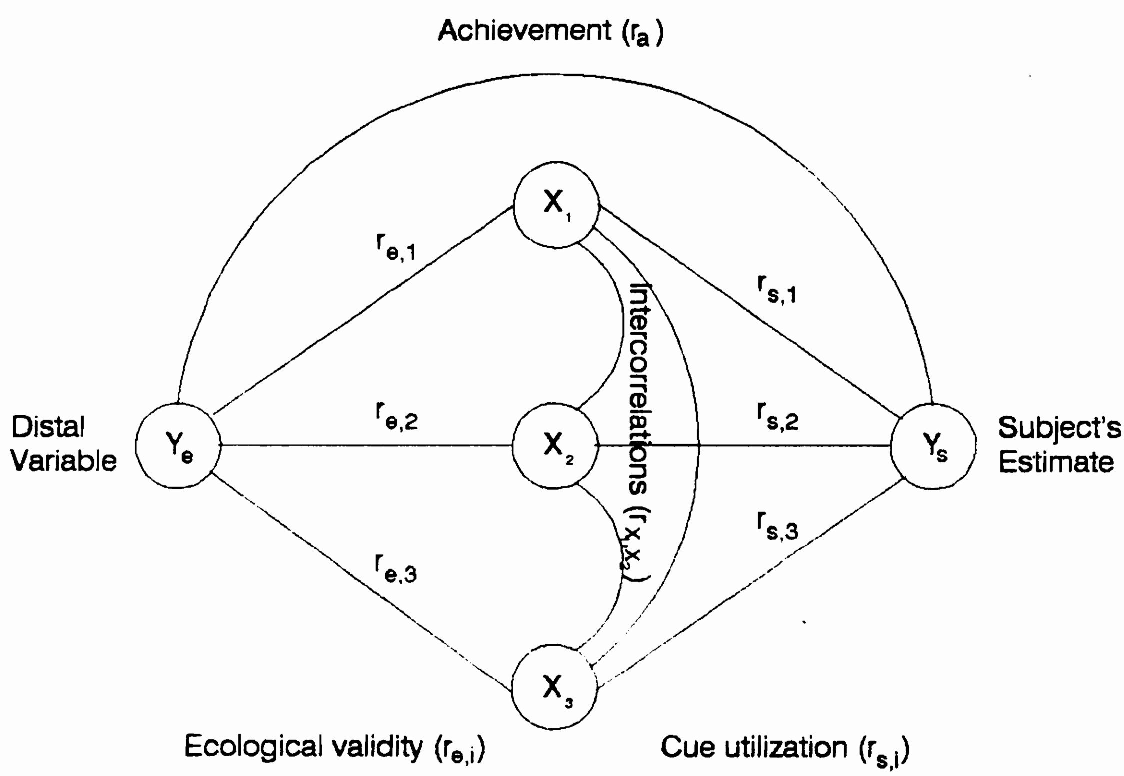


Figure 5
Brunswik's lens model

R^2e = Square of the multiple correlation between actual stock prices and cues

R^2s = Square of the multiple correlation between predictions and cues

D = $\Sigma(\beta_{ei} - \beta_{si})(r_{ei} - r_{si})$

C = Partial correlation between predictions and actual stock prices when the effects of the cues are eliminated.

R^2e measures the limit of performance imposed by the task. This is estimated by regressing the information cues on the criterion. Multiple correlation between the information cues and criterion has been used as a measure of coordinative complexity for information processing tasks (Wood, 1986). A task with high coordinative complexity is indicated by a low R^2e.

R^2s measures the consistency with which the subject applies a linear weighing formula to combine the cues. This is computed by regressing the information cues on the subjects's predictions. A consistent strategy is reflected by a high R^2s. As the above equation shows, the more consistent the strategies are used, the performance will be higher.

D represents the difference between ecological validities and utilization coefficients. β_{ei} are the standardized regression coefficients for the distal variable and are estimated by regressing the information cues on the criterion. β_{si} are the standardized regression coefficients for the predictions and are estimated by regressing the information cues on the predictions. r_{ei} are the ecological validity coefficients which are estimated by the correlations between the information cues and the criterion. r_{si} are the cue utilization coefficients which are estimated by the correlations between the information cues and the predictions. If the utilization coefficients completely match with validity coefficients, D equals to zero. D was used to measure the quality of the strategy employed. The above equation shows that performance is low when D is large.

In order to estimate R^2s and D for each subject, a separate regression analysis with the performance information as independent variables and the subject's predictions as dependent variable was performed for both the pretest and test. In addition, to estimate the changes of the quality and consistency of the strategies used, a separate regression equation was used for each of the four blocks for the pretest and the test. Thus, ten regression equations were estimated for each subject: one regression equation for each of the four blocks in the pretest, a regression equation for all 60 trials for the pretest, one regression equation for each of the four blocks in the test, and a regression equation for all 60 trials in the test.

Two questions in the postexperimental questionnaire in Earley et al.'s (1989) study were used to verify the regression results. The first question was "After you familiarized yourself with how to work on the task (say, after the first 5 predictions), how often did you try new strategies for methods for making stock predictions?" The second question asks "How useful were each of the two/three cues in helping them make decisions."

Specific self-efficacy. Modification to the method measuring specific self-efficacy strength proposed by Locke et al. (1984) was used to assess specific self-efficacy. Specific self-efficacy magnitude was not measured because of the limited variance in the measurement (Locke et al., 1984) and its limited uses in previous studies. Subjects were asked to rate the strength of their specific self-efficacy for six performance levels, ranging from a low performance level of a MAE from \$20 to \$24 to a high performance level of a MAE from \$0 to \$4. However, instead of asking the subjects to assess the certainty for each performance level with a scale from 0% to 100%, the subjects assessed the certainty for each performance level with a 9-point scale ranging from 1 (no chance at all) to 9 (completely certain). The anchors for the specific self-efficacy scale were used in Klein (1991).

Probabilities or certainty ratings from 0% to 100% were not used since it is doubtful if people can distinguish a few percentage points, i.e., between 35% and 37% certainty, when assessing specific self-efficacy. In addition, when using a scale from 0% to 100%, some subjects may treat the performance levels as mutually exclusive by adding the probabilities for all performance levels to 100%. However, since not all subjects treat the performance levels as mutually exclusive, the subjects will assess their specific self-efficacy in different ways. Using a scale from 1 to 9 discourages subjects to consider the performance levels as mutually exclusive.

Initially, the certainty responses for all six performance levels were summed up to form the specific self-efficacy measure. Since the internal consistency measure (Cronbach's alpha) was only .64, a factor analysis was performed on the six responses to the specific self-efficacy scale[2]. The results yielded two factors with eigenvalues of 2.69 and 2.09. The specific self-efficacy for the lower three performance levels loaded

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Note: 2. According to Nunnally (1967: 226), a Cronbach's alpha of .80 is adequate for basic research.

on the first factor, accounting for 45% of the variance. The specific self-efficacy for the higher three performance levels loaded on the second factor, accounting for an additional 35% of the variance. Since the responses to the lower three performance levels of the specific self-efficacy scale have similar factor loadings (.92, .95, .83), the responses to these three items were summed to form the specific self-efficacy -low performance scale (SSE-L), having a Cronbach's alpha of .89. The responses to the higher three performance levels of the specific self-efficacy scale also have similar factor loadings (.79, .85, .77), the responses to these three items were summed to form the specific self-efficacy - high performance scale (SSE-H), having a Cronbach's alpha of .78, which was marginally acceptable.

Performance valence. Performance valence was assessed with the method outlined by Garland (1985). Subjects were asked to indicate how satisfied they would be if they achieved one of the six performance levels used in the specific self-efficacy scale. A 9-point scale ranging from 1 (extremely dissatisfied) to 9 (extremely satisfied) was used to record their responses. The responses to these six performance levels were summed for a composite performance valence score having an internal consistency (Cronbach's alpha) of .81.

Personal goals. Subjects were asked to set a personal goal before working for the test (the second company). The personal goal was assessed with a single item ("Your personal goal for the next 60 trials is to make predictions within $__ of the actual stock prices.") with a scale from 1 ($3 - $4) to 10 ($21 - $22). The scale was created by including performance levels for all subjects in the pilot study. In addition, subjects were instructed that their personal goals should be the performance levels they intended to achieve regardless of whether or not they were the same as the assigned goals. To be consistent with previous studies where a higher personal goal measure represented a more difficult personal goal, personal goals in this study were reversely coded.

Perceived control over performance. The items used in Fisher (1978) were used to measure subjects' perceived control over performance. Subjects were asked to rate the importance of four factors in determining their performance: luck, task difficulty, effort, and ability on a 9-point scale ranging from 1 (unimportant) to 9 (extremely important). Ratings on the first two factors were summed to produce an attribution to external forces index and ratings on the last two factors were summed to form an internal attribution index.

Effort. Average time spent on the predictions was used as a measure of the amount of effort a subject spent on the task. In addition, the energy expended (effort and persistence) questions used in Earley et al. (1987) were included in the postexperimental questionnaire. The internal consistency measure (Cronbach's α) of the three items was .57. A factor analysis showed that the item on persistence and the two items on effort loaded on two factors. Therefore, the two items on effort were summed to form an effort measure and the item on persistence was used to measure persistence. The correlation between persistence measure and effort measure is .16 ($p < .01$).

General self-efficacy. General self-efficacy was measured by the 17-item General Self-efficacy scale developed by Sherer et al. (1982). This scale was specifically recommended by Eden (1988) to measure general self-efficacy. The internal consistency

(Cronbach's alpha) of the scale in the current study was .84.

Results

Manipulation Checks

Assigned goal. Subjects were asked to recall their assigned goals before answering the questions on specific self-efficacy and performance valence. Twenty-six subjects failed to recall their assigned goals. Many of them put down their performance for the pretest as the assigned goals. These 26 subjects were removed from the final analysis.

Personal goal. Subjects were asked to recall their personal goals after they have finished working for the second 60 trials. Fourteen subjects failed to recall their personal goals and they were removed from the final analysis.

Time for the pretest. The average time used for each prediction in the pretest is presented in Table 7. On average, 1.4% of the total predictions were made after the 15-seconds time limit. ANOVA on the average time used for each prediction in the pretest with component complexity and coordinative complexity shows that subjects who performed the tasks with high component complexity required significantly longer time to make each prediction than subjects who performed the tasks with low component complexity ($p < .01$).

Pretest performance. Performance in pretest was analyzed by a ANOVA with assigned goal, component complexity, and coordinative complexity as factors. Presented in Table 8A are performance in pretest for each treatment group. Results of the ANOVA are shown in Table 8B. There is no significant difference on performance in pretest

Table 7

Average Time Used for Each Prediction in Pretest

Task	Time (seconds)	% of predictions > 15 seconds
L-L	5.89	1.36
L-H	5.57	0.73
H-L	6.37	1.22
H-H	6.65	2.21

L-L = Low component - Low coordinative

L-H = Low component - High coordinative

H-L = High component - Low coordinative

H-H = High component - High coordinative

Table 8A

Performance for Pretest

	Assigned Goal			
Task	Easy	Moderate	Difficult	Overall
L-L	-9.94	-10.89	-9.97	-10.27
L-H	-12.99	-12.79	-12.15	-12.65
H-L	-12.08	-12.09	-12.47	-12.21
H-H	-13.88	-14.16	-15.02	-14.35

L-L = Low component - Low coordinative

L-H = Low component - High coordinative

H-L = High component - Low coordinative

H-H = High component - High coordinative

Table 8B

ANOVA on Performance for Pretest

Source	SS	df	MS	F
AGOAL	2.89	2	1.44	.21
COOR	288.00	1	288.00	42.19**
COMP	188.77	1	188.77	27.65**
AGOAL x COOR	2.11	2	1.06	.16
AGOAL x COMP	21.09	2	10.55	1.55
COOR x COMP	.77	1	.77	.11
AGOAL x COOR x COMP	7.45	2	3.73	.55
Residual	1460.74	214	6.83	

AGOAL = Assigned goals

COMP = Component complexity

COOR = Coordinative complexity

** $p < .01$

between assigned goal groups, $F(2, 214) = .21$, $p > .05$.

Task difficulty. Table 8B shows that both component complexity and coordinative complexity have significant effect on performance in pretest, $F(1,214) = 27.65$, $p < .001$; $F(1, 214) = 42.19$, $p < .001$. The means of performance in pretest show that the more complex the task, the lower the performance.

Descriptive Statistics

Presented in Table 9A to Table 9D are means, standard deviations, and Pearson correlations for the variables in the cognitive process model for each task group. In addition to the ANOVA on pretest performance, ANOVA on general self-efficacy, SSE-L, SSE-H, performance valence and personal goals were performed with component complexity and coordinative complexity as factors. The results show that there is no significant difference on general self-efficacy across all task groups.

There is a significant effect for coordinative complexity on SSE-L ($p < .01$). The means show that subjects who performed the tasks with high coordinative complexity have a significantly higher specific self-efficacy for low performance levels than subjects who performed the tasks with low coordinative complexity. On the other hand, the effect of coordinative complexity on SSE-H is reversed, although only marginally significant ($p = .06$). Subjects who performed the tasks with high coordinative complexity have a lower specific self-efficacy for the high performance levels than subjects who performed the tasks with low coordinative complexity. These findings suggest that subjects who performed the tasks with high coordinative complexity perceived a greater chance to

Table 9A

Means, Standard Deviations, and Pearson Correlations for Variables in the Cognitive Process Model: Task with Low Component - Low Coordinative Complexity

Variable	M	SD	1	2	3	4	5	6	7	8
			Pearson Correlations							
1. SSE-L	15.53	7.59	----							
2. SSE-H	13.56	3.86	-.20	----						
3. PV	27.72	5.14	.29*	-.62**	----					
4. PGOAL	8.09	1.30	-.14	.60**	-.43**	----				
5. Performance	-8.96	2.49	-.13	.49**	-.40**	.34**	----			
6. GSE	116.42	11.77	.11	.20	-.15	.09	-.07	----		
7. AGOAL	2.00	.82	-.17	.10	-.15	.28*	.06	.08	----	
8. Ability	-10.27	2.87	-.18	.47**	-.49**	.47**	.61**	-.15	-.00	----

Note. n = 57 * p < .05 ** p < .01

SSE-L = Specific self-efficacy - Low performance

SSE-H = Specific self-efficacy - High performance

PV = Performance Valence

PGOAL = Personal goals

AGOAL = Assigned Goals

GSE = General self-efficacy

Table 9B

Means, Standard Deviations, and Pearson Correlations for Variables in the Cognitive Process Model: Task with Low Component - High Coordinative Complexity

Variable	M	SD	1	2	3	4	5	6	7	8
			Pearson Correlations							
1. SSE-L	19.02	5.32	----							
2. SSE-H	12.36	3.43	.16	----						
3. PV	31.69	6.33	-.00	-.29*	----					
4. PGOAL	6.80	1.21	.10	.37**	-.57**	----				
5. Performance	-12.01	2.30	-.03	.06	-.48**	.52**	----			
6. GSE	116.24	15.62	.23*	.33**	-.28*	.44**	.19	----		
7. AGOAL	2.00	.82	-.22	.07	-.29*	.19	.21	.01	----	
8. Ability	-12.65	2.35	-.00	.25*	-.48**	.55**	.50**	.06	.15	----

Note. n = 55 * $p < .05$ ** $p < .01$

SSE-L = Specific self-efficacy - Low performance

SSE-H = Specific self-efficacy - High performance

PV = Performance Valence

PGOAL = Personal goals

AGOAL = Assigned Goals

GSE = General self-efficacy

Table 9C

Means, Standard Deviations, and Pearson Correlations for Variables in the Cognitive Process Model: Task with High Component - Low Coordinative Complexity

			Pearson Correlations							
Variable	M	SD	1	2	3	4	5	6	7	8
1. SSE-L	17.04	6.08	----							
2. SSE-H	11.58	3.47	-.01	----						
3. PV	31.47	5.52	.19	-.30*	----					
4. PGOAL	6.44	1.64	-.06	.37**	-.35**	----				
5. Performance	-10.43	2.71	.07	.18	-.32**	.43**	----			
6. GSE	113.82	13.61	.21	.00	.21	-.01	-.15	----		
7. AGOAL	2.00	.82	-.17	.18	-.31**	.23*	.09	-.08	----	
8. Ability	-12.21	2.41	-.03	.18	-.54**	.16	.40**	-.15	-.07	----

Note. n = 57 * p < .05 ** p < .01

SSE-L = Specific self-efficacy - Low performance

SSE-H = Specific self-efficacy - High performance

PV = Performance Valence

PGOAL = Personal goals

AGOAL = Assigned Goals

GSE = General self-efficacy

Table 9D

Means, Standard Deviations, and Pearson Correlations for Variables in the Cognitive Process Model: Task with High Component - High Coordinative Complexity

Variable	M	SD	1	2	3	4	5	6	7	8
			Pearson Correlations							
1. SSE-L	18.51	4.76	----							
2. SSE-H	11.00	3.15	.02	----						
3. PV	32.44	5.70	.10	-.14	----					
4. PGOAL	6.44	1.54	.24*	.44**	-.44**	----				
5. Performance	-12.92	2.43	-.01	.28*	.06	.50**	----			
6. GSE	114.96	12.46	.03	.19	.02	.20	.27*	----		
7. AGOAL	2.00	.82	-.15	.17	-.25*	.13	-.14	-.07	----	
8. Ability	-14.35	2.71	.09	.31**	-.18	.58**	.60**	.12	-.17	----

Note. n = 57 * p < .05 ** p < .01

SSE-L = Specific self-efficacy - Low performance

SSE-H = Specific self-efficacy - High performance

PV = Performance Valence

PGOAL = Personal goals

AGOAL = Assigned Goals

GSE = General self-efficacy

achieve a lower performance level than to achieve a higher performance level. In addition, component complexity also has a significant effect on SSE-H ($p < .01$). Subjects who performed the tasks with low component complexity have a significantly higher specific self-efficacy for high performance levels than subjects who performed the tasks with high component complexity.

There is a significant interaction effect of component complexity and coordinative complexity on performance valence ($p < .05$). The means show that subjects who performed the task with low component - low coordinative complexity have significantly lower performance valence than subjects in other task groups. There is also a significant interaction effect of component complexity and coordinative complexity on personal goals ($p < .01$). The means show that subjects who performed the task with low component - low coordinative complexity set personal goals that are significantly more difficult than the personal goals set by subjects in other task groups.

Overview of Analyses for Hypothesis 1 through Hypothesis 5

Hypothesis 1 through hypothesis 5 were tested by a multi-sample analysis of LISREL VII. The method is described in detail in both Jöreskog and Sörbom (1989) and Hayduk (1987). A multi-sample analysis is simply analyzing data from several groups simultaneously according to the model specified for each group with some parameters constrained to be equal between groups. LISREL first generates initial estimates for each group without considering the equality constraints. Then the parameters that are constrained to be equal between groups are replaced by their mean values. LISREL then tries to improve the initial estimates by raising some estimates and lowering others. This process is repeated until the maximum likelihood solutions are arrived by minimizing the weighted fit functions for the groups, i.e., maximizing the fit between the observed covariance matrix and the estimated covariance matrix for each group.

The first step of the multi-sample analysis is to split the sample into mutually exclusive groups based on the value of the moderating variable. Each group consists of observations that have the same value or fall within the same range of values of the moderator. The grouping variable or the moderator can also be groups receiving different treatments. As stated by Jöreskog and Sörbom (1989: 227), multi-sample analysis "is particularly useful in comparing a number of treatment and control groups." In testing hypothesis 1 through hypothesis 5, component complexity and coordinative complexity were used as the grouping variables. Thus, the sample was divided into four task groups: task with low component - low coordinative complexity, task with low component - high coordinative complexity task, task with high component - low coordinative complexity task, and task with high component - high coordinative complexity task.

The second step of the analysis is to generate a covariance matrix for each group as inputs for the multi-sample analysis. It is important to note that to compare parameters across groups, the unstandardized parameters are compared and the variables must be measured in the same metric. This means that sample covariance matrices must be analyzed instead of correlation matrices because correlation matrices have standardized the variables within each group.

The third step is to run the multi-sample analysis under the null hypothesis by specifying all path coefficients to be different across all groups, except for the hypothesized path coefficients to be the same across the groups. The results include the estimated path coefficients for each group and a Chi-square for goodness of fit (D1) with f1 degrees of freedom.

Then the multi-sample analysis is rerun by specifying the hypothesized path coefficients to be different across groups. This is the model under the alternate hypothesis. LISREL will generate different estimated path coefficients for each group according to the specified models and a Chi-square for goodness of fit (D2) with f2 degrees of freedom.

Significance of the moderating effect of the grouping variable on the unconstrained path coefficients can be tested by the "difference Chi-square" test described by Hayduk (1987). A Chi-square statistic (D^2) is calculated by subtracting D2 from D1 with f1 minus f2 (Df) degrees of freedom. If D^2 with Df degrees of freedom is significant, the grouping variable is concluded to be significantly moderating the unconstrained path coefficients for the model. In addition, when comparing the unstandardized path coefficients across the groups, the unconstrained path coefficients should be different between groups and the difference should be in the direction as predicted. The χ^2 for the null model and χ^2 for the alternate model for Hypotheses 1 through 5 are presented in Table 10A to Table 10E.

Table 10A

Results of Multi-sample Analysis for Hypothesis 1

Specific Self-efficacy - Low Performance

Model	χ^2	df	D^2	df
Null	34.68	23		
1A	34.65	22	.03	1
1B	33.21	22	1.47	1
Unconstrained	32.08	20	2.60	3

Specific Self-efficacy - High Performance

Model	χ^2	df	D^2	df
Null	39.57	23		
1A	39.51	22	.06	1
1B	36.85	22	2.72*	1
Unconstrained	32.08	20	7.49*	3

* $p < .10$

Table 10B

Results of Multi-sample Analysis for Hypothesis 2

Model	χ^2	df	D^2	df
Null	40.32	23		
1A	39.19	22	1.13	1
1B	39.09	22	1.23	1
Unconstrained	32.08	20	8.24**	3

** $p < .05$

Table 10C

Results of Multi-sample Analysis for Hypothesis 3

Low Component - Low Coordinative Complexity

Model	χ^2	df	D^2	df
Null	4.79	6		
Alternative	2.77	5	2.02	1

Low Component - High Coordinative Complexity

Model	χ^2	df	D^2	df
Null	16.77	6		
Alternative	14.62	5	2.15	1

High Component - Low Coordinative Complexity

Model	χ^2	df	D^2	df
Null	7.60	6		
Alternative	2.06	5	5.54**	1

High Component - High Coordinative Complexity

Model	χ^2	df	D^2	df
Null	17.32	6		
Alternative	12.65	5	4.67**	1

** $p < .05$

Table 10D

Results of Multi-sample Analysis for Hypothesis 4

Specific Self-efficacy - Low Performance

Model	χ^2	df	D^2	df
Null	37.12	23		
1A	35.37	22	1.75	1
1B	34.71	22	2.41	1
Unconstrained	32.08	20	5.04	3

Specific Self-efficacy - High Performance

Model	χ^2	df	D^2	df
Null	35.35	23		
1A	35.22	22	.13	1
1B	33.02	22	2.33	1
Unconstrained	32.08	20	3.27	3

Table 10E

Results of Multi-sample Analysis for Hypothesis 5

Model	χ^2	df	D^2	df
Null	37.38	23		
1A	35.53	22	1.85	1
1B	34.37	22	3.01*	1
Unconstrained	32.08	20	5.30	3

* $p < .10$

The Unconstrained Model

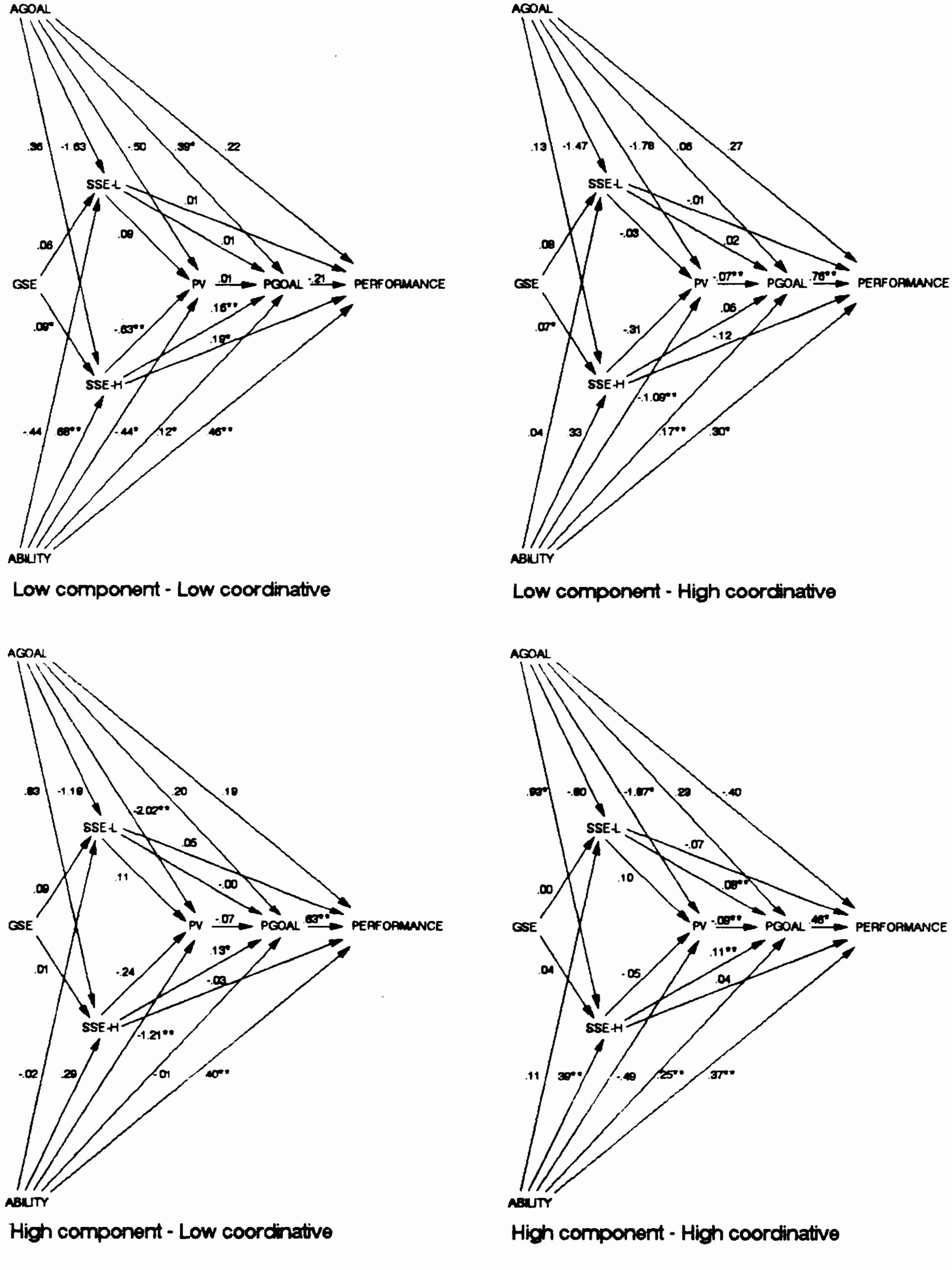
Before testing the hypotheses, a multi-sample analysis was run by specifying the path coefficients to be different across all task complexity groups to generate the unconstrained model. Results of the analysis are presented in Figure 6. The χ^2 with 20 d.f. equals to 32.08 ($p = .04$). The goodness of fit (GOF) indices for the four models ranges from .94 to .99, which indicate a good fit between the models and the data.

Hypothesis 1

Hypothesis 1 states that the direct effect from specific self-efficacy to performance for a task with low complexity is greater than that for a task with high complexity. For the null model for hypothesis 1, path coefficients for the path from SSE-H to performance were constrained to be the same for all task groups. Then the model for the alternate hypothesis 1A was estimated with path coefficients for the path from SSE-H to performance constrained to be the same for task groups with the same component complexity. To test hypothesis 1A, the null model was compared with the alternate model, yielding a $D^2(1) = .06$ ($p > .10$).

To estimate the model for the alternate hypothesis 1B, path coefficients for the path from SSE-H to performance were constrained to be the same for task groups with the same coordinative complexity. The D^2 for hypothesis 1B with 1 d.f. = 2.72 ($p < .10$).

To test hypothesis 1C, χ^2 for the model for hypothesis 1B was compared with the χ^2 for the model for hypothesis 1A. The difference is 2.66, which indicates that the



* p < .05 ** p < .01

Figure 6
Unstandardized path coefficients for unconstrained models

moderating effect of coordinative complexity on the direct effect of SSE-H to performance is greater than that for component complexity. Since the two models have the same degree of freedom, the D^2 test cannot be performed because the D^2 statistic has zero degrees of freedom.

Finally, the unconstrained model was compared with the null model. The $D^2(3) = 7.49$ ($p < .10$), which indicates that path coefficients for the path from SSE-H to performance are different across all task groups. Figure 6 shows that the direct effect from SSE-H to performance is only significant for the task with low component - low coordinative complexity ($p < .05$).

In summary, the results of the unconstrained model show that the interaction of component complexity and coordinative complexity affects the direct effect from SSE-H to performance. SSE-H has a significant direct positive effect on performance ($p < .05$) only when both component complexity and coordinative complexity are low. Since the interaction between component complexity and coordinative complexity is significant, the main effects proposed in hypotheses 1A to 1C are not interpreted.

Hypothesis 1 was then retested by comparing the path coefficients for the path from SSE-L to performance across task groups. For hypothesis 1A, $D^2(1) = .03$ ($p > .10$). For hypothesis 1B, $D^2(1) = 1.47$ ($p > .10$). For the unconstrained model, $D^2(3) = 2.60$ ($p > .10$). Figure 6 shows that the direct effects from SSE-L to performance are not significant for all task groups.

Hypothesis 2

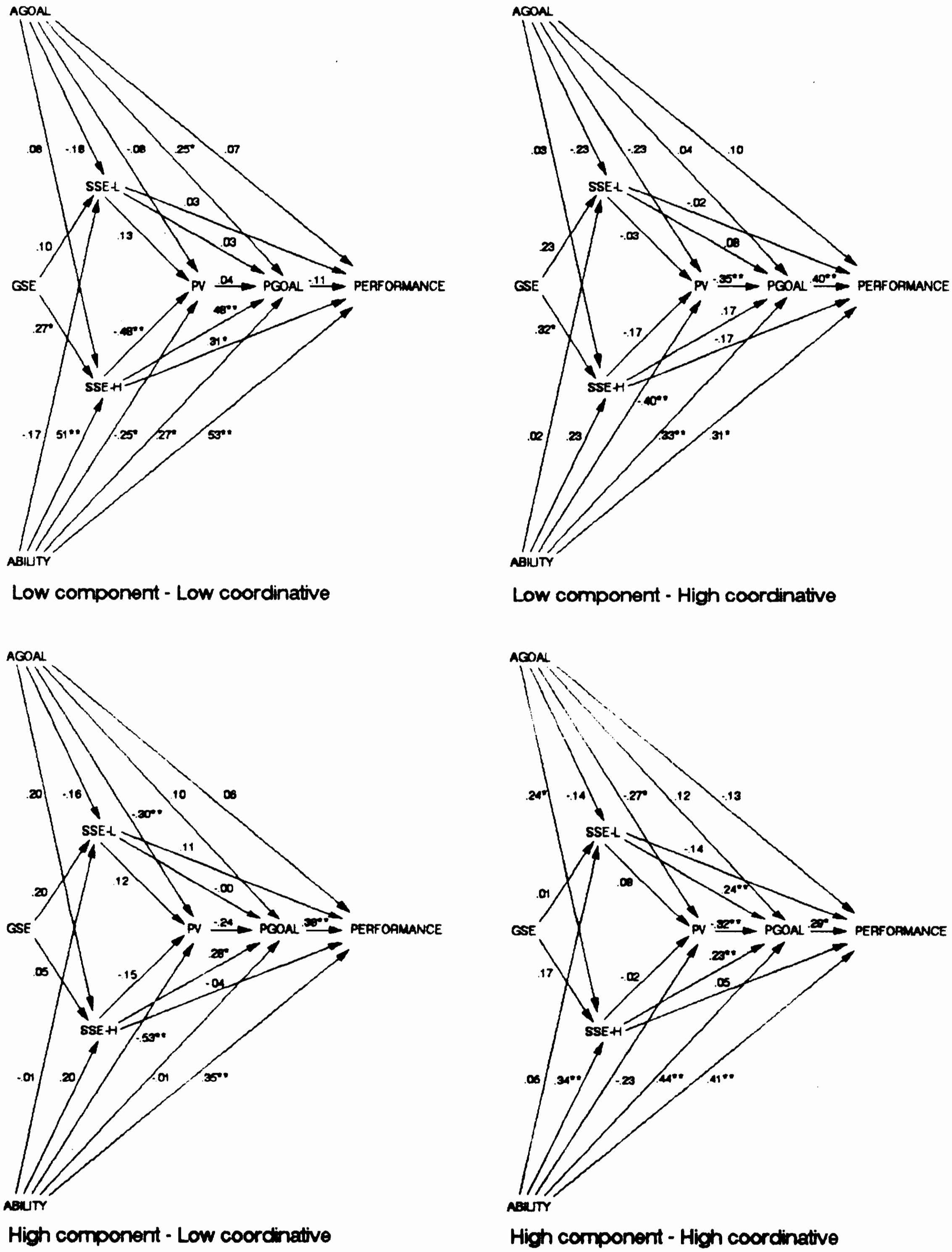
Hypothesis 2 states that the direct effect from personal goal to performance for a task with low complexity is smaller than that for a task with high complexity. To estimate the model under the null hypothesis for hypothesis 2, path coefficients for the path from personal goal to performance were constrained to be the same for all task groups. The model for alternate hypothesis 2A was estimated with path coefficients for the path from personal goal to performance constrained to be the same for task groups with the same component complexity. A comparison of the alternate model and the null model generates a $D^2(1) = 1.13$ ($p > .10$). To test hypothesis 2B, the model was reestimated with path coefficients for the path from personal goal to performance constrained to be the same for task groups with the same coordinative complexity. The D^2 for hypothesis 2B with 1 d.f. = 1.23 ($p > .10$). The difference in χ^2 for the alternate models for hypothesis 2A and hypothesis 2B is .10, which indicates that there is only a small difference between the moderating effect of coordinative complexity on the direct effect from personal goal to performance and that of component complexity. Finally, the unconstrained model was compared with the null model under hypothesis 2. The $D^2(3) = 8.24$ ($p < .05$), which indicates that path coefficients for the path from personal goal to performance are different across task groups. Figure 6 shows that the direct effects from personal goal to performance are significant for the task with low component - high coordinative complexity ($p < .01$), the task with high component - low coordinative complexity ($p < .01$), and the task with high component - high coordinative complexity ($p < .05$).

In short, there is a significant interaction effect between component complexity and coordinative complexity on the direct effect from personal goal to performance. There is a significant direct effect from personal goal to performance only when component complexity and/or coordinative complexity are high. Since the interaction between component complexity and coordinative complexity is significant, the main effects proposed in hypotheses 2A to 2C are not interpreted.

Hypothesis 3

Hypothesis 3 states that the direct effect from self-efficacy to performance is greater than the direct effect from personal goal to performance for a task with low complexity and vise versa for a task with high complexity. Since hypothesis 3 requires comparisons of path coefficients within each task group, standardized path coefficients are estimated and presented in Figure 7. Hypothesis 3 was then tested within each task group. The null model for hypothesis 3 constrained path coefficient for the path from SSE-H to performance to be the same as the path coefficient for the path from personal goal to performance, while the alternate model allowed the two path coefficients to be different. The alternate model was compared with the null model to test the hypothesis. For the low component - low coordinative complexity, $D^2(1) = 2.02$ ($p > .10$), which indicates that the direct effect from personal goal to performance is not significantly different from the direct effect from SSE-H to performance.

D^2 for hypothesis 3 for the low component - high coordinative complexity with 1 d.f. = 2.15 ($p > .10$), which indicates that the direct effect from personal goal to



* $p < .05$ ** $p < .01$

Figure 7
Standardized path coefficients for unconstrained models

performance is not significantly different from the direct effect from SSE-H to performance. D^2 for hypothesis 3 for the high component - low coordinative complexity with 1 d.f. = 5.54 ($p < .05$), which indicates that the direct effect from personal goal to performance is significantly different from the direct effect from SSE-H to performance. Figure 7 shows that the direct effect from personal goal to performance is significantly stronger than the direct effect from SSE-H to performance. D^2 for hypothesis 3 for the high component - high coordinative complexity with 1 d.f. = 4.67 ($p < .05$), which indicates that the direct effect from personal goal to performance is significantly different from the direct effect from SSE-H to performance. Figure 7 shows that the direct effect from personal goal to performance is significantly stronger than the direct effect from SSE-H to performance.

In brief, hypothesis 3 is supported only for the tasks with high component complexity. That is, when component complexity is high, the direct effect from personal goal to performance is significantly stronger than the direct effect from SSE-H to performance. On the other hand, when component complexity is low, the direct effect from personal goal to performance is not significantly different from the direct effect from SSE-H to performance.

Hypothesis 4

Hypothesis 4 states that the direct effect from specific self-efficacy to personal goal for a task with low complexity is greater than that for a task with high complexity. Hypothesis 4 was first tested with path coefficients for the path from SSE-H to personal goal. Results presented in Table 10D shows that the direct effects from SSE-H to personal goals are not significantly different across all task groups. Figure 6 shows that the direct effects from SSE-H to personal goal are significant for the task with low component - low coordinative ($p < .01$), the task with high component - low coordinative ($p < .05$), and the task with high component - high coordinative complexity ($p < .01$), while the direct effect from SSE-H to personal goal is marginally significant ($p = .11$) for task with low component - high coordinative.

Hypothesis 4 was tested again with path coefficients for the path from SSE-L to personal goal. Results presented in Table 10D shows that the direct effects from SSE-L to personal goals are not significantly different across all task groups. However, Figure 6 shows that the direct effect from SSE-L to personal goal for the task with high component - high coordinative complexity is very different from those for the other task groups. A supplementary analysis was performed by constraining the path coefficients for the path from SSE-L to personal goal for the task with low component - low coordinative complexity, the task with low component - high coordinative complexity, and the task with high component - low coordinative complexity to be the same and the path coefficient for the path from SSE-L to personal goal for the task with high component - high coordinative complexity to be different from those for the other task groups. The χ^2 for the alternate model with 1 d.f. is 32.33. When comparing the alternate model and the null model, the $D^2(1)$ equals to 4.79 ($p < .05$).

In summary, hypothesis 4 is not supported for the path from SSE-H to personal goal. Although the direct effect of SSE-L on personal goal for the task with high component - high coordinative complexity is significantly stronger than those in other task groups, interpretation of this finding should be with great care because it is expo facto.

Hypothesis 5

Hypothesis 5 states that the direct effect from performance valence to personal goal for a task with low complexity is smaller than that for a task with high complexity. D^2 for component complexity with 1 d.f. = 1.85 ($p > .10$). D^2 for coordinative complexity with 1 d.f. = 3.01 ($p < .10$). For the unconstrained model, $D^2(3) = 5.30$ ($p > .10$). In short, hypothesis 5 is only supported for coordinative complexity. The results show that coordinative complexity moderates the direct effect from performance valence to personal goals. Figure 6 shows that the direct effects from performance valence to personal goal are only significant for the tasks with high coordinative complexity ($p < .01$).

Hypothesis 6

Hypothesis 6 states that task complexity affects people's perceived control over performance. The means and standard deviations of external attribution for each task group are presented in Table 11A. Hypothesis 6 was tested by a ANOVA on external attribution with component complexity and coordinative complexity as factors. The results are shown in Table 11B. The interaction effect of component complexity and coordinative complexity on external attribution is significant ($p < .05$). The means of external attribution for each task group show that subjects who performed the task with

Table 11A

Means and Standard Deviations of External Attribution

Task	Mean	SD
L-L	9.60	3.05
L-H	11.38	2.78
H-L	10.86	2.62
H-H	10.95	2.52

L-L = Low component - Low coordinative

L-H = Low component - High coordinative

H-L = High component - Low coordinative

H-H = High component - High coordinative

Table 11B

ANOVA on External Attribution

Source	SS	df	MS	F
COOR	48.74	1	48.74	6.45*
COMP	10.06	1	10.06	1.33
COOR x COMP	40.70	1	40.70	5.38*
Residual	1678.42	222	7.56	

COMP = Component complexity

COOR = Coordinative complexity

* $p < .05$

low component - low coordinative complexity attributed the performance to external factors less than subjects in all other three task groups.

The means and standard deviations of internal attribution for each task group are presented in Table 12A. Results of the ANOVA on internal attribution with component complexity and coordinative complexity as factors presented in Table 12B show that internal attribution is not significantly different between task groups.

Hierarchical regression analyses were used to test the interaction effect of perceived control and specific self-efficacy on performance for each task group. The results are presented in Table 13A to Table 13D. Table 13A shows that for subjects who performed the task with low component - low coordinative complexity, internal attribution has a significant effect on performance after controlling for specific self-efficacy and ability ($p < .01$). Subjects who attributed their pretest performance more to internal factors performed better in the test. Table 13B shows that for the task with low component - high coordinative complexity, subjects who attributed their pretest performance less to external factors performed significantly better in the test ($p < .05$). Table 13C shows that neither the internal attribution nor external attribution has significant effect on performance for the task with high component - low coordinative complexity. Table 13D shows that the interaction between specific self-efficacy and perceived control was significant for the task with high component - high coordinative complexity ($p < .01$). However, the direction of the interaction effect is in an opposite direction as predicted. Subjects who attributed their pretest performance more to external factors have a stronger relationship between specific self-efficacy and performance.

Table 12A

Means and Standard Deviations of Internal Attribution

Task	Mean	SD
L-L	12.51	3.90
L-H	12.27	3.48
H-L	12.05	3.26
H-H	12.35	3.07

L-L = Low component - Low coordinative

L-H = Low component - High coordinative

H-L = High component - Low coordinative

H-H = High component - High coordinative

Table 12B

ANOVA on Internal Attribution

Source	SS	df	MS	F
COOR	.06	1	.06	.01
COMP	2.07	1	2.07	.18
COOR x COMP	4.03	1	4.03	.34
Residual	2626.98	222	11.83	

COMP = Component complexity

COOR = Coordinative complexity

Table 13A

Hierarchical Regression of Perceived Control and Specific Self-efficacy on Performance: Task with Low Component - Low Coordinative Complexity

Internal Attribution

Step	Variable	ΔR^2	F
1	Ability	.38	33.36**
2	SSE-H	.05	4.95*
3	ATT-INT	.08	9.13**
4	SSE-H x ATT-INT	.01	1.85

External Attribution

Step	Variable	ΔR^2	F
1	Ability	.38	33.36**
2	SSE-H	.05	4.95*
3	ATT-EXT	.03	2.94
4	SSE-H x ATT-EXT	.03	2.64

SSE-H = Specific Self-efficacy - High Performance

ATT-INT = Internal Attribution

ATT-EXT = External Attribution

* $p < .05$ ** $p < .01$

Table 13B

Hierarchical Regression of Perceived Control and Specific Self-efficacy on Performance: Task with Low Component - High Coordinative Complexity

Internal Attribution

Step	Variable	ΔR^2	F
1	Ability	.25	17.58**
2	SSE-H	.01	.35
3	ATT-INT	.00	.02
4	SSE-H x ATT-INT	.01	.40

External Attribution

Step	Variable	ΔR^2	F
1	Ability	.25	17.58**
2	SSE-H	.01	.35
3	ATT-EXT	.07	5.49*
4	SSE-H x ATT-EXT	.01	.40

SSE-H = Specific Self-efficacy - High Performance

ATT-INT = Internal Attribution

ATT-EXT = External Attribution

* $p < .05$ ** $p < .01$

Table 13C

Hierarchical Regression of Perceived Control and Specific Self-efficacy on Performance: Task with High Component - Low Coordinative Complexity

Internal Attribution

Step	Variable	ΔR^2	F
1	Ability	.16	10.70**
2	SSE-H	.01	.76
3	ATT-INT	.00	.04
4	SSE-H x ATT-INT	.01	.63

External Attribution

Step	Variable	ΔR^2	F
1	Ability	.16	10.70**
2	SSE-H	.01	.76
3	ATT-EXT	.00	.00
4	SSE-H x ATT-EXT	.00	.00

SSE-H = Specific Self-efficacy - High Performance

ATT-INT = Internal Attribution

ATT-EXT = External Attribution

* $p < .05$ ** $p < .01$

Table 13D

Hierarchical Regression of Perceived Control and Specific Self-efficacy on Performance: Task with High Component - High Coordinative Complexity

Internal Attribution

Step	Variable	ΔR^2	F
1	Ability	.36	31.23**
2	SSE-H	.01	.77
3	ATT-INT	.03	2.26
4	SSE-H x ATT-INT	.00	.18

External Attribution

Step	Variable	ΔR^2	F
1	Ability	.36	31.23**
2	SSE-H	.01	.77
3	ATT-EXT	.01	.58
4	SSE-H x ATT-EXT	.07	6.90**

SSE-H = Specific Self-efficacy - High Performance

ATT-INT = Internal Attribution

ATT-EXT = External Attribution

* $p < .05$ ** $p < .01$

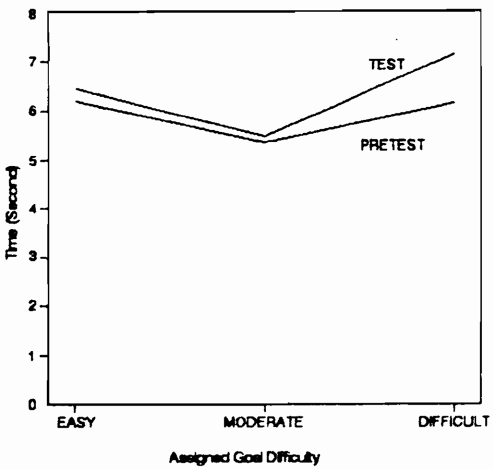
In summary, hypothesis 6 is partially supported. Results show that component complexity and coordinative complexity have significant effects on the external attribution of performance. Subjects who performed the task with low component - low coordinative complexity attributed their performance less to external factors than subjects in other task groups.

Overview of analysis for hypothesis 7

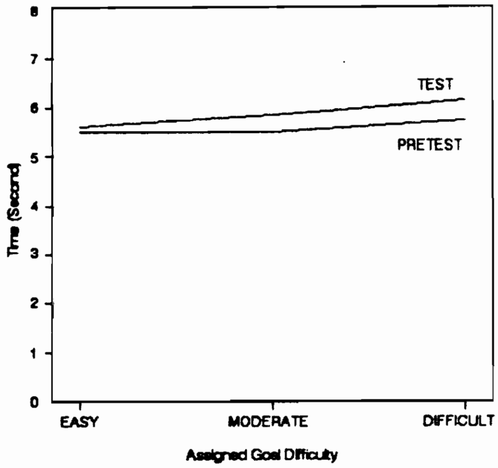
Hypothesis 7 tries to explain the effects of assigned goals and personal goals on performance by examining the goal effects on effort spent, strategy searches activities, and the learning effects. Testing for hypothesis 7 required to group the subjects' responses into four blocks of 15 trials each to allow for analysis of possible learning effects.

Hypothesis 7A

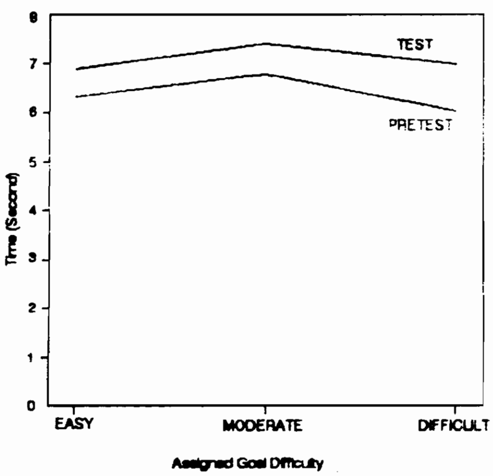
Hypothesis 7A states that goal difficulty has a positive effect on the amount of effort spent on strategy search activities. The average time spent for each prediction for each treatment group is plotted in Figure 8. Hypothesis 7A was tested by regression analysis within each task group. The average time spent in the test was regressed on the personal goal and assigned goal, with average time spent in the pretest controlled. The three levels of assigned goal difficulty were dummy coded. For the task with low component - low coordinative complexity, subjects with difficult assigned goal spent significantly more time for each prediction than subjects with moderate and easy goals



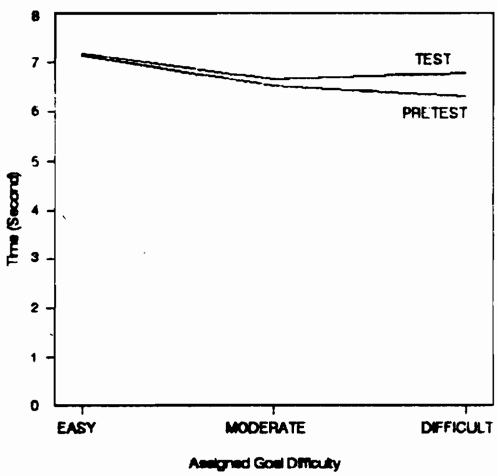
Low component - Low coordinative



Low component - High coordinative



High component - Low coordinative



High component - High coordinative

Figure 8
Average time for each prediction

($p < .05$). For the task with low component - high coordinative complexity and the task with high component - low coordinative complexity, subjects with more difficult personal goals spent significantly longer time than subjects with easier personal goals in the test ($p < .01$ and $p < .001$ respectively). For subjects who performed the task with high component - high coordinative complexity, both assigned goals and personal goals do not show significant effect on the time spent in the test.

The questions on effort and persistence in the postexperimental questionnaire provide further insights on how goal difficulty affects effort. A regression analysis on effort with personal goals and dummy coded assigned goals as independent variables was performed for each task group. The effect of assigned goal was not significant in all task groups. On the other hand, personal goal has a significant effect on effort for the task with high component - low coordinative complexity ($p < .05$). Subjects with more difficult personal goals spent significantly more effort than subjects with easier personal goals.

A regression analysis on persistence with personal goals and dummy coded assigned goals as independent variables was also performed for each task group. The effect of assigned goal was again not significant in all task groups. However, personal goal has a significant effect on persistence for the task with low component - high coordinative complexity, the task with high component - low coordinative complexity, and the task with high component - high coordinative complexity. Subjects with more difficult goals reported that they worked on the task without getting tired for a significantly longer time than subjects with easier goals.

In summary, hypothesis 7A is only partially supported. The assigned goal was found to have a positive effect on the average time spent on each prediction for the task with low component - low coordinative complexity. For the more complex tasks, personal goal has positive effects on the average time spent on each prediction and persistence of performing the task.

Hypotheses 7B and 7C

R^2s in the test for each treatment group adjusted for the R^2s in the pretest is plotted in Figure 9. Hypothesis 7B and hypothesis 7C state that the goal effects on strategy development will be stronger for tasks with high component complexity and tasks with high coordinative complexity. To test the hypotheses, a repeated measures ANOVA was run for each task group, using assigned goal condition as the first variable and blocks (1-4) as the repeated measures variable, with R^2s as the dependent variable and personal goal and R^2s in the pretest as covariates. Both assigned goal and assigned goal x block were not significant for all task groups. Block has a significant effect only for the task with low component - low coordinative complexity. Figure 9 shows that strategies used by subjects in this task group became more stable as time past.

Then a hierarchical regression on R^2s for the test was performed for each block within each task group. R^2s for the previous block was controlled. For R^2s in block 1, R^2s (block 1) for the pretest was controlled. Results for the hierarchical regression are presented in Table 14A to Table 14D. Assigned goal was not significant for all blocks in all task groups. However, personal goal has significant effects on R^2s in block 1 (p

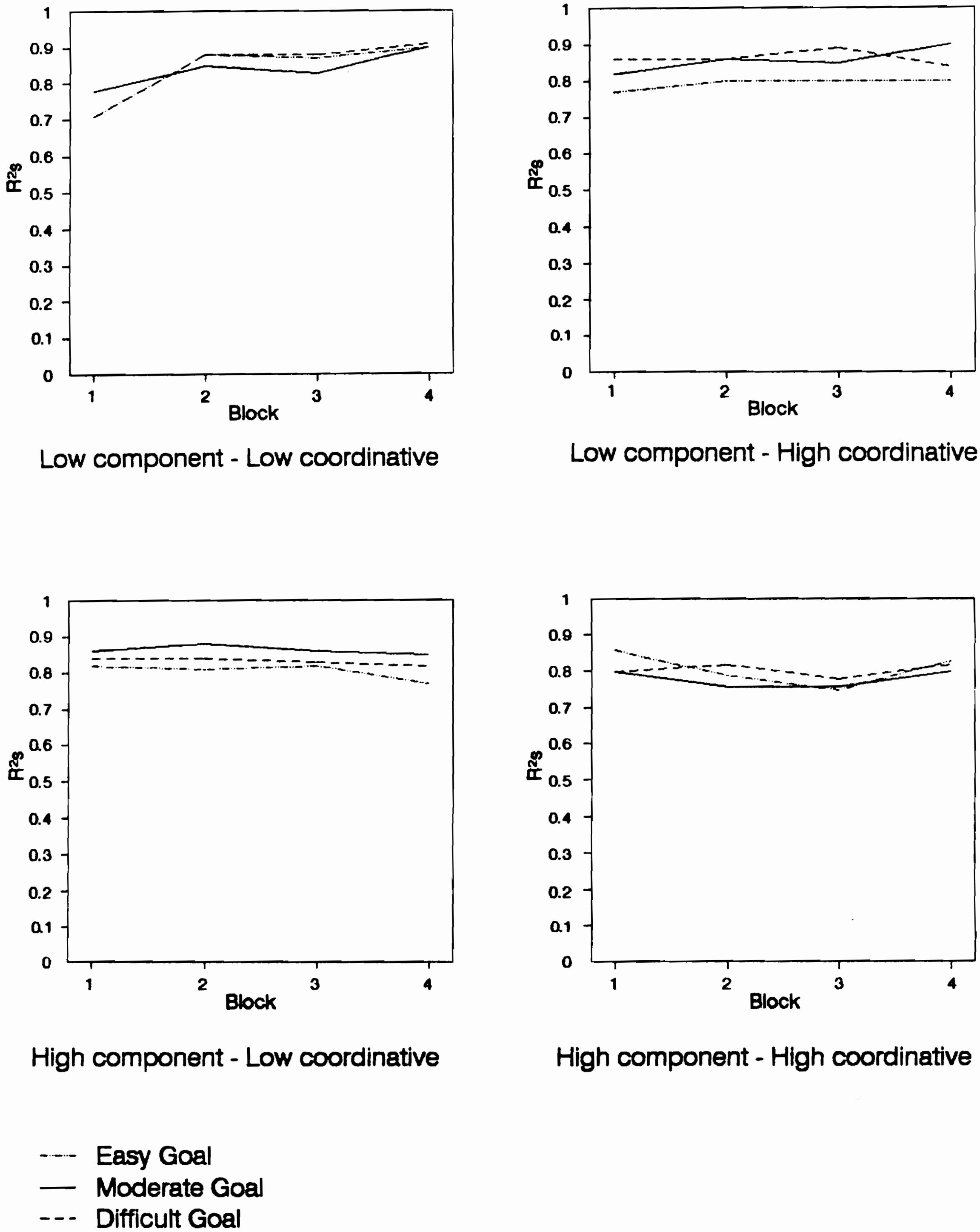


Figure 9
Adjusted R^2s

Table 14A

Hierarchical Regression Analyses on R^2s with Assigned Goals and Personal Goals: Task with Low Component - Low Coordinative Complexity

Block 1

Variable	ΔR^2	F
R^2s (Block 1 - Pretest)	.12	7.41**
Assigned Goals	.02	.60
Personal Goals	.01	.31

Block 2

Variable	ΔR^2	F
R^2s (Block 1 - Test)	.12	7.43**
Assigned Goals	.05	1.72
Personal Goals	.02	1.50

Block 3

Variable	ΔR^2	F
R^2s (Block 2 - Test)	.26	18.94**
Assigned Goals	.02	.83
Personal Goals	.05	3.55

Block 4

Variable	ΔR^2	F
R^2s (Block 3 - Test)	.17	11.23**
Assigned Goals	.00	.07
Personal Goals	.01	.77

* $p < .05$ ** $p < .01$

Table 14B

Hierarchical Regression Analyses on R^2s with Assigned Goals and Personal Goals: Task with Low Component - High Coordinative Complexity

Block 1		
Variable	ΔR^2	F
R^2s (Block 1 - Pretest)	.08	4.35*
Assigned Goals	.04	1.30
Personal Goals	.07	4.46*
Block 2		
Variable	ΔR^2	F
R^2s (Block 1 - Test)	.15	9.54**
Assigned Goals	.06	1.98
Personal Goals	.00	.02
Block 3		
Variable	ΔR^2	F
R^2s (Block 2 - Test)	.31	24.35**
Assigned Goals	.01	.26
Personal Goals	.10	8.35**
Block 4		
Variable	ΔR^2	F
R^2s (Block 3 - Test)	.43	40.42**
Assigned Goals	.05	2.29
Personal Goals	.03	3.51

* $p < .05$ ** $p < .01$

Table 14C

Hierarchical Regression Analyses on R^2s with Assigned Goals and Personal Goals: Task with High Component - Low Coordinative Complexity

Block 1		
Variable	ΔR^2	F
R^2s (Block 1 - Pretest)	.05	2.89
Assigned Goals	.02	.48
Personal Goals	.03	1.66
Block 2		
Variable	ΔR^2	F
R^2s (Block 1 - Test)	.27	20.11**
Assigned Goals	.04	1.55
Personal Goals	.01	.78
Block 3		
Variable	ΔR^2	F
R^2s (Block 2 - Test)	.39	25.65**
Assigned Goals	.00	.06
Personal Goals	.04	4.04*
Block 4		
Variable	ΔR^2	F
R^2s (Block 3 - Test)	.47	49.59**
Assigned Goals	.00	.04
Personal Goals	.08	9.04**

* $p < .05$ ** $p < .01$

Table 14D

Hierarchical Regression Analyses on R^2s with Assigned Goals and Personal Goals: Task with High Component - High Coordinative Complexity

Block 1

Variable	ΔR^2	F
R^2s (Block 1 - Pretest)	.09	5.60*
Assigned Goals	.04	1.18
Personal Goals	.04	2.39

Block 2

Variable	ΔR^2	F
R^2s (Block 1 - Test)	.08	5.02*
Assigned Goals	.02	.52
Personal Goals	.00	.12

Block 3

Variable	ΔR^2	F
R^2s (Block 2 - Test)	.33	26.63**
Assigned Goals	.00	.05
Personal Goals	.05	3.98*

Block 4

Variable	ΔR^2	F
R^2s (Block 3 - Test)	.15	9.95**
Assigned Goals	.01	.37
Personal Goals	.00	.07

* $p < .05$ ** $p < .01$

$< .05$) and block 3 ($p < .01$) for the task with low component - high coordinative complexity. Personal goal also has significant effects on R^2s in block 3 ($p < .01$) and block 4 ($p < .001$) for the task with high component - low coordinative complexity. For the task with high component - high coordinative complexity, personal goal has a significant effect on R^2s in block 3 ($p < .05$). Contrary to hypotheses 7B and 7C, subjects who performed the task with higher component complexity and/or higher coordinative complexity and set more difficult goals engaged in significantly less strategy searches activities.

Hypothesis 7D, 7E, and 7F

Performance adjusted for ability is plotted in Figure 10. For testing hypotheses 7D, 7E, and 7F, a hierarchical regression on performance was performed for each block within each task group. Performance for the previous block was controlled. For the hierarchical regressions on performance in block 1, ability (Block 1) was controlled. Results for the hierarchical regression are presented in Table 15A to Table 15D. Hypothesis 7D states that goal difficulty has a negative effect on initial performance (block 1) for a task with high component complexity. The results show that both assigned goal and personal goal were not significant for the two tasks with high component complexity.

Hypothesis 7E states that goal difficulty has a positive effect on performance after practices for a task with high component complexity. Results presented in Table 15C and Table 15D show that assigned goal was not significant for all blocks for the two tasks

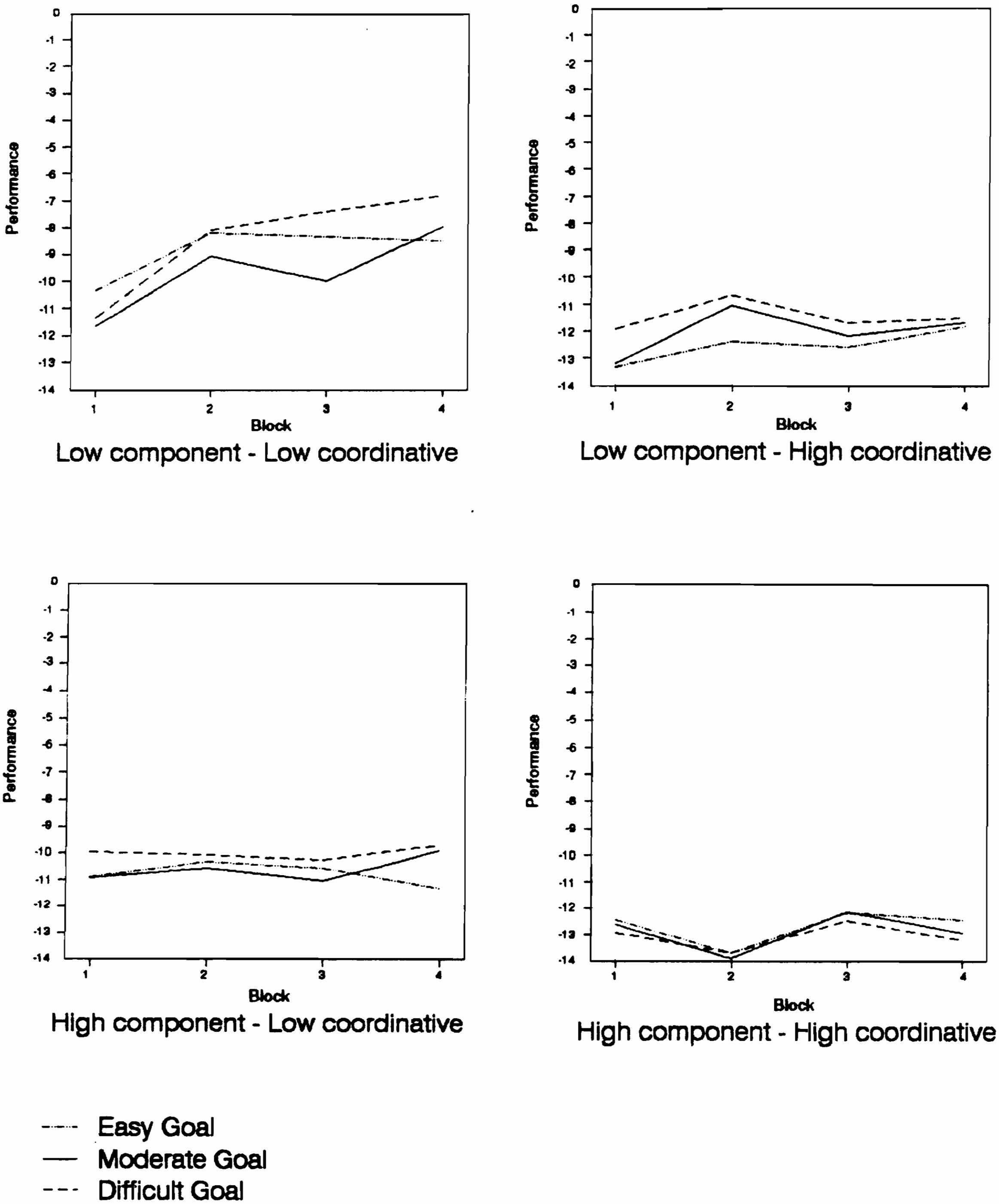


Figure 10
Performance adjusted for ability

Table 15A

Hierarchical Regression Analyses on Performance with Assigned Goals and Personal Goals: Task with Low Component - Low Coordinative Complexity

Block 1

Variable	ΔR^2	F
Ability (Block 1)	.07	4.40*
Assigned Goals	.02	.64
Personal Goals	.02	.32

Block 2

Variable	ΔR^2	F
Performance (Block 1)	.20	14.13**
Assigned Goals	.02	.57
Personal Goals	.05	3.30

Block 3

Variable	ΔR^2	F
Performance (Block 2)	.43	40.78**
Assigned Goals	.09	4.80*
Personal Goals	.01	.96

Block 4

Variable	ΔR^2	F
Performance (Block 3)	.33	26.53**
Assigned Goals	.04	1.54
Personal Goals	.02	2.01

* $p < .05$ ** $p < .01$

Table 15B

Hierarchical Regression Analyses on MAE with Assigned Goals and Personal Goals: Task with Low Component - High Coordinative Complexity

Block 1

Variable	ΔR^2	F
Ability (Block 1)	.01	.68
Assigned Goals	.04	1.06
Personal Goals	.16	9.82**

Block 2

Variable	ΔR^2	F
Performance (Block 1)	.07	4.10*
Assigned Goals	.04	1.09
Personal Goals	.03	1.99

Block 3

Variable	ΔR^2	F
Performance (Block 2)	.13	7.75**
Assigned Goals	.00	.13
Personal Goals	.11	7.00**

Block 4

Variable	ΔR^2	F
Performance (Block 3)	.45	42.78**
Assigned Goals	.00	.03
Personal Goals	.03	3.29

* $p < .05$ ** $p < .01$

Table 15C

Hierarchical Regression Analyses on MAE with Assigned Goals and Personal Goals: Task with High Component - Low Coordinative Complexity

Block 1

Variable	ΔR^2	F
Ability (Block 1)	.04	2.40
Assigned Goals	.02	.61
Personal Goals	.03	1.80

Block 2

Variable	ΔR^2	F
Performance (Block 1)	.38	33.53**
Assigned Goals	.01	.28
Personal Goals	.05	4.58*

Block 3

Variable	ΔR^2	F
Performance (Block 2)	.43	42.15**
Assigned Goals	.00	.23
Personal Goals	.07	7.06**

Block 4

Variable	ΔR^2	F
Performance (Block 3)	.53	62.28**
Assigned Goals	.01	.44
Personal Goals	.01	.58

* $p < .05$ ** $p < .01$

Table 15D

Hierarchical Regression Analyses on MAE with Assigned Goals and Personal Goals: Task with High Component - High Coordinative Complexity

Block 1

Variable	ΔR^2	F
Ability (Block 1)	.14	8.80**
Assigned Goals	.00	.13
Personal Goals	.06	3.66

Block 2

Variable	ΔR^2	F
Performance (Block 1)	.17	11.07**
Assigned Goals	.00	.04
Personal Goals	.08	5.64*

Block 3

Variable	ΔR^2	F
Performance (Block 2)	.33	27.34**
Assigned Goals	.02	1.03
Personal Goals	.08	6.95**

Block 4

Variable	ΔR^2	F
Performance (Block 3)	.33	26.71**
Assigned Goals	.00	.04
Personal Goals	.00	.01

* $p < .05$ ** $p < .01$

with high component complexity. Personal goal was significant in block 2 ($p < .05$) and block 3 ($p < .01$) for the task with high component - low coordinative complexity, and in block 2 ($p < .05$) and block 3 ($p < .01$) for the task with high component - high coordinative complexity. The results show that subjects who set more difficult personal goals performed better after controlling for performance in previous block.

Hypothesis 7F states that for a task with high coordinative complexity, goal difficulty has a negative effect on performance. Table 15B shows that for the task with low component - high coordinative complexity, personal goal has significant effect on performance in block 1 ($p < .01$) and block 3 ($p < .01$). For the task with high component - high coordinative complexity, personal goal has significant effect in block 2 ($p < .05$) and block 3 ($p < .01$). Contrary to hypothesis 7F, for the two tasks with high coordinative complexity, subjects who set more difficult personal goals performed better after controlling for performance in previous block.

In addition to the strategy searches activities, the difference between ecological validities and utilization coefficients, D, also provides some insight into how the differences in performance come about. D for the test for each treatment group adjusted for the D for the pretest is plotted in Figure 11. A repeated measures ANOVA was run for each task group, using assigned goal condition as the first variable and blocks (1-4) as the repeated measures variable, with D for the test as the dependent variable and personal goal and D for the pretest as covariates. Both assigned goal and assigned goal x block were not significant for all task groups. Block has significant effects in the low component - low coordinative complexity and low component - high coordinative task

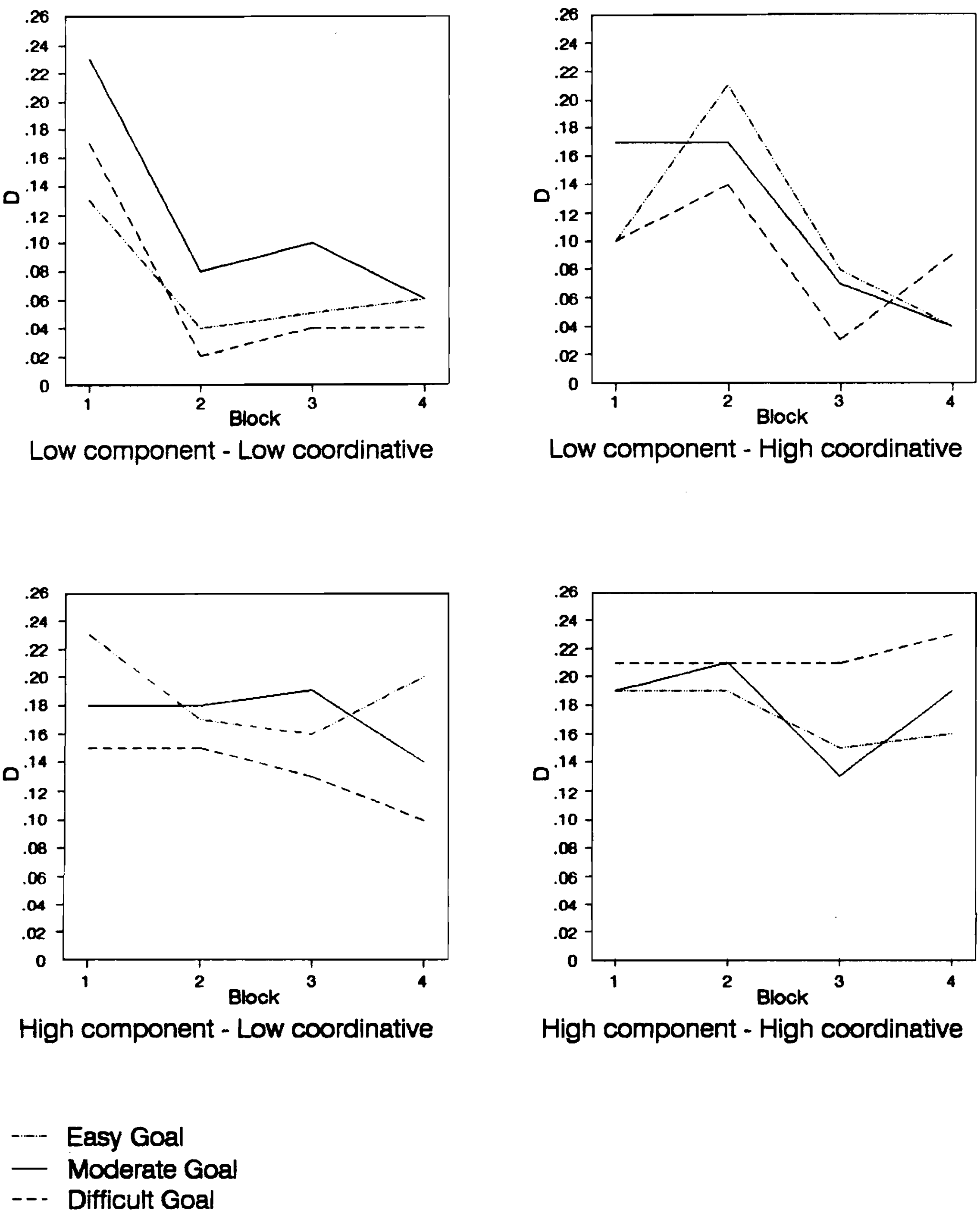


Figure 11
Adjusted D

groups. Figure 11 shows that the difference between ecological validities and utilization coefficients in these two task groups became smaller as time past.

A hierarchical regression on D was performed for each block within each task group. D for the previous block was controlled in the hierarchical regressions. For analyses for block 1, D for block 1 in the pretest was controlled. The results are presented in Table 16A to Table 16D. Assigned goal was only significant for the task with low component - low coordinative complexity in block 2 ($p < .05$). Figure 11 shows that subjects with difficult assigned goals have a significant larger improvement in D from block 1 to block 2 than subjects with easy goals.

Personal goal also has a significant effect on D in block 1 ($p < .05$) for the task with low component - low coordinative complexity. Personal goal has significant effects on D in block 1 ($p < .01$) and block 2 ($p < .05$) for the task with low component - high coordinative complexity, and in block 1 ($p < .05$) and block 2 ($p < .01$) for the task with high component - low coordinative complexity. For the task with high component - high coordinative complexity, personal goal has a significant effect on D in block 3 ($p < .05$). All significant effects of personal goal on D shows that subjects with more difficult personal goals have smaller D values (better quality of strategies).

Table 16A

Hierarchical Regression Analyses on D with Assigned Goals and Personal Goals: Task with Low Component - Low Coordinative Complexity

<u>Block 1</u>

Variable	ΔR^2	F
D (Block 1 - Pretest)	.00	.21
Assigned Goals	.03	.89
Personal Goals	.10	5.87*

<u>Block 2</u>

Variable	ΔR^2	F
D (Block 1 - Test)	.09	5.58*
Assigned Goals	.10	3.28*
Personal Goals	.03	2.14

<u>Block 3</u>

Variable	ΔR^2	F
D (Block 2 - Test)	.50	56.01**
Assigned Goals	.00	.23
Personal Goals	.00	.04

<u>Block 4</u>

Variable	ΔR^2	F
D (Block 3 - Test)	.28	21.44**
Assigned Goals	.03	1.29
Personal Goals	.03	2.27

* $p < .05$ ** $p < .01$

Table 16B

Hierarchical Regression Analyses on D with Assigned Goals and Personal Goals: Task with Low Component - High Coordinative Complexity

Variable	ΔR^2	F
Block 1		
D (Block 1 - Pretest)	.00	.16
Assigned Goals	.04	1.05
Personal Goals	.14	8.86**
Block 2		
D (Block 1 - Test)	.19	12.71**
Assigned Goals	.03	1.06
Personal Goals	.06	3.88
Block 3		
D (Block 2 - Test)	.42	39.06**
Assigned Goals	.01	.40
Personal Goals	.00	.30
Block 4		
D (Block 3 - Test)	.57	70.00**
Assigned Goals	.01	.54
Personal Goals	.02	2.84

* $p < .05$ ** $p < .01$

Table 16C

Hierarchical Regression Analyses on D with Assigned Goals and Personal Goals: Task with High Component - Low Coordinative Complexity

<u>Block 1</u>

<u>Variable</u>	ΔR^2	F
D (Block 1 - Pretest)	.00	.06*
Assigned Goals	.04	1.18
Personal Goals	.07	4.13*

<u>Block 2</u>

<u>Variable</u>	ΔR^2	F
D (Block 1 - Test)	.21	14.44**
Assigned Goals	.01	.34
Personal Goals	.10	7.54**

<u>Block 3</u>

<u>Variable</u>	ΔR^2	F
D (Block 2 - Test)	.35	30.24**
Assigned Goals	.01	.52
Personal Goals	.01	1.19

<u>Block 4</u>

<u>Variable</u>	ΔR^2	F
D (Block 3 - Test)	.44	43.60**
Assigned Goals	.03	1.69
Personal Goals	.02	1.59

* $p < .05$ ** $p < .01$

Table 16D

Hierarchical Regression Analyses on D with Assigned Goals and Personal Goals: Task with High Component - High Coordinative Complexity

Block 1

Variable	ΔR^2	F
D (Block 1 - Pretest)	.02	1.27
Assigned Goals	.00	.10
Personal Goals	.06	3.12

Block 2

Variable	ΔR^2	F
D (Block 1 - Test)	.05	2.92
Assigned Goals	.00	.01
Personal Goals	.07	3.83

Block 3

Variable	ΔR^2	F
D (Block 2 - Test)	.24	17.53**
Assigned Goals	.03	1.03
Personal Goals	.06	4.82*

Block 4

Variable	ΔR^2	F
D (Block 3 - Test)	.40	36.32**
Assigned Goals	.01	.36
Personal Goals	.00	.02

* $p < .05$ ** $p < .01$

Discussion

Similar to the findings in Kernan and Lord (1990), results of this study give substantial support to the hypothesis that people use different motivation mechanisms when performing tasks with different complexity. When the task is simple, people use simple motivation mechanisms such as specific self-efficacy to motivate their behaviors directly. On the other hand, when people perform complex tasks, they use a more rational motivation mechanism by setting personal goals and using personal goals to motivate their behaviors.

In a review of the relationship between specific self-efficacy, personal goals, and performance, Locke and Latham (1990) state that both specific self-efficacy and personal goals affect performance directly. In addition, specific self-efficacy also affect performance indirectly through personal goals. The first question this study tries to answer is whether people use both specific self-efficacy and personal goals directly to motivate their behaviors, or people use different mechanisms to motivate their behaviors when performing tasks with different complexity.

Results for hypothesis 1 through hypothesis 3 show that people use different ways to motivate their behaviors when performing different tasks. In this study, the direct effect of specific self-efficacy on performance was only significant for the task with low component - low coordinative complexity. This task group was also the only one that did not have a significant path from personal goals to performance. For those subjects who performed the tasks with high component complexity, they used personal goals directly to motivate their behaviors significantly more than used specific self-efficacy directly to motivate their behaviors. This finding replicates Klein's (1991) results for an academic task where he found that personal goals mediate the relationship between specific self-efficacy and performance.

When performing a simple task, people may not bother to use personal goals to motivate their behaviors. Using personal goals to motivate behaviors involve negative feedback loops by frequently comparing the performance with personal goals and adjusting the strategies when discrepancies happen. This involves a lot more decision making than using a simple mechanism such as specific self-efficacy to increase efforts and persistence. When performing a complex task, people may be more concerned about the probability of failure or low performance. The increased concern may cause them to use a more rational motivation mechanism to motivate their behaviors.

The second question this study tries to answer is whether people set personal goals in similar manners when performing tasks with different complexity. The finding that specific self-efficacy affects personal goals for both simple and complex tasks does not support hypothesis 4. This shows the close relationship between specific self-efficacy and personal goals regardless of the task people are performing. However, the results for hypothesis 4 must be interpreted with great caution. Although subjects who performed the task with low component - low coordinative complexity set personal goals by considering specific self-efficacy, they did not use personal goals to motivate their behaviors. They were only asked to set personal goals. Hence, a priming effect (Salancik and Pfeffer, 1977) may have been operating.

The findings that specific self-efficacy for moderate to high performance levels predicts personal goals and performance better replicate the results in the study by Locke et al. (1984). They found that specific self-efficacy measure was most valid when it pertained to performance levels that were neither within the reach of all subjects nor within the reach of none. In this study, the performance levels for specific self-efficacy scale for low performance ranged from $13 to $24. Most of the subjects who performed the task with low component - low coordinative complexity, the task with low component - high coordinative complexity, and the task with high component - high coordinative complexity made a MAE less than $13 in the pretest. Therefore, specific self-efficacy scale for low performance was not significantly related to performance valence, personal goals and performance for these three task groups. On the other hand, 70% of subjects who performed the task with high component - high coordinative complexity made a MAE of $13 or more in the pretest, the specific self-efficacy for low performance therefore becomes a valid measure for them.

Results for hypothesis 5 show that performance valence has significant effects on personal goals for the tasks with high coordinative complexity. As suggested by Mento et al. (1992), people are working toward a meta-goal for self-satisfaction. When performance valence is low, people need to perform at a higher level to produce satisfaction than they need to perform when performance valence is high. As a result, they set more difficult personal goals when performance valence is low.

The effect of performance valence on performance found in this study should be interpreted with great caution for two reasons. First, the cost of performance such as effort in this study is negligible. As stated by Mento et al. (1992), in the real world where high goals have higher costs in terms of effort and short-term pleasures foregone, many people may not choose to set higher personal goals. Second, the direct effect of performance valence on personal goals only happen when performance valence is not too low. In the current study, performance valence did not have a direct effect on personal goals for the task with low component - low coordinative complexity. This might be caused by the finding that performance valence in this task group is significantly lower than the performance valence in other task groups.

Results in this study partially support the hypothesis that task complexity affects people's perceived control over performance. Subjects in the low component - low coordinative complexity group significantly attributed their performance to external factors less than subjects in the more complex task groups. However, the internal attribution for performance was not significantly different between task groups.

Gist and Mitchell (1992) suggest that attributions about the causes of performance differ for people with high and low specific self-efficacy. For persons with low specific self-efficacy, they attribute both high and low performance to their ability. On the other hand, for persons with high specific self-efficacy, they attribute their failure to insufficient effort or bad luck while attribute their success to their ability. Regression analyses on internal attribution and external attribution with performance in the pretest and specific self-efficacy as independent variables were performed. Although the interaction effect is not significant, specific self-efficacy was found to have significant main effect on external attribution ($p < .01$) and internal attribution ($p < .01$) of performance. Subjects with high specific self-efficacy attribute their performance to internal factors significantly more than subjects with low specific self-efficacy. On the contrary, subjects with low specific self-efficacy attribute their performance more to external factors than subjects with high specific self-efficacy. Performance in the pretest was also found to have significant main effect on external attribution ($p < .05$). Subjects who performed poorly in the pretest attributed their performance to external factors more than subjects who performed well in the pretest.

The interaction effect of specific self-efficacy and external attribution for the high component - high coordinative complexity is unexpected. One possible explanation is that instead of blocking the path from specific self-efficacy to performance, high external attribution may block the path from personal goals to performance. People who attribute their performance more to external factors may think that setting personal goals will not be helpful since performance is not under their control. Therefore, they use a simple motivation mechanism such as specific self-efficacy to motivate their behaviors instead of a more rational motivation mechanism by setting personal goals.

The meta-analysis by Wood et al. (1987) concluded that goal effect is stronger for simple tasks than for complex tasks. However, they did not distinguish between the effects of assigned goals and personal goals on performance. The last section of this study tries to separate the moderating effect of task complexity on the assigned goal effects from that on the personal goal effects.

Results for hypothesis 7 suggest how assigned goals and personal goals affect performance for tasks with different complexity. First, assigned goals only have significant effects on the time expended and performance in block 3 for the task with low component - low coordinative complexity. Subjects with more difficult assigned goals spent significantly more time on the task and they performed significantly better than subjects with easy assigned goals in block 3. However, assigned goals do not have significant effect on performance in other blocks, effort, persistence, quality of strategy used, and strategy searches activities. These nonsignificant results may be explained by two reasons. First, even for the task with low component - low coordinative complexity in this study, it might be considered as a difficult task by the subjects. Second, the goals were assigned to subjects through computers. This method of assigning goals excludes the persuasion effect of the experimenter occurs in other goal setting studies where the goals are assigned by the experimenter verbally. Therefore, acceptance of the assigned goals in this study is expected to be lower than that in other goal setting studies.

Although assigned goals do not have significant effects on performance for all complex task groups in this study, personal goals have significant effect on performance in many ways. First, subjects with difficult personal goals spent significantly longer time in making the predictions and were more persistent on the task. Second, subjects who performed the task with low component - high coordinative complexity and the task with high component - low coordinative complexity and set difficult personal goals found out a better strategy (smaller D) in block 1 and block 2, which resulted in fewer strategy searches activities in block 3. Both the better strategy and fewer strategy searches activities contributed to a better performance. For subjects who performed the task with high component - high coordinative complexity, personal goals only have a significant effect on the quality of strategy in block 3, which also resulted in less strategy searches activities in block 3. Therefore, the performance was significantly better for subjects with difficult personal goals in block 3.

The delay of personal goal effects on performance for the task with high component - high coordinative complexity supports the hypothesis that there is a time lag in the effects of goals on performance for complex tasks (Locke and Latham, 1990: 315). For the low component - high coordinative and high component - low coordinative tasks, personal goals have significant effects on performance in block 1. This immediate goal effect may be due to the limited number of possible strategies available in these two task groups and the subjects found out the better strategies in the early trials. However, there are a lot more possible strategies for the task with high component - high coordinative complexity. As a result, subjects performing this task needed longer time to find out a better strategy and efforts were not paid off until the subjects have found a better strategy.

The finding that personal goals effects are stronger than assigned goals effects for the complex tasks is worthy of further investigation. In a study on the effects of goal origin on goal setting and performance, Hollenbeck and Brief (1987) experimentally control the difficulty for personal goals and assigned goals. They found a strong goal difficulty - performance relationship for the personal goal group. On the other hand, the goal difficulty - performance relationship for the assigned goal group was only evidenced among subjects with high generalized self-esteem. One explanation for the stronger personal goal effect is that a choice in the goal increase goal commitment through an increase perceived control over the actions (Erez & Kanfer, 1983).

However, after reviewing the results of a series of laboratory experiments, Locke and Latham (1990: 168) conclude that "it is not the method by which a goal is set that is important, but rather it is the difficulty level of the goal that affects performance positively." To test if the subjects in this study set more difficult personal goals than their assigned goals, a paired t-test was conducted within each task group. The results show that subjects set significantly more difficult personal goals than their assigned goals for all task groups ($p < .01$ for all task groups).

Comparison of results between the moderating effect of component complexity and the moderating effect of coordinative complexity on the cognitive process model of goal setting are not conclusive. The moderating effects of coordinative complexity on the paths from specific self-efficacy and performance valence to personal goals are stronger than those of component complexity. On the other hand, the hypothesis that people use personal goals to motivate their behaviors directly more than use specific self-efficacy to motivate their behaviors directly is only significant for the tasks with high component complexity. For the first two hypotheses on the effect of specific self-efficacy and personal goals on performance, the results suggest that only the low component - low coordinative task is different from the other three more complex task groups. The results for hypothesis 7 also show that the goal effects for the low component - low coordinative task are different from those for other tasks. These inconclusive results may be due to the fact that the treatment effects of component complexity and coordinative complexity on total task complexity were not controlled in this study. Although both component complexity and coordinative complexity affect total task complexity, the exact form of the relationship between different types of complexity and total task complexity cannot be specified yet (Wood, 1986). A comparison of the moderating effects of component complexity and coordinative complexity on the motivation mechanism can only be accomplished when the relationship between different types of complexity and total task complexity is identified.

Although not hypothesized in this study, there are some additional findings which need further explanations. The first finding is the strong effect of ability on performance. In addition to the explanation proposed in this study that effort and ability together affect performance, Earley and Lituchy (1991) propose that there are limitations on an individual's self-assessments. When an individual overestimates or underestimates his or her ability when evaluating specific self-efficacy or setting personal goals, the relationship between ability and performance will be strengthened.

The way which assigned goals affect personal goals also needs further explanations. For the low component - low coordinative complexity, subjects used assigned goals directly to set their personal goals. On the other hand, for the more complex tasks, subjects used assigned goals to determine their performance valence, and then set their personal goals by referring to the performance valence. This finding suggests that people use a simple mechanism to set personal goals when performing simple tasks (if they have to set personal goals). When people performing a complex task, they use a more rational mechanism by considering the performance valence and specific self-efficacy to set their personal goals.

One unexpected finding for this study is the suppression effect of performance valence on the effect of personal goals on performance for the task with high component - high coordinative complexity. Suppression happens when a variable that is not correlated with the criterion but is correlated with the predictor and thus adds irrelevant variance to the predictor and reduces its relationship with the criterion (Cohen and Cohen, 1983: 95). For the task with high component - high coordinative complexity, performance valence is not correlated with performance but is significantly correlated with personal goals ($p < .05$). Therefore performance valence reduces the relationship between personal goals and performance. The results of hierarchical regression analyses presented in Table 17 demonstrate this suppression effect. When performance valence is controlled in the second regression analysis, the effect of personal goals on performance is much larger than that in the first regression analysis where performance valence is not controlled. However, since the suppression effect is not found in other task groups, adjustment is not made for the suppression effect that is found for the task with high component - high coordinative complexity only.

Table 17

Suppression Effect of Performance Valence on the Effect of Personal Goals on Performance

Regression 1

Step	Variable	ΔR^2	F
1	Ability	.36	31.23**
2	Assigned Goals	.00	.06
3	Personal Goals	.04	3.76

Regression 2

Step	Variable	ΔR^2	F
1	Ability	.36	31.23**
2	Assigned Goals	.00	.06
3	Performance Valence	.03	2.42
4	Personal Goals	.09	8.44**

** $p < .01$

Conclusion

The objective of this study is to examine the moderating effect of task complexity on the cognitive processes of goal setting. Four general conclusions from this study seem especially important. First, people use different motivation mechanisms when performing tasks with different complexity. In addition to the argument that task complexity moderates goal effects through the amount of strategies available (Earley et al. 1989), task complexity was found to moderate which mechanism people use to motivate their behaviors. This finding supports the contingency approach to work motivation (Kernan and Lord, 1990; Mayes, 1978; Pinder, 1984; Staw, 1977) and future studies on motivation should work toward this direction.

Second, when performing a simple task, people use a simple mechanism to motivate their behaviors. People use specific self-efficacy directly to motivate their behaviors. Even when they are asked to set personal goals, they are not using personal goals to motivate their behaviors.

Third, people use a more rational motivation mechanism when performing complex tasks. The results in this study replicate findings of previous studies on the mediating role of personal goals on the effect of specific self-efficacy on performance (Earley & Lituchy, 1991; Klein, 1991). People set personal goals by considering specific self-efficacy and performance valence and use personal goals to motivate their behaviors. This finding is consistent with many studies that propose a central role of cognitive processing in work motivation (e.g., Earley & Shalley, 1991; Kanfer & Ackerman, 1989;

Locke & Latham, 1990; Wood & Locke, 1990).

Fourth, the effects of personal goals on performance are stronger for complex tasks than for simple tasks. After the meta-analysis by Wood et al. (1987), goal effects are thought to be stronger for simple tasks than for complex tasks (Locke and Latham, 1990). Since assigned goals effects and personal goals effects were not distinguished in their study, it is possible that their conclusion is valid for assigned goals only. This suggests that different goal setting strategies should be used for different tasks.

The above conclusions provide some practical implications for work motivation. First, when employees are performing complex tasks, help them to set more difficult personal goals. This can be achieved by provide training in goal setting. Second, when employees are performing simple tasks, help them to strengthen their specific self-efficacy. This can be achieved through mastery experiences, modeling, social persuasion, and psychological arousal (Wood & Bandura, 1989). In a recent theoretical analysis of the determinants and malleability of specific self-efficacy, Gist and Mitchell (1992: 203) propose three strategies that can be used for changing specific self-efficacy. First, provide information that increases understanding of the task attributes, complexity, task environment, and shows how these factors can be controlled. Second, provide training that directly improves the individual's abilities in performing the task. Third, provide information that increases understanding of behavioral, analytical, or psychological performance strategies or effort expenditure required for task performance. In addition, the significant positive direct effects of general self-efficacy on specific self-efficacy for the two tasks with low component complexity suggest that general self-efficacy training can increase specific self-efficacy at least for some tasks.

Lastly, this study demonstrates how to use the multi-sample analysis of LISREL to test moderating effects on path models. Testing the moderating effect of task complexity on the motivation mechanism requires to examine the motivation mechanism for multiple tasks in a study. Significant testing for the difference between motivation mechanisms for different tasks is possible when using the multi-sample analysis. Previous studies on goal setting either test the path model for cognitive processes or test for moderators for the goal effects. The multi-sample analysis provides a mean to integrate these two types of goal setting studies. The use of multi-sample analysis for other moderators on the goal setting process or in other areas should be explored.

Limitations

The first limitation for this study is that there is an even distribution of subjects for the three assigned goals. Although the even distribution facilitates analyses with ANOVA, it violates the normality assumption for LISREL. This problem can be handled in two ways. The first way is to calculate polyserial correlations instead of Pearson correlations and analyze the matrix of polyserial correlations with the WLS method with a correct weight matrix. The WLS method is not employed in this study for two reasons. First, this method is only appropriate if we intend to analyze a correlation matrix and not a covariance matrix (Hayduk, 1987: 328). However, covariance matrices are analyzed instead of correlation matrices for the multi-sample analysis. The second reason for not using this method is that it requires a large sample size (at least 200) to estimate the asymptotic covariance matrix for each subgroup. Results produced in small samples may not be reliable.

The second way to handle the problem of non-normal distribution of assigned goals is to analyze the data with a multi-sample analysis by using assigned goals as the grouping variable. This method creates twelve groups for the multi-sample analysis (3 assigned goal levels x 2 levels of component complexity x 2 levels of coordinative complexity) instead of four in this study. There are three problems for this method. First, the large number of groups makes interpretation of the differences between groups difficult. Second, the increase in number of groups significantly increases the number of subjects required. Third, removing the assigned goal from the path model prohibits direct comparisons of models in this study with models identified in previous studies.

The second limitation for this study is that no extrinsic rewards are awarded contingent on performance. For the two tasks with high coordinative complexity in this study, subjects perceived higher performance valence set lower personal goals. On the other hand, Mento et al. (1992) state that people set higher personal goals when extrinsic rewards are contingent on performance. If both intrinsic rewards and extrinsic rewards have positive effects on performance valence (anticipated satisfaction), the effect of performance valence on personal goals may be very different when extrinsic rewards contingent on performance are involved.

The third limitation for this study is the possibility of priming effect. Subjects were asked to evaluate their specific self-efficacy and performance valence, and to set personal goals before they work for the test. Therefore, subjects may appear to be more rational than they use to be. Thus, this study may demonstrate how rational the subjects can be, instead of how they use to be.

Future Research

While this study answers some research questions on goal setting, it also generates some research questions that are worthwhile for further studies. The first research question is whether the conclusion in the meta-analysis by Mento et al. (1987) that goal effects are stronger for simple tasks is also applicable to personal goals. During the last few years, many goal setting studies measure both assigned goals and personal goals. There may be enough studies for a meta-analysis to test the moderating effect of task complexity on the personal goals effect.

The second research question raised by this study is what is the role of performance valence in the cognitive process of goal setting. Unlike specific self-efficacy, there is little theoretical discussion on the concept of performance valence. Unless more theoretical works are done on the concept of performance valence, we will not know the role of performance valence in the motivation process. The effect of assigned goals on performance valence presented in Figure 3 may be a good starting point for studies in this direction. In addition, since extrinsic rewards are involved in all work environment, the effect of extrinsic rewards on performance valence should be explored.

Another research question is to examine how the overestimate or underestimate of specific self-efficacy may affect subsequent performance. This study shows that there are limitations for people's self-assessment on their ability and their specific self-efficacy perception may either be overestimated or underestimated. Studies in this direction require to measure specific self-efficacy and performance in multiple times and examine the changes of perceptions and performance.

Finally, experimental control of goal origins is required to control the priming effects that may be operating in this study. Asking subjects to set personal goals before working for the task may underscore the direct effect of assigned goals because subjects are primed to use personal goals to motivate their behaviors. In addition, it is necessary to examine whether the rational behaviors of the subjects are experimental artifact by asking them to think about their specific self-efficacy and performance valence before working for the tasks.

References

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84: 191-215.

Bandura, A. (1982). Self-efficacy mechanisms in human agency. American Psychologist, 37: 122-147.

Bandura, A. (1986). Social foundations of thought and action: A social-cognitive theory. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1988). Self-regulation of motivation and action through goal systems. In V. Hamilton, G. H. Bower, & N H. Frijda (Eds.), Cognitive perspectives on emotion and motivation (pp. 37-61). Dordrecht, Netherlands: Kluwer Academic Publishers.

Bandura, A., & Cervone, D. (1983). Self-evaluative and self-efficacy mechanisms governing the motivational effects of goal systems. Journal of Personality and Social Psychology, 45: 1017-1028.

Boyatzis, R. E. (1982). The competent manager. New York: John Wiley & Sons.

Brunswik, E. (1956). Perception and the representative design of psychological experiments. Berkeley: Univer. California Press.

Bryant, F. B. (1989). A four-factor model of perceived control: avoiding, coping, obtaining, and savoring. Journal of Personality, 57: 773-797.

Campbell, D. J. (1984). The effect of goal-contingent payment on the performance of a complex task. Personnel Psychology, 37: 23-40.

Campbell, D. J. (1988). Task complexity and strategy development: A review and conceptual analysis. Academy of Management Review, 13: 40-52.

Chesney, A. & Locke, E. (1991). Relationships among goal difficulty, business strategies, and performance on a complex management simulation task. Academy of Management Journal, 34: 400-424.

Chidester, T. R., & Grigsby, W. C. (1984). A meta-analysis of the goal setting performance literature. Academy of Management Proceedings: 202-206.

Cohen, J., & Cohen, P. (1983). Applied multiple regression/correlation analysis for the behavioral sciences (2nd Ed.). Hillsdale, NJ: Lawrence Erlbaum.

Crocker, J., & Major, B. (1989). Social stigma and self-esteem: The self-protective properties of stigma. Psychological Bulletin, 96: 608.

Dachler, H. P., & Mobley, W. H. (1973). Construct validation of an instrumentality-expectancy-task-goal model of work motivation: Some theoretical boundary conditions. Journal of Applied Psychology Monograph, 58: 397-418.

Deci, E. L. (1975). Intrinsic Motivation. New York: Plenum Press.

Deci, E. L. (1980). The psychology of self-determination. Lexington, Mass: D. C. Health, Lexington Books.

Deci, E. L., & Ryan, R. M. (1980). The empirical exploration of intrinsic motivational processes. In L. Berkowitz (Ed.), Advances in experimental social psychology, 13: 39-80. New York: Academic Press.

Earley, P. C., Connolly, T., & Ekegren, G. (1989). Goals, strategy development, and task performance: Some limits on the efficacy of goal setting. Journal of Applied Psychology, 7: 24-33.

Earley, P. C., Hanson, L. A., & Lee, C. (1986). Relation of task complexity, task strategies, individual differences and goals to performance. Academy of Management Best Papers Proceedings: 184-188.

Earley, P., Lee, C., & Hanson, L. (1990a). Joint moderating effects of job experience and task component complexity: Relations among goal setting, task strategies, and performance. Journal of Organizational Behavior, 11: 3-15.

Earley, P. & Lituchy, T. (1991). Delineating goal and efficacy effects: A test of three models. Journal of Applied Psychology, 76: 81-98.

Earley, P., Northcraft, G., Lee, C., & Lituchy, T. (1990b). Impact of process and outcome feedback on the relation of goal setting to task performance. Academy of Management Journal, 33: 87-105.

Earley, P., & Perry, B. (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.

Earley, P. C., & Shalley, C. E. (1991). New perspectives on goals and performance: Merging motivation and cognition. In G. R. Ferris & K. M. Rowland (Eds.) Research in Personnel and Human Resources Management.

Earley, P. C., Wojnaroski, P., & Prest, W. (1987). Task planning and energy expended: An exploration of how goals influence performance. Journal of Applied Psychology, 72: 107-114.

Eden, D. (1988). Pygmalion, goal setting, and expectancy: Compatible ways to boost productivity. Academy of Management Review, 13: 639-652.

Fisher, C. D. (1978). The effects of personal control, competence, and extrinsic reward systems on intrinsic motivation. Organizational Behavior and Human Performance, 21: 273-28.

Garland, H. (1982). Goal levels and task performance: A compelling replication of some compelling results. Journal of Applied Psychology, 67: 245-248.

Garland, H. (1983). Influence of ability, assigned goals, and normative information on personal goals and performance: A challenge to the goal attainability assumption. Journal of Applied Psychology, 68: 20-30.

Garland, H. (1984). Relation of effort-performance expectancy to performance in goal-setting experiments. Journal of Applied Psychology, 69: 79-84.

Garland, H. (1985). A cognitive mediation theory of task goals and human performance. Motivation and Emotion, 9: 345-367.

Garland, H., & Adkinson, J. H. (1987). Standards, persuasion, and performance: A test of cognitive mediation theory. Group and Organization Studies, 12: 208-220.

Garland, H., Weinberg, R., Bruya, L., & Jackson, A. (1988). Self-efficacy and endurance performance: A longitudinal field test of cognitive mediation theory. Applied Psychology: An International Review, 37: 381-394.

Gellatly, I. R., & Meyer, J. P. (1986). Determinants of goal choice and task performance: Examination of a cognitive mediation model. Paper presented at the annual meeting of the Canadian Psychological Association, Toronto, Canada.

Gist, M. E., & Mitchell, T. R. (1992). Self-efficacy: A theoretical analysis of its determinants and malleability. Academy of Management Review, 17: 183-211.

Griffin D., & Tversky, A. (1992). The weighing of evidence and the determinants of confidence. Cognitive Psychology, 24: 411-435.

Hall, D. T., & Foster, L. W. (1977). A psychological success cycle and goal setting: Goals, performance, and attitudes. Academy of Management Journal, 20: 282-290.

Hayduk, L. A. (1987). Structural equation modeling with LISREL: Essentials and Advances. Baltimore, MD: Johns Hopkins.

Huber, V. (1985). Effects of task difficulty, goal setting, and strategy on performance of a heuristic task. Journal of Applied Psychology, 70: 492-504.

Hunt, J. (1965). Intrinsic motivation and its role in psychological development. In D. Levine (Ed.), Nebraska Symposium on Motivation, 13: 189-282. Lincoln: University of Nebraska Press.

Hunter, J. E., & Schmidt, F L. (1983). Quantifying the effects of psychological interventions on employee job performance and work force productivity. American Psychologist, 38: 473-478.

Jöreskog, K., & Sörbom, D. (1989). LISREL 7: A guide to the program and applications. Illinois: SPSS Inc.

Hursch, C. J., Hammond, K. R., & Hursch, J. I. (1964). Some methodological considerations in multiple-cue probability studies. Psychological Review, 71: 42-60.

Kanfer, R., & Ackerman, P. L. (1989). Motivation and cognitive abilities: An integrative/aptitude-treatment interaction approach to skill acquisition [Monograph]. Journal of Applied Psychology, 74: 657-690.

Kernan, M. C., & Lord, R. G. (1990). Effects of valence, expectancies, and goal-performance discrepancies in single and multiple goal environments. Journal of Applied Psychology, 75: 194-203.

Klein, H. (1991). Further evidence on the relationship between goal setting and expectancy theories. Organizational Behavior and Human Decision Processes, 49: 230-257.

Koriat, A., Lichtenstein, S., & Fischhoff, B. (1980). Reasons for confidence. Journal of Experimental Psychology: Human Learning and Memory, 6: 107-118.

Locke, E. A. (1968). Toward a theory of task motivation and incentives. Organizational Behavior and Human Performance, 3: 157-189.

Locke, E. A., Frederick, E., Buckner, E., & Bobko, P. (1984a). Effect of previously assigned goals on self-set goals and performance. Journal of Applied Psychology, 69: 694-699.

Locke, E. A., Frederick, E., Lee, C., & Bobko, P. (1984b). Effect of self-efficacy, goals, and task strategies on task performance. Journal of Applied Psychology, 69: 241-251.

Locke, E. A., & Latham, G. (1990). A theory of goal setting and task performance. New York: Prentice-Hall.

Locke, E. A., & Shaw, K. N. (1984). Atkinson's inverse-U curve and the missing cognitive variables. Psychological Reports, 55: 403-412.

Matsui, T., Kakuyama, T., & Onglatco, M. L. (1987). Effects of goals and feedback on performance in groups. Journal of Applied Psychology, 72: 407-415.

Matsui, T., Okada, A., & Mizuguchi, R. (1981). Expectancy theory prediction of the goal theory postulate: The harder the goals, the higher the performance. Journal of Applied Psychology, 66: 54-58.

Mayes, B. T. (1978). Some boundary conditions in the application of motivation models. Academy of Management Review, 3: 51-58.

Mento, A. J., Cartledge, N. D., & Locke, E. A. (1980). Maryland vs. Michigan vs. Minnesota: Another look at the relationship of expectancy and goal difficulty to task performance. Organizational Behavior and Human Performance, 25: 419-440.

Mento, A. J., Locke, E. A., & Klein, H. J. (1992). Relationship of goal level to valence and instrumentality. Journal of Applied Psychology, 77: 395-405.

Mento, A. J., Steel, R. P., & Karren, R. J. (1987). A meta-analytic study of the effects of goal setting on task performance: 1966-1984. Organizational Behavior and Human Decision Processes, 39: 52-83.

Meyer, J., & Gellatly, I. (1988). Perceived performance norm as a mediator in the effect of assigned goal on personal goal and task performance. Journal of Applied Psychology, 73: 410-420.

Meyer, J., Schacht-Cole, B., & Gellatly, I. (1988). An examination of the cognitive mechanisms by which assigned goals affect task performance and reactions to performance. Journal of Applied Social Psychology, 18: 390-408.

Mitchell, T. R. (1974). Expectancy models of job satisfaction, occupational preference and effort: A theoretical, methodological, and empirical appraisal. Psychological Bulletin, 30: 243-281.

Mitchell, T. R. (1982). Expectancy-value models in organizational psychology. In Feather, N. T. (Ed.) Expectations and actions: Expectancy-value models in psychology. Hillsdale, New Jersey: Lawrence Erlbaum.

Naylor, J. C., & Ilgen, D. R. (1984). Goal setting: A theoretical analysis of a motivational technology. In B. M. Staw & L. L. Cummings (Eds.), Research in Organizational Behavior, 6: 95-140. Greenwich, CT: JAI Press.

Nunnally, J. C. (1967). Psychometric theory. New York: McGraw-Hill.

Pinder, C. C. (1984). Work motivation: Theory, issues, and applications. Glenview, IL: Scott, Foresman and Co.

Riedel, J. A., Nebeker, D. M., & Cooper, B. L. (1988). The influence of monetary incentives on goal choice, goal commitment, and task performance. Organizational Behavior and Human Decision Processes, 42: 155-180.

Salancik, G. R., & Pfeffer, J. (1977). An examination of need-satisfaction models of job attitudes. Administrative Science Quarterly, 22: 427-456.

Salancik, G. R., & Pfeffer, J. (1978). A social information processing approach to job attitudes and task design. Administrative Science Quarterly, 23: 224-253.

Shaw, K. N. (1984). A laboratory investigation of the relationships among goals, strategies, and task performance. Unpublished doctoral dissertation, University of Maryland.

Smith, K., Locke, E., & Barry, D. (1990). Goal setting, planning and organizational performance: An experimental simulation. Organizational Behavior and Human Performance, 34: 402-418.

Staw, B.M. (1977). Motivation in organizations: Toward synthesis and redirection. In B. M. Staw and G. R. Salancik (Eds.) New directions in organizational behavior. Chicago: St. Clair Press.

Taylor, J. (1987). Predicting athletic performance with self-confidence and sematic and cognitive anxiety as a function of motor and psychological requirements in six sports. Journal of Personality, 55: 139-153.

Taylor, M. S., Locke, E. A., Lee, C., & Gist, M. E. (1984). Type A behavior and faculty research productivity: What are the mechanisms? Organizational Behavior and Human Performance, 34: 402-418.

Tubbs, M. (1986). Goal setting: A meta-analytic examination of the empirical evidence. Journal of Applied Psychology, 71: 474-483.

Tubbs, M., & Ekeberg, S. (1991). The role of intentions in work motivation: Implications for goal-setting theory and research. Academy of Management Review, 16: 180-199.

Vroom, V. H. (1964). Work and Motivation. New York: John Wiley.

White, R. W. (1959). Motivation reconsidered: The concept of competence. Psychological Review, 66: 297-333.

Wood, R. E. (1986). Task complexity: Definition of the construct. Organizational Behavior and Human Decision Processes, 37: 60-82.

Wood, R. E., & Bandura, A. (1989). Social cognitive theory of organizational management. Academy of Management Review, 14: 361-384.

Wood, R. E., & Locke, E. A. (1987). The relation of self-efficacy and grade goals to academic performance. Educational and Psychological Measurement, 47: 1013-1024.

Wood, R., & Locke, E. (1990). Goal setting and strategy effects on complex tasks. In B. M. Staw & L. L. Cummings (Eds.), Research in Organizational Behavior, 12: 73-109. Greenwich, CT: JAI Press.

Wood, R., Mento, A., & Locke, E. (1987). Task complexity as a moderator of goal effects: A meta-analysis. Journal of Applied Psychology, 72: 416-425.

Yukl, G. A., & Latham, G. P. (1978). Interrelationships among employee participation, individual differences, goal difficulty, and performance. Personnel Psychology, 31: 305-323.

Appendix A

Pre-experimental Questionnaire

For statements 1 - 17, please select a number that best represent yourself using the scale given below.

1	2	3	4	5	6	7	8	9
Absolutely Disagree		Disagree		Neither Agree Nor Disagree		Agree		Absolutely Agree

1. When I make plans, I am certain I can make them work.

2. One of my problems is that I cannot get down to work when I should.

3. If I can't do a job the first time, I keep trying until I can.

4. When I set important goals for myself, I rarely achieve them.

5. I give up on things before completing them.

6. I avoid facing difficulties.

7. If something looks too complicated, I will not even bother to try it.

8. When I have something unpleasant to do, I stick to it until I finish it.

9. When I decided to do something, I go right to work on it.

10. When trying to learn something new, I soon give up if I am not initially successful.

11. When unexpected problems occur, I don't handle them well.

12. I avoid trying to learn new things when they look too difficult for me.

13. Failure just makes me try harder.

14. I feel insecure about my ability to do things.

15. I am a self-reliant person.

16. I give up easily.

17. I do not seem capable of dealing with most problems that come up in life.

Appendix B

Experimental Questionnaire

Statements 18 - 22 are about your perceptions on the stock value prediction exercise that you have worked on. For each statement, select a number from 1 to 9 that best matches your feelings using the following scale.

1	2	3	4	5	6	7	8	9
Absolutely Disagree		Disagree		Neither Agree Nor Disagree		Agree		Absolutely Agree

18. The task that you have worked on was complex.

19. It seemed that you had very little control over how many accurate predictions you can make.

20. The amount of effort that you put in, i.e., how hard you tried, really determined how well you performed on the predictions.

21. Task difficulty plays the major role in determining my performance on the predictions.

22. My performance has little or nothing to do with luck.

23. Your assigned goal for the second company is to make predictions within $_____ of the actual stock prices. (Your assigned goal is on the computer)

1.	$6	6.	$13
2.	$8	7.	$14
3.	$10	8.	$15
4.	$11	9.	$16
5.	$12	10.	$17

Statements 24-25 are about the goal that you have been assigned for the next 60 trials. For each question, select the number that best matches your feelings using the following scale.

1	2	3	4	5	6	7	8	9
Absolutely Disagree		Disagree		Neither Agree Nor Disagree		Agree		Absolutely Agree

24. The goal assigned to you for prediction of stock values for the next 60 trials is easy.

25. The goal that you are assigned is challenging.

Please indicate how satisfied you would feel about making the following predictions in the next 60 trials. For each possible performance, select a number from 1 to 9 that best matches your feelings using the following scale.

1	2	3	4	5	6	7	8	9
Extremely Dissatisfy		Dissatisfy		Neither Satisfy Nor Dissatisfy		Satisfy		Extremely Satisfy

26. How satisfied you would feel if you have made predictions $21 to $24 differ from the actual stock prices?
27. How satisfied you would feel if you have made predictions $17 to $20 differ from the actual stock prices?
28. How satisfied you would feel if you have made predictions $13 to $16 differ from the actual stock prices?
29. How satisfied you would feel if you have made predictions $9 to $12 differ from the actual stock prices?
30. How satisfied you would feel if you have made predictions $5 to $8 differ from the actual stock prices?
31. How satisfied you would feel if you have made predictions $0 to $4 differ from the actual stock prices?

Please indicate below what you think your chances (probabilities) are of making each of those number of accurate predictions in the next 60 trials. For each possible score, select a number from 1 to 9 which best describes what you think the probability is of your making that number of accurate predictions using the following scale.

1	2	3	4	5	6	7	8	9
No chance at all		A slight chance		A 50/50 chance		A good chance		Completely certain

32. The chances that you will make predictions $21 to $24 differ from the actual stock prices.

33. The chances that you will make predictions $17 to $20 differ from the actual stock prices.

34. The chances that you will make predictions $13 to $16 differ from the actual stock prices.

35. The chances that you will make predictions $9 to $12 differ from the actual stock prices.

36. The chances that you will make predictions $5 to $8 differ from the actual stock prices.

37. The chances that you will make predictions $0 to $4 differ from the actual stock prices.

Please indicate the importance of the factors in 38 - 41 in determining your performance in this stock prices prediction exercise using the scale given below:

```
1          2          3          4          5          6          7          8          9
|----------|----------|----------|----------|----------|----------|----------|----------|
Unimportant                                                                     Extremely
                                                                                Important
```

38. Luck
39. Task difficulty
40. Effort
41. Ability

How useful was the performance of each of the divisions in helping you make your predictions for the first company?

```
1          2          3          4          5          6          7          8          9
|----------|----------|----------|----------|----------|----------|----------|----------|
No use           Hardly           Somewhat           Useful                  Very
at all           any use          useful                                     Useful
```

42. Division A
43. Division B
44. Division C (Skip Q.44 if your company has two divisions only)

45. Now please set a personal goal (how far your predictions are from the actual stock prices in dollar term) that you will try to attain in the next 60 trials. It may or may not be the same as the one you were given by the experimenter.

    Your personal goal for the next 60 trials is to make predictions within $_____ of the actual stock prices.

1.	$3 - $4	6.	$13 - $14
2.	$5 - $6	7.	$15 - $16
3.	$7 - $8	8.	$17 - $18
4.	$9 - $10	9.	$19 - $20
5.	$11 - $12	10.	$21 - $22

(Can you remember your personal goal?)

Have you answered all questions ? THANK YOU!

Note: The password is 123

Appendix C

Post-experimental Questionnaire

46. Your personal goal for the last 60 trials (the second company) was to make predictions within $_____ of the actual stock prices.

1.	$3 - $4	6.	$13 - $14
2.	$5 - $6	7.	$15 - $16
3.	$7 - $8	8.	$17 - $18
4.	$9 - $10	9.	$19 - $20
5.	$11 - $12	10.	$21 - $22

Questions 47-54 are about your perceptions on working on the task. Please select the number that best represents yourself using the scale given below.

1	2	3	4	5	6	7	8	9
Absolutely Disagree		Disagree		Neither Agree Nor Disagree		Agree		Absolutely Agree

47. I find the task boring

48. The task requires a lot of information processing.

49. I find the experiment too long.

50. I am exhausted at the end of the experiment.

51. I find the task interesting.

52. I find the task difficult.

53. I find the task challenging.

54. There is a strong relationship between the stock values and performance of the divisions.

55. I worked at the last 60 trials (the second company) without getting tired for _____.

1	2	3	4	5	6	7	8	9
Only a very short time								A very long time

56. How much effort did you expend to work on the last 60 trials (the second company)?

1	2	3	4	5	6	7	8	9
Little or no effort								Almost all the effort

57. While working on the last 60 trials (the second company), I found myself working _____.

1	2	3	4	5	6	7	8	9
Not at all hard								Extremely hard

58. After you familiarized yourself with how to work on the task (say, after the first 5 predictions), how often did you try new strategies for methods for making stock predictions?"

1. I tried one or two methods then stayed with a single one.
2. I tried several new ways to see which one was best.
3. I kept trying new ways of making predictions throughout the experiment and finally settled on one.
4. I tried new ways to make predictions throughout the experiment and would switch back and forth between several effective methods.
5. I tried new ways to make predictions for every trial.

How useful was the performance of each of the divisions in helping you make your predictions for the second company?

1	2	3	4	5	6	7	8	9
No use at all		Hardly any use		Somewhat useful		Useful		Very Useful

59. Division A
60. Division B
61. Division C (Skip Q.61 if your company has two divisions only)

For statements 62 - 78, please select a number that best represent yourself using the scale given below.

1	2	3	4	5	6	7	8	9
Absolutely Disagree		Disagree		Neither Agree Nor Disagree		Agree		Absolutely Agree

62. When I make plans, I am certain I can make them work.

63. One of my problems is that I cannot get down to work when I should.

64. If I can't do a job the first time, I keep trying until I can.

65. When I set important goals for myself, I rarely achieve them.

66. I give up on things before completing them.

67. I avoid facing difficulties.

68. If something looks too complicated, I will not even bother to try it.

69. When I have something unpleasant to do, I stick to it until I finish it.

70. When I decided to do something, I go right to work on it.

71. When trying to learn something new, I soon give up if I am not initially successful.

72. When unexpected problems occur, I don't handle them well.

73. I avoid trying to learn new things when they look too difficult for me.

74. Failure just makes me try harder.

75. I feel insecure about my ability to do things.

76. I am a self-reliant person.

77. I give up easily.

78. I do not seem capable of dealing with most problems that come up in life.

Please answer the following questions on your demographic data:

79. Gender
1. Male
2. Female

80. College
1. Agriculture and Life Sciences
2. Architecture & Urban Studies
3. Arts and Sciences
4. Business
5. Education
6. Engineering
7. Human Resources

81. Year
1. Freshman
2. Sophomore
3. Junior
4. Senior

82. Age
1. Younger than 18
2. 18
3. 19
4. 20
5. 21
6. 22
7. 23
8. 24
9. 25
10. Older than 25

83. QCA
1. Lower than 1.4
2. 1.4 - 1.6
3. 1.7 - 1.9
4. 2.0 - 2.2
5. 2.3 - 2.5
6. 2.6 - 2.8
7. 2.9 - 3.1
8. 3.2 - 3.4
9. 3.5 - 3.7
10. 3.8 - 4.0

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EDUCATION

1993	Ph.D., Department of Management, Virginia Polytechnic Institute and State University Major: Organizational Behavior Minor: Organizational Psychology Dissertation: How goals affect performance: Task complexity as a moderator on the cognitive processes of goal setting (Advisor: Professor T. W. Bonham)
1987	Bachelor of Business Administration, Chinese University of Hong Kong Major: General Business Management Minor: Marketing

SPECIAL AWARDS

Oct 1986	Champion, The Best Business Administration Paper of the Year 1986, organized by the Hong Kong Federation of Business Students.
July 1986	Bank of America Research Grant for the research "Problems of Quality Circle Activities in Hong Kong."

EXPERIENCE - TEACHING/RESEARCH:

Virginia Polytechnic Institute and State University

Instructor:

Summer, 1993	Undergraduate organizational behavior
Fall, 1992	Undergraduate organizational behavior

Research Assistant:

1993	Assisted Professor William Lehrman in studies in insurance industries in Japan and United States.
1991 - 1993	Assisted Professor James Lang in studies in entrepreneurship
1990 - 1992	Assisted Professor Kent Murrmann in studies in labor relations, developed computer programs to computerize a salary and benefit survey in Western Virginia.
1990 - 1991	Assisted Professor Joseph Cheng in studies of the effect of innovations on organizational effectiveness in the pharmaceutical industry

OTHER EXPERIENCE

Executive Officer, Hong Kong Government

1987 - 1989	Supervisor of an office with 10 clerical employees Issued licenses for restaurants and markets Computerized a personnel record system of a department with 8000 employees Staff Relations Officer

PROFESSIONAL ASSOCIATIONS

Academy of Management

Division 14, American Psychological Association

RESEARCH INTERESTS

1. Integration of intrinsic motivation, expectancy theory and goal setting theory.

2. The role of intrinsic motivation in self-managed work teams.

3. Research methodology: testing pretest sensitization effect in experimental studies; the use of ANOVA in experimental studies; testing moderating effects of path models.

4. Motivation for entrepreneurial behaviors.

TEACHING INTERESTS

1. Organizational Behavior

2. Organization Theory

3. Research Methods and Statistics

4. General Business Management

CONFERENCE PAPER

Cheung, G. W. (1992). Test of Pretest Sensitization: An Inexpensive and Easy Task. Research Method Division, 1992 Academy of Management Annual Meeting, Las Vegas, Nevada.

RESEARCH IN PROGRESS

Cheung, G. W. "Testing pretest sensitization: Research design, analyses, and control."

Cheung, G. W. "Testing interaction and moderating effects in a path model: A comparison of two methods".

Cheung, G. W. "What can we learn from the interaction term in an ANOVA table".

Cheung, G. W., and Lang, J. "Motivation for entrepreneurial behaviors: An expectancy-instrumentality-valence model".

GRADUATE LEVEL COURSES

Organizational Behavior	Instructor
Organizational Behavior	BONHAM, T.W.
Seminar in Organizational Behavior I	COBB, A.T.
Seminar in Organizational Behavior II	BONHAM, T.W.
Organizational Psychology I	FOTI, R.J.
Organizational Psychology II	FOTI, R.J.
Organization Theory	
Seminar in Organization Theory I	CHENG, J.L.
Seminar in Organization Theory II	CHENG, J.L.
Independent Study: Organization Learning and Innovation	CHENG, J.L.
Independent Study: Information Technology and Organization	LEHRMAN, W.G.
Organizations in Society	SNIZEK, W.E.
Research Methods and Statistics	
Statistics for Behavioral Science (Regression)	IMPARA, J.C.
Advanced Statistics for Education (Regression)	IMPARA, J.C.
Experimental Design and Analysis I (ANOVA)	HINKELMANN, K.H.
Advanced Research Design and Methodology (ANOVA)	CROSS, G.H.
Quantitative Methods in Industrial/ Organizational Psychology	FOTI, R.J.
Advanced Marketing Research	MONROE, K.B.
Research Methods (Survey Research)	HERTEL, B.R.
Application of Structural Equations In Education	WOLFLE, L.M.
Advanced Psychometric Theory	HARVEY, R.J.

REFERENCES

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