THE RELATIVE EFFECTIVENESS OF TWO TYPES OF GOALS ON THE PERFORMANCE OF SIMPLE VERSUS COMPLEX TASKS: THE EFFECT OF EXPERIENCE

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ABSTRACT

Goal theory defines specific goals as quantitative goals. Although these goals generally lead to improved performance, recent research suggests that they are ineffective for highly complex tasks such as managerial jobs. This dissertation explores whether goals which are specific with regard to the content of the goal can lead to improved performance of complex tasks.

Goals improve performance by defining the desired outcome. When the task is simple, a simple statement of the goal is hypothesized to provide a clear definition of the outcome, to promote the use of an appropriate strategy, and, therefore, to lead to improved performance.

A highly complex task, however, requires the individual to choose an appropriate course of action. A goal system which includes both superordinate goals and subgoals provides a more complete definition of the desired outcome. For a complex task, therefore, goal systems are hypothesized to improve goal comprehension, to lead to the use of a more appropriate action plan, and to improve performance.

These hypotheses were tested with a computer-based game that simulates a managerial task. The performance of all subjects combined did not support the hypotheses. However, when the hypotheses were tested with only the more experienced subjects, the simple goal led to improved performance on the simple task. When the task was complex, the goal system led to improved performance. This indicates that content specific goals can improve the performance of experienced individuals on complex tasks.

For the less experienced subjects, the goal system led to improved performance on the simple task. Conversely, the simple goal led to improved performance on the complex task. This suggests the need for a more complex theory of the joint effects of task complexity, goal type, and experience on performance.

Thesis Committee: Deborah Ancona, John Carroll (chair),
Robert Wood

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I always thought that authors who wrote that their work would have been impossible without the assistance of others were charmingly modest. I now know that their expressions of appreciation probably understated the contributions of others. This dissertation, and perhaps any dissertation, is a drawing together of the ideas and efforts of many individuals. Some of these individuals receive recognition in the form of footnotes and quotes, but the individuals who have made the most important contributions cannot be adequately recognized in this way. What follows here is my attempt to thank some of these people.

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CHAPTER 1: INTRODUCTION

Organization theorists and researchers have long been interested in the determinants of individual performance. This interest initially focussed on studies with blue collar workers: Taylor (1923) conducted time and motion studies and Mayo and his associates (Roethlisberger and Dickson, 1967) studied workers assembling and wiring telephone equipment. Later, researchers began to study white collar workers in addition to blue collar workers: Dalton (1959) studied three factories and a department store and Blau (1955) wrote about workers in an employment agency. Now, interest is shifting to workers who perform highly complex tasks: Kotter (1982) studied general managers and Sathe (1982) studied comptrollers.

Similiarly, goal theorists initially studied individuals performing extremely simple tasks. A review of studies performed prior to 1985 commented that the studies tended to involve tasks of relatively low complexity (Wood, Mento, and Locke, 1987). Since then, researchers' interest has increasingly shifted toward the study of more complex tasks. Recent studies involve tasks such as estimation of stock prices (Earley, Connolly, and Ekegren, 1989; Earley, Connolly, and Lee, 1988), and managerial simulations (Bandura and Wood, 1989; Wood and Bandura, 1989; Wood, Bandura, and Bailey, 1989). The present research extends work done in these studies. It considers the effect of two different types of specific-difficult goals on the performance of simple versus complex tasks and the processes by which these goals exert their influence.

Statement of the Problem

A key finding of goal theory is that specific-difficult goals, defined in the literature as quantitative goals which are challenging to the individual (Locke, Shaw, Saari, & Latham, 1981), are more effective than vague do-your-best goals in improving performance; this has been confirmed by research in both laboratory and field settings (Latham & Lee, 1985; Mento, Steel, & Karren, 1987; Tubbs, 1986). However, a recent meta-analysis demonstrates that specific-difficult goals are decreasingly effective in improving performance as task complexity increases, although usually still significant (Wood, Mento, & Locke, 1987). Additionally, for some highly complex tasks, specific-difficult goals even lead to poorer performance than a non-specific do-your-best goal (Earley, Connolly, & Ekegren, 1989; Huber, 1985). This suggests that specific-difficult goal may be ineffective or counterproductive for some highly complex managerial tasks. If that is true, then we have lost a potentially valuable tool for improving managerial performance; goal theory is widely recognized as one of the most useful theories in organizational behavior (Miner, 1984; Pinder, 1984; Schneider, 1985; Staw, 1984).

The present research is premised on the assumption that specific-difficult goals can improve performance on complex tasks, even highly complex managerial tasks. The problem is the operationalization of specific-difficult goals, not the theory. Goal theory virtually always operationalizes specific-difficult goals as quantitative goals. This has happened because most of the research on goals has been done with simple tasks (Huber, 1985; Locke et al. 1981) or tasks of only moderate complexity (Locke, Chah, Harrison, & Lustgarten, 1989); quantitative goals are highly effective for such tasks. For more complex tasks, however, quantitative goals appear to put excessive pressure on the individual for immediate performance. This may lead to excessive arousal which interferes with the cognitive processes needed for good performance on a complex task (Bandura and Wood, 1989; Huber, 1985; Humphreys and Revelle, 1984).

However, goals do not have to be quantitative to be difficult or specific. Goal difficulty is defined as the extent to which the goal is challenging to the individual (Locke et al. 1981) or the probability that the individual will achieve the goal (Naylor & Ilgen, 1984). Goal specificity is defined as the explicitness or clarity with which the desired outcome is defined (Locke & Latham, forthcoming; Locke et al. 1989; Naylor & Ilgen, 1984). Thus, it is legitimate to use an alternative operationalization of specific-difficult goals.

Naylor and Ilgen (1984) propose that there are two types of goal specificity. One type of goal specificity is quantitative specificity (i.e., the degree of quantitative precision with which the level of performance of the desired outcome is defined); however, another type of goal specificity is content or outcome specificity (i.e., the explicitness with which the content of the desired outcome is defined). For example, the goal of writing two publishable papers a year is specific with regard to both quantity and content. The goal of writing publishable papers is specific with regard to content but is not specific regarding quantity. The goal of making two scientific contributions a year is specific with regard to quantity but is not specific regarding the content of the goal (Naylor & Ilgen, 1984). Although there is a substantial body of research on the effect of quantitative specificity on task performance, there is little consideration of the effect of content specificity on performance (exceptions include Campbell & Gingrich, 1986; Earley 1985, 1986; Erez & Arad, 1986). The present research considers how content specificity influences the performance of simple versus complex tasks.

Overview of the Research

The present study employs two types of goals. One type of goal is a simple goal; this includes both the traditional quantitative specific-difficult goal and the less specific non-quantitative goal (henceforth these will be referred to as simple quantitative goals and simple non-quantitative goals, respectively). The second type of goal is a goal system which includes a superordinate goal plus subgoals (Bandura, 1988). Simple goals are hypothesized to lead to superior performance on a simple task, but goal systems are hypothesized to lead to better performance on a complex task. The study measures the effect of goal type on performance and on each of the key cognitive steps[1] in the process by which goals influence performance.

Contribution of the Research

There is a recognized need among goal researchers for studies of the process by which goals influence performance (Bandura & Cervone, 1983; Locke et al. 1981; Mento et al. 1987; Riedel Nebeker, & Cooper, 1988; Steers & Porter, 1987; Wood et al. 1987; Wood & Locke, forthcoming). Although many researchers have studied one of the steps in the process by which goals influence performance, only a handful of studies have considered two steps (see Table 1.1), and no study has attempted to measure all of the steps in the process. Additionally, few studies have included tasks at more than

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[1] These steps are generally described as goal comprehension, goal acceptance, and action or strategy planning (Locke, 1968; Locke et al. 1981; Wood and Locke, forthcoming).

one level of complexity (for exceptions see Table 1.2).

The present study includes two types of specific-difficult goals and two levels of complexity; it measures each of the three cognitive processes by which goals are hypothesized to influence performance. The research therefore is designed to increase our knowledge of the process by which specific-difficult goals influence performance. It also provides a more complete test of one model of that process than is currently available.

CHAPTER 2: LITERATURE REVIEW AND HYPOTHESES

This chapter discusses a model of the major steps by which goals influence performance. It argues that goal systems lead to improved performance of complex tasks because they combine superordinate goals with subgoals. Bandura states that superordinate goals "... give purpose to an activity and serve a general directive function, but subgoals are better suited to serve as the proximal determinants of specific choice of activities and how much effort is devoted to them" (1988, p. 50). This chapter describes how these two functions improve the goal comprehension and action planning of complex tasks. Conversely, the chapter argues that goal systems provide superfluous information which may hinder goal comprehension and action planning for simple tasks; simple goals are hypothesized to lead to improved performance of simple tasks.

The Goal Literature

Task Complexity and the Effectiveness of Simple Specific Goals

By definition, simple specific goals are goals with high content specificity. Such goals provide a precise definition of the content of the desired outcome (Naylor & Ilgen, 1984) thus focussing the individual's attention on a narrow range of possible actions (Wood and Locke, forthcoming). This leads to improved performance on simple tasks. For example, if a widget maker has been successfully meeting the goal of producing 12 widgets per hour, that individual is likely to continue using the approach which has been successful in the past. If someone were to ask the widget maker why he/she always uses the same approach, the widget maker might shrug and say: "If it ain't broke, don't fix it." In the short run at least, the widget maker is making the correct decision. If the widget maker were to look for a better approach, performance would initially suffer because the time used in experimenting with different approaches would be unavailable for making widgets.

Performance on a complex task, however, is improved by a broader consideration of action plan possibilities. Task complexity is defined by the extent to which the task possesses one or more of the following attributes: multiple components (including acts and information cues), high coordination needs, and dynamic or uncertain conditions (Wood, 1986). As the complexity of the task increases, it is decreasingly possible to predict the relationship between an action and its consequence. Therefore, the performance of a highly complex task is improved by having an individual with relevant specialized knowledge decide on an appropriate action plan (Carroll & Tosi, 1973; Perrow, 1970; Wood & Locke, forthcoming). When the individual considers many options or engages in extensive planning, the quality of these choices improves (Janis and Mann, 1977).

These points are supported by a study done by Hackman, Brousseau, and Weiss (1976) concerning the effect of time spent planning on both simple and complex tasks. In this experiment, performance was measured by the dollar value of all components assembled by a group of students. In the simple condition, all subjects knew what components the group was expected to assemble. Thus, each subject could independently decide what components to produce in order to maximize the dollar value of the group's production. In the high complexity condition, however, each subject knew only some of the components which were requested. Production of the most profitable components therefore required coordination. The experimenters found that on the simple task, time spent planning hurt performance. On the complex task, however, time spent planning improved performance. This suggests that goals which lead to reduced planning should be associated with superior performance on simple tasks; on complex tasks, however, goals which lead to increased planning should be associated with improved performance.

In the example of the widget maker we saw that a simple specific goal is unlikely to lead the widget maker to look for a new production method or to engage in planning. (This point is discussed in greater detail below.) Simple specific goals lead to a reduced consideration of options and therefore decrease the individual's ability to make good choices in complex situations. Goal theory therefore needs to identify a different type of goal for complex situations.

Goal theory makes two different suggestions of what constitutes an appropriate goal for a complex task. Sometimes, goal theorists suggest that vague goals may lead to better performance of complex tasks than specific challenging goals:

> Under [some circumstances] (e.g., managing in an uncertain environment) vague goals could conceivably be more effective than specific goals in that the manager would have more flexibility in responding to environmental contingencies (Locke et al. 1989, p. 272).

However, while vague goals give the individual flexibility, they do not define the desired outcome. This may create problems because different individuals may have different understandings of the organization's goal (or goals); this may lead to poor coordination and inefficiency as each individual pursues the project which in his or her judgment is of greatest importance. Several people may perform one task while other tasks are left undone.

Goal theorists also suggest that multiple quantitative goals lead to improved performance in some situations. The effectiveness of such goals has been demonstrated for proofreading tasks (Ilgen and Moore, 1987), salesclerks (Ivancevich, 1976; Kim, 1984), highly skilled technicians (Ivancevich 1977; Ivancevich and McMahon, 1977a, 1977b, 1977c, 1982; Pritchard, Jones, Roth, Stuebing, and Ekeberg, 1988), and materiel handling and storage units (Pritchard et al. 1988). Multiple goals lead to improved performance on such tasks because they increase the individual's awareness of a number of specific objectives and suggest action plans which are appropriate for each objective. However, multiple goals are less effective in improving the performance of more complex jobs such as middle level managerial jobs. Managers frequently need to choose between two different objectives when achieving one objective precludes achievement of the other objective. Multiple goals may indicate the various tasks which are to be performed; they do not, however, provide information about the relative importance of the various tasks.

Therefore, what is needed is a type of goal which specifically defines one or more desired outcomes and indicates their relative importance. This goal should stimulate the creation of a new action plan by increasing the individual's awareness of his/her freedom to select a course of action and by contributing to the individual's ability to consider multiple factors and objectives in creating an appropriate action plan.

Goal Systems

A goal system can lead to improved performance of complex tasks because it defines the desired outcome while simultaneously identifying areas within which the individual has discretion. A goal system includes one or more superordinate or overarching goals and multiple subgoals.

The superordinate goal defines the individual's primary objective(s). Subgoals may specify particularly desirable features of the superordinate goal, identify several steps toward the superordinate goal as separate goals, or describe other desirable but less critical goals. For example, the superordinate goal may be to clean the house and subgoals may include dusting and making beds. In this example the subgoals can be thought of either as means by which the superordinate goal is accomplished or as additional specifications of the definition of a clean house. Alternatively, the superordinate goal might be to clean the house and an additional but unrelated subgoal might be to rearrange a vase of flowers. For example, "if there is time after you clean the house, please rearrange the flowers." This subgoal specifies the relative importance of rearranging the flowers.

The presence of multiple goals does not necessarily create a goal system. Multiple goals become a goal system only when there is a clearly identifiable superordinate goal and, therefore, a goal hierarchy. It is the hierarchical nature of the goal system which enables it simultaneously to provide clear specification of the desired outcome and flexibility regarding selection of the means by which that outcome is to be achieved. The superordinate goal is a non-optional goal which identifies the individual's primary objective(s). Subgoals identify less critical but desirable outcomes; these represent the individual's area of discretion.

A goal system is particularly effective when the subgoals relate the superordinate goal to the factors which make the situation complex. This focusses the individual's attention on the source of task complexity thereby leading to an improved choice of actions. For example, the job of an air traffic controller is complex because of component complexity (e.g., fuel availability, multiple runways, and landing order), coordinative complexity (e.g., coordinating the plane's landing with that of other planes which are advised by other controllers), and dynamic complexity (e.g., wind rate, wind direction, and the plane's position in the holding pattern) (Wood, 1986). Clearly, the controller's superordinate goal is the prevention of accidents. Ideally, subgoals will increase the controller's awareness of all three types of complexity, thereby leading to a broader consideration of options and, consequently, to improved performance.

Although the term "goal system" is new, the concept is far from new. Discussions of the ways in which goal systems can lead to improved performance abound in the literature. These discussions include individual-level hierarchical goal systems where both the superordinate goal and the subgoals are individual goals (for example, Lord & Kernan, 1987; Newell & Simon, 1972), and organization-level hierarchical goal systems where the superordinate goal is an organizational goal and subgoals identify the individual's responsibilities (for example, Carroll & Tosi, 1973; Cyert & March, 1963; Drucker, 1989; March & Simon, 1958; Quinn, 1980). Each author customarily identifies one or two ways in which goals influence performance, explains how hierarchical goal systems improve that process, and then argues that a goal system leads to improved performance. For example, Lord and Kernan (1987) argue that hierarchical goals improve strategy choice, Quinn (1980) speaks of their ability to improve co-ordination, and Caroll and Tosi (1973) say they define areas within which the individual is free to exercise discretion. These explanations are cogent and persuasive, but they do not include a full consideration of the process by which goals influence performance or the possible interactions between the various steps in the process. Additionally, this literature generally considers only the performance of complex tasks (Carroll and Tosi are an exception). It therefore does not consider whether hierarchical goal systems are appropriate for all tasks.

The next section describes a model of the process by which goals influence performance. Subsequently, the chapter discusses the relative appropriateness of simple goals versus goal systems for simple versus complex tasks.

Model of the Process by Which Goals Influence Performance

Scope of the Model

The model is concerned with the process by which externally-imposed goals, such as those assigned by employers to employees, influence the initial understanding and, therefore, the performance of cognitive tasks[2] by experienced employees. It is a highly simplified model (as shown below), which includes only the key cognitive processes by which specific goals influence the performance of cognitive tasks.

[Insert Figure 2.1 about here]

The model in Figure 2.1 omits the effect of goals on effort. This is an appropriate choice because effort is considered to be of less importance in influencing the performance of cognitive as compared to psychomotor tasks (Wood and Locke, forthcoming). This is a limited model intended to facilitate a discussion of the process by which goals influence the performance of cognitive tasks.

The model is designed to clarify the initial steps by which goals influence performance. It therefore assumes that each step of the process precedes the next step and it omits all feedback loops. These simplifying assumptions do not interfere with our ability to consider the influence of detailed goals on the three steps. The model is not appropriate, however, for considering the way that goals influence the individual's persistence (Locke & Latham, forthcoming; Locke et al. 1981), assist the individual in

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[2] Wood et al. (1987) state that it is possible that there are significant differences in the process by which goals influence the performance of cognitive versus psychomotor tasks.

refining an action plan (Campion & Lord, 1982), or serve as guides in verifying the appropriateness of the action plan (Bandura, 1986).

Because the model excludes all interactions, processes, and variables which are not directly relevant to considering the effect of goal systems versus simple goals on the performance of cognitive tasks, it is parsimonious and therefore easily comprehended. Pfeffer (1982) argues that parsimonious theories are preferable to complex theories:

> The criterion of parsimony means that theories that are simpler in their explanations, presuming fewer causal variables and more simple causal mechanisms (e.g., direct effects rather than multiple interactions), should be preferred, other things being equal (p. 39).

This paper therefore uses the simple model presented in Figure 2.1.

The purpose of the research is not to test the entire causal sequence but to examine the effect of goals on each step in the sequence. I will also examine the relationships among the steps in this model. However, the study is not designed directly for this purpose; it therefore provides a weak test of the causal ordering of the steps.

Step 1: Goal Comprehension

Before a goal can influence performance, it must be comprehended (Locke, 1968). An experiment by Bavelas & Lee (1978) demonstrates that simple quantitative goals influence goal comprehension by providing information which defines the task. In this experiment subjects were shown 50 cards:

one card had a 15 x 15 mm square drawn on it, the other 49 cards had parallelograms which increasingly deviated from the square. The subjects were then asked to find the 5, 15, 25, 35, or 45 cards with squares drawn on them. The experimenters found that the subjects selected the specified number of figures, gradually relaxing the definition of a square, as the specified goal increased. This shows that the goal influenced the subjects′understanding of what the experimenters meant by a square.

<u>A simple task</u> requires only a few decisions. For example, a widget maker may perform only a few repetitious tasks in a predictable environment. Since the tasks are repetitious, the widget maker does not need to think about the steps by which the task is performed. A simple goal suggests that the goal is a familiar one and that the widget maker has all necessary information to comprehend the goal.

Conversely, a goal system may reduce the widget maker′s understanding of the goal. Since the environment is predictable, this widget maker does not need to think about the necessity of coordinating with others; the standard procedures do all the coordination necessary. Goals which relate the widget maker′s task to the tasks of others may confuse the widget maker as to his/her precise responsibilities. Similiarly, goals which relate the widget maker′s task to environmental contingencies, such as the possibility of problems with obtaining the necessary materials, may lead the widget maker to wonder: "Should I obtain the necessary materials, or wait for them to be brought to the work station?" This suggests that:

Hypothesis #1 - For a simple task, simple goals lead to better goal comprehension than do goal systems.

On the other hand, it may not be clear to the individual performing a complex task just what the goal is; for such a task, a goal system provides information which can increase the individual's goal comprehension. Subgoals explicitly focus the individual's attention (Bandura, 1988; Locke et al. 1981) on a group of desirable objectives. This can help to clarify the superordinate goal.

For example, the air traffic controller's superordinate goal may specify that the goal is plane safety. Subgoals can clarify this objective by noting that the controller determines whether it is safe to use the scheduled airport. A simple goal would omit the clarifying subgoal; the air traffic controller might, therefore, think that the superordinate goal was plane safety at the assigned airport. Thus, subgoals may lead to a better understanding of the superordinate goal.

[Insert Figure 2.2 about here]

Additionally, because a goal system is hierarchical, it is a schema (Foti & Lord, 1987; Lichtenstein & Brewer, 1980; Lord & Kernan, 1987), i.e., a framework for systematizing information (Abelson, 1981; Brewer & Treyens, 1981). This framework increases the amount of knowledge which the individual can store (Anderson & Pichert, 1978; Chase &

Ericsson, 1982). Schemas can include both information which has been explicitly related to the framework (i.e., formally presented goals and subgoals), and information which has not been explicitly related to the framework (i.e., inferred goals) (Bower, Black, & Turner, 1979; Lord & Kernan, 1987). Schemas therefore improve comprehension (Foti & Lord, 1987; Lichtenstein & Brewer, 1980). Since a goal system is a schema, it should lead to improved goal comprehension.

This suggests:

Hypothesis #2 - For a complex task, goal systems lead to better goal comprehension than do simple goals.

Step 2: Goal Acceptance

Goal comprehension does not necessarily lead to performance; an individual may comprehend a goal and yet decline to work for it. This is most likely to happen when the individual believes that he/she is unlikely to succeed in reaching the goal (Erez & Zidon, 1984; Locke, Latham & Erez, 1988); the probable failure may appear less painful if it is possible to say: "I never really intended to do that."

Specific-difficult goals influence goal acceptance by contributing to the individual's understanding of the task and his/her assigned goal in that situation. When the individual understands the task, his/her self-efficacy increases (Earley, 1986); this leads to increased goal acceptance (Earley, 1985). However, specific-difficult goals may also influence goal acceptance by influencing the individual's estimate of the difficulty of achieving the goal. As the individual's understanding of the task increases, the perceived difficulty of the goal may also increase, thus decreasing the individual's self-efficacy (Bandura & Wood, 1989); this should lead to decreased goal acceptance (Wood, Bandura, & Bailey, in press[3]). The net effect of goal type on goal acceptance is, therefore, the result of two potentially conflicting tendencies. Clearly, it is possible for these two effects to cancel each other out.

For a simple task, a simple goal is hypothesized to lead to better goal comprehension than a goal system; this implies that simple goals should lead to increased goal acceptance. A goal system, however, provides additional information; for example, if the individual has some control over the way in which he/she performs the task, this information might lead the individual to perceive the task as being less difficult and therefore lead to increased goal acceptance. This may explain why research shows both that information has no effect on goal acceptance (Campbell & Gingrich, 1986; Earley, 1985 - for subjects with assigned work strategies; Erez & Arad, 1986) and that information increases goal acceptance (Earley, 1985 - for subjects who were permitted to select their preferred work strategy).

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[3] Wood, Bandura, and Bailey expected to demonstrate this but obtained little variance in goal acceptance with their subjects.

Thus, it is unclear whether a simple goal or a goal system will lead to higher goal acceptance for simple tasks. Resolution of this question requires testing two competing hypotheses[4]:

Hypothesis #3a - For a simple task, simple goals lead to higher goal acceptance than do goal systems.

Hypothesis #3b - For a simple task, goal systems lead to higher goal acceptance than do simple goals.

For a complex task, goal systems have been hypothesized to provide information which leads to increased goal comprehension. Since goal comprehension is thought to be an important determinant of self-efficacy and, therefore, of goal acceptance, goal systems should lead to increased goal acceptance for complex tasks. This hypothesis is supported by Earley (1985), who found that providing additional information increased goal acceptance of subjects who were asked to perform complex versions of scheduling and cleaning tasks, whether or not they had control over their choice of work strategies.

It is also possible, however, that goal systems will lead to lower goal acceptance for a complex task. We have seen that goal systems provide information which should increase the individual's awareness of the need to choose between several competing goals. This may lead to an increase in perceived goal difficulty. Since goal acceptance is decreased by goal difficulty (Erez & Zidon,

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[4] The research design also includes measurement of self-efficacy and perceived goal difficulty.

1984), this suggests that goal systems may lead to lower goal acceptance than simple goals.

This is also an unresolved question which requires testing two competing hypotheses.

Hypothesis #4a - For a complex task, goal systems lead to higher goal acceptance than do simple goals.

Hypothesis #4b - For a complex task, simple goals lead to higher goal acceptance than do goal systems.

Step 3: Strategy or Action Planning

Once the individual has accepted the goal, he/she forms or selects an action plan. Wood and Locke (forthcoming) propose that there are two kinds of task-specific action plans: stored action plans and new action plans. When an individual understands a task and performs it repeatedly (i.e., when the individual is experienced at performing the task), that individual develops a habitual strategy (i.e., a stored action plan) for performing that task. A new action plan is created either when the individual combines several stored action plans in a new way or when the individual invents a new approach to accomplishing the task (Wood & Locke).

On a simple task, stored action plans lead to improved performance. Wood and Locke point out that: "In the case of a simple repetitive task or goal, such as driving downtown to pick up the dry cleaning, one hardly needs to think of a plan of action at all in order to perform it" (forthcoming, p.2). A familiar or stored action plan is executed with a minimum of effort while a new action plan requires considerable effort. (Consider trying to write a letter or brush your teeth with the hand you do not usually use.) I therefore postulate, as do Wood and Locke, that on a simple task, the use of a stored action plan leads to better performance than the creation and use of a new action plan.

A highly complex task, however, requires the creation of a new action plan. A task is complex because it has multiple objectives and because there are a large number of potentially appropriate actions for achieving those objectives. The choice of an appropriate action is influenced by multiple information cues and/or high coordination needs and/or dynamic conditions (Wood, 1986). Thus, it is impossible to specify in advance what constitutes an appropriate action plan. I therefore postulate that the performance of ighly complex tasks is improved by the use of new action plans.

A simple goal specifies the desired outcome and omits mention of complicating factors. It therefore impies that the present situation is a familiar situation and that the desired outcome is a familiar outcome. A simple goal also implies that a known approach has previously produced satisfactory results and that this approach is anticipated to continue producing satisfactory results. If this were not the case, then a more complete set of goal communications would presumably be used. Thus, a simple goal increases the individual's tendency to use a stored action plan (see Figure 2.2). Wood and Locke call this the cueing effect. They say: "Specific [i.e., simple] goals may have a priming effect which leads to the selection of a particular STSP [stored task specific plan]" (forthcoming, pp. 28-29). For example, if the widget maker has been successfully meeting the goal of making 12 widgets an hour, that individual is unlikely to consider other procedures; the widget maker will tend to use a proven approach. Thus, simple goals tend to lead to decreased planning or consideration of options and to increased use of stored action plan (Wood and Locke).

Goal systems aid in the development of a new plan. Inclusion of multiple subgoals increases the number of action plan possibilities which the individual considers (Lord and Kernan, 1987) because each subgoal needs to be addressed by an action plan. When these subgoals are both specific and familiar, they remind the individual of stored action plans, thus potentially increasing the appropriateness of the included stored action plans. When the subgoals are unfamiliar, the individual does not have a stored action plan; unfamiliar subgoals therefore force the individual to select or develop new action plans (Wood & Locke, forthcoming).

Then, assuming that the individual understands that the key determinant of performance is achievement of the superordinate goal, all of these action plans will be evaluated for their effect on the superordinate goal. Any plans which are incompatible with the achievement of the superordinate goal will be discarded. Here the goal system serves as a template against which to judge the appropriateness of the various possibilities.

Because the goal system is a schema, it helps the individual to design an overall action plan. A schema provides a framework which encourages the individual to look at the overall set of desired objectives and the associated action plan possibilities. This framework then enables the individual to select an appropriate group of action plan possibilities without consciously considering each possibility (Alba & Hasher, 1983; Cantor & Mischel, 1979; Dutton & Jackson, 1987). Thus, a goal system increases the possibility that the individual will find an effective plan which simultaneously accomplishes multiple objectives.

Since performance on a simple task is anticipated to be improved by the use of a stored action plan, and since the performance on a complex task is anticipated to be improved by the use of a new action plan, this suggests:

> **Hypothesis #5 - For a simple task, simple goals lead to a more appropriate action plan than do goal systems.**
>
> **Hypothesis #6 - For a complex task, goal systems lead to a more appropriate action plan than do simple goals.**

Outcome: Performance

We have hypothesized that for a <u>simple task</u>, goal comprehension and action planning are improved by the use of simple goals. We have said that it is unclear whether simple goals or goal systems will lead to higher goal acceptance. However, most studies have found that goal acceptance shows little variance; therefore, goal acceptance generally has a relatively small effect on performance (Garland, 1984; Locke et al. 1981; Locke et al. 1988). Therefore, assuming that we compare quantitative simple goals with quantitative goal systems and non-quantitative simple goals with non-quantitative goal systems, we can hypothesize that:

> **Hypothesis #7 - For a simple task, simple goals lead to better performance than do goal systems.**

We have hypothesized that goal systems lead to better goal comprehension and action planning than simple goals. Since the performance of a complex task is thought to be primarily influenced by goal comprehension and action plan development (Wood & Locke, forthcoming), this suggests that goal systems lead to improved performance of complex tasks.

Additionally, research has shown that information about the task is particularly effective in improving the performance of a complex task (Campbell & Gingrich, 1986; Earley 1985, 1986; Erez & Arad, 1986). Since goal systems provide the individual with more information than do simple goals, goal systems should lead to better performance than simple goals.

Further support for this hypothesis comes from the schema literature. Theorists suggest that performance of a complex task is related to the quality of the individual's decisions (Carroll & Tosi, 1973; Perrow, 1970; Quinn, 1980; Smith, Locke, & Barry, forthcoming). Since goal systems are schemas and since schemas lead to improved decision making (Lurigio & Carroll, 1985), goal systems should lead to improved decision making and therefore to improved performance of complex tasks. We therefore hypothesize:

Hypothesis #8 - For a complex task, goal systems lead to better performance than do simple goals.

CHAPTER 3: METHODOLOGY

I tested the hypotheses by conducting an experiment in which task complexity and goal type were independently manipulated. I used an experiment because it permitted the creation of two distinctly different goal types; a field study would have provided far less control over the goal communications during the study. Additionally, in a field situation, goal comprehension would have been influenced by previous experience with the task and previous goal communications about the task.

Design of the Experiment

Criteria

The experiment needed to be appropriate for use with both simple goals and goal systems. This implied that the simple task should be straightforward, so that subjects could rapidly develop an appropriate stored action plan. Conversely, there should not be a clearly identifiable correct approach for performing the complex task; each trial should require evaluation of multiple objectives or changing conditions. Only on tasks with this degree of complexity was performance hypothesized to be improved by the use of a goal system.

Additionally, in order to test the eight hypotheses, it had to be possible to measure goal comprehension, goal acceptance, the quality of the action plan, and overall performance.

Description of The Furniture Factory Game

I obtained permission to use a revised version of a computer simulation, initially developed by Wood and Bailey (1985), which satisfied these criteria. In this simulation the subjects take the role of managers with responsibility for restoring furniture in the Special Order Department. Restoration work requires multiple production functions such as: milling timber, assembling parts, and upholstering.

The subject makes four types of decisions on each trial:

1. Assignment of workers to production functions. Descriptions of production function requirements and employee skills, experience, motivational level, preference for routine versus challenging work, and standards of work quality are provided.

2. Assignment of production targets. Choices are: no target set, do your best, target set at estimated time, target set 25% easier than estimated time, target set 25% harder than estimated time.

3. Feedback. Four choices are possible: no feedback, tell the worker the actual hours in relation to the estimated hours, discuss working methods but do not reveal the actual time taken, discuss both the time taken and the reasons for it.

4. Social rewards. Three options are possible: no reward, compliment the employee on performance, post a memo in the lunchroom acknowledging the worker's contribution.

On each trial, the subject assigns workers to production functions and selects a production target for each worker. The computer then informs the subject of the time taken by each worker to complete the assigned function and the total time taken by the unit to complete the production order. The subject then determines the type of feedback and reward each worker will receive.

The complexity of the simulation is varied through the production order and employee roster which are given to the subject at the beginning of each trial. A simple simulation involves only three employees, each of whom is best suited to one of three production jobs. Conversely, there are eight employees and eight production jobs in the complex condition, and the roster is designed so that it is less obvious which set of assignments will optimize departmental performance.

Suitability of the Simulation

The simulation appeared suitable for testing the relative effectiveness of a simple goal versus a goal system. Both tasks require the subject to consider multiple factors in making decisions. For example: Should a poor performer with extensive prior experience be given instructive feedback? Will high performers become demoralized if low performers receive equivalent recognition? Conversely, will low performers be demoralized if they do not receive recognition? However, the three person situation requires only twelve decisions each trial; there are three production functions, and for each production function the subject selects an employee, assigns a production target, and gives feedback and reward. The eight person simulation requires thirty-two decisions for each trial. Clearly, the three person task is not extremely simple, but it does require analysis of less information and involves fewer decisions than the eight person task. The simple goal was therefore anticipated to lead to improved performance on the simple task while the goal system was anticipated to lead to improved performance on the more complex task.

But the model needed some modifications to make it appropriate for use with a goal system. Three conditions have to met in order for the game to be appropriate to test the relative effectiveness of a simple goal versus a goal system. First, the type of goal cannot influence the difficulty of the game; within a task condition, the game has to be equally difficult for all subjects. Second, subgoals are hypothesized to improve performance by increasing the individual´s awareness of factors which have a substantial influence on performance. Thus, the factors chosen as subgoals must have a substantial influence on performance. Third, a goal only influences performance if the individual receives feedback on that goal (Erez, 1977; Locke, Shaw, Saari, and Latham, 1981). It is therefore necessary to give subjects feedback about their performance on the subgoals.

No factors in the Wood and Bailey model met all three conditions. The first factor I considered using was the appropriateness of employee assignments. This factor was inappropriate because feedback on this factor would alter the difficulty of the game. It seemed likely that many subjects would, at some time, select the optimal allocation of employees. If the subject were then told that the appropriateness of employee assignments was 100%, the subject would then stay with that allocation for the remainder of the game. This would make the game significantly easier for the goal system subjects than it would be for the subjects who were given the simple goal and therefore did not receive this feedback. Alternatively, if the subjects were given false feedback (for example, dividing the appropriateness score by .7 so that the maximum score possible was 70%), then even if they got to the optimal allocation they would not stay with it. This would make the game harder for them than for the simple goal subjects.

I then considered two other factors: employees´ expectations that effort leads to performance, and employees´ expectations that performance leads to rewards. Unlike the appropriateness of employee assignments, these factors are influenced by what has happened on previous trials. The strategy which yields a score of 100% on these factors is therefore unlikely to yield that score on the next trial. Thus, it is possible to give completely accurate information without making the game significantly easier.

But employee expectations that effort leads to performance and performance leads to rewards have very little influence on performance in the Wood and Bailey version of the game. I therefore decided to increase the influence of these factors on performance.

Model of Performance Used in the Experiment

The revised model is based on the model used by Wood and his colleagues. My model utilizes the same descriptions of the employees and gives employees approximately the same motivation and abilities as the Wood and Bailey model (see Table 3.1). Like the Wood and Bailey model, feedback improves performance for good performers and instructive feedback improves performance for poor performers. Additionally, the value of the reward to the individual is determined by the appropriateness of the reward relative to the employee's performance and the average reward given to other employees (see Figure 3.1 and Table 3.2).

[Insert Figure 3.1 and Tables 3.1 and 3.2 about here.]

My game differs from the Wood and Bailey game in several ways. First, the Wood and Bailey game runs on an IBM personal computer, my game runs on a Macintosh. While the screens shown in my model are similiar to the screens shown in the Wood and Bailey model, they are not identical. Additionally, on the IBM, the subject enters decisions by typing numbers; on the Macintosh the subject enters decisions by clicking the cursor on the desired choice.

Furthermore, the calculations are noticeably slower on the Macintosh although the time required to play the game is still moderate. Assuming that the game is played on a Mac II, and assuming that the individual reads the directions with some care, the simple game takes a minimum of 40 or 45 minutes to play and the complex game takes a minimum of an hour and a quarter. It takes approximately seven minutes longer to play the game on an SE20 with a hard disk. The SE20 without the hard disk is not satisfactory: it takes 15 minutes longer and often misunderstands the intended selection. The advantages of the Macintosh are that it stores the subject's responses after each screen and declines to accept answers which indicate that the subject has misunderstood the question. Specifically, self-efficacy ratings cannot decline as the goal becomes easier.

Second, there are several differences between the formulas used in my model and those used in the Wood and Bailey (1985) model (see Figure 3.1). The Wood and Bailey model calculates the employee's expectatation that effort leads to performance as a function of prior expectation that effort leads to performance, prior feedback, and the current goal. My model calculates this as a function of the individual's ability on the assigned task, prior feedback, prior performance, and the current goal. The Wood and Bailey model calculates the employee's expectation that performance leads to reward as a function of the individual's prior expectation that performance leads to reward. My model calculates this as a function of prior reward and the appropriateness of the current goal. These changes reflect my assumptions about the processes by which employees' expectations are established. The changes do not appear to have a major effect on the model. Table 3.3 shows the maximum possible influence of each factor on performance in my model.

[Insert Table 3.3 about here.]

Third, although the underlying model of individual performance is similiar to the Wood and Bailey model, I did modify the model so that goals and rewards have slightly different effects on the various employees depending on the employee's motivation and experience (see Table 3.2). I did this because the individual's motivation and experience influences how organizational policies affect that individual (Schein, 1980). Specifically, for the three novices, high reward is appropriate at a lower level of performance than it is for more experienced employees.

Additionally, for the three highest motivation employees, the do-your-best goal was as effective as the specific-difficult goal. I made this choice because Yuckl and Latham (1978) found that high need for achievement individuals set more difficult goals for themselves than did lower need for achievement individuals. This suggested that the effect of a do-your-best goal on high need for achievement individuals would be equivalent to the effect of a specific-difficult goal on a lower need achievement individual. In retrospect, this may have been a poor choice. Steers (1975) found that specific-difficult goals were associated with improved performance for high need for achievement individuals. This aspect of the model will require reconsideration.

Experimental Procedures

Role and Task Information

All subjects received identical orientation to their role in the experiment:

> The Special Order Department operates on a weekly cycle. All special orders which are received by noon on Friday are produced in the following week. Each Friday afternoon you receive a Job Requirements Manifest and a memo from your manager (these will appear on the screen). The Job Requirements Manifest shows the estimated hours in each job category required to complete the special order for the following week. You will also receive a roster of workers available to work on the Special Order production line for the following week. As the Special Order Manager you must determine the allocation of personnel from the Special Order Roster to specific jobs, on the basis of personnel available, their skills, and the job requirements.

Subjects also received identical information about the relationships between the four variables:

> The actual time an employee takes to complete a job depends in part on the match between the employee's abilities and the skill requirements of the job, and in part on the employee's motivation to do the job well. Employee abilities and job skill requirements cannot be changed in the short term, but motivation can be affected to some extent by the way in which you set production targets, by the nature of the feedback about past performance that you provide to the employee, and by your allocation of rewards.

Goal Assignments

The experiment was run in both simple and complex conditions with four types of goals:

simple goal - non-quantitative,
simple goal - quantitative,
goal system - non-quantitative, and
goal system - quantitative.

[Insert Figure 3.2 about here.]

Subjects received identical orientation to their goal assignments:

> Although the estimated hours are sometimes realistic, both you and your manager recognize that they are often quite inaccurate. Your manager therefore assigns you what he believes to be a realistic goal in a memo which accompanies the Job Requirements Manifest.

The statement about the possible inaccuracy of the estimated hours was included to increase the apparent validity of the assigned quantitative goals.

Subjects then received goal assignments which related to the experimental condition to which they were assigned. The goal statement for the simple non-quantitative goal subjects (cells 1 and 5) said:

> The memo says that your goal is to fill the orders in as few hours as possible.

The goal statement for subjects in the simple quantitative goal condition (cells 2 and 6) said:

> The memo says that your goal is to fill the orders in 75% of the estimated time or less.

The goal statement for subjects in the non-quantitative goal system condition (cells 3 and 7) said:

> The memo says that your goal is to fill the orders in as few hours as possible. Your manager reminds you that productivity will be enhanced if, in addition to the productivity goal, your objective on each trial is to:
>
> 1. increase employees' expectations that increased effort leads to better performance, and
> 2. increase employees' expectations that improved performance leads to rewards.

The goal statement for subjects in the quantitative goal system conditions (cells 4 and 8) said:

> The memo says that your goal is to fill the order in 75% of the estimated time or less. Your manager reminds you that productivity will be enhanced if, in addition to the productivity goal, your objective on each trial is to:
>
> 1. achieve a score of 75% or better for the strength of employees' expectations that increased effort leads to better performance, and
> 2. achieve a score of 75% or better for the strength of employees' expectation that improved performance leads to rewards.

Selection of Subjects

I began pilot testing the experiment during the January Independent Activity Period (IAP). I recruited subjects by approaching people who were working in the Mac Lab, explaining that I was a doctoral student at the Sloan School, and asking them if they would be willing to play my game. Subjects recruited in this way included master's students, Sloan Fellows (managers with approximately 15 years work experience), Ph.D. students with prior business experience (none of these subjects were in the Organizational Studies Department), and special students who were taking the Sloan master's courses. Many agreed, and as soon as I had 20 subjects, I analyzed the data. These data supported the original hypotheses. I therefore continued recruiting subjects in this way.

Periodically, I reanalyzed the data. By the time I had run 70 subjects, it appeared unlikely that the results would support the hypotheses. I therefore began to look at the effect of goals on various populations within the sample to see what had happened. Goals influenced the performance of U.S. citizens, European citizens, and Asian citizens in approximatly the same way. However, goals had a significantly different effect on the performance of the first- versus the second-year subjects.

The overall performance of the first- and second-year students was approximately equal. The second-year students performed slightly better than the first-year students on the first six trials ($F = 2.8$, $p = .10$), but the two groups performed equally well by the end of the game (Table 3.5). When the quantitative and non-quantitative goals were separated, however, it became evident that the first- and second-year students differed. Quantitative goals improved the performance of the first-year students but decreased the performance of the second-year students (Trials #1-#6, $F = 5.5$, $p = .02$; Trials #7-#12, $F = 3.9$, $p = .05$) (see Table 3.6).

[Insert Tables 3.5 and 3.6 about here.]

This demonstrated that the first- and the second-year students differed in a way that was relevant to their performance on this game. There were too few other subjects (i.e., Sloan Fellows, special students, and Ph.D. students) to determine whether their performance ressembled the performance of either the first- or the second-year students. I therefore eliminated all subjects except master's students with more than one year of full-time work experience from the subject pool. I then recruited additional first and second year students to obtain at least seven first-year students and seven second-year students in each experimental cell. The sample includes 130 first- and second-year master's students at the Sloan School. All subjects had at least one year of full-time work experience prior to attending Sloan.

Measures of Variables

Ability and Motivation: Pre-Goal Performance

Subjects' initial performance was measured by having all subjects play two trials of the game before goal assignment. Subjects' performance during these two weeks is therefore indicative of their underlying ability and motivation on this task. These two trials were particularly easy: assignment of employees to tasks was unambiguous. The trials were programmed as a separate game from the twelve experimental trials; performance on these trials did not influence employees' subsequent performance, employees' expectations that effort leads to performance, or employees´ expectations that performance leads to rewards.

Performance

On every trial, a subject´s performance was measured by the time taken by the department to complete the production order; fewer hours therefore represent better performance. The number of hours was calculated by the model based on the subject´s choice of employee assignments, production targets, feedback, and reward. Performance is reported as the percentage of actual hours to standard hours; lower percentages represent better performance.

Goal Comprehension

Goal comprehension was measured with slightly modified versions of five questions used by Latham and Steele (1983). Subjects rated their agreement with each statement on a 9 point scale.

1. I am confident that I understand the instructions for this simulation.
2. I am confident that I understand my role in the simulation.
3. I am confident that I know how to go about doing the task.
4. My assigned goal is clear.
5. I know what I am accountable for on this task.

Goal comprehension was measured twice. The first measurement was made after the subjects received their goal and reported their perceptions of goal difficulty. The second measurement was made after Trial #6. Latham and Steele obtained an alpha of .75 for this scale. I obtained an alpha of .86 for the first measurement of goal comprehension and an alpha of .87 for the second measurement. The correlation between the two measures was .79 ($p<.001$). This indicates that the scale measures one construct.

Goal Acceptance

Goal acceptance was measured with a slightly modified three item scale used by Erez and Arad (1986) (Cronbach's alpha = .83).

1. (Commitment to a goal means acceptance of it as your own personal goal and your determination to attain it.) I am committed to attaining the goal that was set.
2. It is important to me to at least attain the goal that was set.
3. I will strive to attain the goal that was set.

Subjects rated their agreement with these statements on a 9 point scale.

Goal acceptance was measured twice. The first measurement was made after the two pre-goal trials, after the goal was assigned, and after subjects reported their perceptions of goal difficulty, their goal comprehension and their self-efficacy. Thus, the subjects had some experience with the game and had (presumably) thought about the difficulty of the goal and the probablility that they would achieve their goal before indicating their goal acceptance. The placement of the question was intended to increase the variance in goal acceptance. Goal acceptance was also measured after Trial #6, again following the measurement of goal difficulty, self-efficacy and goal comprehension. I obtained an alpha of .84, for the first measure of goal acceptance and an alpha of .84 for the second measure. The correlation of the two measures was .80 ($p<.001$). This indicates that goal acceptance measures one construct.

Strategy: The Appropriateness of the Action Plan

Strategy was measured in four ways. The first measure is the same measure that has been used in previous studies (Bandura & Wood, 1989; Wood & Bandura, 1989; Wood, Bandura, & Bailey, forthcoming). Wood and his associates argue that subjects who engage in hypothesis testing by changing only one factor per employee, learn more about the effect of each factor on the employee. They therefore measure strategy by the proportion of employees in a trial for whom the subject changes only one factor (i.e, task assignment or goal assignment or feedback or reward) for an employee. This measure evaluates strategy as being either optimal or suboptimal; subjects who change two factors in a trial are not differentiated from subjects who change four factors in a trial. A high score reflects more use of the "change-only-one-factor" strategy than a low score.

The second measure of strategy is like the measure used by Wood and his associates in that it considers changing one factor per employee per trial to be the optimal strategy. This measure differs from their measure in that it considers changing three or four factors per trial to be significantly less effective than changing zero or two factors. This measure calculates strategy as the absolute value of the number of changes that the subject makes for each employee, less the number one. These are averaged over employees. The higher this score, the less optimal the strategy because it is more different from the "change-only-one" strategy.

The third strategy measure is the mean number of changes which the subject makes for each employee during a trial. There is evidence that the search for an appropriate strategy degrades performance when 1) there are many possible strategies and 2) either because of time limitations or the inherent complexity of the model, it is difficult to know how the various strategies influence the outcome (Earley, Connolly, and Ekegren, 1989; Earley, Connolly, and Lee, 1988; Huber, 1985).

The fourth measure is not a measure of strategy; it measures the individual's conceptual understanding of the model. This understanding, while not a direct measure of strategy, might influence performance. The measure is composed of six true-false questions which were asked immediately after the subject played the last trial in the game. The questions ask subjects to assess the relative effectiveness of various strategies. Three of the questions are identical to question used by Wood and his associates; three are new. The questions are:

1. The best strategy was to provide high rewards to good performers, moderate rewards to average performers, and no rewards to poor performers.

2. Setting "do your best" goals for novices generally led to better performance than goals of average difficulty.
3. Discussing production methods with good performers reduced their performance.
4. The best reward strategy was to give equally high rewards to all workers each week.
5. Setting difficult goals for low performers lowered their performance in the following week.
6. When workers performed poorly, it was better not to give them specific feedback.

[Insert Table 3.4 about here.]

The third of the four measures is most strongly associated with performance (see Table 3.4). This suggests that reduced strategy search was the most effective strategy for this task. This measure is therefore employed as the measure of strategy.

Other Variables

Perceived goal difficulty was measured with a question used by Yuckl and Latham (1978):

> We are interested in your perception of the difficulty of the goal which your manager specified in his memo. The memo said that your goal was to [repeat goal statement].
>
> How difficult do you think your goal is?

Subjects rated goal difficulty on a 9 point scale. This question was asked twice; once immediately after goal assignment, and again after Trial #6. The correlation of the two measures is .45 ($p<.001$).

Yuckl and Latham found that this question was not correlated with performance; this suggested that it measured perceived goal difficulty, not subjective probability of success which generally correlates with performance (e.g., Meyer, Schacht-Cole, & Gellatly, 1988; Motowidlo, Loehr, & Dunnette, 1978; Yuckl & Latham, 1978). Similiarly, in the present study this measure is not correlated with performance. The first measurement correlates .05 (p=n.s.) with performance on Trials #1 through #6; the second measure correlates -.05 with performance on Trials #7 through #12.

Self-efficacy was measured with a modification of the question used in previous studies (Bandura & Wood, 1989; Wood & Bandura, 1989; Wood, Bandura, & Bailey, in press). Their measure described nine possible levels of production efficiency for the Special Order Department ranging from 30% faster than the estimated time to 40% slower. Subjects were asked whether they could perform at the level identified (yes-no). Subjects then rated the strength of their confidence that they could attain each goal level on a 10 point scale where 0 represents no confidence and 9 equals total confidence. The measure used in the present study retained the 10 point scale but omitted the yes-no question. Self-efficacy was the sum of the subject's confidence scores for all nine levels.

Self-efficacy was measured three times. The first measure was made after subjects read the game directions but before they played the two pre-goal trials or received their goal assignment. Thus, this measure was not influenced by subjects' perception of the difficulty of the goal or their probability of achieving that goal. The second measure was made after the practice trials, after goal assignment, and after the goal difficulty and goal comprehension questions. The third measure followed Trial #6. These measures are highly correlated. The correlation of the first measure with the second is .65 ($p<.001$) and with the third is .57 ($p<.001$). The correlation of the second measure with the third is .74 ($p<.001$).

CHAPTER 4: RESULTS

This chapter includes five sections. The first section checks sample randomization by comparing the subjects' self-efficacy and ability. The second section analyzes the study's findings using the methodology originally proposed.

The research design assumed that the difference in experience and training between the first- and second-year students would be insignificant with regard to the experiment. However, this was not the case. The third section therefore reanalyzes the data separating the first-year students from the second-year students. The fourth section supports the separation of the first-year students from the second-year students by demonstrating that goal quantification has a significantly different effect on the strategy of the first- and second-year students. The fifth section examines the process by which goals influence performance and re-evaluates the validity of strategy measure in view of that analysis.

Sample Randomization

Self-efficacy (Table 4.1) and pre-goal performance (Table 4.2) appear to vary among the various cells, but the variance is not significant. This indicates that subjects were randomly assigned to the various conditions. Although the differences between the cells are not significant, initial self-efficacy was highly correlated with subsequent self-efficacy, goal comprehension and goal acceptance. Similiarly, pre-goal performance was significantly correlated with subsequent performance, self-efficacy, and strategy (Table 4.3). Self-efficacy and pre-goal performance are therefore included as covariates in later analyses.

[Insert Tables 4.1, 4.2, and 4.3 about here.]

Evaluation of Hypotheses

This analysis employs the original research design: goal type (simple goal and goal system) by task type (simple and complex task) by goal quantification. The dependent variables analyzed include goal comprehension and acceptance as measured prior to trial #7, and strategy and performance on Trials #1 through #6 (combined) and on Trials #7 through #12 (combined).

Goal comprehension and goal acceptance as measured prior to Trial #1 are reported but are analyzed differently. These measures were made before the individual attempted any of the actual experimental trials and are, therefore, independent of task complexity. Accordingly, the data from these measures are reported in a 2 x 2 design, goal quantification by goal type, and are included for completeness.

Effect of Goal Type on Goal Comprehension

Hypothesis #1 states:

For a simple task, simple goals lead to better goal comprehension than do goal systems.

Hypothesis #2 states:

For a complex task, goal systems lead to better goal comprehension than do simple goals.

For both the simple and the complex tasks, the simple goal and the goal system did not lead to significantly different goal comprehension. Similiarly, when the quantitative and non-quantitative goals are separated, there is not a significant difference in the effect of the two types of goals.

[Insert Tables 4.4 and 4.5 about here.]

An analysis of variance looked at the interaction of goal type with goal quantification and task complexity. None of the interactions were significant (see Table 4.5). Thus, this analysis does not support Hypothesis #1 or Hypothesis #2.

Effect of Goal Type on Goal Acceptance

Hypotheses #3a and #3b are in direct opposition:

#3a - For a simple task, simple goals lead to higher goal acceptance than do goal systems.

#3b - For a simple task, goal systems lead to higher goal acceptance than do simple goals.

For the complex task there are also two competing hypotheses.

#4a - For a complex task, goal systems lead to higher goal acceptance than do simple goals.

#4b - For a complex task, simple goals lead to higher goal acceptance than do goal systems.

These conflicting hypotheses were made because goals were anticipated to influence goal acceptance through their effect on goal comprehension, perceived goal difficulty, and self-efficacy. A simultaneous regression was performed to determine which factors influence goal acceptance. Goal acceptance, self-efficacy, goal comprehension, and perceived goal difficulty are not static; they are influenced by the individual's experience on the task. Table 4.6 therefore relates the early measure of each of the dependent variables to the early measure of goal acceptance and the later measures of the dependent variables to the later measure of goal acceptance.

[Insert Table 4.6 about here.]

Table 4.6 indicates that goal acceptance was significantly influenced by goal comprehension and was also influenced, although to a lesser degree, by self-efficacy. Perceived goal difficulty was not a significant influence on goal acceptance and was, therefore, excluded from further analyses.

[Insert Table 4.7 about here.]

In the previous section on goal comprehension we saw that goal comprehension was not significantly influenced by goal type. However, Table 4.7b indicates that self-efficacy was higher with the simple goal than it was with the goal system (means are 55.9 and 50.9, respectively, $F = 5.2$, $p = .02$). This suggests that goal acceptance should be higher with the simple goal than it is with the goal system (Hypotheses #3a and #4a).

[Insert Table 4.8 about here.]

Table 4.8 shows that for the simple task, goal acceptance was slightly but not significantly higher with the goal system than it was with the simple goal. When the task was complex, however, goal acceptance was slightly but not significantly higher with the simple goal than it was with the goal system.

[Insert Table 4.9 about here.]

An analysis of variance considered whether the interaction of task complexity with goal type, with or without goal quantification, had a significant influence on goal acceptance. Goal quantification had a significant influence on goal acceptance, but goal acceptance was not affected by goal type or task complexity (Table 4.9). The hypotheses assumed that goal acceptance is a joint effect of goal type and task complexity. Thus, this analysis does not support any of the four hypotheses.

Effect of Goal Type on Strategy

Hypothesis #5 states:

For a simple task, simple goals lead to a more appropriate action plan than do goal systems.

Hypothesis #6 states:

For a complex task, goal systems lead to a more appropriate action plan than do simple goals.

Table 4.10 shows that the simple goal and the goal system did not lead to a signficant difference in strategy for either the simple or the complex task. When the quantitative and non-quantitative goals were separated, there was still no signifcant difference between the simple goal and the goal system.

[Insert Tables 4.10 and 4.11 about here.]

An analysis of variance also indicates that none of the interactions of goal type, task condition, and goal quantification are significant. This analysis therefore does not support either Hypothesis #5 or Hypothesis #6.

Effect of Goal Type on Performance

For the simple task, the hypothesis is:

Hypothesis #7 - For a simple task, simple goals lead to better performance than do goal systems.

For the complex task, the hypothesis is:

Hypothesis #8 - For a complex task, goal systems lead to better performance than do simple goals.

These hypotheses were tested by comparing the difference in means between the relevant cells. Table 4.12 shows that the simple goal and the goal system did not lead to significant differences in performance whether the quantitative and non-quantitative goals were separated or combined.

[Insert Tables 4.12 and 4.13 about here.]

An analysis of variance was then performed to test whether the interaction of goal type with task complexity was significant. The interaction of goal type with task condition, with or without goal quantification, was not significant (see Table 4.13). This analysis therefore does not support either Hypothesis #7 or Hypothesis #8.

Re-Consideration of the Effect of Goal Type: The Effect of Experience

This section re-evaluates the effect of the two types of goals, this time separating the first- from the second-year students. The section first evaluates the support for each hypothesis using the second-year students only. This is appropriate; the hypotheses assume an experienced population and Chapter 5 presents evidence that the second-year students had relevant training and experiences which the first-year students had not yet had.

Effect of Goal Type on Goal Comprehension: The Effect of Experience

The simple goal led to slightly but not significantly better goal comprehension for the second-year students for both the simple and the complex task. The first-year students exhibited a different pattern. For them, the goal system led to somewhat better goal comprehension than the simple goal. While neither of these effects is significant by itself, the interaction of goal type with experience approaches significance (Trials #1-#6, $F = 2.5$, $p = .12$; Trials #7-#12, $F = 2.8$, $p = .10$). Table 4.15 is a clearer presentation of the interaction.

[Insert Tables 4.14 and 4.15 about here.]

Since goal comprehension was anticipated to be affected by task complexity as well as goal type, and since the effect of goal type on goal comprehension clearly relates to the experience of the individual, not to the complexity of the task, neither hypothesis is supported.

The Effect of Goal Type on Goal Acceptance: The Effect of Experience

Neither the simple goal nor the goal system led to a significant difference in the second-year students' goal acceptance.

[Insert Table 4.16 about here.]

Table 4.16 demonstrates that goal acceptance is not influenced by task complexity or goal type, either independently or jointly. Since the hypotheses assume an interaction between task complexity and goal type, none of the four hypotheses are supported.

The Effect of Goal Type on Strategy: The Effect of Experience

Goal type influences strategy. The initial effect is small, but it approaches significance as the individual gains experience with the task. For the second-year students, strategy on the simple task was improved by the simple goal (see Table 4.17). In the first half of the game the mean number of changes was 1.4 per employee with the simple goal, but 1.6 with the goal system ($T = .9$, $p =$ n.s.). The simple goal also led to a better strategy than the goal system for Trials #7 through #12 (means are 1.0 and 1.3, respectively, $T = 1.5$, $p = .14$). Although these results are not statistically significant, they are extremely consistent. The simple goal is associated with a better strategy for both the quantitative and the non-quantitative goal. These results therefore provide partial support for Hypothesis #5.

On the complex task, the strategy of the second year students was slightly improved by the goal system. However, none of the differences are statistically significant. This analysis therefore does not prove or disprove Hypothesis #6.

[Insert Tables 4.17 and 4.18 about here.]

When we look at the interaction of goal type with experience and task complexity, we see that goal type has the opposite effect on the strategy of the first-year students. For the first-year students the goal system led to a better strategy on the simple task while the simple goal led to a better strategy on the complex task. The interaction of goal type, task complexity, and experience approaches significance (Trials #1-#6, $F = 3.4$, $p = .07$; Trials #7-#12, $F = 3.5$, $p = .06$) in both halves of the game.

Table 4.18 is a clearer presentation of the interaction. Since these results are consistent, this indicates that the type of goal has a significant influence on strategy, depending on the experience of the individual and task complexity. This therefore provides partial support for Hypothesis #6.

Effect of Goal Type on Performance: The Effect of Experience

For the second-year students, goal type has little effect on performance during the first six trials. In the second half of the game, when the individual has become familiar with the task, simple goals led to significantly better performance on the simple task than the goal system (means are 92.1 and 99.1, respectively, T = 2.0, p = .05). Since the hypotheses assume an experienced population performing a familiar task, Hypothesis #7 is supported.

For the second-year students alone, the goal system led to slightly better performance on the complex task than the simple goal. However, the difference in the relative effectiveness of the two types of goals on the complex task is not significant (in the second half of the game means are 97.7 and 98.4, respectively, T = .2, p = n.s.). Therefore, this analysis does not support Hypothesis #8.

[Insert Table 4.19 about here.]

The interaction of goal type with task complexity and the experience of the individual is significant in the second half of the game (F = 5.1, p = .03). For the second-year students, the simple goal led to improved performance on the simple task while the goal system led to improved performance on the complex task. For the first-year students, the opposite is true: the goal system led to improved performance on the simple task while the simple goal led to improved performance on the complex task. This provides partial support for Hypothesis #8. Table 4.20 combines the quantitative and non-quantitative goals. It therefore shows the interaction more clearly.

[Insert Table 4.20 about here.]

Differentiation of the First- from the Second-Year Students: Effect of Goal Quantification on Strategy

Goal quantification affected the first- and second-year students' strategies differently. As the game progressed, the second-year students used an appropriate strategy whether they were given a quantitative or a non-quantitative goal. The first-year students, however, used an appropriate strategy only when given a quantitative goal. Table 4.21 shows the mean number of changes which the subjects made for each employee in each trial.

[Insert Table 4.21 about here.]

By the end of the game, the second-year students came close to making one change per employee with both the quantitative and the non-quantitative goal. The first-year students, however, used a good strategy by the end of the game when the goal was quantitative, but used a far less appropriate strategy when the goal was non-quantitative.

Presumably, the master's students come to Sloan, in part, because they have strong quantitative skills and are comfortable using those skills. When the goal was quantitative, therefore, both the first- and the second-year students had the necessary skills to use the information provided by the goal to employ an efficient strategy.

When the goal was non-quantitative, however, the second-year students employed an efficient strategy, but the first-year students employed an inefficient strategy. This suggests that the second-year students have had some experience or training that the first-year students have not yet had which has taught the second-year students to use non-quantitative data effectively. This is discussed in Chapter 5.

Model of the Process

Path Analysis[5]

In accordance with previous research by Wood and his associates (Bandura and Wood, 1989; Wood and Bandura, 1989; Wood, Bandura, and Bailey, forthcoming), path analyses were conducted to determine how the cognitive factors influence performance. Self-efficacy and goal difficulty had been

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[5] Robert Wood provided invaluable assistance with this analysis.

hypothesized to influence goal acceptance and were, therefore, included. Self-efficacy mediated the effect of goals on performance as it has in previous studies, but goal difficulty did not exert a significant influence on any of the factors and was eliminated from the analysis. The direction of causality of the three cognitive processes is established by the model described in Chapter 2 (Figures 2.1 and 2.2).

The overall path analysis is composed of three separate path analyses, representing performance on the pre-goal trials, performance on Trials #1 through #6, and performance on Trials #7 through #12. The unexplained variance in performance was then entered into the next analysis. This was done because the initial and subsequent measures of each factor are highly autocorrelated (see Table 4.3); the introduction of two measures of any factor therefore obscures all other processes.

[Insert Figure 4.1 about here.]

The path coefficients that are significant at $p = .05$ are shown to the left on each line, and the first order partial coefficients are shown to the right in parentheses.

Strategy has the largest effect on performance in both halves of the game. In the first half, strategy is primarily influenced by the individual's underlying ability. The effect of the goal is also mediated by self-efficacy and goal comprehension through goal acceptance. Goal acceptance, however, is negatively associated with strategy.

In the second half of the game, prior performance influences the individual's self-efficacy which influences strategy. Prior performance also has a direct effect on performance. Goal comprehension and goal acceptance did not have a significant influence on strategy or performance. The full model explains a significant amount of variance in performance in Trials #1 through #6, $r^2 = .22$, $p < .001$, and in Trials #7 through #12, $r^2 = .48$, $p < .001$.

Does Strategy Cause Performance?[6]

The strong correlation of strategy with performance (Trials #1-#6, $r^2 = .46$, $p < .01$; Trials #7-#12, $r^2 = .65$, $p < .01$) raised the question of whether strategy led to performance or performance led to strategy. The questions returned with additonal vigor when the path analysis demonstrated that strategy was by far the most significant influence on performance. This suggested that autocorrelation might be obscuring the effect of the other factors on performance.

An argument could be made that the direction of causality runs in either direction. If strategy led to performance, then subjects who made few changes learned more and therefore performed better. But performance led to strategy if subjects who did well in the game stayed with the same choices because they were doing well, and if

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[6] John Carroll provided invaluable assistance with this analysis.

subjects who did poorly made many changes in the hope of improving their performance. A cross-lagged panel correlation was performed to test the direction of causality (Kenny, 1979).

Cross-lagged panel correlation looks at the correlation of one variable (strategy, for example) in the first time period with the other variable (here, performance) in the second time period. It then compares this correlation with the correlation of performance in the first time period with strategy in the second time period. The larger correlation suggests the direction of causality. This approach was tried with the data from this study.

Change in strategy is not calculable until Trial #3. Therefore, in order to obtain three equal time periods, the correlation of strategy with performance was analyzed for Trials #4 through #6, Trials #7 through #9, and Trials #10 through #12. Figure 4.2 shows the correlations.

[Insert Figures 4.2 and 4.3 about here.]

Performance appears to exert a stronger influence on strategy than strategy does on performance. Tests were therefore conducted to determine whether the difference was significant. Figure 4.3 shows the formulas recommended by Kenny (1979). For the first wave, $Z = 1.89$, $p = .06$; for the second wave, $Z = 2.53$, $p = .01$. This suggests that this measure of strategy is an outcome of performance and not a cause of it. Chapter 5 discusses the need for a different measure of strategy.

Chapter 5: DISCUSSION AND CONCLUSIONS

The experiment tests the theory that for a simple task, simple goals lead to improved goal comprehension and strategy and, therefore, to improved performance. For a complex task, goal systems were anticipated to lead to improved goal comprehension and strategy and, therefore, to improved performance. When the analysis combines the more experienced and the less experienced students, the experiment fails to support the theory. However, when the students are divided according to their experience, the experiment suggests an expanded version of the theory.

[Insert Table 5.1 about here.]

For an experienced individual performing a simple task, simple goals lead to improved goal comprehension and to improved performance. When the task is complex, however, a goal system provides additional information about the task which leads to improved performance. This demonstrates that a context specific goal does not have to be quantitative in order to lead to improved performance on a complex task.

For an inexperienced individual the reverse is true. For a simple task, the goal system leads to improved goal comprehension and, therefore, to improved performance. When the task is complex, however, the simple goal leads to improved performance.

The experiment does not adequately test the full model of the process by which goals influence performance. Two of the four strategy measures are insufficiently associated with performance to be considered mediators (see Table 3.4). One measure is clearly determined by performance, not a determinant of it. Similiarly, the fourth measure of strategy, i.e., the absolute value of the mean number of changes minus the number one, also appears to more strongly determined by performance than a determinant of it, although the difference between the correlations is not significant.

The remainder of this chapter is divided into four sections. The first section discusses goal systems as schemas and the difference in training and experience between the first- and the second-year students. This section explains why goal systems lead to improved performance on complex tasks for experienced individuals. The second section discusses methodological issues, particularly the need for a better measure of strategy. The third and fourth sections discuss the limitations of the study, directions for future research, and the implications of the study for managers.

Discussion of Theoretical Issues

The Effect of Schematic and Non-Schematic Goals on the Performance of Experienced Versus Inexperienced Individuals

A schema is a framework for systematizing information

(Abelson, 1981; Brewer and Treyens, 1981). This makes it easier for the individual to store and recall information (Anderson and Pichert, 1978; Chase and Ericsson, 1982), and increases the individual's cognitive resources for a new problem (Cantor and Mischel, 1979; Lurigio and Carroll, 1985).

Schematic and non-schematic goals differ in the amount and structure of the information they provide. A goal system includes a superordinate goal and related subgoals; it is a hierarchical schema. A simple goal is presented as a solitary objective; it is not given as part of a schema. Schematic and non-schematic goals differ in the way they influence the comprehension and utilization of goal relevant information, but the relative effectiveness of the two types of goals depends on the complexity of the task and the experience of the individual.

Let us consider the chore of picking up the dry cleaning as an example of a simple task. If one spouse asks the other to pick up the dry cleaning, the goal is instantly comprehended and an action plan is quickly available: "Sure, I go right by there on my way home from work." For the experienced spouse, the simple goal leads to improved goal comprehension. It is also anticipated to trigger the use of a stored action plan, thereby leading to improved performance. A goal system would have increased the spouse's awareness of the way in which this trip to the dry cleaners differs from previous trips. This awareness would then have led to the creation of a new action plan even though a stored action plan would have been more efficient (Wood and Locke, forthcoming).

But if a parent is asking a teenager to pick up the dry cleaning for the first time, then a discussion of the location of the dry cleaners, the hours during which the cleaners will be open, and the necessity of taking the appropriate receipt and sufficient cash will lead to improved performance. Because the task is simple, these (relatively) few task factors influence performance. A discussion of these factors therefore involves only a moderate amount of information; this increases the teenager's goal comprehension. Additionally, although the task of picking up the dry cleaning is objectively simple, the inexperienced teenager does not have an appropriate stored action plan. The goal system which describes the way the various subgoals (e.g., taking the receipt and money), relate to the superordinate goal (picking up the cleaning) increases the teenager's awareness of the way that these factors influence performance. The teenager is therefore more likely to take these factors into account in creating a new action plan. The goal system should therefore lead to the creation of a more appropriate strategy. Thus, the goal system improves the teenager's performance. If the parent were to use a simple goal, the teenager would probably go to the cleaners that the family stopped using five years earlier (low goal comprehension) or fail to take the receipt (inappropriate action plan).

Let us now consider the writing of a literature review as an example of an objectively complex task. If the individual writing the review is an advanced doctoral student, then his/her action plan will be improved by a goal system which specifies whether the review is to be used in an elementary textbook, or whether the review is to be used to support a researchable hypothesis. If the review is for a textbook, a chronological review of the literature may lead to new insights. If the review is for research, it may be more efficient to acquire an extensive knowledge of the key theory and then contrast that theory with other theories. When the goal is presented as a schema, it increases the doctoral student's awareness that the purpose of the literature review is a factor which influences performance. The goal system also increases the student's awareness of the way in which this literature review differs from previous reviews. It should lead to the creation of a more appropriate new task specific plan (Wood and Locke, forthcoming) and therefore to improved performance.

If a freshman is writing the review, however, the goal system provides more information than the freshman can handle. When the information conveyed by the goal system is added to the information conveyed by the task, the freshman is overwhelmed by the information. The freshman may flit back and forth between trying to understand the various theories and trying to understand the appropriate structure for the specified type of review. A simple goal, however, should encourage the freshman to use a stored action plan; the plan may be suboptimal for the task, but it is more efficient for the freshman to use a suboptimal plan than to engage in the chaotic behavior prompted by the frantic search for an appropriate new action plan. The simple goal should therefore lead to a better strategy and, thus, to better performance than a goal system.

Relevant Experiences of the Second-Year Students

The preceding chapter demonstrates that the simple goal and the goal system have differing effects on the performance of the first- and second-year students. It also suggests that the second-year students have some experience or training which has taught them to use non-quantitative data effectively. The experiment was run during January and February. Let us now consider some experiences that occur after the first term which may have provided relevant experience, thereby creating these differences.

Three types of educational experiences that provide training in using skills which are relevant to the game are used infrequently in the first term but relatively frequently thereafter. First, case analysis provides practice in sorting through a multitude of factors and selecting those factors which are relevant to the situation at hand. Information included in the cases can be both quantitative and non-quantitative; performance is most improved when the student employs both kinds of information. The core courses taken by the first-year students during the first term include strategy, organizational behavior, statistics, accounting, micro-economics and a computer course. Strategy and organizational behavior use some cases; the other courses are not case courses. The use of cases increases later in the program; marketing and advanced strategy courses, for example, rely extensively on case materials. The second-year students have therefore had significantly more of this kind of training than the first-year students.

Second, courses such as Decision Support Systems III (linear programming) and Introduction to Operations Management familiarize the students with the process of obtaining information from computers. Linear programming begins in February, but the relevant computer exercises tend to fall in the second half of the semester. Operations Management begins later in the spring; this year it began after the students played the Furniture Factory Game. The second-year students have therefore had significant training in a relevant skill; the first-year students had not had the training when they played the game.

Third, some games require the student to use the computer to obtain information experientially. Virtually all of these games are played after the first semester. (An exception is the People's Express Game which is played during orientation week.) For example, this year all the first-year students played a collective bargaining game in Human Resource Management; however, the game began after the data for this study were collected. Electives in marketing and system dynamics also use experiential computer games; again, the games are played in the second half of the spring. Performance in these games is improved by the use of a strategy which provides the clearest possible information about the model. The second-year students have therefore had more experience in creating an efficient strategy for obtaining computer-based information than the first-year students.

Thus, the second-year students have had both training and experiences which are relevant to their performance on the game. This may explain the difference in performance between the first- and the second-year students. However, other experiences may also have interacted with goals to influence performance.

Methodological Issues

Measurement of Strategy

This dissertation used the mean number of changes per employee as the measure of strategy. This measure is similiar to the measure used in previous studies (Bandura & Wood, 1989; Wood & Bandura, 1989; Wood, Bandura, & Bailey, forthcoming). However, the cross-lagged panel correlation strongly suggests that measures of strategy which evaluate the changes in an individual's choices are more likely to be outcomes of performance, rather than determinants of it. We therefore need a better measure of strategy if we are to develop a comprehensive model of the process by which goals influence performance.

Perhaps the individual's consciously selected strategy is a determinant of performance. This could be measured by asking subjects at various points in the game, what strategy they are using. If subjects report relatively few strategies (ideally six or fewer) then a strategy questionnaire could be included in future games. The strategy questionnaire would need to be completed at least twice by each subject in order to determine the direction of causality. Clearly, the use of such a questionnaire during the game could influence subjects' strategies, but if all subjects receive identical questionnaires, then the effect would be symmetrical and would not invalidate other analyses.

Desirability of Permitting Review of Prior Decisions

Although the goal system led to improved performance on the complex task for the experienced subjects, it is possible that the effect would have been stronger if the game had included an option whereby the subject could review prior choices. Although the game provided feedback about the subject's performance on the goal and (in the goal system condition) subgoals, this feedback may have been of limited value if a subject did not remember the decisions which led to the result. Many subjects commented that they would have liked to review prior decisions. This suggests that they did not keep a record of their prior decsions. Inclusion of a review option in future games might, therefore, increase the effectiveness of context specific goals.

The game should also be modified to record the frequency with which subjects use the review option. Frequency of using the review option represents the degree to which the individual actively seeks information about the task. This might correlate with performance. If so, and if it leads to performance more strongly than performance leads to the search for information, it may be a good measure of strategy. The program of the Furniture Factory Game should therefore be redesigned so that subjects have the option of obtaining a review of their prior decisions.

Difficulty of the Quantitative Goal

I expected the quantitative goal to lead to improved performance on the simple task and the non-quantitative goal to lead to improved performance on the complex task. This is what happened on a similiar game used by Wood, Bandura, and Bailey (forthcoming). However, I found that with the simple goal only[6], the quantitative goal improved the

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[6] This is the type of goal used by Wood, Bandura, and Bailey.

performance of the first-year students but decreased the performance of the second-year students on both the simple and the complex tasks (Table 3.1).

The quantitative goal may have improved the first-year students' performance on the complex task as well as on the simple task because of the students' comfort with using quantitative data combined with their lack of experience with computer-based games. Perhaps the first-year students failed to realize how difficult the quantitative goal was (it was achieved on only 1% of the trials). Alternatively, the first-year students may have considered both tasks to be simple. The quantitative goal may therefore not have increased their anxiety; if it had done so, it would probably have decreased their performance (Bandura and Wood, 1989; Huber, 1985; Humphreys and Revelle, 1984).

Conversely, the non-quantitative goal may have increased the second-year students' performance on both the simple and the complex tasks because these students' familiarity with computer-based games led them to interpret the non-quantitative goal as a quantitative goal. The production order screen shows the standard hours for each production function; perhaps the second-year students who were given the non-quantitative goal condition took the standard hours for the task as their goal. In this case, the standard hours would have been a difficult but achievable goal: mean performance on the last half of the game was 96.7% of standard hours.

Because of their greater experience with computer-based games, the second-year students may have realized that the quantitative goal was nearly impossible. If the second-year students considered the non-quantitative goal to be a difficult but achievable goal and the quantitative goal to be an impossible goal, then the non-quantitative goal might lead to better performance than the quantitative goal. Some previous studies have found that extremely difficult goals sometimes lead to poorer performance than difficult but achievable goals even on relatively simple tasks (Bavelas and Lee, 1977; Erez and Zidon, 1984; Motowidlo, Loehr, and Dunnette, 1978).

Future research should include questions about the individual's perception of the complexity of the task; this would facilitate comparison of different groups of subjects through their perceptions of task complexity. Future research should also include quantitative goals at different levels of difficulty; this would provide information about the interaction of goal difficulty with task complexity.

Limitations of the Study and Directions for Future Research

This study found that for experienced individuals, a goal system led to better performance on a complex task while a simple goal led to better performance on simple tasks. The reverse pattern was obtained with less experienced individuals. However, the experiment fails to test the full model of the process by which goals exert their influence. Future research which includes better measures of strategy appropriateness is therefore needed.

Additionally, although the research suggests that experience is an important mediator of the effect of goals on performance, the evidence obtained by study is not very strong. However, this theory has important implications for task performance. A study should therefore be designed to test the theory. Such a study should make the simple task simpler and the complex task more complex; it should also include subjects with a wider range of relevant experience.

For example, Sloan Fellows could be compared with first-year students. These two populations have approximately equal experience with computer-based games, but the Sloans have more extensive managerial experience than the masters students. However, if the game is to be used with the Sloans, it needs to be modified so that the game is highly similiar to the real world. Specifically, the game should be revised so that employees learn from experience; the present game does not permit employees to learn. Several Sloans commented that the game was unrealistic in this respect. This lack of realism reduces the potential effect of the individual's experience on his/her performance in the game.

If this research supports the theory, then it would be valuable to know at what level of complexity on-the-job performance is improved by a goal system. It would also be useful to know more about how much experience an individual needs to have with a task in order for goal systems to lead to improved performance. These questions are particularly appropriate for a field study which could include more variance in task complexity and more variance in individuals' experience. Subsequently, research could consider what constitutes an effective process for the implementation of effective goal systems in organizations.

Implications for Managers

This research suggests that the use of a goal which is appropriate to the individual and the task will lead to improved performance. Novices should be given substantial information about their goals when the task is simple, but should be given simple goals for more complex tasks. As the employee gains experience on the complex task, additional goal information will lead to improved performance.

This is precisely the opposite of the type of goal used in some jobs. When the job is simple, a novice is often given a few simple instructions and a simple goal. A more complete explanation of the goal would help the individual to find a more efficient way of performing the same task. Once the individual becomes experienced, however, a complete description of that individual's goal may annoy the employee, suggest that his/her performance is not satisfactory, or lead to the adoption of an alternative but less efficient method of production.

Conversely, when a novice begins a complex job, the novice may be deluged with information about the organization's goal and his/her role in achieving that goal. Helpful co-workers sometimes offer stacks of memos and company information to be reviewed. Informational meetings and lunches further bewilder the novice. Months later, the novice has sufficient familiarity with the task to be able to comprehend what was previously offered. But by then, the novice is an "old-hand", the previous goal communications are imperfectly recalled and the information which might now clarify the goal is no longer offered. Additional informational meetings would now provide useful goal information but requests for such meetings may make the individual appear inattentive or incompetent. This suggests that if a job is complex, the manager should begin a novice employee with a simple goal and then move to the use of a goal system as the employee becomes experienced.

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Table 1.1

STUDIES MEASURING TWO OR MORE STEPS IN THE PROCESS BY WHICH GOALS INFLUENCE PERFORMANCE OR INCLUDING TWO MEASURES OF ACTION PLANNING

Study	Goal Comprehension	Goal Acceptance	Action Plan or Strategy	Causal Analysis
Bandura & Wood, 1989		Self-set goals	# decisons on which subject changed one factor	Yes
Chesney & Locke, working paper		Personal goal	Self report, analysis of choices	Yes
Earley, Wojnaroski, & Prest, 1987			Planning, effort	Yes
Garland, 1983		Personal goal	Effort	Yes
Ivancevich & McMahon, 1977a	Goal clarity	Goal commitment, goal acceptance	Effort	No
Ivancevich & McMahon, 1977b	Goal clarity	Goal commitment, goal acceptance	Effort	No

Table 1.1 (continued)

Ivancevich & McMahon, 1977c	Goal clarity	Goal commitment, goal acceptance	Effort	No
Kim, 1984	Goal clarity	Goal acceptance		No
Latham & Steele, 1983	Clarity of role, task, instructions, and performance expectations	Goal commitment	Effort (included in the goal acceptance scale)	No
Locke, Frederick, Lee, & Bobko, 1984		Self-set goal, goal commitment	Strategy employed	Yes
McCaul, Hinsz, & McCaul, 1987		Goal commitment	Time spent studying	No
Mento, Cartledge, & Locke, 1980		Goal acceptance, personal goal	Effort: number of rows attempted (correlated .92 and .98 with performance)	Yes
Motowidlo, Loehr, & Dunnette, 1978	Goal specificity (independent variable)	Goal acceptance		No

Table 1.1 (continued)

Neale, Nortncraft, & Earley, working paper			Effort: # of completed agreements Strategy: % of integrative agreements	No
Steers, 1975	Goal specificity		Goal effort (supervisor rated)	No
Tatum, Nebeker, Cooper, & Riedel, 1986		Goal level (self report)	Work breaks (observed)	Yes
Terborg, 1976			Effort: % of time spent working Strategy: self report	No
Wood & Bandura, 1989		Self-set goal	Number of decisions on which changed one factor	Yes
Wood, Bandura, & Bailey, unpublished		Self-set goal	Number of decisions on which changed one factor	Yes

Table 1.2

STUDIES MEASURING THE EFFECT OF GOALS ON TASKS OF VARYING COMPLEXITY

Study	Task (s)	Variables	Findings
Baumler, 1971	Resource allocation game- minimal versus extensive interdependence	Performance, number of messages, type of messages, coordination, teamwork	Subgoals improved performance of simple task only. Subgoals reduced communication.
Campbell & Gingrich, 1986	Field study - programming	Performance, perceived goal difficulty, goal acceptance, perceived task difficulty	Participation improved performance of complex task only
Campbell & Ilgen, 1976	One, two, and three move chess problems	Number solved, number attempted, goal difficulty	Early experience on complex task led to better performance
Earley, 1985	1) Scheduling task, unrestricted versus 3 restrictions. 2) Animal care, with versus without record keeping	Information about task importance and methods, choice of strategy and work breaks, goal acceptance, personal goal, performance	Information influenced goal acceptance and had an effect on performance. Information had greater effect on performance of complex task. Choice only improved performance with information

Table 1.2 (Continued)

Earley, Hanson, & Lee, 1986	Field study - complexity f(clarity, variety, # of strategies, outcome contingencies)	Performance, planning, goal specificity and difficulty, Type A personality	Complexity did not moderate effect of goals on performance, but did moderate effect of goals on planning.
Earley, Lee, & Hanson, 1989	Re-analysis of Earley, Hanson, and Lee, 1986	Performance, goal specificity and difficulty, job experience, job level	On a complex task, goal setting improved the performance of experienced workers
Frost & Mahoney, 1976	Identification of wrong word in reading passage. Jigsaw puzzle.	Performance, goal specificity, goal difficulty, goal acceptance, performance interval frequency	Quantitative goals led to better performance on puzzle.
Hirst, 1988	Resource allocation task, minimal versus extensive interdependence	Goal specificity, task order, intrinsic motivation	Quantitative goal increased motivation for simple task, decreased motivation for complex task.
Huber, 1985	Simple versus difficult maze - heuristic task	Goal commitment, arousal, performance	Complex task: quantitative goal reduced performance, affected strategy. Simple task: quantitative goal did not affect performance.

Table 1.2 (Continued)

Jackson & Zedeck, 1982	1) Model building, Lego - one model versus five models. 2) Estimation of carpet for floor plan - simple versus complex calculation	Goal level, evaluation context, task order, performance, satisfaction, task perception, effort (measured, not reported: no effect on performance)	1) Goal level did not influence performance on either simple or complex task. 2) Goal level influenced performance on both simple and complex task
Wood, Bandura, & Bailey, in press	Managerial simulation - 3 versus 8 production functions	Goal level, self-efficacy, goal acceptance, self set goal, analytic strategy, performance	Goal level did not affect performance of complex task.

Table 3.1

INDIVIDUAL STORED VALUES IN THE SCHIRO MODEL OF THE FURNITURE FACTORY GAME

Employee (i)	M_i	A_{i1}	A_{i2}	A_{i3}	A_{i4}	A_{i5}	A_{i6}	A_{i7}	A_{i8}
Jack	0	0	3	-3	9	0	-9	-9	0
Bert	-3	-3	-6	-6	-9	-9	-6	-6	9
Dave	3	9	6	9	3	-9	-3	0	9
Janice	3	-3	0	3	0	0	0	9	-6
Hilary	3	-9	-9	-9	-6	6	9	-9	0
Evelyn	-1	-9	-9	-9	-9	9	0	-9	-6
John	0	3	-3	6	-6	-6	-9	-9	0
Neil	-3	-6	-9	0	-9	-6	-9	-6	3
James	0	6	0	3	1	-3	-9	-6	6
Charlie	-1	3	6	6	-6	0	-3	0	3

Employee (i)	I_{i1}	I_{i2}	I_{i3}	I_{i4}	I_{i5}	I_{i6}	I_{i7}	I_{i8}
Jack	2	-2	2	2	-2	-2	2	-2
Bert	0	0	2	-2	2	2	-2	-2
Dave	2	-2	0	0	0	-2	2	2
Janice	-2	-2	2	-2	2	2	2	-2
Hilary	2	2	-2	-2	0	2	2	0
Evelyn	-2	-2	-2	-2	2	0	-2	0
John	-2	0	2	-2	-2	0	2	2
Neil	-2	-2	-2	-2	0	-2	2	2
James	0	-2	0	-2	2	0	2	0
Charlie	0	-2	0	-2	-2	0	-2	-2

Table 3.2

STORED VALUES IN THE SCHIRO MODEL OF THE FURNITURE FACTORY GAME: VALUES FOR PROCESS FACTORS

Variable	Choice	Value
VG	No goal	-12
	125%	- 8
	Estimated	2
	75%	- 4
	Do your best	0

Variable	Choice	PP>1.0 or $A_{ij} \leq 0$	Else
FEEDBACK	No feedback	1	4
	Advise	4	10
	Discuss	7	1
	Advise & Discuss	10	7

Variable	Choice	PP≤.8	.8<PP≤1.0	1.0<PP≤1.25	PP>1.25
GOAL	No goal	1	1	1	1
	125%	2	2	7	10
	Estimated	3	6	10	7
	75%	10	8	3	3
	Do Yr Best*	8	4	2	2

* If i = Dave, Janice, or Hilary, Do Yr Best = 10

Variable	Choice	PP≤1.0**	Else
REWARD	No Reward	1	1
	Moderate Reward	6	10
	High Reward	10	6

** or if i = Bert, John, or James and PP≤1.1

Note: $P_{ij\,t-1}/ST_{j\,t-1}$ = Prior Performance (PP)

Table 3.3

MAXIMUM POSSIBLE PERCENTAGE INFLUENCE OF FACTORS
ON PERFORMANCE IN THE FURNITURE FACTORY GAME

	TRIAL #1		LATER TRIALS	
Factor	Max Inc	Max Dec	Max Inc	Max Dec
Ability	9.0	-9.0	9.0	-9.0
Value of the Job to the Employee	2.0	-2.0	2.0	-2.0
Employee's Motivation	3.0	-3.0	3.0	-3.0
Effect of Production Target	2.0	-7.0	-	-
Expect. that Effort Leads to Perf.	-	-	13.6	-18.9
Expect. that Perf. Leads to Reward	-	-	15.0	-16.5
Value of the Reward to the Indiv.	-	-	9.0	-9.0

Table 3.4

ASSOCIATION OF POTENTIAL STRATEGY MEASURES WITH PFRFORMANCE
(CORRELATION: N=130)

	TRIALS	
Measure	#1-6	#7-12
Percentage of Trials Changing 1 Factor	.21*	.03
Absolute Value of (N of Changes - 1)	.33**	.37**
Mean Number of Changes per Employee	.46**	.65**
Conceptual Understanding of the Model	.19+	.16+

Note: + p<.10
* p<.05
** p<.01

Table 3.5

COMPARISON OF THE PERFORMANCE OF
FIRST- VERSUS SECOND-YEAR STUDENTS:
QUANTITATIVE AND NON-QUANTITATIVE GOALS COMBINED
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

a. MEAN PERFORMANCE - TRIALS #1-#6

	1st YEAR STUDENTS	2nd YEAR STUDENTS
Performance	101.1 (67)	99.4 (63)

[Effect of Status, F=2.8, p=.10]

b. MEAN PERFORMANCE - TRIALS #7-#12

	1st YEAR STUDENTS	2nd YEAR STUDENTS
Performance	96.6 (67)	96.8 (63)

[Effect of Status, F=.005, p=.94]

Note: Lower scores indicate better performance

Table 3.6

COMPARISON OF THE PERFORMANCE OF FIRST- AND SECOND-YEAR STUDENTS: THE EFFECT OF GOAL QUANTIFICATION (ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

a. MEAN PERFORMANCE - TRIALS #1-#6

Goal	1st YEAR STUDENTS	2nd YEAR STUDENTS
Non-Quantitative	103.5 (32)	98.3 (32)
Quantitative	99.0 (35)	100.5 (31)

	F	p
Main Effects		
Status	2.8	.10
Goal Quantification	1.1	n.s.
Two-Way Interaction	5.5	.02

b. MEAN PERFORMANCE - TRIALS #7-#12

Goal	1st YEAR STUDENTS	2nd YEAR STUDENTS
Non-Quantitative	98.9 (32)	95.2 (32)
Quantitative	94.6 (35)	98.5 (31)

	F	p
Main Effects		
Status	<.1	n.s.
Goal Quantification	.3	n.s.
Two-Way Interaction	3.9	.05

NOTE: Lower scores indicate better performance.

Table 4.1

MEAN PRE-GOAL SELF-EFFICACY

	SIMPLE GOAL		GOAL SYSTEM	
	Non-Quant.	Quant.	Non-Quant.	Quant.
Task				
Simple	53 (N=16)	52 (N=16)	50 (N=15)	46 (N=15)
Complex	48 (N=17)	52 (N=17)	54 (N=16)	48 (N=18)

[Anova, one way, F(7,122)=.7, p=n.s.]

Table 4.2

MEAN PRE-GOAL PERFORMANCE

	SIMPLE GOAL		GOAL SYSTEM	
	Non-Quant.	Quant.	Non-Quant.	Quant.
Task				
Simple	87 (N=16)	90 (N=16)	91 (N=15)	89 (N=15)
Complex	90 (N=17)	90 (N=17)	90 (N=16)	90 (N=18)

[Anova, one way, F(7,122)=.7, p=n.s.]

Note: Performance is expressed as a percentage of actual time to estimated time. Lower numbers represent better performance.

Table 4.3

ASSOCIATIONS AMONG SELF-EFFICACY, PERFORMANCE, AND PROCESS VARIABLES
(N=130)

INTERCORRELATIONS

Factor	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1S-Eff[a]	50.5	12.9	-										
2Perf[a]	89.6	5.5	.07										
3S-Eff[b]	56.4	12.9	.65**	.21**									
4GComp[b]	6.6	1.7	.42**	.04	.40**								
5GAcc[b]	7.0	1.8	.35**	.07	.43**	.41**							
6Strt[c]	1.4	.6	.06	.26**	.07	.05	-.12+						
7Perf[c]	100.3	7.8	.02	.17*	.13+	.09	.04	.46**					
8S-Eff[d]	53.4	12.5	.57**	.17*	.74**	.35**	.39**	.22**	.35**				
9GComp[d]	7.1	1.5	.31**	.06	.32**	.79**	.41**	.08	.17*	.42**			
10GAcc[d]	7.0	1.7	.26**	.07	.31**	.41**	.80**	.03	.05	.36**	.55*		
11Strt[e]	1.3	.7	<.01	.37**	.12	.13+	-.09	.79**	.48**	.29**	.21**	.05	
12Perf[e]	96.7	9.9	.04	.30**	.06	.14+	.07	.48**	.49**	.19*	.24**	.06	.65**

Note: S-Eff = Self Efficacy
Perf = Performance
GComp = Goal Comprehension
GAcc = Goal Acceptance
Strt = Strategy

a Measured before goal.
b Measured after goal.
c Average of Trials #1-#6.
d Measured after Trial #6.
e Average of Trials #7-#12.

+ $p<.10$
* $p<.05$
** $p<.01$

Table 4.4
TESTS OF HYPOTHESES REGARDING
THE EFFECT OF GOAL TYPE ON GOAL COMPREHENSION

RESEARCH DESIGN - CELL NUMBERS

	SIMPLE GOAL		GOAL SYSTEM	
	Non-Quant.	Quant.	Non-Quant.	Quant.
Task				
Simple	1	2	3	4
Complex	5	6	7	8

a. TESTS OF HYPOTHESIS #1

ANALYSIS OF GOAL COMPREHENSION AFTER TRIAL #6

	A		B			
Supported if:	Mean	N	Mean	N	T	sig.T
Cell #1 (A)>Cell #3 (B)	7.1	16	7.3	15	- .5	n.s.
Cell #2 (A)>Cell #4 (B)	7.1	16	6.5	15	1.1	n.s.
Cells #1+#2>Cells #3+#4	7.1	32	6.9	30	.5	n.s.

b. TESTS OF HYPOTHESIS #2

ANALYSIS OF GOAL COMPREHENSION AFTER TRIAL #6

	A		B			
Supported if:	Mean	N	Mean	N	T	sig.T
Cell #7 (A)>Cell #5 (B)	7.3	16	7.2	17	.3	n.s.
Cell #8 (A)>Cell #6 (B)	6.8	18	7.4	17	-1.1	n.s.
Cells #7+#8>Cells #5+#6	7.0	34	7.3	34	- .6	n.s.

Table 4.5
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION, AND TASK COMPLEXITY ON GOAL COMPREHENSION
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

a. MEAN GOAL COMPREHENSION AFTER THE PRACTICE TRIALS

SIMPLE GOAL		GOAL SYSTEM	
Non-Quant.	Quant.	Non-Quant.	Quant.
6.4 (33)	7.0 (33)	6.7 (31)	6.3 (33)

	F	p
Covariates		
Performance on Two Practice Trials	<.1	n.s.
Pre-Goal Self-Efficacy	26.2	<.001
Main Effects		
Goal Quantification	.3	n.s.
Goal Type	.1	n.s.
Two-Way Interaction		
Goal Quantification x Goal Type	1.5	n.s.
One-Way Anova (5, 124)	13.6	<.001

Residual	
Sum of Squares	296.6
Mean Square	2.4

Table 4.5 (Continued)
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION,
AND TASK COMPLEXITY ON GOAL COMPREHENSION
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

b. MEAN GOAL COMPREHENSION AFTER TRIAL #6

	SIMPLE GOAL		GOAL SYSTEM	
	Non-Quant.	Quant.	Non-Quant.	Quant.
Task				
Simple	7.1 (16)	7.1 (16)	7.3 (15)	6.5 (15)
Complex	7.2 (17)	7.4 (17)	7.3 (16)	6.8 (18)

	F	p
Covariates		
Performance on Two Practice Trials	.2	n.s.
Pre-Goal Self-Efficacy	12.9	<.001
Main Effects		
Goal Quantification	.7	n.s.
Task Condition	.5	n.s.
Goal Type	.3	n.s.
Two-Way Interactions		
Goal Quantification x Task Condition	.1	n.s.
Goal Quantification x Goal Type	1.5	n.s.
Task x Goal Type	.2	n.s.
Three-Way Interaction		
Goal Quantification x Task x Goal Type	.2	n.s.
One-Way Anova F (9, 120)	1.9	.07

Residual	
Sum of Squares	263.1
Mean Square	2.2

Table 4.6

THE INFLUENCE OF PROCESSES ON GOAL ACCEPTANCE
(N=130)

a. GOAL ACCEPTANCE AFTER THE TWO PRACTICE TRIALS

	Variables		Equation	
	Beta	T	R^2	F
Performance[a]	-.02	.2		
Self-Efficacy[b]	.31	3.6**		
Goal Comprehen.[b]	.29	3.5**		
Goal Difficulty[b]	-.07	-.9	.26	10.9**

b. GOAL ACCEPTANCE AFTER TRIAL #6

	Variables		Equation	
	Beta	T	R^2	F
Performance[c]	-.11	-1.4		
Self-Efficacy[d]	.19	2.3*		
Goal Comprehen.[d]	.48	6.0**		
Goal Difficulty[d]	-.08	-1.1	.32	16.1**

NOTE: [a] average of pre-goal trials.
[b] measured after pre-goal trials and after goal.
[c] average of Trials #1-#6.
[d] measured after Trial #6.

+ p<.10
* p<.05
** p<.01

Table 4.7
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION
AND TASK COMPLEXITY ON SELF-EFFICACY
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

a. MEAN SELF-EFFICACY AFTER THE TWO PRACTICE TRIALS

SIMPLE GOAL		GOAL SYSTEM	
Non-Quant.	Quant.	Non-Quant.	Quant.
57.5 (33)	59.2 (33)	54.0 (31)	54.8 (33)

		F	*p*
Covariates			
Performance on Two Practice Trials		6.6	.01
Pre-Goal Self-Efficacy		93.9	<.001
Main Effects			
Goal Quantification		1.9	n.s.
Goal Type		2.4	n.s.
Two Way Interaction			
Goal Quantification x Goal Type		.3	n.s.
One-Way Anova (5, 124)		21.8	<.001
Residual			
Sum of Squares	11,374.9		
Mean Square	91.7		

Table 4.7 (Continued)
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION
AND TASK COMPLEXITY ON SELF-EFFICACY
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

b. MEAN SELF-EFFICACY AFTER TRIAL #6

	SIMPLE GOAL		GOAL SYSTEM	
	Non-Quant.	Quant.	Non-Quant.	Quant.
Task				
Simple	55.1 (16)	56.1 (16)	49.2 (15)	44.8 (15)
Complex	52.3 (17)	60.1 (17)	55.9 (16)	52.9 (17)

	F	p
Covariates		
Performance on Two Practice Trials	3.5	.06
Pre-Goal Self-Efficacy	63.5	<.001
Main Effects		
Goal Quantification	.7	n.s.
Task Condition	5.6	.02
Goal Type	5.2	.03
Two-Way Interactions		
Goal Quantification x Task Condition	.7	n.s.
Goal Quantification x Goal Type	3.0	.08
Task x Goal Type	1.2	n.s.
Three-Way Interaction		
Goal Quantification x Task x Goal Type	<.1	n.s.
One-Way Anova (9, 119)	9.5	<.001

Residual	
Sum of Squares	11,779.8
Mean Square	98.2

Table 4.8
TESTS OF HYPOTHESES REGARDING
THE EFFECT OF GOAL TYPE ON GOAL ACCEPTANCE

RESEARCH DESIGN - CELL NUMBERS

	SIMPLE GOAL		GOAL SYSTEM	
	Non-Quant.	Quant.	Non-Quant.	Quant.
Task				
Simple	1	2	3	4
Complex	5	6	7	8

a. SIMPLE TASKS: TESTS OF HYPOTHESIS #3a

ANALYSIS OF GOAL ACCEPTANCE AFTER TRIAL #6

	A		B			
Supported if:	Mean	N	Mean	N	T	sig.T
Cell #1 (A)>Cell #3 (B)	7.5	16	6.9	15	1.0	n.s.
Cell #2 (A)>Cell #4 (B)	6.1	16	6.6	15	- .7	n.s.
Cells #1+#2>Cells #3+#4	6.8	32	6.7	30	.2	n.s.

b. COMPLEX TASK: TESTS OF HYPOTHESIS #4a

ANALYSIS OF GOAL ACCEPTANCE AFTER TRIAL #6

	A		B			
Supported if:	Mean	N	Mean	N	T	sig.T
Cell #5 (A)>Cell #7 (B)	7.4	17	7.3	16	- .2	n.s.
Cell #6 (A)>Cell #8 (B)	6.9	17	7.2	17	- .6	n.s.
Cells #5+#6>Cells #7+#8	7.1	34	7.3	33	- .3	n.s.

Table 4.9
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION
AND TASK COMPLEXITY ON GOAL ACCEPTANCE
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

a. MEAN GOAL ACCEPTANCE AFTER THE TWO PRACTICE TRIALS

SIMPLE GOAL		GOAL SYSTEM	
Non-Quant.	Quant.	Non-Quant.	Quant.
7.1 (33)	6.6 (33)	7.2 (31)	7.3 (33)

		F	*p*
Covariates			
Performance on Two Practice Trials		.2	n.s.
Pre-Goal Self-Efficacy		17.8	<.001
Main Effects			
Goal Quantification		.3	n.s.
Goal Type		2.5	n.s.
Two Way Interaction			
Goal Quantification x Goal Type		1.9	n.s.
One-Way Anova (5, 124)		4.6	.001
Residual			
Sum of Squares	335.8		
Mean Square	2.7		

Table 4.9 (Continued)
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION
AND TASK COMPLEXITY ON GOAL ACCEPTANCE
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

b. MEAN GOAL ACCEPTANCE AFTER TRIAL #6

	SIMPLE GOAL		GOAL SYSTEM	
	Non-Quant.	Quant.	Non-Quant.	Quant.
Task				
Simple	7.5 (16)	6.1 (16)	6.9 (15)	6.6 (15)
Complex	7.4 (17)	6.9 (17)	7.3 (16)	7.2 (17)

	F	p
Covariates		
Performance on Two Practice Trials	.3	n.s.
Pre-Goal Self-Efficacy	9.4	.003
Main Effects		
Goal Quantification	3.5	.06
Task Condition	2.1	n.s.
Goal Type	.1	n.s.
Two-Way Interactions		
Goal Quantification x Task Condition	.8	n.s.
Goal Quantification x Goal Type	2.4	n.s.
Task x Goal Type	<.1	n.s.
Three-Way Interaction		
Goal Quantification x Task x Goal Type	.1	n.s.
One-Way Anova (9, 119)	2.1	.03

Residual
Sum of Squares 330.7
Mean Square 2.8

Table 4.10
TESTS OF HYPOTHESES REGARDING
THE EFFECT OF GOAL TYPE ON STRATEGY

RESEARCH DESIGN - CELL NUMBERS

	SIMPLE GOAL		GOAL SYSTEM	
	Non-Quant.	Quant.	Non-Quant.	Quant.
Task				
Simple	1	2	3	4
Complex	5	6	7	8

a. TESTS OF HYPOTHESIS #5

ANALYSIS OF STRATEGY ON TRIALS #1-#6

	A		B			
Supported if:	Mean	N	Mean	N	T	sig.T
Cell #1 (A)<Cell #3 (B)	1.46	16	1.72	15	1.1	n.s.
Cell #2 (A)<Cell #4 (B)	1.50	16	1.21	15	-1.3	n.s.
Cells #1+#2<Cells #3+#4	1.48	32	1.46	30	- .1	n.s.

ANALYSIS OF STRATEGY ON TRIALS #7-#12

	A		B			
Supported if:	Mean	N	Mean	N	T	sig.T
Cell #1 (A)<Cell #3 (B)	1.23	16	1.48	15	1.0	n.s.
Cell #2 (A)<Cell #4 (B)	1.14	16	1.14	15	<.1	n.s.
Cells #1+#2<Cells #3+#4	1.18	32	1.31	30	.7	n.s.

b. TESTS OF HYPOTHESIS #6

ANALYSIS OF STRATEGY ON TRIALS #1-#6

	A		B			
Supported if:	Mean	N	Mean	N	T	sig.T
Cell #7 (A)<Cell #5 (B)	1.46	16	1.35	17	- .5	n.s.
Cell #8 (A)<Cell #6 (B)	1.47	18	1.36	17	- .5	n.s.
Cells #7+#8<Cells #5+#6	1.47	34	1.35	34	- .7	n.s.

ANALYSIS OF STRATEGY ON TRIALS #7-#12

	A		B			
Supported if:	Mean	N	Mean	N	T	sig.T
Cell #7 (A)<Cell #5 (B)	1.21	16	1.28	17	.3	n.s.
Cell #8 (A)<Cell #6 (B)	1.31	18	1.29	17	- .01	n.s.
Cells #7+#8<Cells #5+#6	1.26	34	1.28	34	.1	n.s.

NOTE: Lower numbers indicate a more appropriate strategy.

Table 4.11
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION AND TASK COMPLEXITY ON STRATEGY
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

a. STRATEGY - TRIALS #1-#6

	SIMPLE GOAL		GOAL SYSTEM	
	Non-Quant.	Quant.	Non-Quant.	Quant.
Task				
Simple	1.5 (16)	1.5 (16)	1.7 (15)	1.2 (15)
Complex	1.4 (17)	1.4 (17)	1.5 (16)	1.5 (18)

		F	p
Covariates			
Performance on Two Practice Trials		9.6	.002
Pre-Goal Self-Efficacy		.8	n.s.
Main Effects			
Goal Quantification		.9	n.s.
Task Condition		.7	n.s.
Goal Type		.1	n.s.
Two-Way Interactions			
Goal Quantification x Task		1.4	n.s.
Goal Quantification x Goal Type		.5	n.s.
Task x Goal Type		.4	n.s.
Three-Way Interaction			
Goal Quantification x Task x Goal Type		.9	n.s.
One-Way Anova (9, 120)		1.7	.10
Residual			
Sum of Squares	47.1		
Mean Square	.4		

Note: Lower numbers indicate a more appropriate strategy.

Table 4.11 (Continued)
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION
AND TASK COMPLEXITY ON STRATEGY
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

b. STRATEGY - TRIALS #7-#12

	SIMPLE GOAL		GOAL SYSTEM	
	Non-Quant.	Quant.	Non-Quant.	Quant.
Task				
Simple	1.2 (16)	1.1 (16)	1.5 (15)	1.1 (15)
Complex	1.3 (17)	1.3 (17)	1.2 (16)	1.3 (18)

	F	p
Covariates		
Performance on Two Practice Trials	19.4	<.001
Pre-Goal Self-Efficacy	.1	n.s.
Main Effects		
Goal Quantification	.5	n.s.
Task Condition	<.1	n.s.
Goal Type	.1	n.s.
Two-Way Interactions		
Goal Quantification x Task	1.6	n.s.
Goal Quantification x Goal Type	.1	n.s.
Task x Goal Type	.3	n.s.
Three-Way Interaction		
Goal Quantification x Task x Goal Type	.1	n.s.
One-Way Anova (9, 120)	2.5	.03

Residual
Sum of Squares 51.3
Mean Square .4

Note: Lower numbers indicate better strategy.

Table 4.12
TESTS OF HYPOTHESES REGARDING
THE EFFECT OF GOAL TYPE ON PERFORMANCE

RESEARCH DESIGN - CELL NUMBERS

	SIMPLE GOAL		GOAL SYSTEM	
Task	Non-Quant.	Quant.	Non-Quant.	Quant.
Simple	1	2	3	4
Complex	5	6	7	8

TESTS OF HYPOTHESIS #7

ANALYSIS OF PERFORMANCE ON TRIALS #1-#6

	A		B			
Supported if:	Mean	N	Mean	N	T	sig.T
Cell #1 (A)<Cell #3 (B)	103	16	106	15	1.0	n.s.
Cell #2 (A)<Cell #4 (B)	104	16	104	15	- .3	n.s.
Cells #1+#2<Cells #3+#4	104	32	105	30	.5	n.s.

ANALYSIS OF PERFORMANCE ON TRIALS #7-#12

	A		B			
Supported if:	Mean	N	Mean	N	T	sig.T
Cell #1 (A)<Cell #3 (B)	96	16	97	15	.2	n.s.
Cell #2 (A)<Cell #4 (B)	94	16	95	15	.2	n.s.
Cells #1+#2<Cells #3+#4	95	32	96	30	.3	n.s.

TESTS OF HYPOTHESIS #8

ANALYSIS OF PERFORMANCE ON TRIALS #1-#6

	A		B			
Supported if:	Mean	N	Mean	N	T	sig.T
Cell #7 (A)<Cell #5 (B)	98	16	97	17	- .2	n.s.
Cell #8 (A)<Cell #6 (B)	97	18	95	17	- .6	n.s.
Cells #7+#8<Cells #5+#6	97	34	96	34	- .5	n.s.

ANALYSIS OF PERFORMANCE ON TRIALS #7-#12

	A		B			
Supported if:	Mean	N	Mean	N	T	sig.T
Cell #7 (A)<Cell #5 (B)	97	16	98	17	.4	n.s.
Cell #8 (A)<Cell #6 (B)	99	18	97	17	- .6	n.s.
Cells #7+#8<Cells #5+#6	98	34	98	34	- .2	n.s.

NOTE: Lower numbers indicate better performance.

Table 4.13
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION,
AND TASK COMPLEXITY ON PERFORMANCE
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

a. MEAN PERFORMANCE - TRIALS #1-#6

	SIMPLE GOAL		GOAL SYSTEM	
Task	Non-Quant.	Quant.	Non-Quant.	Quant.
Simple	103.2 (16)	104.3 (16)	105.8 (15)	103.5 (15)
Complex	97.3 (17)	95.2 (17)	97.7 (16)	96.7 (18)

	F	p
Covariates		
Performance on Two Practice Trials	5.1	.03
Pre-Goal Self-Efficacy	<.1	n.s.
Main Effects		
Goal Quantification	1.1	n.s.
Task Condition	41.7	<.001
Goal Type	.4	n.s.
Two-Way Interactions		
Goal Quantification x Task	<.1	n.s.
Goal Quantification x Goal Type	<.1	n.s.
Task x Goal Type	<.1	n.s.
Three-Way Interactions		
Goal Quantification x Task x Goal Type	.4	n.s.
One-Way Anova F (9, 120)	5.4	<.001

Residual	
Sum of Squares	5629.8
Mean Square	46.9

Note: Lower numbers indicate better performance.

Table 4.13 (Continued)
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION,
AND TASK COMPLEXITY ON PERFORMANCE
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

b. MEAN PERFORMANCE - TRIALS #6-#12

	SIMPLE GOAL		GOAL SYSTEM	
Task	Non-Quant.	Quant.	Non-Quant.	Quant.
Simple	95.8 (16)	94.0 (16)	96.6 (15)	94.6 (15)
Complex	98.4 (17)	97.3 (17)	97.1 (16)	99.2 (18)

	F	p
Covariates		
Performance on Two Practice Trials	12.1	.001
Pre-Goal Self-Efficacy	.1	n.s.
Main Effects		
Goal Quantification	.3	n.s.
Task Condition	1.7	n.s.
Goal Type	<.1	n.s.
Two-Way Interactions		
Goal Quantification x Task	.6	n.s.
Goal Quantification x Goal Type	.7	n.s.
Task x Goal Type	<.1	n.s.
Three-Way Interaction		
Goal Quantification x Task x Goal Type	<.1	n.s.
One-Way Anova, F (9, 120)	1.7	.09

Residual	
Sum of Squares	11,090.5
Mean Square	92.4

Note: Lower numbers indicate better performance.

Table 4.14
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION, TASK COMPLEXITY, AND EXPERIENCE ON GOAL COMPREHENSION
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

a. GOAL COMPREHENSION AFTER THE TWO PRACTICE TRIALS

FIRST-YEAR STUDENTS			
SIMPLE GOAL		GOAL SYSTEM	
Non-Quant.	Quant.	Non-Quant.	Quant.
5.9 (17)	6.8 (16)	6.9 (15)	6.5 (19)

SECOND-YEAR STUDENTS			
SIMPLE GOAL		GOAL SYSTEM	
Non-Quant.	Quant.	Non-Quant.	Quant.
6.9 (16)	7.1 (17)	6.6 (16)	6.0 (14)

	F	p
Covariates		
Performance on Two Practice Trials	<.1	n.s.
Pre-Goal Self-Efficacy	25.9	<.001
Main Effects		
Goal Quantification	.3	n.s.
Goal Type	.1	n.s.
Experience	<.1	n.s.
Two-Way Interactions		
Goal Quantification x Goal Type	1.7	n.s.
Goal Quantification x Experience	.1	n.s.
Goal Type x Experience	2.5	.12
Three-Way Interaction		
Goal Quantification x Goal Type x Experience	<.1	n.s.
One-Way Anova (9, 120)	3.4	.001

Residuals	
Sum of Squares	290.3
Mean Square	2.4

Table 4.14 (Continued)
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION,
TASK COMPLEXITY, AND EXPERIENCE ON GOAL COMPREHENSION
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

b. GOAL COMPREHENSION AFTER TRIAL #6

	FIRST-YEAR STUDENTS			
	SIMPLE GOAL		GOAL SYSTEM	
Task	Non-Quant.	Quant.	Non-Quant.	Quant.
Simple	6.2 (8)	7.4 (8)	7.3 (8)	7.1 (8)
Complex	7.4 (9)	6.7 (8)	7.9 (7)	6.6 (11)

	SECOND-YEAR STUDENTS			
	SIMPLE GOAL		GOAL SYSTEM	
Task	Non-Quant.	Quant.	Non-Quant.	Quant.
Simple	7.9 (8)	6.9 (8)	7.3 (7)	5.7 (7)
Complex	7.0 (8)	8.0 (9)	6.9 (9)	7.2 (7)

	F	p
Covariates		
Performance on Practice Trials	.2	n.s.
Pre-Goal Self-Efficacy	13.5	<.001
Main Effects		
Goal Quantification	.8	n.s.
Task Condition	.5	n.s.
Goal Type	.3	n.s.
Experience	<.1	n.s.
Two-Way Interactions		
Goal Quantification x Task	<.1	n.s.
Goal Quantification x Goal Type	1.6	n.s.
Goal Quantification x Experience	.2	n.s.
Task x Goal Type	.1	n.s.
Task x Experience	.2	n.s.
Goal Type x Experience	2.8	.10
Three-Way Interactions		
Goal Quantification x Task x Goal Type	.3	n.s.
Goal Quantification x Task x Experience	9.6	.002
Goal Quantification x Goal Type x Experience	<.1	n.s.
Task x Goal Type x Experience	.7	n.s.
Four-Way Interaction	.1	n.s.
One-Way Anova (17, 112)	1.8	.03

Residuals
Sum of Squares 234.7
Mean Square 2.1

Table 4.15

THE EFFECT OF GOAL TYPE AND EXPERIENCE
ON GOAL COMPREHENSION
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF EFFICACY)

a. MEAN GOAL COMPREHENSION AFTER THE TWO PRACTICE TRIALS

1st YEAR STUDENTS		2nd YEAR STUDENTS	
Simple Goal	Goal System	Simple Goal	Goal System
6.4 (33)	6.7 (34)	7.0 (33)	6.3 (30)

	F	p
Two-Way Interaction	2.5	.12

b. MEAN GOAL COMPREHENSION AFTER TRIAL #6

1st YEAR STUDENTS		2nd YEAR STUDENTS	
Simple Goal	Goal System	Simple Goal	Goal System
6.9 (33)	7.2 (34)	7.5 (33)	6.8 (30)

	F	p
Two-Way Interaction	2.8	.10

Table 4.16
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION, TASK COMPLEXITY, AND EXPERIENCE ON GOAL ACCEPTANCE (ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

a. GOAL ACCEPTANCE AFTER THE TWO PRACTICE TRIALS

FIRST-YEAR STUDENTS

SIMPLE GOAL		GOAL SYSTEM	
Non-Quant.	Quant.	Non-Quant.	Quant.
7.3 (17)	6.6 (16)	7.0 (15)	7.5 (19)

SECOND-YEAR STUDENTS

SIMPLE GOAL		GOAL SYSTEM	
Non-Quant.	Quant.	Non-Quant.	Quant.
6.9 (16)	6.7 (17)	7.4 (16)	6.9 (14)

	F	*p*
Covariates		
Performance on Two Practice Trials	.2	n.s.
Pre-Goal Self-Efficacy	17.7	<.001
Main Effects		
Goal Quantification	.3	n.s.
Goal Type	2.4	n.s.
Experience	.9	n.s.
Two-Way Interactions		
Goal Quantification x Goal Type	1.9	n.s.
Goal Quantification x Experience	<.1	n.s.
Goal Type x Experience	.2	n.s.
Three-Way Interaction		
Goal Quantification x Goal Type x Experience	2.4	n.s.
One-Way Anova (9, 120)	2.9	.004

Residuals	
Sum of Squares	326.6
Mean Square	2.7

Table 4.16 (Continued)
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION, TASK COMPLEXITY, AND EXPERIENCE ON GOAL ACCEPTANCE (ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

b. GOAL ACCEPTANCE AFTER TRIAL #6

FIRST-YEAR STUDENTS

	SIMPLE GOAL		GOAL SYSTEM	
Task	Non-Quant.	Quant.	Non-Quant.	Quant.
Simple	7.4 (8)	6.8 (8)	7.2 (8)	6.8 (8)
Complex	7.6 (9)	6.2 (8)	7.5 (7)	7.1 (10)

SECOND-YEAR STUDENTS

	SIMPLE GOAL		GOAL SYSTEM	
Task	Non-Quant.	Quant.	Non-Quant.	Quant.
Simple	7.7 (8)	5.4 (8)	6.7 (7)	6.3 (7)
Complex	7.2 (8)	7.4 (9)	7.2 (9)	7.4 (7)

	F	p
Covariates		
Performance on Practice Trials	.3	n.s.
Pre-Goal Self-Efficacy	9.2	.003
Main Effects		
Goal Quantification	3.6	.06
Task Condition	2.1	n.s.
Goal Type	.1	n.s.
Experience	.8	n.s.
Two-Way Interactions		
Goal Quantification x Task	.7	n.s.
Goal Quantification x Goal Type	2.6	n.s.
Goal Quantification x Experience	.6	n.s.
Task x Goal Type	<.1	n.s.
Task x Experience	2.0	n.s.
Goal Type x Experience	<.1	n.s.
Three-Way Interactions		
Goal Quantification x Task x Goal Type	<.1	n.s.
Goal Quantification x Task x Experience	2.1	n.s.
Goal Quantification x Goal Type x Experience	<.1	n.s.
Task x Goal Type x Experience	<.1	n.s.
Four-Way Interaction	1.0	n.s.
One-Way Anova (17, 111)	1.5	n.s.

Residuals

Sum of Squares	312.8
Mean Square	2.8

Table 4.17
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION, TASK COMPLEXITY, AND EXPERIENCE ON STRATEGY
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

a. STRATEGY - TRIALS #1-#6

FIRST-YEAR STUDENTS

	SIMPLE GOAL		GOAL SYSTEM	
	Non-Quant.	Quant.	Non-Quant.	Quant.
Task				
Simple	1.65 (8)	1.53 (8)	1.77 (8)	.93 (8)
Complex	1.44 (9)	1.31 (8)	1.73 (7)	1.59 (11)

SECOND-YEAR STUDENTS

	SIMPLE GOAL		GOAL SYSTEM	
	Non-Quant.	Quant.	Non-Quant.	Quant.
Task				
Simple	1.28 (8)	1.47 (8)	1.65 (7)	1.52 (7)
Complex	1.24 (8)	1.41 (9)	1.25 (9)	1.29 (7)

	F	p
Covariates		
Performance on Two Practice Trials	9.7	.002
Pre-Goal Self-Efficacy	.8	n.s.
Main Effects		
Goal Quantification	1.0	n.s.
Task Condition	.8	n.s.
Goal Type	.1	n.s.
Experience	1.8	n.s.
Two-Way Interactions		
Goal Quantification x Task	1.2	n.s.
Goal Quantification x Goal Type	.7	n.s.
Goal Quantification x Experience	1.9	n.s.
Task x Goal Type	.5	n.s.
Task x Experience	1.8	n.s.
Goal Type x Experience	.1	n.s.
Three-Way Interactions		
Goal Quantification x Task x Goal Type	.6	n.s.
Goal Quantification x Task x Experience	.6	n.s.
Goal Quantification x Goal Type x Experience	.1	n.s.
Task x Goal Type x Experience	3.4	.07
Four-Way Interaction	.5	n.s.
One-Way Anova (17, 112)	1.5	n.s.

Residuals	
Sum of Squares	43.3
Mean Square	.4

Table 4.17 (Continued)
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION, TASK COMPLEXITY, AND EXPERIENCE ON STRATEGY
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

b. STRATEGY - TRIALS #7-#12

FIRST-YEAR STUDENTS

	SIMPLE GOAL		GOAL SYSTEM	
Task	Non-Quant.	Quant.	Non-Quant.	Quant.
Simple	1.62 (8)	1.18 (8)	1.74 (8)	.85 (8)
Complex	1.40 (9)	1.16 (8)	1.33 (7)	1.46 (11)

SECOND-YEAR STUDENTS

	SIMPLE GOAL		GOAL SYSTEM	
Task	Non-Quant.	Quant.	Non-Quant.	Quant.
Simple	.83 (8)	1.09 (8)	1.19 (7)	1.48 (7)
Complex	1.15 (8)	1.40 (9)	1.11 (9)	1.07 (7)

	F	p
Covariates		
Performance on Two Practice Trials	20.9	<.001
Pre-Goal Self-Efficacy	.1	n.s.
Main Effects		
Goal Quantification	.7	n.s.
Task Condition	.1	n.s.
Goal Type	.1	n.s.
Experience	4.0	.05
Two-Way Interactions		
Goal Quantification x Task	1.6	n.s.
Goal Quantification x Goal Type	.1	n.s.
Goal Quantification x Experience	3.7	.05
Task x Goal Type	.3	n.s.
Task x Experience	.1	n.s.
Goal Type x Experience	.1	n.s.
Three-Way Interactions		
Goal Quantification x Task x Goal Type	<.1	n.s.
Goal Quantification x Task x Experience	3.9	.05
Goal Quantification x Goal Type x Experience	.1	n.s.
Task x Goal Type x Experience	3.5	.06
Four-Way Interaction	2.1	n.s.
One-Way Anova (17, 112)	2.4	.003

Residuals	
Sum of Squares	44.4
Mean Square	.4

Table 4.18

THE EFFECT OF GOAL TYPE, TASK COMPLEXITY, AND EXPERIENCE ON STRATEGY
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

a. MEAN CHANGES - TRIALS #1-#6

	1st YEAR STUDENTS		2nd YEAR STUDENTS	
	Simple Goal	Goal System	Simple Goal	Goal System
Task				
Simple	1.6 (16)	1.4 (16)	1.4 (16)	1.6 (14)
Complex	1.4 (17)	1.6 (18)	1.3 (17)	1.3 (16)

	F	p
Three-Way Interaction	3.4	.07

b. MEAN CHANGES - TRIALS #7-#12

	1st YEAR STUDENTS		2nd YEAR STUDENTS	
	Simple Goal	Goal System	Simple Goal	Goal System
Task				
Simple	1.4 (16)	1.3 (16)	1.0 (16)	1.3 (14)
Complex	1.3 (17)	1.4 (18)	1.3 (17)	1.1 (16)

	F	p
Three-Way Interaction	3.5	.06

Note: Optimal number of changes is 1.

Table 4.19
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION, TASK COMPLEXITY, AND EXPERIENCE ON PERFORMANCE
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

a. MEAN PERFORMANCE - TRIALS #1-#6

FIRST-YEAR STUDENTS

	SIMPLE GOAL		GOAL SYSTEM	
Task	Non-Quant.	Quant.	Non-Quant.	Quant.
Simple	105.5 (8)	104.8 (8)	108.9 (8)	101.4 (8)
Complex	99.5 (9)	94.8 (8)	100.0 (7)	96.2 (11)

SECOND-YEAR STUDENTS

	SIMPLE GOAL		GOAL SYSTEM	
Task	Non-Quant.	Quant.	Non-Quant.	Quant.
Simple	100.9 (8)	103.8 (8)	102.3 (7)	106.1 (7)
Complex	94.9 (8)	95.5 (9)	95.9 (9)	97.4 (7)

	F	p
Covariates		
Performance on Two Practice Trials	5.2	.02
Pre-Goal Self-Efficacy	<.1	n.s.
Main Effects		
Goal Quantification	1.1	n.s.
Task Condition	2.8	.10
Goal Type	.4	n.s.
Experience	2.8	.10
Two-Way Interactions		
Goal Quantification x Task	.2	n.s.
Goal Quantification x Goal Type	<.1	n.s.
Goal Quantification x Experience	5.5	.02
Task x Goal Type	<.1	n.s.
Task x Experience	<.1	n.s.
Goal Type x Experience	.2	n.s.
Three-Way Interactions		
Goal Quantification x Task x Goal Type	.3	n.s.
Goal Quantification x Task x Experience	.3	n.s.
Goal Quantification x Goal Type x Experience	.6	n.s.
Task x Goal Type x Experience	.1	n.s.
Four-Way Interaction	.8	n.s.
One-Way Anova (17, 112)	3.5	<.001

Residual	
Sum of Squares	5153.4
Mean Square	46.0

Table 4.19 (Continued)
THE EFFECT OF GOAL TYPE, GOAL QUANTIFICATION
TASK COMPLEXITY, AND EXPERIENCE ON PERFORMANCE
(ANOVA CONTROLLING INITIAL PERFORMANCE AND SELF-EFFICACY)

b. MEAN PERFORMANCE - TRIALS #7-#12

FIRST-YEAR STUDENTS

	SIMPLE GOAL		GOAL SYSTEM	
Task	Non-Quant.	Quant.	Non-Quant.	Quant.
Simple	101.7 (8)	93.4 (8)	95.1 (8)	89.9 (8)
Complex	101.2 (9)	92.8 (8)	96.9 (7)	99.8 (11)

SECOND-YEAR STUDENTS

	SIMPLE GOAL		GOAL SYSTEM	
Task	Non-Quant.	Quant.	Non-Quant.	Quant.
Simple	90.0 (8)	94.2 (8)	98.3 (7)	100.0 (7)
Complex	95.3 (8)	101.3 (9)	97.3 (9)	98.2 (7)

	F	p
Covariates		
Performance on Two Practice Trials	12.8	.001
Pre-Goal Self-Efficacy	.1	n.s.
Main Effects		
Goal Quantification	.3	n.s.
Task Condition	1.8	n.s.
Goal Type	<.1	n.s.
Experience	<.1	n.s.
Two-Way Interactions		
Goal Quantification x Task	.7	n.s.
Goal Quantification x Goal Type	.9	n.s.
Goal Quantification x Experience	3.9	.05
Task x Goal Type	<.1	n.s.
Task x Experience	.1	n.s.
Goal Type x Experience	2.2	n.s.
Three-Way Interactions		
Goal Quantification x Task x Goal Type	<.1	n.s.
Goal Quantification x Task x Experience	.4	n.s.
Goal Quantification x Goal Type x Experience	<.1	n.s.
Task x Goal Type x Experience	5.1	.03
Four-Way Interaction	1.0	n.s.
One-Way Anova (17, 112)	1.9	.03

Residual
Sum of Squares 9750.8
Mean Square 87.1

Table 4.20

THE EFFECT OF GOAL TYPE, TASK COMPLEXITY, AND EXPERIENCE ON PERFORMANCE
(ANOVA CONTROLLING ABILITY AND INITIAL SELF-EFFICACY)

a. MEAN PERFORMANCE - TRIALS #1-#6

	1st YEAR STUDENTS		2nd YEAR STUDENTS	
Task	Simple Goal	Goal System	Simple Goal	Goal System
Simple	105.1 (16)	105.1 (16)	102.3 (16)	104.2 (14)
Complex	97.3 (17)	97.7 (18)	95.2 (17)	96.6 (16)

	F	p
Three-Way Interaction	.1	n.s.

b. MEAN PERFORMANCE - TRIALS #7-#12

	1st YEAR STUDENTS		2nd YEAR STUDENTS	
Task	Simple Goal	Goal System	Simple Goal	Goal System
Simple	97.8 (16)	92.5 (16)	92.1 (16)	99.1 (14)
Complex	97.2 (17)	98.7 (18)	98.4 (17)	97.7 (16)

	F	p
Three-Way Interaction	5.1	.03

Table 4.21

THE EFFECT OF GOAL QUANTIFICATION ON STRATEGY: COMPARISON OF FIRST- AND SECOND-YEAR STUDENTS (MEAN NUMBER OF CHANGES PER EMPLOYEE)

NON-QUANTITATIVE GOAL

Trial	1st YEAR STUDENTS (N=32) changes	2nd YEAR STUDENTS (N=32) changes
Trial #3	1.74	1.34
Trials #4-#6	1.61	1.35
Trials #7-#9	1.56	1.15
Trials #10-#12	1.49	.98

QUANTITATIVE GOAL

Trial	1st YEAR STUDENTS (N=35) changes	2nd YEAR STUDENTS (N=31) changes
Trial #3	1.45	1.49
Trials #4-#6	1.33	1.40
Trials #7-#9	1.23	1.36
Trials #10-#12	1.15	1.17

INTERACTION OF GOAL QUANTIFICATION AND EXPERIENCE

	F	p
Trial #3	2.1	n.s.
Trials #4-#6	1.5	n.s.
Trials #7-#9	3.8	.05
Trials #10-#12	2.9	.09

NOTE: Optimal number of changes equals 1.0.

Table 5.1

SUMMARY TABLE:
SIGNIFICANT EFFECTS OF GOAL TYPE ON PERFORMANCE
AND THE PROCESSES WHICH ARE HYPOTHESIZED
TO INFLUENCE PERFORMANCE

(SIGNIFICANCE OF F STATISTICS:
EXERPTED FROM TABLES 4.14, 4.16, 4.17 AND 4.19)

	Perform		Comprehen		Accept		Strat	
	A	B	A	B	A	B	A	B
Main Effects								
Goal Quantification						+		
Task Condition	+							
Goal Type								
Experience	+							*
Two-Way Interactions								
Quant. x Task								
Quant. x Type								
Quant. x Exp.	*	*						*
Task x Type								
Task x Exp.								
Type x Exp.			+	+				
Three-Way Interactions								
Quant. x Task x Type								
Quant. x Task x Exp.				**				*
Quant. x Type x Exp.								
Task x Type x Exp.		*					*	+
Four-Way Interaction							+	

+ $p \leq .10$
* $p \leq .05$
** $p \leq .01$

FIGURE 2.1

A SIMPLIFIED MODEL OF THE KEY COGNITIVE PROCESSES BY WHICH GOALS INFLUENCE PERFORMANCE

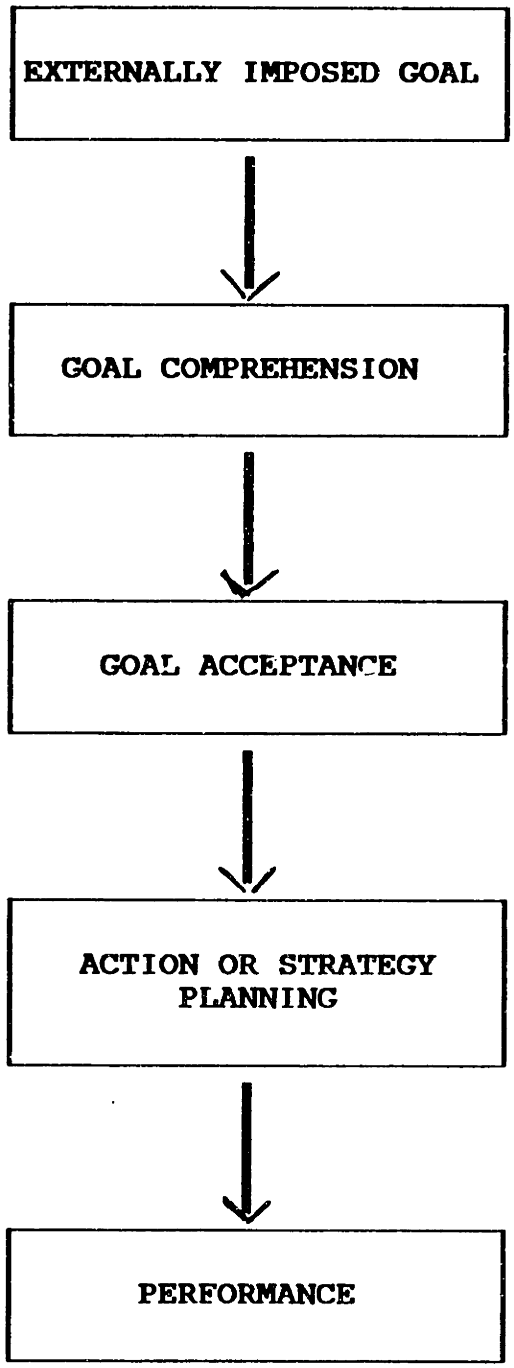
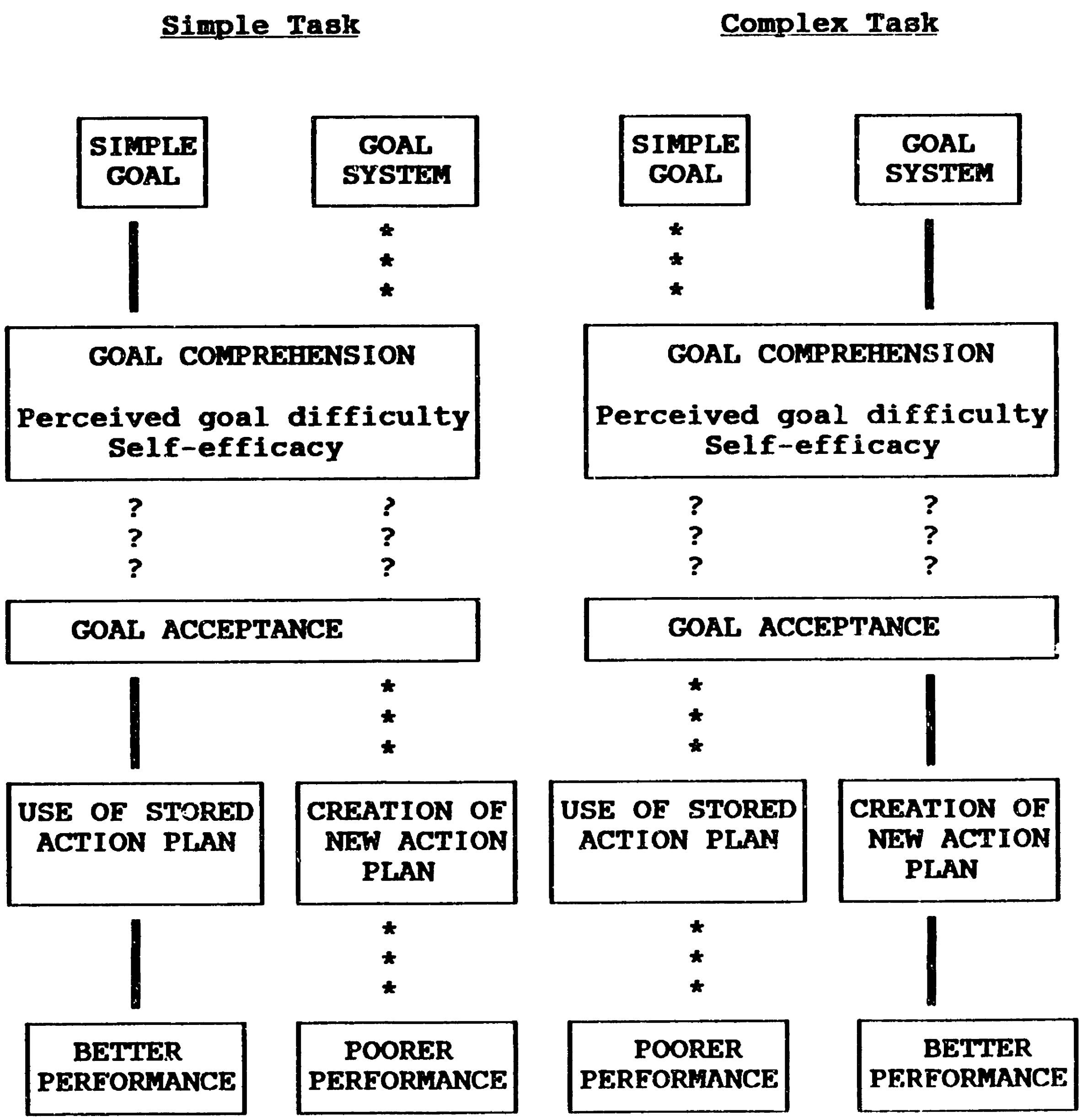


FIGURE 2.2

HYPOTHESIZED STRENGTH OF RELATIONSHIPS AMONG TASK COMPEXITY, GOAL TYPE, AND STEPS BY WHICH GOALS INFLUENCE PERFORMANCE



Note: * * * indicates a weak relationship

═══ indicates a strong relationship

? ? ? indicates an unknown relationship

Note: The distinction between use of stored action plans and creation of new action plans is attributable to a model by Wood and Locke (forthcoming).

Figure 3.1

COMPARISON OF THE WOOD AND BAILEY MODEL WITH THE SCHIRO MODEL OF THE FURNITURE FACTORY GAME

Wood and Bailey's Formulas	Schiro's Formulas
$T_t = \sum_{j=1}^{m} \sum_{i=1}^{n} P_{ijt}$	$T_t = \sum_{j=1}^{m} \sum_{i=1}^{n} P_{ijt}$
$P_{ijt} = S_{jt}\{U_{ij} - f(X_{ijj}, Y_{ijt}, I_{ij}, E_{it})(U_{ij} - L_{ij})\}$	$P_{ijt} = ST_{jt} - ST_{jt}(A_{ij} + I_{ij} + M_i + Y_{ijt} + X_{ijt} + VR_{ijt-1})/100$
$X_{ijt} = g\{X_{ijt-1}, F_{ijt-1}, G_{ijt}\}$	$X_{ijt} = [3\{(A_{ijt} + 10)/2 (F_{ijt-1})(G_{ijt})((2ST_{ijt-1}/P_{ijt-1}) - 1)\}^{1/3}] - 20$
$Y_{ijt} = h\{Y_{ijt-1}, G_{ijt}\}$	$Y_{ijt} = [2\{(R_{it-1})(G_{ijt})\}^{1/2}] - 12$
$E_{it} = k\{R_{it-1}, TR_{t-1}\}$	$VR_{ijt-1} = R_{it-1} - TR_{it-1}$

Where:

T_t = Departmental performance or sum of employee performances in period t.

P_{ijt} = Employee i's performance on job j in period t.

S_{jt} = Operator which means P values are only calculated for jobs to which individuals are assigned in period t.

ST_{jt} = Standard hours (stored value) for jobs to which individuals need to be assigned in period t.

U_{ij} = Upper limit for employee i's performance on job j, based on the skills described in his/her employee profile and the required skills described in the job's profile.

L_{ij} = Lower limit for employee i's performance on job j, based on the skills descriptions in the employee and job profiles.

A_{ij} = Employee i's ability to perform the job j, based on the skills descriptions in the employee and job profiles (stored value).

X_{ijt} = Employee i's expectancy that his or her effort will produce the desired performance on job j in period t.

Y_{ijt} = Employee i's expectancy that producing the desired performance on job j in period t will lead to extrinsic rewards.

M_i = The motivation of employee i to perform a job well (stored value).

I_{ij} = The valence of intrinsic rewards employee i associates with performing job j (stored value).

E_{it} = The valence of extrinsic rewards expected by employee i in period t.

F_{ijt} = Feedback given by manager/subject to employee i for his/her performance on job j in period t.

G_{ijt} = Production goal set by manager/subject for employee i's performance on job j in period t.

R_{it} = Reward given by manager/subject to employee i in period t.

TR_{it} = Total rewards given by manager/subject to all employees in period t.

t-1 = Subscript indicates same variable for previous work period.

Notes: Functions g, h, and k are not specified in Wood and Bailey (1985).

In Trial #1, VG_i is substitued for Y_{ijt}, X_{ijt}, and VR_{ijt-1}.

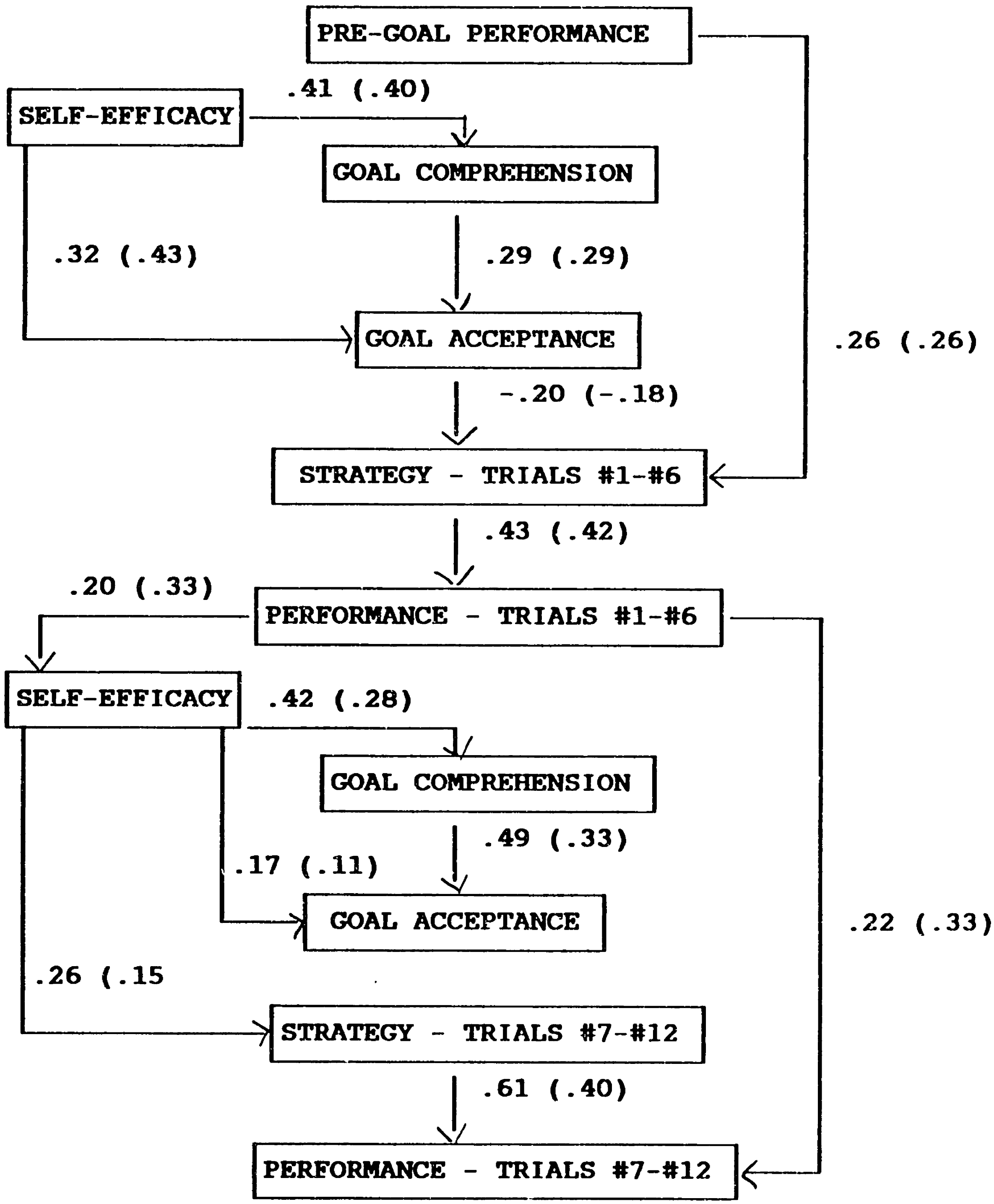
FIGURE 3.2

RESEARCH DESIGN

Goal Type	SIMPLE GOAL		GOAL SYSTEM	
	Non-Quant.	Quant.	Non-Quant.	Quant.
Situation: SIMPLE	1	2	3	4
COMPLEX	5	6	7	8

Figure 4.1

PROCESS BY WHICH GOALS INFLUENCE PERFORMANCE:
PATH ANALYSIS



Note: Figures on the left represent path coefficients. Figures to the right (in parentheses) are first order correlations.

Figure 4.2

ASSOCIATION OF STRATEGY AND PERFORMANCE:
CROSS-LAGGED CORRELATIONS

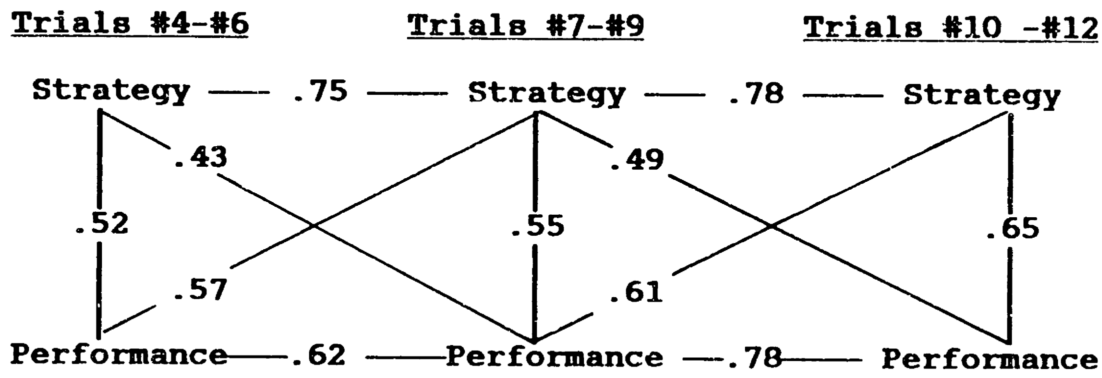


Figure 4.3

CROSS-LAGGED CORRELATIONS: TESTS OF SIGNIFICANCE

$$k=(r_{12} - r_{24}r_{14})(r_{34} - r_{24}r_{23}) + (r_{13} - r_{12}r_{23})(r_{24} - r_{12}r_{14})$$
$$+ (r_{12} - r_{13}r_{23})(r_{34} - r_{13}r_{14}) + (r_{13} - r_{14}r_{34})(r_{24} - r_{34}r_{23})$$

$$Z = \{(N)^{1/2} (r_{14} - r_{23})\} / \{(1 - r^2_{14})^2 + (1 - r^2_{23})^2 - k)^{1/2}\}$$

Comparing Trials #4-6 with Trials #7-#9:

$$k= (.52 - (.62)(.43)) (.55 - (.62)(.57)) +$$
$$(.75 - (.52)(.57)) (.62 - (.52)(.75)) +$$
$$(.52 - (.75)(.57)) (.55 - (.75)(.43)) +$$
$$(.75 - (.43)(.55)) (.62 - (.55)(.57))$$

$$Z =\{(130)^{1/2} (.43 - .57)\} /$$
$$\{(1 - .43^2)^2 + (1 - .52^2)^2 - .408\}^{1/2}$$

Note: Formulas are from Kenny (1979)