

SELF-EFFICACY, SELF-REGULATION, AND  
COMPLEX DECISION-MAKING IN YOUNGER AND OLDER ADULTS

by

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### **ABSTRACT**

A computer simulation of a managerial decision making task (Wood & Bailey, 1985) was used to investigate the role that self-efficacy and self-regulatory factors play in younger and older adults' cognitive processes. Sixty-eight younger (aged 18 to 30 years) and 69 older (aged 65 to 77 years) adults were included in this study. Participants were randomly assigned to receive either progressively positive, stable, or progressively negative social comparison feedback information as they performed the task across three blocks of trials (Bandura & Jourden, 1991). Mean-level results indicated that performance, decision making time, strategy use, goal setting, performance satisfaction, and self-efficacy decreased across the course of the experiment. Younger adults performed the task more efficiently, took less time to make their decisions, and reported less positive mood than older adults. Moreover, path analyses indicated that the role self-efficacy and self-regulatory factors play in complex cognitive processes differed depending on the participants' age. In earlier stages of the experiment, both younger and older adults' self-efficacy influenced self-regulatory factors and performance in the expected fashion. However, goal setting played a more direct role in older adults' performance, whereas the role of performance satisfaction was more apparent in younger adults' performance. The most visible age differences occurred in the latter part of the experiment. Younger adults' Block 3 performance was primarily determined by their earlier task performance, whereas older adults' Block 3 performance was primarily determined by their earlier

performance was primarily determined by their earlier self-efficacy ratings. In addition, the higher older adults' self-efficacy scores, the poorer their Block 3 performance. Collateral results addressed the relation between (a) task-specific measures of self-efficacy and questionnaire measures of efficacy, and (b) task-specific self-efficacy and self-reported interest to participate in future studies varying in similarity to the present one.

**Examiners:**

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## TABLE OF CONTENTS

Chapter	Page
I. Introduction.....	1
II. Literature Review.....	6
The Self-Concept.....	7
Stereotypes.....	7
Social Comparison.....	10
Metacognition and Aging.....	12
Age and Self-Efficacy.....	15
Task-Specific Self-Efficacy.....	19
Theoretical Framework.....	21
The Role of Self-Efficacy and Self-Regulatory Factors on Behaviour.....	22
Self-Efficacy.....	23
Affect.....	24
Motivation.....	25
Strategy Use.....	28
The Self-Regulatory Process.....	29
Advantages of Adopting a Process View into Cognitive/Developmental Research.....	34
The Present Study.....	36
The Experimental Task.....	37
Experimental Manipulation of Self-Efficacy.....	38

Primary Research Questions.....	40
1. Age Differences in Self-Efficacy, Self-Regulation, and Performance.....	40
2. Age Differences in the Self-Regulatory Process.....	44
Collateral Questions.....	46
1. Do General Efficacy Beliefs Correlate More Strongly with Initial 'Task-Specific Self-Regulatory Measures than with Measures Obtained After Task Experience?.....	46
2. Does Self-Efficacy Influence Self-Reported Behaviour?.....	47
III. Method.....	49
Design.....	49
Subjects.....	49
Measures I. Questionnaire Battery.....	51
Measures II. Computer Display Self-Regulatory Factors.....	54
Measures III. Performance Measures.....	56
Measures IV. Post-Experimental Measure.....	57
Procedure.....	57
IV. Results.....	61
Managerial Experience.....	61
Primary Analyses.....	62
Performance and Self-Regulation with Task Experience.....	62
Path Models.....	67
Collateral Analyses.....	71

	vi
General Beliefs and Self-Regulatory Factors.....	71
Correlations Between General Beliefs and Performance Measures.....	72
Correlations Between General Beliefs and Self-Regulatory Measures.....	74
Post-Experimental Questionnaire.....	76
V. Discussion.....	79
Performance and Self-Regulation.....	79
Performance.....	79
Self-Regulation.....	81
The Role of Self-Regulatory Factors in Cognitive Processes.....	84
The Use of Self-Efficacy as a Motivator of Performance.....	85
The Role of Previous Performance.....	88
Perceptions of the Experimental Task.....	89
Collateral Findings.....	91
General Efficacy Beliefs.....	91
Post-Experimental Questionnaire.....	93
Conclusion.....	95
References.....	99
Appendix.....	112

**LIST OF TABLES**

- Table 1:** Mean sample characteristics as a function of participants' age group.
- Table 2:** Younger and older adults' mean scores on performance and self-regulatory variables across all three blocks of trials.
- Table 3:** Mean initial scores for questionnaire and self-regulatory measures as a function of age group.
- Table 4:** Correlations between older adults' PIC questionnaire scale scores, decision-time scores for each block, and change in decision-time across blocks 1 and 3.
- Table 5:** Correlations between younger adults' questionnaire scores and self-regulatory variables.
- Table 6:** Correlations between older adults' questionnaire scores and self-regulatory variables.
- Table 7:** Correlations between Block 3 self-efficacy and self-reported interest to participate in future psychology studies.

**LIST OF FIGURES**

- Figure 1:** Decision making performance as a function of age group and trial block.
- Figure 2:** Decision making time as a function of age group and trial block.
- Figure 3:** Strategy use as a function of age group and trial block.
- Figure 4:** Goal setting as a function of age group and trial block.
- Figure 5:** Performance satisfaction as a function of social comparison information condition and trial block.
- Figure 6:** Self-efficacy levels as a function of social comparison information condition and trial block.
- Figure 7:** Bandura and Jourden's (1991) path model for the younger adults' data.
- Figure 8:** Bandura and Jourden's (1991) path model for the older adults' data.
- Figure 9:** The younger adults' path model indicating the relationships between self-efficacy, self-regulatory factors, and performance on a complex decision making task.
- Figure 10:** The older adults' path model indicating the relationships between self-efficacy, self-regulatory factors, and performance on a complex decision making task.

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## Chapter One

### INTRODUCTION

Researchers interested in behavioural development have begun to focus on psychosocial factors that may play an important role in successful aging in later life. Adults' beliefs influence their choices to become involved in certain situations which may, in turn, shape their overall development. In particular, it has been suggested that positive self-efficacy is necessary for improving performance (i.e., cognitive) levels and moving towards optimal development (Maciel, Heckhausen, & Baltes, 1992). According to Bandura (1986), "self-efficacy is defined as people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is not concerned with the skills one has but with judgments of what one can do with whatever skills one possesses" (p. 391). It is important to note that the self-efficacy concept is not a passive judgment about one's capability; rather, it is a call to action (Bandura, 1986). Thus, individuals who have the same potential for development may behave and develop quite differently because one person has very positive beliefs and chooses to act in a way that promotes optimal development, whereas another person has very negative beliefs and acts in a way that does not (Maciel et al., 1992).

Growing older in our society is often associated with negative images (e.g., Richman, 1977) and stereotypes (Hendrick, Gekoski, & Knox, 1991; Hendrick, Knox, Gekoski, & Dyne, 1988; Rubin & Brown, 1975; Schwab & Heneman, 1978). This negative social context may shape older adults' beliefs about themselves. In particular, it has been suggested that beliefs about cognitive declines may be

internalized by individuals as they grow older (e.g., Langer, 1989), or used as heuristics to estimate change (e.g., Ross, 1989). Such beliefs may influence not only how older adults view their abilities, but also affect their cognitive abilities directly.

Some researchers, interested in the role that older adults' beliefs play in cognitive performance, have developed questionnaire instruments to measure self-efficacy within specific cognitive domains such as memory (Berry, West, & Dennehey, 1989; Dixon, Hultsch, Hertzog, 1988) and intelligence (Lachman, Baltes, Nesselroade, & Willis, 1982). Generally, these researchers have found that older adults have more negative self-reported efficacy beliefs than younger adults. For example, older adults report that they feel less capable in a variety of everyday memory situations than younger adults (e.g., Hultsch, Hertzog, & Dixon, 1987). Although studies have shown that the questionnaire measures are quite reliable and valid (e.g., Berry et al., 1989; Hertzog, Hultsch, & Dixon, 1989; Hultsch, Hertzog, Dixon, & Davidson, 1988; Lachman et al., 1982), the relation between adults' self-reported beliefs and their cognitive performance is quite modest (see Gilewski & Zelinski, 1986; Herrmann, 1982).

The modest relation between questionnaire measures of self-efficacy beliefs and cognitive performance has prompted some researchers to make the distinction between general self-efficacy beliefs and task specific self-efficacy beliefs. Hertzog, Dixon, and Hultsch (1990a) suggested that questionnaires measure self-efficacy in a general manner by sampling a variety of cognitive situations (albeit within a particular domain of cognitive functioning), whereas cognitive performance is often measured quite specifically (e.g., word-list recall). This distinction suggests that different levels of

self-efficacy (i.e., general vs. specific) may operate at different times during cognitive processing. It follows then, that the relation between general self-efficacy and cognitive performance may be much weaker than the relation between task specific self-efficacy and performance.

Some researchers have used participants' global predictions to examine age differences in the relation between task-specific self-efficacy and cognitive performance. A global prediction might consist of participants predicting the number of words they will correctly recall from a 30 word-list. Although the findings with regard to age differences in prediction accuracy are mixed (e.g. Lovelace & Marsh, 1985), older adults typically predict that they will perform at a lower level than younger adults (e.g., Hertzog, Dixon, & Hultsch, 1990b; Hertzog, Saylor, Fleece, & Dixon, 1994; McDonald-Miszczak, Hunter, & Hultsch, 1994).

Bandura (1989) has argued that self-efficacy scales that vary the level of task difficulty, provide a more sensitive measure to variations in perceived self-efficacy. Bandura (1986) suggested that if one's interest is in the relation between self-efficacy and cognitive performance, then self-efficacy should be measured with respect to particular levels of performance on a task in conjunction with other self-regulatory measures (i.e., goal setting, strategy use, affect). Typically, Bandura and his colleagues have measured self-efficacy as the number of times a person agreed that s/he could perform at different levels on the same task (Bandura, 1986; Bandura & Cervone 1983, 1986). For example, on a memory task involving 30 words, individuals might be asked to indicate "Yes" (I will remember) or "No" (I won't

remember) given the choices of 5, 10, 15, 20, 25, and 30 words, respectively. Following each increment in performance, subjects are also asked to indicate how confident they feel about each response on a scale ranging from 100 percent (very sure) to 10 percent (very unsure). In this way, Bandura suggested that both Self-Efficacy Level (the total number of "Yes" responses) and Self-Efficacy Strength (the total level of confidence) can be measured. In addition, more recent studies have examined the relation between self-efficacy and other self-regulatory factors (i.e., goal setting and strategy use) in younger adults' cognitive performance. Self-efficacy measures were found to work in conjunction with other aspects of self-regulatory behaviour to influence overall performance (Bandura & Jourden, 1991; Bandura & Wood, 1989; Wood & Bandura, 1989).

Within cognitive aging research, Berry et al., (1989) developed a reliable and valid questionnaire (the Memory Self-Efficacy Questionnaire; MSEQ) to measure adult age differences in memory self-efficacy based on Bandura's method for measuring self-efficacy level and self-efficacy strength. For example, one study included both laboratory and everyday measures of memory and showed that self-efficacy scores were significantly correlated with everyday memory measures but not with laboratory measures (West, Berry, & Powlishta, 1986). However, although the MSEQ measures self-efficacy for different levels of performance using a questionnaire format, it still treats self-efficacy as a passive (i.e., isolated) judgment rather than as an element of a process (e.g., a call to use strategies and motivation) as Bandura intended it (Bandura, 1986).

According to Bandura's (1986) perspective, self-efficacy is an integral part of cognitive processes. Thus, in order to examine age differences in cognitive abilities, researchers have begun to focus on the role that self-efficacy may play in such differences. However, the relation between self-efficacy and other self-regulatory factors has been largely overlooked. Perhaps by reframing the relation between self-efficacy and cognitive performance as an active one involving other self-regulatory factors, researchers might better understand the social components of cognitive processing in younger and older adults.

The purpose of the present investigation was to examine the role that self-regulatory factors play in younger and older adults' decision-making performance. The self-regulatory process outlined by Bandura and his colleagues (e.g., Bandura & Jourden, 1991; Bandura & Wood, 1989; Wood & Bandura, 1989) was used to study potential age differences in self-regulation and the relation of such age differences to performance of a complex task. Specifically, the present study included measures of self-efficacy, goal setting, mood, strategy use, performance satisfaction, and decision-making performance. In order to obtain these measures, subjects performed a complex decision-making task over multiple trials and answered questions regarding their self-regulatory behaviours at regular intervals.

## Chapter Two

### LITERATURE REVIEW

Beliefs about the self are dynamically interconnected with each other and with behavioural experiences (Markus & Wurf, 1987). As individuals age, their self-referent thoughts are shaped by the developmental process and may be based on past, present, or future situations. Self-efficacy is one measure of self-referent thought, believed to be related not only to behaviours that one performs (e.g., Bandura, 1986), but also to other types of self-referent thought such as one's self-concept (Markus & Wurf, 1987).

Why are older adults' beliefs about their cognitive capabilities hypothesized to be different from younger adults' beliefs? In order to understand the potential role of self-efficacy in cognitive development across the lifespan, it is important to place such beliefs within the context of other (i.e., more general) self-referent beliefs. In particular, the early sections of this review will focus on self-referent beliefs that may be more readily understood in terms of possible age-related differences (i.e., age-related stereotypes), than task-specific beliefs (i.e., self-efficacy for performing a particular cognitive task). In this way, I hope to demonstrate that such general beliefs make it necessary to examine task specific beliefs, especially when the purpose of this line of research is to examine the relation between beliefs and behaviour.

I will first review literature addressing (a) self-concept and stereotypes, and how such beliefs may, in turn, shape older adults' behaviour (i.e., social comparison), (b) age differences in general self-efficacy beliefs within the general domain of cognition

(i.e., metacognitive questionnaire assessments), and (c) age differences in task specific self-efficacy within the context of particular cognitive tasks (i.e., global predictions on a particular memory task). Next, I will review the social psychological perspective on self-efficacy and other self-regulatory variables as an active process in behaviour. Finally, I will discuss the potential usefulness of the social psychological view in studies of cognitive ability in later life.

### **The Self-Concept**

Different types of self-referent thought may represent different levels of generality involving self-referent beliefs and knowledge. The more domains of functioning a self-referent concept encompasses, the more general it is (Markus & Wurf, 1987). It has been suggested that everyone has a concept of the self which influences their behaviour. Although researchers have disagreed about the structural content of the self-concept, most agree that the self-concept is a multifaceted and dynamic structure that is systematically implicated in all aspects of social information processing (Markus & Wurf, 1987; Mueller, Johnson, Dandoy, & Keller, 1992). Given that the way in which we view ourselves (i.e., our self-concept) influences our self-referent thoughts and behaviours, one issue pertinent to this discussion is whether aspects of the self-concept (i.e., self-image) can become systematically distorted or changed over the life span.

### **Stereotypes**

Age-related stereotypes have been the focus of much research (Kite & Johnson, 1988; Kogan, 1979; Lutsky, 1981; Walsh & Connor, 1979). It has been suggested that

socially held perceptions may interact with age-related events to foster a different self-image in elderly individuals than in younger adults (Langer, 1989; Mueller et al., 1992). Research on attitudes toward the elderly varies quite extensively in its findings with respect to whether negative or positive attitudes are held by members of society (Kogan, 1979; Lutsky, 1981). Obviously, when studying an entire age group, opinions and attitudes will differ depending on what aspect of the group is highlighted. For example, some research has shown that there are multiple stereotypes of older individuals that include both positive and negative subcategories (Hummert, 1990; Hummert, Garstka, T.A., Shaner, J.L., & Strahm, S, 1994; Schmidt & Boland, 1986). In one study, Hummert (1990) found that there is little overlap of stereotypes between younger and older age groups. Hummert's (1990) findings indicated that although the elderly are not necessarily evaluated in a negative light, some elderly people are (e.g., perceptions of severe mental and physical impairment increased with target age), and the probability of negative evaluation increases with the target's age (e.g., age 75 and over). Research by Heckhausen, Dixon, and Baltes (1989) also found both positive and negative characteristics assigned to individuals of various ages. In addition, they discovered there was considerable agreement between younger and older subjects' ratings (Heckhausen et al., 1989).

Although research on age-related stereotypes has generally shown mixed results, one line of research that has routinely found negative views toward the elderly focuses on attitudes toward intellectual and cognitive competence with age. In a meta-analysis of research on attitudes toward the elderly, Kite and Johnson (1988) found that older

people are consistently rated more negatively than younger people in terms of their competence. Specific studies have shown that the elderly are perceived to be less competent and have lower potential as employees (Rosen & Jerdee, 1976), are viewed as less intellectually competent than both younger and middle-aged adults (Rubin & Brown, 1975), and have received negative ratings with respect to memory ability (Hendrick, Knox, Gekowski, & Dyne, 1988; Ryan, 1992) and psychomotor speed variables (Hendrick et al., 1988). These findings suggest that intellectual and cognitive abilities are perceived to decline in later adulthood. Thus, there may be a negative societal context in which adults develop cognitively.

Although research on younger and middle-aged adults' attitudes toward the elderly has indicated some negative perceptions, it is a separate issue whether older individuals view themselves in the same light. Perhaps belonging to a specific age group influences one's view. Group membership may influence perceptions in a number of ways. For example, older individuals may view their age group more positively than younger members of society because membership creates a personal stake which may lead to positive perceptions of one's self. Alternatively, older adults may endorse negative perceptions of their group and of themselves. The elderly may also make a distinction between themselves and other older adults which may lead to more positive (i.e., above the mean) views of the self in comparison to their peers. Thus, a separate issue for examination is older adults' self-referent beliefs about their own cognitive behaviour.

### Social Comparison

One important way in which perceptions of an age group influence individuals is through social comparison. Two of the most basic propositions of social comparison theory are that (a) individuals do indeed compare themselves to other people and (b) to do this, they compare themselves with people who are similar to themselves (Festinger, 1954). It is useful to know how we perform certain activities. Knowing if one is good or bad at some activity can aid one's choice of behaviours so that one's time and effort are used most efficiently. Such choices ultimately influence individuals' development across the lifespan (Maciel et al., 1992).

Because physical and objective measures are rarely available, social comparison is often used to gauge how good individuals are at some activity. Comparison often gives us a standard by which we are able to judge ability (Goethals & Darley, 1987). For example, a person might feel good because he or she is able to complete a cross word puzzle in ten minutes. However, the act is given more meaning when one learns that very few people can complete similar puzzles within that time frame.

Another important aspect of social comparison theory is that individuals prefer to compare themselves with other people who are similar to themselves (Goethals & Darley, 1987). Similarity with the comparison group gives the comparison meaning. If the comparison group is very similar to the individual, then the feedback information readily applies to that individual's performance. This aspect of social comparison theory might explain why age-related attitudes and beliefs are potentially important factors in older adults' self-referent beliefs.

One important amendment to Festinger's original theory of social comparison, suggested by Goethals and Darley (1987), is that not only do people have a need to evaluate their abilities and their performance, but such a need is rooted in their need for self-esteem (i.e., self-worth or self-image, commonly noted as the evaluative and affective dimension of the self-concept). For example, person A might seek out comparative information regarding his or her memory abilities. If person A is an elderly individual, part of the reason for comparing one's self to others is to gain knowledge about one's abilities. Another reason for comparison is validation that one is doing pretty well for one's age and thereby gain positive information to support self-esteem.

One's choice of comparison group will obviously influence the information one receives with respect to their standing in the group (i.e., above or below the group mean) (see Baltes & Baltes, 1993). In particular, changing one's comparison group can be an important mechanism in maintaining one's self-esteem across the lifespan. In support of this suggestion, some researchers have found that older individuals do not differ from younger adults on many self-reports related to the self (Baltes & Baltes, 1986; Butt & Beiser, 1987; Lachman, 1986b). Thus, the maintenance of self-esteem across the lifespan cannot be overlooked. However, one might expect that within some domains of functioning, older adults might not exhibit such maintenance.

With respect to cognition, it has been suggested that because there are so many generalized perceptions regarding changes in older adults' cognitive abilities with age, it is very difficult for them to accurately assess changes in their own abilities (Ross,

1989; McFarland, Ross, & Giltrow, 1992). Such difficulty may not only stem from generalized societal stereotypes, but also from internalizing age-related stereotypes thereby viewing personal cognitive abilities in an increasingly negative light (Langer, 1989). Thus, it may be very difficult for older individuals to use social comparison information in an optimal fashion. Moreover, because many commonly held beliefs about cognitive aging are negative, these beliefs may work to diminish self-esteem, self-efficacy, and even cognitive abilities.

### **Metacognition and Aging**

Metacognitive research has addressed the relation between adults' perceptions of their abilities and their actual abilities (e.g., Dixon & Hertzog, 1988; Dixon, Hertzog, & Hultsch, 1986; Gilewski, Zelinski, & Schaie, 1990; Hultsch, Hertzog, & Dixon, 1987; Lachman, 1986a). Obviously, individuals' beliefs about their cognitive abilities will depend on the cognitive domain of interest. For example, if asked about one's perceived cognitive abilities within the domain of practical advice giving versus the domain of memory, an individual might give very different responses.

Several questionnaires have been developed to examine adults' perceptions of their memory (e.g., Dixon & Hultsch, 1983; Dixon et al., 1988; Gilewski, Zelinski, & Schaie, 1990) and intellectual abilities (Lachman et al., 1982). Typically, these questionnaires assess different dimensions of metacognition within a particular domain of cognitive functioning (e.g., memory or intelligence). For example, the Metamemory In Adulthood (MIA) questionnaire has seven different dimensions tapping perceived memory (Capacity, Change, Strategy Use, Anxiety, Achievement motivation, Task

knowledge, and Locus of Control) (see Dixon et al., 1988). In addition, the Personality In Context (PIC) questionnaire has six different dimensions of intellectual functioning (Internal Locus of Control, External Locus of Control, Powerful Other, Achievement, Anxiety, and Morale) (Lachman et al., 1982). Although such questionnaires address a particular cognitive domain, these measures are still considered to be relatively general because the questions cover several different types of everyday tasks (e.g., perceived ability to remember telephone numbers, names, and important dates) (Hertzog et al., 1988).

Typically, cross-sectional studies using such questionnaire instruments have shown that older adults have more negative perceptions of their cognitive abilities than do younger adults (Gilewski, et al., 1990; Hultsch et al., 1987). In addition, Lachman (1986b) showed that domain specific measures of cognitive (i.e., intelligence) are more likely to result in age differences in self-reported ability than measures that encompass several domains of cognition or do not specify a particular domain (i.e., Levenson's (1974) Locus of Control Scale). Thus, specifying a particular cognitive domain in questionnaire assessments should lead to a higher relation between self-reported abilities and actual cognitive abilities.

Originally, many of these questionnaires were indeed designed to tap perceptions of cognition that might prove to be valid indicators of cognitive performance (Herrmann, 1982). For example, an individual's self-rated ability to remember phone numbers should reflect their actual memory ability. Generally, it was expected that the correlation between questionnaire responses and measures of ability would be very

high. Indeed some research has shown that certain metacognitive dimensions are more likely to correlate with ability than other dimensions (see Dixon & Hertzog, 1988). In particular, some research has found significant correlations between the knowledge dimension of the MIA (e.g., Strategy Use and Task Knowledge) and measures of cognitive ability (Dixon et al., 1986). However, correlations between self-reported abilities (i.e., scale relating to the efficacy dimension on the MIA) and actual abilities are typically modest (Hertzog et al., 1990a). Various reasons for such modest correlations have been suggested (Rabbitt & Absen, 1990), including the validity of the questionnaires themselves (Herrmann, 1982).

Dixon and Hertzog (1988) and Hertzog et al. (1990a) suggest that such questionnaires are reliable and valid measures of self-reported ability, but that such self-reports reflect beliefs about ability that may be quite inaccurate. Psychometric research on metacognitive questionnaires has indeed resulted in evidence for a belief laden factor (e.g., Memory Self-Efficacy in the MIA and MFQ and Intellectual Self-Efficacy in the PIC). Consistent with the view that the modest relation between self-reports and ability stems from inaccurate beliefs, Hertzog and his colleagues (Hertzog et al., 1989; Hultsch et al., 1988) report (a) high internal consistency reliability estimates (Cronbach's alpha) from five independent samples for the MIA questionnaire, (b) good discriminant validity between the self-efficacy factor on the MIA and related concepts (i.e., subscales in the Jackson Personality Inventory), and (c) good convergent validity of the memory self-efficacy factor in both the MIA and MFQ instruments. In addition, the PIC questionnaire has also shown psychometric evidence

for (a) good reliability and validity in both younger and older samples (Lachman, 1978) and factor analytic evidence for an Intellectual Self-Efficacy factor (Lachman, 1983). In particular, the Internal Locus of Control Scale and the Anxiety Scale from the PIC were found to load highly and significantly on the Intellectual Self-Efficacy factor (Lachman, 1983). Thus, there appears to be strong evidence, at least for certain metacognitive measures, that self-efficacy is an important aspect of adults' perceptions of their cognitive abilities. Several researchers have suggested that self-reported abilities are influenced by perceptions of personal efficacy (Berry et al., 1989; Cavanaugh & Green, 1990; Dixon & Hertzog, 1988; Hultsch et al., 1988).

#### Age and Self-Efficacy

It has been suggested that adults of all ages form their self-efficacy beliefs in the same manner (e.g., direct and vicarious experiences) (Bandura, 1986; Schulster, 1981a, 1981b, 1982), but the types of experiences or information attended to during such experiences might be very different for younger and older adults. For example, it is a common belief that memory declines with age (e.g., Ryan, 1992). If both younger and older adults misplace their car keys, the experience might be interpreted quite differently. The younger person might not even think of the event as a memory slip, whereas the older person may be more likely to attend to it and may even interpret it as evidence of a memory problem since memory is often a growing concern with age (see Gilewski & Zelinski, 1986 & Herrmann, 1982 for reviews). The reason is probably quite simple; memory problems are commonly associated with advancing age (e.g., Ryan, 1992). Therefore, a memory slip would not typically be interpreted as a

sign of a problem to a younger person who is not expected to have memory problems, but might be interpreted as such by an older person (Hammer, 1994). Such an interpretation becomes problematic, however, when an older individual is not cognitively impaired and such beliefs negatively influence their performance (e.g., they avoid or expend less effort in memory situations).

Cross-sectional studies have indicated that one of the major challenges facing researchers who are interested in the interface between social and cognitive factors is dissociating the age-related beliefs from the age group differences on task variables. For example, older adults may simply find certain laboratory tasks quite difficult because they are placed in an unfamiliar cognitive situation. In short, older adults' cognitive performance on laboratory tasks may suffer due to their lack of familiarity in the testing situation. Specifically, task factors such as task familiarity (lab vs everyday tasks) and training have been examined (Dittman-Kohli, Lachman, Kliegl, & Baltes, 1991; Rebok & Balcerak, 1989; West, et al., 1986). Generally, researchers have found that there are age differences in self-efficacy levels in favour of younger adults, and that task factors do correlate with self-efficacy levels (e.g., higher task familiarity correlates with higher self-efficacy levels). For example, West et al., (1986) found that younger adults had higher self-efficacy scores than older adults, people who did not complain about their memory ability had higher self-efficacy scores than people who did complain, and individuals who performed familiar tasks rated their self-efficacy higher than those who performed unfamiliar tasks.

With regard to task training, Rebok and Balcerak (1989) found that older adults who received memory training had higher performance expectations than older adults in the other conditions, but these results were not statistically significant. However, another study conducted by Dittmann-Kohli et al. (1989) found that ratings of self-efficacy improved after subjects received training on cognitive tasks, even though performance on the tasks did not improve any more than the performance of subjects who were simply re-tested. Moreover, Dittmann-Kohli et al., (1989) found enhanced self-efficacy on tasks for which subjects received training, but not on other tasks. Thus, cross-sectional studies have shown that self-efficacy differs between younger and older adults, and also between different aspects of the task.

An important focus of developmental research is the relationship between self-efficacy and performance change across time. A study by Cornelius and Caspi (1986) examined the relationship between perceptions of intelligence and intellectual performance in an elaborate cross-sectional study spanning middle-aged and older adults. They found that internal and external control beliefs were quite stable during middle-age, but participants in their 60s or 70s perceived less internal control and more external control than middle-aged participants. Moreover, adults who scored high on external control perceived a decline in their intellectual ability, experienced more anxiety, generally endorsed an external locus of control, and had lower fluid and crystallized intelligence scores. Changes in one's perceived intellectual efficacy and concern with intellectual behaviour may be related to actual changes in intellectual ability and changes in generalized perceptions of control.

Longitudinal studies have been conducted to examine the link between older adults' efficacy beliefs and cognitive performance (Grover & Hertzog, 1991; Lachman, 1983; Lachman & Leff, 1989). Specifically, these studies focused on the relationship between self-reported personality variables (i.e., Intellectual Self-Efficacy) and measures of intellectual ability (i.e., crystallized and fluid intelligence) over longitudinal periods. Generally, personality variables (e.g., Intellectual Self-Efficacy) did not affect changes in memory performance (e.g., memory span) even though there were significant changes in cognitive ability across time. Self-efficacy was not associated with changes in intellectual performance across the longitudinal period, but intellectual performance did predict changes in self-efficacy. Thus, when generalized measures are used, the direction of influence is from performance to self-efficacy perceptions, but not the other way around.

One recent study conducted by McDonald-Miszczak, Hertzog, and Hultsch (in press) did not support these longitudinal findings. Using a two- and a six-year longitudinal period with different samples, McDonald-Miszczak et al. (in press) found that adults' perceptions of changes in their memory abilities were significantly correlated with their memory self-efficacy beliefs, but not correlated with actual changes in memory abilities. This study more strongly supported the notion that perceptions of changes in memory abilities stem from an age-related implicit theory of age-related changes in cognitive abilities (i.e., age-related stereotypes about cognitive declines), rather than a realistic assessment of memory changes across time.

One problem that arises when examining the relation between generalized assessments of memory/intellectual self-efficacy and cognitive abilities, is that such beliefs are measured at a general level on the questionnaires (e.g., several questions assessing perceptions of different everyday memory/intelligence situations), whereas performance is often measured specifically (e.g., memory for particular lists of nouns). The relation between perceived ability and actual ability may be very complex depending on the specific ability that is measured (Dixon & Hertzog, 1988). Because of potential task differences, task specific measures of self-efficacy beliefs and cognitive abilities are reviewed next.

#### **Task Specific Self-Efficacy**

Several researchers have used performance predictions to measure metamemory (Bruce, Coyne, Botwinick, 1982; Connor & Hertzog, 1993; Hertzog et al., 1990b; Hertzog et al., 1994; Lachman, Lachman, & Thronesbury, 1979; Lovelace & Marsh, 1985; McDonald-Miszczak et al., 1994; Murphy, Sanders, Gabriesheski, & Schmitt, 1981; Perlmutter, 1987; Rabinowitz, Ackerman, Craik, & Hinchley, 1982). Predictions are typically either global or item-by-item in nature. A global prediction is a general task prediction which requires the individual to estimate how he or she will perform on an entire memory task. For example, study participants might be asked to predict how many words they will correctly recall on a 30-word list. Item-by-item predictions require the individual to estimate the likelihood that a specific test item will or will not be recalled. For instance, an individual might be presented with memory test items one at a time and asked to rate the likelihood of remembering each item on a 5-

point Likert scale ranging from 1 (will certainly not remember) to 5 (will certainly remember). It has been suggested that these two different prediction measures tap different aspects of metacognition (Nelson & Narens, 1990). Global predictions have been hypothesized to tap task specific self-efficacy because individuals are required to estimate their personal performance on a task prior to task experience (Hertzog et al., 1990b). Alternatively, item-by-item predictions are generally regarded as a judgement of learning (i.e., the degree to which an item has been learned or encoded) because individuals have had a chance to study the particular item prior to making a judgment (Dunlosky & Nelson, 1992; 1994). Because it has been suggested that global predictions are a measure of task specific self-efficacy (Hertzog et al., 1990b), research involving global predictions will be discussed in more detail below.

The relation between global predictions and performance is typically inaccurate (e.g., Lovelace & March, 1985; Rabinowitz et al., 1982). Due to such inaccuracy, Hertzog et al. (1990b) suggested that global predictions might represent task-specific self-efficacy. If global predictions are belief (i.e., self-efficacy) laden like metacognitive questionnaires, the relation between global predictions and performance will not necessarily be accurate. One would expect, however, that predictions would be significantly correlated with general self-efficacy beliefs (e.g., the Capacity subscale from the MIA questionnaire). Hertzog et al. (1990b) suggested that the prediction process involves (a) an estimation of one's general memory self-efficacy, (b) an estimation of the difficulty of the task, and (c) mapping one's self-efficacy onto the task distribution (Hertzog et al., 1990b).

Support for this suggestion comes from studies that have incorporated both a questionnaire measure of general memory self-efficacy (e.g., the Capacity scale from the MIA), a task-specific measure of memory self-efficacy (i.e., global performance prediction), and multiple memory test trials. Using this paradigm, researchers have found that initial global predictions are more highly correlated with questionnaire measures of general memory self-efficacy than with memory performance (Hertzog et al., 1990b, Hertzog, et al., 1994; McDonald-Miszczak et al., 1994). However, subsequent global predictions (i.e., on the second and third trials) are increasingly correlated with task performance and decreasingly correlated with general memory self-efficacy (Hertzog et al., 1990b, Hertzog, et al., 1994; McDonald-Miszczak, et al., 1994). Thus, there is evidence to suggest that prior to direct task experience, individuals' global predictions reflect general memory self-efficacy, whereas following experience, reflect task-specific self-efficacy.

### **Theoretical Framework**

Questionnaire and prediction studies have provided valuable information regarding the multidimensionality of metacognition and age differences in metacognitive functioning. Metamemory and metacognitive research has already addressed some aspects (i.e., task factors, task training/experience, implicit theories of memory change) concerning the interplay between social and cognitive factors in age-related differences in and changes in cognitive performance. Cavanaugh has outlined such aspects in a framework pertaining to memory performance (see Cavanaugh, 1989). This model includes general concepts (i.e., biological factors, personality, experience, social

context), general cognitive constructs (i.e., executive abilities and processing, on-line awareness), elements of the task itself (i.e., task factors, task evaluation), self-regulatory constructs (i.e., beliefs, efficacy judgments, outcome expectations, effort, strategy selection, performance evaluation), and performance. Primarily, the model encourages researchers to think about the connection between social and cognitive factors as an active process. However, because the model is a theoretical representation of a complex process, it does not overtly suggest a method for empirically examining particular subprocesses or submodels. Other areas of psychological research have examined the connection between cognitive and social factors related to the present discussion. Although such research has not highlighted developmental issues per se, the methods might be used with younger and older adults to address age-related research questions.

### **The Role of Self-Efficacy and Self-Regulatory Factors on Behaviour**

Bandura (1986) suggested that the role of self-efficacy in performance be examined using a micro-analytic technique. This technique involves taking several different measures of self-efficacy and self-regulatory factors when observing performance on a specific task. The measures of self-efficacy and self-regulatory behaviour are assumed to tap different processes involved in cognition (i.e., motivation and affect). Thus, this method allows for a proximal examination of the factors hypothesized to play an important role in behaviour.

### **Self-Efficacy**

In social psychological studies of self-efficacy, the construct has typically been measured in two different ways. First, subjects are asked to provide their level of self-efficacy. The exact form the prediction takes will depend on the task, but generally it is an estimate of how an individual will perform. For example, subjects will be given several different performance levels (e.g., 2 out of 10, 4 out of 10, etc.) and will be asked to respond "yes" or "no" as to whether they will be able to perform at each level. The number of "yes" responses is used as the measure of Self-Efficacy Level (SEL). A person who feels highly efficacious about a task will have a higher SEL than a person who does not feel efficacious about a task. Second, subjects are typically asked to provide a confidence rating of their performance at each level. For example, subjects might be highly confident (100%) about their performance at the lowest levels (e.g., 2 & 4), but less confident about their performance at higher levels. All confidence estimates are summed and the overall mean rating is used as the measures of Self-Efficacy Strength (SEST). These two measures usually comprise an individual's self-efficacy measures in social psychology studies conducted with younger adults.

Several studies have supported the suggestion that task specific self-efficacy does influence performance (e.g., Bandura & Cervone, 1983; Weinberg, Gould, & Jackson, 1979). The level of self-efficacy (high vs low) is usually manipulated by the experimenter (e.g., by competition with another individual or by false performance feedback). Generally, high self-efficacy leads to better performance than low self-

efficacy (Bandura & Cervone, 1983; Weinberg, et al., 1979). Other important factors, however, may play a very important role in the effect of self-efficacy on performance. Self-regulatory factors regulate the relationship between self-efficacy and performance on a specific task. Bandura (1986; 1989) has specifically suggested (a) affect, (b) goal setting, (c) motivation/effort/task persistence, and (d) strategy use as important self-regulatory factors. These factors are discussed below.

### Affect

According to Bandura (1989) individuals' emotional states interact with their feelings of efficacy. Emotional reactions can alter the course of thinking and thereby influence performance (Bandura, 1989). Performance anxiety is often mentioned in experimental studies, and researchers often endeavour to put their subjects at ease when they arrive at the laboratory since such anxiety may influence their results (e.g., lower performance). Thoughts about one's inefficacy may indeed impair performance, and such impairment may, in turn, encourage more negative thinking. Thoughts of inefficacy are often accompanied by subjective distress and autonomic arousal (Bandura, Reese, & Adams, 1982). In turn, subjective distress may be interpreted as inefficacy to perform certain behaviours which may lead to avoidance and/or depression. Bandura (1989) suggests that perceived efficacy in control of one's thoughts is a primary factor in the regulation of cognitively generated arousal. Besides anxiety, Bandura (1989) also specifically links self-efficacy and depression. Since negative efficacy involves negative thoughts about one's self, the individual may become depressed by such ruminations.

The role of affect in self-efficacy and performance can be illustrated by a number of studies examining anxiety and depression. Bandura and his colleagues (Bandura & Adams, 1977; Bandura, Adams, Hardy, & Howells, 1980) conducted studies focusing on self-efficacy and anxiety related to phobias. These studies indicated that self-efficacy was a very accurate predictor of desensitizing behaviour (e.g., decreasing anxiety so that a participant could approach a snake) and also future behaviours not practised during the desensitizing procedure. Studies of the relationship between self-efficacy judgments and depression in younger adults indicates that depression is related to lower self-efficacy (Kanfer & Zeiss, 1983) and that gender differences may influence certain manipulation of affect (Davis and Yates, 1982). Thus, these studies indicate that there is an important relationship between self-efficacy, affect, and performance. Emotional disruptions may demand individuals' attention and energy thereby taking important resources away from performing the task at hand. Such disruptions lead to avoidance behaviour (e.g., phobias), or may lead to debilitated performance through depression or learned helplessness. Research findings suggest that self-efficacy is influenced by (Kanfer & Zeiss, 1983), and exerts an influence on performance (Bandura & Adams, 1977; Bandura et al., 1980).

### **Motivation**

It has been suggested that intentions regarding future performance are important aspects of performance (Locke, 1968), and are also thought to be highly related to self-efficacy (Bandura, 1986). According to Bandura (1986) an intention may be defined as "the determination to perform certain activities or to bring about a certain

future state of affairs" (p. 467). Locke (1968) developed a theory about goals which also states that goals play an important role in performance motivation. Locke (1968) suggested that the relationship between goals and performance is linear as long as the performance goal is perceived to be attainable. Thus, the more challenging individuals' performance goals are, the more motivated they are to achieve their goals and this higher motivation should lead to higher performance attainments.

Goal setting is viewed as an extremely important element of performance in Bandura's (1986) model of task performance because goals are thought to measure individual's performance intentions, which, in turn, are viewed as highly related to self-efficacy levels. Typically, subjects are asked to set their own performance goal or a goal is provided by the experimenter that is either difficult to achieve or very easy to achieve. Self-efficacy is thought to influence the goals adults set for themselves and also influence how they react to goals set by the experimenter. For example, someone with high self-efficacy is more likely to set higher goals and will probably react positively to a challenging goal, whereas a person with low self-efficacy is more likely to set lower goals and will likely be discouraged by a high goal.

Studies on goal setting have shown that previous goal assignment affects subsequent goal choice and task performance (Latham & Baldes, 1975; Locke, Frederick, Buckner, and Bobko, 1984). For example, subjects who were previously assigned a difficult goal were more likely to choose more difficult goals for themselves, whereas those assigned easier goals were more likely to choose easier goals on subsequent trials (Locke et al., 1984). Generally, goals do affect

performance, but this relationship depends on the perceived attainability (Locke et al., 1984) and commitment to the goals (McCaul, Hinz, & McCaul, 1987). Moreover, in the absence of other task information, a goal is treated much like a performance norm reflecting the difficulty of the task (Meyer & Gellatly, 1988). It seems that one way in which assigned performance goals influence performance is by providing an estimate of the difficulty of the task and implicit information about what is acceptable performance. Thus, assigned goals may provide a performance standard for assigning one's own goals and the level of satisfaction one should feel with their performance.

With respect to the present discussion, goals are hypothesized to be an important self-regulatory element determining performance (Bandura, 1986). Goals provide important information about the task that helps adults determine what level of performance they should be satisfied with. Individuals with higher self-efficacy set higher performance goals, and are more committed to such goals than subjects with lower self-efficacy (Bandura, 1986; 1989). In addition, people with high self-efficacy are typically less satisfied with performances that fall short of a goal than subjects with low self-efficacy because such shortcomings contradict the person's theory about himself or herself (Bandura 1986; 1989). Research on effort and task persistence supports these findings. Bandura (1986; 1989) suggested that individuals with higher self-efficacy will persist longer in the face of adversity than those with lower self-efficacy since they feel more capable of completing the task. Researchers found that subjects with high measures of self-efficacy persisted longer on a task (Jacobs, Prentice-Dunn, & Rogers, 1984) and showed a greater increase in effort than subjects

with low self-efficacy (Bandura & Cervone, 1986; Cervone & Peake, 1986).

Moreover, subjects who reported being most dissatisfied with their performance also heightened their effort (Bandura & Cervone, 1986). Motivation to perform, then, stemmed from the match between subjects' self-efficacy and their performance standards (i.e., goals and goal commitment). Therefore, performance motivation should be considered a multifaceted aspect of self-regulation which requires a variety of measures (i.e., goals, goal commitment, performance satisfaction and task persistence) to understand the relation between self-efficacy, motivation, and performance.

### **Strategy Use**

People who report being highly efficacious about their abilities remain more focused in their analytic thinking than those who are significantly less efficacious (Bandura, 1989). One way to measure how focused individuals are in their analytic skills is to examine the strategies that they use to perform a task. One would assume that the more optimal the strategies used to complete a task, the better one's performance.

Research has shown that perceptions of the task and one's self-efficacy significantly affect strategic behaviour. Wood and Bandura (1989) found that the type of analytical thinking that fostered managerial decisions differed depending on subjects' implicit theories of their ability. Those within the skill condition (i.e., those with the concept that skill on the experimental task could be continually enhanced by acquiring knowledge) were systematic in their use of analytic strategies and became

even more systematic with practice, whereas entity theory holders (i.e., adhering to the concept that ability is a fixed entity) became less efficient. Moreover, Bandura and Wood (1989) found that the less controllable participants' thought the task was and the higher the pre-set performance standard, the less strategic were subjects' decisions. Another study by Locke, Frederick, Lee and Bobko (1984) examined the effects of self-efficacy, goals, and task strategies on task performance. Using path analysis, Locke et al. (1984) found that ability is directly related to strategies used along with other self-regulatory behaviours (i.e., self-efficacy measures and goals). Thus, perceptions of one's ability to perform the task significantly affected subjects' use of analytic strategies and their overall task performance.

### **The Self-Regulatory Process**

With all the self-regulatory factors influencing each other and, in turn, influencing cognitive performance, perhaps the most interesting and direct test of the process suggested by Bandura (1986) are studies that used path analytic techniques. In such studies, it is extremely important to choose a task that is complex enough to incorporate all the factors researchers wish to measure (e.g., goal setting, task persistence, strategy use). A decision making task developed by Wood and Bailey (1985) has been used in several studies. The task is a computer simulation of a manufacturing business which the subjects must run appropriately by filling different manufacturing orders within the budgeted number of hours specified by the program. The computer program may be changed and manipulated to vary different aspects of the decision-making process under examination. Subjects are asked to (a) assign

employees to appropriate jobs, (b) set appropriate goals for themselves and for the employees, (c) motivate the workers using appropriate incentives, (d) monitor and make changes over multiple trials (e.g., change managerial strategies, goals, and incentives) in order to meet or beat the budget, and (e) monitor their own performance and the employees' performance over multiple trials. Subjects' perceptions of their own capability to perform the task (i.e., self-efficacy level and self-efficacy strength) are also measured at regular intervals during the simulation. The complexity of this task permits examination of decision-making as an active process that involves several self-regulatory factors (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone, Jiwani, & Wood, 1991; Wood & Bandura, 1989).

The ordering of variables is crucial to the statistical integrity of the path model. Studies of self-regulatory models (e.g., Bandura & Wood, 1989; Wood & Bandura, 1989) usually order the variables (a) past performance (on previous trials) (b) self-efficacy, (c) goal-setting, (d) analytic strategies, and (e) present performance. This ordering of variables assumes that previous task experience positively affects one's self-efficacy. Self-efficacy is then thought to positively affect one's task motivation (goal setting) which, in turn, is thought to positively affect the strategies one uses to perform the task. It should be noted that studies examining causal relationships of self-regulatory variables do not necessarily assume that the effects of these variables are indirect. In addition to an indirect positive effect of self-efficacy through goal setting on performance, the researcher may also predict a positive direct effect of self-efficacy on performance. Using this technique, Bandura and his colleagues examined

the effects of self-efficacy and self-regulatory factors on younger adults' (i.e., MBA students) performance (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone et al., 1991; Wood & Bandura, 1989).

Wood and Bandura (1989) used the complex decision-making task described above to study the relationship between implicit theories of ability, self-regulatory mechanisms, and decision-making performance. The researchers manipulated whether the subjects held a skill (e.g., ability) or entity (e.g., luck) theory of performance through introductory instructions read to them before the session began. These researchers found that the type of implicit theory an individual adheres to does affect performance. The self-efficacy of those within the skill condition, rose with each block of trials (3 blocks with 6 trials in each block), whereas it decreased in the entity condition. The path analysis indicated positive effects between all the variables. Specifically, it showed that higher self-efficacy directly resulted in more analytic strategy use which in turn led to higher performance. Higher self-efficacy also directly resulted in better performance. One puzzling outcome of this study was that self-efficacy was not related to goal setting. The authors suggested that the reasons for a lack of association between these variables may stem from the distal nature of the goal setting procedure as being too far in the future (i.e., encompassing too many trials).

Another study by Bandura and Wood (1989) examined the relationship between perceived organizational controllability, performance standards, self-regulatory factors, and decision-making performance using the same computer simulation. These

researchers found that self-efficacy was higher overall in the high controllability condition. They also found that subjects within the high controllability condition who had been assigned a readily attainable performance standard (low standard) displayed a rising level of managerial self-efficacy, whereas those assigned a difficult standard showed a weakening of perceived efficacy the longer that they performed the task. Subjects in the low controllability condition displayed a low sense of self-efficacy overall, and did not show differences across performance standards (high vs low) or across trials. In general, the path analysis showed that self-efficacy, self-regulatory measures (i.e., goal setting and strategy use) positively influenced each other and performance. Perhaps most interestingly, Bandura and Wood (1989) found that the effect of past performance on present performance decreased with experience, whereas the effect of self-regulatory factors increased.

Finally, a study conducted by Bandura and Jourden (1991) examined social comparison, self-regulatory factors, and performance on the same complex decision making task. Measures of self-efficacy, performance satisfaction, goal setting, and strategy use were obtained across three blocks of task trials (i.e., different managerial decisions). There were four comparison groups in which participants were either falsely informed they had (a) consistently similar capabilities, (b) consistently superior capabilities, (c) progressively improving capabilities, and (d) progressively declining capabilities compared with their peer group. The researchers initially found that self-efficacy was highest in the superior group and similar for the other three groups. However, experience resulted in changes in performance. By the last performance

phase, the participants in the progressive mastery condition had the highest self-efficacy, superior and similar subjects had slightly lower self-efficacy, and subjects in the progressively declining condition had, by far, the lowest self-efficacy. The path analysis of the relation between self-efficacy, self-regulatory factors, and performance in three different phases (i.e., trial blocks) indicated that self-efficacy, analytic strategies, and self-satisfaction has significant and positive effects on early decision-making (i.e., block 2 performance). Although, self-efficacy and self-regulatory factors continued to positively affect later performance (i.e., block three performance), self-efficacy did not continue to have an indirect effect on block three performance through strategy use. With experience, self-efficacy became more of a motivating factor (i.e., influencing goal setting), which in turn affected performance. Moreover, close examination of the paths indicated that previous performance had less impact on later performance, whereas self-efficacy has an increasing effect as participants gained experience.

### **Summary**

Social psychologists have examined the effects of self-efficacy, self-regulatory factors, and the causal process involved in behaviour. Generally, these studies have shown that self-efficacy is positively correlated with self-regulatory factors and with overall performance. The studies of causal associations have typically shown that self-efficacy indirectly influences performance through other self-regulatory factors, but also influences performance directly.

### **Advantages of Adopting A Process View into Cognitive/Developmental Research**

There are several advantages to adopting Bandura and his colleagues' approach to studying age differences in self-regulation and cognition (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone et al., 1991, Wood & Bandura, 1989). First, examining self-regulatory factors as part of an underlying process of behaviour addresses the issue of how self-efficacy may affect cognitive performance. In addition, because path analyses have already been conducted on younger adults' data, cognitive aging researchers have a theoretical starting point from which to begin to examine the self-regulatory process in older adults' cognitive performance. Thus, Bandura's paradigm can be used to examine age differences in younger and older adults' self-regulatory processes and self-regulatory influences on cognitive performance.

Second, research conducted by Bandura and his colleagues has provided a foundation for understanding the inter-relationships among different self-regulatory factors. For example, this paradigm can be used to examine both direct and indirect influences of self-regulatory factors on performance. By broadening the number and kind of measures that assess self-regulation, cognitive aging researchers may have a greater chance of tapping more influences on older adults' cognitive performance. For example, although global predictions have been used widely by cognitive aging researchers to measure task-specific self-efficacy, such predictions may actually represent combinations of two or more different self-regulatory elements. Because

global predictions are a point estimate of performance most often made prior to any task experience, it is difficult to conclude whether such predictions are a measure of self-efficacy level or task related motivation (i.e., goal setting). Bandura's paradigm allows researchers to distinguish between subtle aspects of self-regulatory behaviours that may have been overlooked by cognitive aging researchers.

Third, the degree of complexity included in Bandura's paradigm might better operationalize the way in which self-efficacy operates in 'real-life' situations. By using a complex simulation to examine the process underlying behaviour, researchers may tap constructs hypothesized to operate in cognition in a more realistic manner. The realistic nature of the decision task used by Bandura and his colleagues has definite advantages in studies with older adults. For instance, West et al. (1986) found that the correlation between self-efficacy and everyday tasks was significant, whereas the correlation between self-efficacy and lab tasks was not significant. Thus, tasks which better reflect the complexity of real-life tasks, may give researchers a clearer picture of age differences in cognition.

Fourth, the approach suggested by Bandura (1986; 1989) may be combined with measures previously used in cognitive/developmental studies in order to provide continuity with cognitive aging research and place it within the context of more general concepts (i.e., personality, self-concept). Measures such as metamemory questionnaires, performance predictions, and questionnaire measures of affect may provide additional information regarding the role of these more general concepts in older adults' cognitive performance. For example, researchers might examine the

correlations between general measures of efficacy (e.g., questionnaire measures of memory self-efficacy) and task specific measures (e.g., SEST & SEL). Such correlations might differ depending on the task that researchers use because some tasks might be more salient to adults' general beliefs (e.g., memory for general knowledge facts) than other tasks (e.g., working memory). In this way, the process underlying cognition is expanded to include general measures and thereby places task-specific performance in a larger context.

### **The Present Study**

Bandura's (1986) method for examining the role of self-efficacy and self-regulatory processes was used in the present investigation to examine the interplay between social and cognitive elements in younger and older adults' cognitive performance. In addition, particular questionnaire measures, designed specifically for research with older adults, were also used. The computer simulation described above (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone et al., 1991, Wood & Bandura, 1989) was adapted for this study. Incorporating both a task-specific process paradigm and a more general questionnaire paradigm in a single study allowed for a more in-depth investigation of different levels of social constructs hypothesized to operate in the social-cognitive process. In particular, it has been suggested that questionnaire measures of self-efficacy are general indicators because the questions address beliefs in various everyday situations (Hertzog et al., 1990b). However, some questionnaires address situations within a particular cognitive domain (i.e., intellectual functioning) and others are even broader. Thus, different questionnaires were used in this study to

address potentially different levels of beliefs related to adults' self-efficacy. Moreover, administration of questionnaires in conjunction with task-specific measures of self-efficacy and self-regulatory processes allowed for examination of the interplay between general levels of self-efficacy, task-specific measures, and overall cognitive performance in younger and older adults. This project was approved by the Committee on Research Involving Human Subjects at the University of Victoria.

### **The Experimental Task**

A computer simulation of a complex managerial decision-making task was used in the present experiment (Wood & Bailey, 1985). As discussed previously, the computer task has been used in studies of self-regulatory behaviour in younger adults (e.g., Bandura & Jourden, 1991). This computer task may be a more appropriate method for examining the relationship between younger and older adults' self-efficacy, self-regulatory variables, and performance than traditional cognitive tasks, because of its complexity. In short, the task provided an excellent bridge between previous work examining self-regulatory influences in social psychology and emerging lifespan developmental issues.

The simulation required participants to act as managers of the special order department in a furniture factory. The objective of the task was to meet production order deadlines within the number of budgeted hours. Each trial of the simulation was represented as a separate work week when a new order for restoring furniture was received and must be filled. For example, the subjects might have been asked to complete an order to recover and refinish six mahogany chairs in eighty-six hours.

The budgeted number of hours differed depending on the specific order which changed each week. The task was designed to be difficult, so it was not likely that subjects would quickly reach high production efficiency (e.g., perform twenty-five percent below the number of budgeted hours each week).

The task was designed to capture some of the complexity of real-life managerial decision-making (Wood & Bailey, 1985). As the manager of the special order department, subjects were required to assign employees to appropriate jobs, set performance goals for each employee, offer feedback to employees after each order or withhold feedback, and offer rewards or withhold rewards for employees' performance. The manager's task was to match employees with the demands of each job and the most appropriate motivational factors to get the best performance from them. Because the number of budgeted hours was difficult to meet, the focus of the task was on subjects' discovery of a combination of factors that worked best to achieve higher production efficiency.

#### **Experimental Manipulation of Self-Efficacy**

In order to study the relationship between self-regulatory factors and performance, the present investigation incorporated a social comparison manipulation (Bandura & Jourden, 1991). The purpose of this manipulation was to create three different levels of self-efficacy in order to study its effects on self-regulatory factors and overall decision-making performance in younger and older adults. These conditions were created through feedback information that reflected the subjects' performance in relation to their social counterparts. This manipulation was successfully used by

Bandura and Jourden (1991) to vary younger business students' self-efficacy for performing the computer task used in this investigation.

Three experimental conditions were used. Subjects received feedback information about how they performed in relation to their same age/same experience group. All participants in a given condition received the same feedback information regardless of their actual performance. Subjects in the Stable Information condition received information indicating that they were performing at the level of their peers (e.g., "You are performing at the same level as your age group"). This condition was designed to maintain a fairly high level of self-efficacy throughout the entire testing procedure (Bandura & Jourden, 1991). Subjects in the Progressive Mastery condition received information that indicated that they initially performed below their peers (e.g., "You are performing 5% worse than your peer group"), but that they progressively mastered the task over the course of the experimental session such that by its completion they performed at a much higher level than their peers (e.g., "You are performing 15% better than your peer group"). The change in an individual's standing in comparison to the social group was hypothesized to enhance subjects' self-efficacy throughout the course of the experimental session (Bandura & Jourden, 1991). Finally, subjects in the Progressive Decline condition some subjects received information that indicated their initial performance was slightly above the level of their peers (e.g., "You are performing 5% better than your peer group), but that they gradually declined with experience such that their performance at the conclusion of the experiment was below their peers (e.g., "You are performing 15% worse than your peer group). The

Progressive Decline condition was designed to create a situation in which self-efficacy declined across the experimental session (Bandura & Jourden, 1991).

### **Research Questions**

There are a number of research questions that are addressed in the present investigation. The primary foci of the study are (a) age differences in mean level self-regulatory change with task experience and manipulation of social comparison information and (b) age differences in the process by which such factors influence decision-making performance over the course of the experiment. In addition to these primary areas of emphasis, collateral research questions focus on (a) the relation between general efficacy beliefs and task-specific measures of self-efficacy, and (b) the relation between final task-specific measures of self-regulation and self-reported interest in participating in future psychology studies. Both the primary and collateral foci are outlined in more detail below.

#### **Age Differences in Task-Specific Self-Efficacy, Self-Regulation, and Performance**

Are there age differences in task-specific self-regulatory variables and performance across the experimental task? According to past research, older adults typically rate their general self-efficacy lower than younger adults on questionnaire measures (Gilewski et al., 1990; Hertzog et al., 1990a; Lachman, 1986b) and laboratory tests (e.g., memory for word lists) (Hertzog et al., 1990b; McDonald-Miszczak et al., 1994). Such age-related differences in participants' initial ratings of their general self-efficacy are expected to interact with social comparison information. As a result, age-related differences in the magnitude of change in participants' task-specific self-efficacy and

other self-regulatory factors are also expected. However, because the present study employed a computer simulation of a real-life decision-making situation, participants may view the experimental task as a (a) difficult laboratory task which would result in typical age related performance differences, or (b) real-life type of task resulting in performance differences favouring those with more managerial experience. Because different interpretations of the task may result in differing expectations with regard to age differences in task-specific self-efficacy and self-regulatory factors, two primary scenarios with regard to these results are outlined below.

The first outcome scenario is based on both younger and older participants' viewing the computer simulation as a complex laboratory task which would result in typical age-related performance differences favouring the younger adults. If older adults do indeed rate their initial task-specific self-efficacy lower than younger adults, it is hypothesized that age will interact with manipulated social comparison information. For example, older adults who receive progressively declining social comparison information may experience a dramatic erosion of their task-specific self-efficacy and a related decline in other self-regulatory factors because their initial levels of efficacy are expected to be low. Alternatively, older adults who receive positive social comparison information (including both the stable and progressively improving social comparison information) are expected to show a gradual increase in their efficacy and self-regulatory factors across the study, although such an increase is expected to have a slower onset due to the older group initially reporting lower levels of efficacy than younger adults. With regard to age differences in the onset of self-

efficacy change, it is expected that individuals who receive social comparison information consistent with their initial efficacy levels will change more quickly than adults who receive inconsistent information. Consistent information for older adults is expected to be negative social comparison information, whereas consistent information for younger adults is expected to be positive social information. According to this scenario then, participants will rate their initial efficacy level based on their perception of the task as a difficult laboratory task that will result in poorer performance levels for the older age group than the younger age group. Thus, the integrity of this scenario depends upon (a) participants' view of the computer simulation as a laboratory task that will result in typical age-related performance differences, and (b) participants' accurately rating their efficacy to reflect these age-related performance differences.

Alternatively, if participants view the task as a reflection of real-life managerial decision-making, a different scenario is likely to occur. Older adults are expected to report more managerial experiences (due to their life experiences and the increased probability for acquiring such experiences), than younger adult university students. Thus, if participants believe the task is a realistic reflection of managerial decision-making, one might expect older adults to rate their self-efficacy and self-regulatory factors higher than younger adults. Moreover, one would expect older adults who receive the progressively declining social comparison information to show "sticky" downward adjustments to their self-efficacy and self-regulatory ratings. In short, these older adults might show a slower onset of declining self-efficacy and self-regulatory

factors across the experiment than younger adults who may endorse such negative feedback information more readily due to their lack of experience within the domain. Alternatively, older adults who receive the positive social comparison information (both stable and progressively increasing information) are expected to maintain a high degree of efficacy over the course of the experiment in the stable condition, and should even increase their efficacy ratings in the progressive mastery condition. Younger adults who receive positive information are also expected to reflect such social comparison information, but are expected to show a more gradual increase and slower onset because the information is hypothesized to be contrary to their initial expectations.

Bandura (1993; personal communication) indicated that novices may find the computer task too difficult and will not display any connection between self-regulatory factors and performance because novices do not have the skills to exert control over their performance (i.e., it is at floor). Although steps were taken to simplify the task in the present study (e.g., requiring only three employees to be allocated throughout the study), the task may still be too complex for non-managers to exert control over their performance. Thus, a third scenario suggests that only participants with experience in managerial decision-making will show any relation between self-regulatory ratings and social comparative information. Within the present context, it is more likely that individuals with a high degree of managerial expertise will be elderly. Given this possibility, only certain older adults may display any relationship between their self-efficacy, self-regulatory factors, social comparison information, and

performance over the course of the experiment if a significant number of older participants do indeed have managerial experience.

### **Age Differences in the Self-Regulatory Process**

Are there age differences in the active role that self-regulatory variables play in decision-making processes? Several path analyses have been conducted which have outlined the complex relationship between self-regulatory factors and decision-making performance (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone et al., 1991; Wood & Bandura, 1989). In particular, Bandura and Jourden (1991) used social comparison information to manipulate self-efficacy levels and outlined the self-regulatory influences on the decision process using path analytic techniques. Generally, these analyses indicated a complex interplay between self-efficacy and other self-regulatory factors and their influence on performance across the experiment. In the present study, it is of interest to examine whether such processes are the same in younger and older adults.

The path models presented in earlier research (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone et al., 1991; Wood & Bandura, 1989) require individuals to accurately monitor their performance, reflect such monitoring in self-regulatory factors, and adjust previous self-regulatory levels for subsequent performance. Indeed, it has been suggested that monitoring one's cognitive processes and strategies will result in better overall performance (Bandura, 1989; Cavanaugh, 1989). Some research has suggested that there may be age differences in adults' ability to accurately monitor their performance. Specifically, older adults may have more difficulty monitoring the

time it takes to adequately study items for a memory test (Murphy et al., 1981), may not choose the best strategy to improve performance (Brigham & Pressley, 1988), and overestimate how they will perform on a memory test (Bruce et al., 1982; Lovelace & Marsh, 1985; Murphy et al., 1981; Rabinowitz, et al., 1982). Because the interplay between different self-regulatory factors and performance is quite complex, accurate monitoring is essential to the viability of a path model. Thus, by modelling the cognitive processes of younger and older adults in the present study, one should be able to examine whether the processes are similar in younger and older age groups. If differences are found, one would expect that the older adults' model may indicate an age-related decrease in monitoring ongoing processes and the use of such processes to improve subsequent performance.

Alternatively, if the present experimental situation does reflect a real-life task which older adults might have more experience with, then age differences obtained in the present study might reflect differences in experience. It is important to note that previous research (e.g., Bandura & Jourden, 1991) tested younger MBA students and derived path models from these data. Differences between the previous study's sample and the present one may lead to some similarities as well as differences in the process models. In short, because one might expect MBA students to have knowledge of managerial principals and some real-world experience, some similarities between previous models (e.g., Bandura & Jourden, 1991) and a model constructed on the older adults' data may be obtained. Such similarities may stem from individuals possessing knowledge about management decisions and the use of such knowledge in performing

the task. In addition, because the previous sample consisted only of younger students, there may also be some similarities between the previous research models and younger adults in the present study (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone et al., 1991; Wood & Bandura, 1989). In particular, younger adults may have a unique approach for completing the experimental task due to their training as students (e.g., they may focus more heavily on objective measures to improve performance). Thus, a second potential outcome of the process models is that younger and older adults' models will be different from each other due to differing life experiences, but both will share some similarities with Bandura and Jourden's (1991) model conducted on younger MBA students' data.

#### **Collateral Questions**

**Do general efficacy beliefs correlate more strongly with initial task-specific self-regulatory measures than with measures obtained after task experience?**

Past research suggests that initial task-specific indicators of self-efficacy correlate more strongly with domain specific belief measures (i.e., metamemory questionnaires) than initial performance (Hertzog, et al., 1990b). Following experience on the task, task-specific self-efficacy correlates more highly with previous performance than general beliefs (Hertzog et al., 1990b; Hertzog et al., 1994; McDonald-Miszczak et al., 1994). It is expected then, that a questionnaire measure of adults' beliefs (i.e., general self-efficacy) will correlate more strongly with task-specific self-efficacy measured prior to task experience than a nonspecific measure. Moreover, such correlations are expected to decrease with task experience.

Because previous research has also shown that domain specific measures of beliefs are more sensitive to age differences (Lachman, 1983) than nonspecific measures, it is hypothesized that the relation between a domain specific measure (i.e., the PIC) and task-specific self-efficacy will be higher than the relation between nonspecific scale (i.e., Levenson Locus of Control scale) and task-specific self-efficacy. Thus, the present study expects to replicate the findings of Hertzog et al (1990b) with a domain specific questionnaire, but not with a nonspecific scale. No age differences in correlational patterns are expected (Hertzog et al., 1990b; McDonald-Miszczak et al., 1994).

#### **Does self-efficacy influence self-reported behaviour?**

Does self-efficacy correlate with one's self-reported interest in participating in further psychology studies that vary in similarity to the present one? It has been difficult to assess previous aging research examining the relation between younger and older adults' self-reported self-efficacy and future behaviours due to differing levels of generality of the measures. Questionnaire assessments of everyday self-efficacy have been used to predict performance on small sets of laboratory tasks (Grover & Hertzog, 1991; Lachman, 1983; Lachman & Leff, 1989). These studies have shown that earlier performance on tasks influences subsequent questionnaire measures of self-efficacy, but not the other way around (Grover & Hertzog, 1991; Lachman, 1983; Lachman & Leff, 1989). These results are contrary to Bandura's (1989) theory of self-regulation which indicates that self-efficacy should indeed influence behaviour. Specifically, research using task specific measures of self-efficacy and task specific behavioural

assessment has shown that self-efficacy is not only an accurate predictor of behaviour within a particular situation, but also predicts future behaviours (Bandura & Adams, 1977; Bandura et al., 1980). Thus, task-specific self-efficacy and self-regulatory variables are expected to correlate with participants' self-reported interest in participating in future psychology studies that are similar to the present one, but not with studies that are significantly different in nature.

## Chapter Three

### METHOD

#### Design

A 2 X 2 X 3 X 3 (Age X Gender X Social Comparison X Trial Blocks) factorial design with repeated measures on the last factor was used in the present investigation. The age groups consisted of younger and older adults aged 18 to 30 years and 65 to 77 years, respectively. Male and female participants were recruited to examine potential gender differences in self-regulatory factors. Social comparison levels were manipulated to create three separate conditions (Stable, Progressive Mastery, and Progressive Decline) to differentially influence self-regulatory variables and performance across the experimental session. There were three blocks of trials that consisted of four trials each (total of 12 trials). The trials factor allowed for examination of change in self-regulation and performance across the experimental session.

#### Subjects

The subjects consisted of 68 younger (34 females and 34 males) and 69 older adults (36 females and 33 males). The younger subjects were recruited through the University of Victoria volunteer subject pool. The older subjects were recruited through newspaper ads and appeals to community organizations. All participants were community dwelling adults. There were 24 (12 males and 12 females) younger adults and 25 (13 males and 12 females) older adults in the Progressive Condition, 21 (10 males and 11 females) younger and 22 (11 males and 11 females) older adults in the

Stable Condition, and 23 (12 males and 11 females) younger and 24 (12 males and 12 females) older adults in the Decline Condition. Gender of the sample was examined due to previous research that indicated females showed age differences with respect to task-specific self-efficacy, whereas males did not (McDonald-Miszczak et al., 1994). In addition, because the experimental task might be perceived as a more masculine task, gender was included as a variable to examine whether gender-related perceptions of the task might emerge.

To examine characteristics of the sample, a 2 X 2 X 3 (Age X Gender X Condition) MANOVA was conducted on number of years of education, self-rated overall health, depression, total number of years of management experience, and self-rated quality of total management experience. This analysis resulted in a significant main effect of Age,  $F(5, 132) = 46.69, p < .001$ . Univariate tests revealed significant effects for three of the five variables included in the analysis: number of years of education,  $F(1, 135) = 12.19, MS_e = 3.04, p = .001$ ; depressive affect,  $F(1, 135) = 38.44, MS_e = 73.054, p < .001$ ; and total years of management experience,  $F(1, 135) = 128.82, MS_e = 173.12, p < .001$ . The means, shown in Table 1, indicate that the younger adults had significantly more education, and reported more depressive affect and less management experience than the older adults in this investigation. The analysis also revealed a significant Age X Gender interaction effect,  $F(5,131) = 2.39, p < .05$ , although no univariate tests were significant. No other effects were significant.

### **Measures I. Questionnaire Battery**

**Personal Data.** Subjects were asked to provide information regarding their chronological age, self-reported health, marital status, and general employment history. The questionnaire consisted of 15 questions pertaining to these issues.

**Managerial Experience Survey.** Prior managerial experience was measured using a questionnaire designed for this study. In the introduction to the survey, various types of managerial examples were listed which ranged from leading a scout troop, organizing an anniversary party or wedding, to managerial positions in business. The wide range of examples was used to prompt both younger and older individuals to think about any type of managerial experience they may have acquired. First, participants were asked, "if you have had some managerial experience, (a) please estimate the total number of years, months or days obtained, and (b) please rate the quality of this experience". These two measures are referred to as Years of Total Managerial Experience, and Quality of Total Managerial Experience, respectively. Next, participants were asked to (a) estimate the number of years, months, or days of managerial experience they acquired from paid employment (although not necessarily as the result of being hired as a manager), and (b) rate the quality of this general employment experience. These two measures are referred to as Years of General Paid Experience, and Quality of General Paid Experience, respectively. Finally, participants were asked whether they were ever hired strictly as a manager. If they answered yes, they were asked to estimate the number of years, months, or days of experience they acquired strictly as a manager. Then, they were asked to rate the quality of this

managerial experience. These last two measures were labelled Years of Strict Managerial Experience and Quality of Strict Managerial Experience, respectively. Experience estimates for all three questions were computed as a proportion of a years (e.g., 1 day experience is 1/365). All quality of experience ratings ranged from 1 (poor experience) to 5 (excellent experience).

**Centre for Epidemiologic Studies - Depression (CES-D).** Because depression might influence subjects' self-efficacy, motivation, and overall performance in the present study, the CES-D Scale was included in the questionnaire battery. This questionnaire consists of 20 items that measure subjects' current depressive symptoms with an emphasis on depressed mood (Radloff, 1977). A 4-point Likert scale is used to score responses with a maximum score of 60. This scale has high internal consistency (an average of .85 using the coefficient alpha and the Spearman-Brown split-halves methods), adequate test-retest reliability, and shows evidence for construct validity.

**General Beliefs.** The Levenson Locus of Control questionnaire (Levenson, 1974) was included in the present investigation to measure participants' most general beliefs regarding personal efficacy and locus of control. Participants were asked to indicate their degree of agreement or disagreement with 24 statements on a 6 point Likert-type scale ranging from 1 (strongly disagree) to 6 (strongly agree). This scale was administered to represent the most general level of beliefs because the situations described in the statements are very broad (i.e., not specific to a particular intellectual or cognitive domain). The Levenson instrument includes an Internal Locus of Control

scale, a Powerful Others scale, and a Chance scale consisting of eight questions each. The Internal scale includes statements such as "Whether or not I get to be a leader depends mostly on my ability". The Powerful Others scale includes items such as "I feel like what happens in my life is mostly determined by powerful people". Finally, the Change scale consists of statements such as "To a great extent my life is controlled by accidental happenings". Scores for items in each scale were summed with a maximum possible score of 48 for each scale. Higher scores indicate a more internal, chance, and powerful others locus of control.

**Intellectual Efficacy.** A shortened version of the Personality in Context (PIC) Inventory (Lachman, 1978) was used to measure general intellectual self-efficacy and perceptions of aging. This measure is domain specific due to its focus on intellectual functioning. The PIC has shown good reliability and validity in both younger and older groups (Lachman, 1978). Four scales of the original six were used in the shortened version. The Internal Locus of Control Scale measures the degree to which one believes that aspects of intelligence and changes in intelligence are under one's own control. The Achievement Scale reflects the desire to attempt and accomplish cognitive tasks. The Morale Scale measures the determination and stamina of the individual when attempting cognitive tasks. Finally, the Anxiety Scale measures the degree of anxiety the individual experiences in intellectually-oriented situations and when performing cognitive tasks. The Powerful Others Scale and the Chance Scale were dropped due to time constraints. The four remaining scales were chosen because they load most highly on the two factors representing the overall questionnaire; the

Intellectual Self-Efficacy Factor (Internal Locus of Control & Anxiety) and the Concern About Intellectual Aging Factor (Morale & Achievement) (Lachman, 1983). Forty-eight questions were used in total which consisted of twelve questions from each scale. Each item is rated on a 6-point Likert scale ranging from strongly disagree to strongly agree. The items are scored 0-5 with a maximum score of 60 on each scale.

### **Measures II. Computer Displayed Self-Regulatory Factors**

The following measures are part of the computer program used in the present investigation. Each variable has been identified as an important self-regulatory factor that may influence performance (Bandura, 1986; 1989). All of the following measures were displayed on each participant's computer screen and were completed in a self-paced fashion. The measures are described in the order they appeared on the computer screen.

**Mood.** Participants were asked to provide estimates of how alert and interested they felt at various points of the experimental session. First, subjects indicated how alert and energetic they felt using a 9-point Likert scale (1=Quite Tired to 9=Very Alert and Energetic). Second, subjects were asked how enthusiastic they felt using a 9-point Likert scale (1=Very Disinterested to 9=Very Enthusiastic). The Mood score is represented by the sum of these two measures.

**Self-Efficacy Level (SEL).** Subjects were asked to indicate whether or not they believed that they would be able to manage the special order department of the furniture factory at various levels of performance. Each performance level was displayed as a percentage of the budgeted number of hours for each order (i.e., 140%

of estimated time, 120%, 110%, 105%, Estimated Time, 95%, 90%, 80%, and 70%). Subjects replied either "yes" or "no" to all of these levels. The total number of "yes" responses comprised the SEL measure.

**Self-Efficacy Strength (SEST).** The strength of subjects' self-efficacy was measured as their confidence rating for each self-efficacy level (i.e., each "yes" response). Self-efficacy levels that received a negative response (i.e., each "no" response) were automatically assigned a confidence score of zero. Subjects rated their confidence in their SEL response on a 10 point scale ranging from total lack of confidence (0) to total confidence (9). The SEST measure consisted of the sum of the confidence scores.

**Goals.** Participants were also asked to indicate the production target that they would try to achieve in the subsequent block of trials. Subjects were given the same nine performance levels as outlined for the SEL measure above and were asked to choose the one they would attempt to reach. Participants also received an option for no self-set goal. The scores were 1 (no self-set goal), 2 (140%), 3 (120%), 4 (110%), 5 (105%), 6 (100%), 7 (95%), 8 (90%), 9 (80%), and 10 (70%). Thus, the lower the percentage, the higher the goal that participants would try to achieve.

**Goal Commitment.** The degree of subjects' commitment to their self-set goal was measured using a 9-point Likert scale displayed on the computer screen. This scale ranged from 1 ("not committed at all") to 9 ("very strongly committed").

**Performance Satisfaction.** Subjects were also asked to rate their satisfaction with their prior performance on a 9-point Likert scale ranging from 1 ("Highly

Dissatisfied") to 9 ("Highly Satisfied"). In addition, participants were asked how satisfied they would be if their future performance was the same as their prior performance. This score also ranged from 1 ("Highly Dissatisfied") to 9 ("Highly Satisfied"). These two measures were summed to represent the Performance Satisfaction score.

**Strategies.** Subjects' use of analytic strategies was defined as the number of times any type of allocation (i.e., employees, targets, feedback, rewards) remained consistent on a subsequent trial. The more changes that were made between trials, the less clear is the relationship between assignment of various factors and overall performance (productivity). Thus, the higher the strategy score (the number of allocations that remained constant between two trials), the more optimal the strategy use. The sum of all such strategies comprised the Strategy Use score.

### **Measures III. Performance Measures**

**Performance.** Participants' decision-making performance was represented by a percentage (the total number of hours taken to complete a weekly order divided by the number of hours budgeted to complete the order). The total number of work hours is automatically computed by the computer program based on the subjects' allocation of employees, goals set, the type of feedback employees received, and the rewards given (see Wood & Bailey, 1985). The less production hours taken to complete an order, the better the performance of the participant. Thus, lower percentages represent better performance levels. Performance scores under 100 percent indicated that participants took less time than budgeted by the program, whereas scores exceed 100 percent

indicate more time was taken. Mean performance scores were computed for each of the three trial blocks.

**Decision-Making Time.** The time it took participants to make their decisions was also measured. Each allocation that participants made (e.g., assigning employees to positions, setting goals for each employee, deciding what type of feedback each should receive, and assigning individual rewards) was timed in seconds. The time for each allocation was summed to represent the time taken for each block of trials.

#### **Measures IV. Post-Experimental Measure**

**Subsequent Experimental Interest.** In order to measure the relationship between self-efficacy and subsequent behaviour, subjects were asked whether they would be willing to participate in future psychology experiments that varied in degree of similarity to the present experiment. Subjects were asked whether they would be interested in (a) playing another computer game which asks them to manage another type of factory (i.e., a shoe factory), (b) playing a computer game in which they choose the type of factory to manage, (c) evaluate how a business is run, (d) give general advice about management, (e) give personal advice on problem solving and decision making situations, and (f) participate in a study on memory. Subjects' ratings of their interest ranged from 1 = Not Interested to 5 = Extremely Interested.

#### **Procedure**

Participants were tested in groups consisting of approximately 2 to 7 individuals for a session lasting for about 2 hours. All group testing took place in a computing

facility classroom at the University of Victoria. Occasionally, some participants were tested individually, but the same procedure was used throughout.

First, participants completed the questionnaire battery. This battery consisted of (a) the personal data questionnaire, (b) the Levenson Locus of Control Scale, (c) the Centre for Epidemiologic Studies - Depression (CES-D) scale, and (d) the Personality in Intellectual Contexts (PIC) Inventory. Following completion of the questionnaire battery, all subjects were given a brief introduction to the computer keyboard and specifically instructed on the keys required to perform the task. All subjects indicated that they were able to use the keys correctly before the experimental session began.

Subjects then received verbal and visual (i.e., computer display) instructions on how to play the computer game. Specifically, the instructions outlined (a) the furniture factory simulation in a broad manner, (b) what the factory does, (c) task of the special order manager (i.e., the subject's role), (d) specific information to assist management decisions (e.g., description of the various jobs required for special orders), (e) details of employees on the weekly roster (e.g., Bert is recently out of school...), (f) specific instructions for completing the job requirements manifest (playing the simulation) (e.g., assigning employees to specific jobs, setting production targets, provision of feedback, and allocation of rewards), (g) how the simulation of production works (e.g., the relationship between motivation and employee performance), and finally (h) practical information on recording decisions (i.e., computer keyboard instruction). A regular IBM computer keyboard was used. The computer keys necessary to play the simulation were (a) the number keys (1 to 9)

which were associated with the majority of decision alternatives during the simulation, (b) the 'Y' key for "yes" and the 'N' key for "no" to make SEL decisions, and (c) the return or enter key to proceed through the decision allocations. At any point during the instructions, participants were encouraged to ask questions, and all such questions were answered immediately.

After all subjects indicated they were familiar with the rules and procedures of the computer simulation, two practice trials were completed. The purpose of these practice trials was to ensure that all participants understood the how the simulation worked and how to manipulate the computer keys to play the simulation.

After completion of the practice trials, participants provided ratings for the initial self-regulatory measures (mood, self-efficacy level, self-efficacy strength, self-set goals, goal commitment, and performance satisfaction) prior to beginning the task or receiving social comparative information. All other self-regulatory measures were obtained after each block of trials (trials four, eight, and twelve).

Participants worked at their own pace on the experimental task. They were asked to assign three workers to jobs across the experimental session (i.e., 12 trials), motivate these workers, offer appropriate feedback, and give rewards. The same three employees (Jack, John, and Neil) were available to work throughout the session and the same three jobs were to be filled. In order to motivate workers, participants selected an appropriate goal for each individual employee (75% of budgeted time, meet the budget, or 125% of budgeted time). Each goal was chosen for each employee to complete a particular job within the budgeted time. Following such

allocations, participants were given general feedback regarding the number of hours their employees took to finish the order. No feedback was given for an individual employee's performance. Then, participants chose what type of feedback to give each employee (no feedback, discuss work but do not give advice, give advice but do not discuss work, discuss work and give advice regarding performance). Finally, each participant assigned rewards to each employee (no reward, moderate reward, high reward).

After completing each trial, the social comparison information appeared on the screen. Everyone was required to graph the feedback information for each trial to ensure that they attended to it (e.g., You are performing 10% better than your age group). Sheets of graph paper with the appropriate axes were provided at the beginning of the session. The graphing procedure ensured all participants attended to the social comparison manipulation. All participants completed their graphs appropriately. Altogether, there were 12 experimental trials arranged into three blocks of four trials each.

Following the experimental session, subjects were asked to fill out a questionnaire on their interest to participate in subsequent experiments. After completing the last questionnaire, everyone was completely debriefed regarding the purpose of the study, the social comparison manipulation, the hypotheses, and the relevance of potential results. This portion of the experimental session was stressed to ensure that subjects did not feel that the social comparative information accurately reflected their decision-making abilities nor the abilities of their peers (see Appendix).

## Chapter Four

### RESULTS

#### Managerial Experience

Because the experimental task is a simulation of managerial decision-making, a correlational analysis was conducted to examine whether self-reported levels of management experience correlated significantly with task variables (i.e., performance and decision time for each of the three blocks of trials), and change of task variables across the three blocks of trials. The appropriate subscripts identify all variables included in the analysis. Block 1 Performance is signified by  $\text{Performance}_{(1)}$ , whereas Block 1 Decision Time is shown as  $\text{Decision Time}_1$ . Appropriate subscripts identify the variables for Block 2 ( $\text{Performance}_2$  and  $\text{Decision Time}_2$ ) and Block 3 ( $\text{Performance}_3$  and  $\text{Decision Time}_3$ ). The change in each variable across the trial blocks was calculated as the difference between the Block 3 score and the Block 1 score ( $\text{Performance}_{(3-1)}$  and  $\text{Decision Time}_{(3-1)}$ ). The management experience variables included the (a) number of years of total management experience of any kind (includes unpaid experience), (b) number of years of employment involving any kind of management experience, and (c) number of years management experience acquired strictly from a paid management position, and (d) ratings of the quality of each management experience (total, employment, and management position, respectively). The correlations were computed separately for younger and older adults to examine whether the correlational patterns were different across the groups. The analyses conducted on the younger group's data did not result in any statistically significant

correlations, whereas the analyses conducted on the older adults' data resulted in one significant correlation between the Quality of Total Management Experience and Performance, ( $r = -.24, p < .05$ ). No other correlations were statistically significant. The overall lack of significant correlations between participants' self-reported managerial experiences and performance on the experimental task probably stems from the fact that although some participants had extensive managerial experience, such experience was not particularly relevant to the experimental task. The one exception stemmed from older adults' self-rated quality of total management experience which resulted in a modest correlation with Block 1 Performance. This result probably stems from older adults having more extensive (i.e., higher quality) managerial experiences than younger adults, which contributed modestly to their task performance. However, it must be noted that even though statistically significant, the relationship between self-rated quality of total managerial experiences and Block 1 Performance was very modest. Thus, the results do not support the suggestion that older adults' previous managerial experiences played a significant role in the performance of the experimental task.

### **Primary Analyses**

#### **Performance and Self-Regulation with Task Experience**

A 2 X 2 X 3 X 3 (Age X Gender X Condition X Block) repeated measures MANOVA was conducted to examine changes in participants' performance measures and self-regulatory measures with task experience. In particular, all three blocks of measures for overall performance, time taken to complete decisions for each block, the

number of optimal strategies used, SEL, SEST, Goal Setting, Goal Commitment, Performance Satisfaction, and Mood were included in the analysis.

The results indicated a significant main effect of Age Group,  $F(9,119) = 11.31$ ,  $p < .001$ . Significant univariate tests were obtained for overall performance,  $F(1,127) = 8.89$ ,  $MS_e = .06$ ,  $p < .01$ , decision time,  $F(1,127) = 40.94$ ,  $MS_e = 60013.54$ ,  $p < .001$ , and mood,  $F(1,127) = 6.88$ ,  $MS_e = 30.56$ ,  $p = .01$ . The results indicated that younger adults performed the task better ( $M = 1.34$ ,  $SD = 0.17$ ), took less time ( $M = 382.45$ ,  $SD = 134.43$ ), and reported a less positive mood ( $M = 11.71$ ,  $SD = 3.26$ ) than older adults (Performance:  $M = 1.41$ ,  $SD = .11$ ; Time:  $M = 537.32$ ,  $SD = 145.01$ ; Mood:  $M = 13.14$ ,  $SD = 3.21$ ).

The main effect of Condition was also significant,  $F(18,238) = 2.43$ ,  $p = .01$ . Univariate tests indicated statistically significant effects for Strategy Use,  $F(2,127) = 3.44$ ,  $MS_e = 1.08$ ,  $p < .05$ , Mood,  $F(2,127) = 3.57$ ,  $MS_e = 30.56$ ,  $p < .05$ , and Performance Satisfaction,  $F(2,127) = 16.22$ ,  $MS_e = 30.46$ ,  $p < .001$ . As expected, participants assigned to the Progressive Condition used more optimal strategies ( $M = 6.22$ ,  $SD = 1.89$ ) than participants assigned to the Stable Condition ( $M = 5.14$ ,  $SD = 2.68$ ) ( $t = 3.68$ ,  $p < .001$ ) or those assigned to the Decline Condition ( $M = 4.84$ ,  $SD = 1.87$ ). However, participants in the Stable Condition did not differ significantly from those in the Decline Condition. With respect to self-rated mood, participants in the Progressive Condition reported the highest levels (most positive) of mood ( $M = 13.08$ ,  $SD = 3.04$ ). However, those in the Progressive Condition did not report a significantly more positive mood than participants in the Stable Condition ( $M = 12.81$ ,  $SD = 3.13$ ),

whereas those in the Stable Condition did report a significantly more positive mood than subjects in the Decline Condition ( $M = 11.43$ ,  $SD = 3.53$ ) ( $t = 2.03$ ,  $p < .01$ ). The results also revealed that participants in the Decline Condition were more dissatisfied with their performance ( $M = 13.80$ ,  $SD = 2.67$ ), than participants in the Stable Condition ( $M = 11.60$ ,  $SD = 3.04$ ) ( $t = -3.29$ ,  $p = .001$ ) who in turn were significantly more dissatisfied than those in the Progressive Condition ( $M = 10.12$ ,  $SD = 3.67$ ) ( $t = -2.24$ ,  $p < .05$ ).

Finally, the main effect of Block was significant,  $F(18,110) = 42.57$ ,  $p < .001$ ). The univariate tests revealed many significant effects. Most tests indicated both significant linear and quadratic effects, so the effects for both will be reported when significant. The means for all variables are shown in Table 2. Specifically, the means indicate that overall performance declined, (Linear:  $F(1,127) = 329.04$ ,  $ME_e = .001$ ,  $p < .001$ ; Quadratic:  $F(1,127) = 44.37$ ,  $ME_e = .003$ ,  $p < .001$ ), participants took less time to complete their decisions, (Linear:  $F(1,127) = 435.60$ ,  $ME_e = 12334.20$ ,  $p < .001$ ; Quadratic:  $F(1,127) = 8.98$ ,  $ME_e = 6127.34$ ,  $p < .01$ ), mood became less positive, (Linear:  $F(1,127) = 29.02$ ,  $ME_e = 3.45$ ,  $p < .001$ ), performance dissatisfaction increased, (Linear:  $F(1,127) = 64.73$ ,  $ME_e = 6.00$ ,  $p < .001$ ; Quadratic:  $F(1,127) = 9.22$ ,  $ME_e = 3.72$ ,  $p < .001$ ), self-efficacy levels decreased (Linear:  $F(1,127) = 65.84$ ,  $ME_e = 1.88$ ,  $p < .001$ ), and self-efficacy strength decreased (Linear:  $F(1,127) = 77.59$ ,  $ME_e = 100.93$ ,  $p < .001$ ; Quadratic:  $F(1,127) = 3.96$ ,  $ME_e = 29.77$ ,  $p < .05$ ), goals decreased (Linear:  $F(1,127) = 27.08$ ,  $ME_e = 1.64$ ,  $p < .001$ ; Quadratic:  $F(1,127) = 4.33$ ,  $ME_e = .57$ ,  $p < .05$ ), and commitment to those goals also decreased, (Linear:

$F(1,127) = 14.39$ ,  $MEE = 1.37$ ,  $p < .001$ ) with experience. Strategy Use was the only variable not to show a significant linear effect, but it did result in a significant quadratic effect ( $F(1,127) = 31.03$ ,  $ME_e = .88$ ,  $p = .001$ ) which indicated that the number of strategies decreased between Blocks 1 and 2, but then increased between Blocks 2 and 3.

With respect to interaction effects, the analysis resulted in a significant effect for Age X Block  $F(18,110) = 2.94$ ,  $p < .001$ . The univariate tests revealed significant linear effects for overall performance,  $F(1,127) = 5.26$ ,  $MS_e = .04$ ,  $p < .05$ , and time taken to complete decisions,  $F(1,127) = 24.92$ ,  $MS_e = 12334.20$ ,  $p < .001$ . Figure 1 indicates that both age groups' increasingly went over budget with experience, but that the older adults were less productive (i.e., went over budget to a greater degree) than the younger adults. Figure 2 shows the results for decision time which indicate that both age groups made their decisions more quickly with experience, but the older adults' decision time decreased significantly more than the younger adults' decision time. The univariate test for Strategy Use revealed a significant quadratic effect,  $F(1,127) = 4.26$ ,  $MS_e = .24$ ,  $p < .05$ . Figure 3 shows that both age groups used the highest number of optimal strategies in Block 1 and the least in Block 2. Although both age groups declined in their strategy use between Blocks 1 and 2, the younger adults showed a greater decline than the older adults. Both groups improved their strategy use on Block 3. In addition, there was also a significant quadratic effect for Goal Setting,  $F(1,127) = 6.53$ ,  $MS_e = .57$ ,  $p = .01$ . Figure 4 shows that the younger adults greatly decreased their goals between Blocks 1 and 2 with their Block 3 goals

just slightly lower than their Block 2 goals. Alternatively, older adults exhibited a more constant decrease in their goal setting with task experience than younger adults. In addition, older adults' goals were lower than younger adults' goals in Blocks 1 and 3, but their block 2 goals were higher than younger adults' goals, probably due to younger adults making the largest adjustment in their goal setting between the first two blocks of trials. However, when considering the actual scale scores, Figure 4 indicates that participants' goals did not decline to a large degree over the course of the experimental session (i.e., about a 5% adjustment).

There was also a significant Condition x Block,  $F(36,220) = 2.13, p = .001$ , interaction effect. Univariate tests revealed a significant linear effect for Performance Satisfaction,  $F(2,126) = 13.66, MS_e = 6.0, p < .001$ . Figure 5 indicates that participants generally became more dissatisfied across trial blocks. Although participants in the Decline Condition were least satisfied with their first block performance, they continued to be least satisfied with experience. Participants in the Progressive Condition increased slightly in their performance dissatisfaction, but to a lesser degree than participants in the other two conditions. Overall, their satisfaction scores were fairly stable. In terms of changes in scores across Blocks 1 and 2, and Blocks 2 and 3, respectively, increased dissatisfaction was greatest in the Stable Condition, and the change between Blocks 1 and 2 was significant when compared to scores in the Progressive Condition ( $t = 3.68, p < .001$ ), but not significant compared with changes between Blocks 1 and 2 in the Decline Condition. For the latter two Blocks, dissatisfaction increased significantly more in the Stable Condition than the

Progressive Condition ( $t = 2.49, p = .01$ ), and the Decline Condition ( $t = -1.98, p = .05$ ). The only other significant univariate effect was a quadratic effect obtained for SEL,  $F(2,127) = 4.64, MS_e = .64, p = .01$ . The interaction for SEL is depicted in Figure 6 which indicates that although participants had similar SEL ratings after the first block of trials, participants in the Decline Condition decreased their ratings most between Blocks 1 and 2. Participants in the other two conditions showed a more constant and slight decrease across blocks. In terms of changes in scores across Blocks, the only significant comparison was between the Stable and Decline Condition scores in Blocks 1 and 2. This comparison indicated that SEL scores declined significantly more in the Decline Condition than those in the Stable Condition between the first two blocks ( $t = -2.30, p < .05$ ) and therefore significantly more than the Progressive Condition. No other effects were statistically significant.

### **Path Models**

Path analyses (LISREL VII, Joreskog & Sorbom, 1989) were conducted to examine the relation between self-regulatory variables and performance. The model, outlined in Bandura and Jourden (1991), was hypothesized to be the most appropriate model for the present data. The path models were conducted separately on younger and older adults' data, so they could be examined for age-related differences. The focus of these analyses was to (a) replicate the causal process observed with younger business students by Bandura and Jourden (1991), and (b) examine whether the causal process is the same for younger and older adults. It was hypothesized that the models for younger and older adults would share some aspects with Bandura and Jourden's

(1991) model, but would also indicate some dissimilarity due to sampling differences. As expected, the path models were not successful in replicating the findings of Bandura and Jourden (1991). The initial models for younger and older adults' data are shown in Figures 7 and 8, respectively.

When a model does not fit the data appropriately (i.e.,  $X^2$  is statistically significant), modification indices generated by LISREL VII can be used to modify the model to improve fit. A modification index is generated for each parameter that shows the approximate expected change in  $X^2$  if the single parameter alone would be free (if constrained) or constrained (if free). Thus, using these indices, model fit can be improved, and an appropriate model can be obtained. Modifications were done one path (i.e., parameter) at a time, and insignificant paths were dropped from the models. Modifications were performed until both the younger and older adults' models fit the data successfully.

The successful path models for younger and older adults are shown in Figures 9 and 10, respectively. As expected, the models show some similarities with as well as differences from the model generated by Bandura and Jourden (1991). The most obvious difference is that the Mood measure was included in the models because it was hypothesized to play an important role in cognition and was obtained in the present study. Bandura and Jourden (1991) did not include this measure in their study of social comparative information and self-regulation. Although the left side of both models depicts the general complexity outlined in earlier research (Bandura & Jourden,

1991; Bandura & Wood, 1989; Cervone et al., 1991; Wood & Bandura, 1989), the right side of both models is drastically different.

Considering the left side of both models first, the younger and older adults' models indicate that Block 2 Self-Efficacy does not directly influence Block 2 Performance, but indirectly influences Performance through Strategy Use. The lack of a direct effect contradicts previous research, but the significant indirect effect generally supports previous findings (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone et al., 1991; Wood & Bandura, 1989). In addition, there are age differences in younger and older adults' models in other paths to Performance<sub>2</sub>. For the older adults, Self-Efficacy<sub>2</sub> directly influences Mood<sub>2</sub>, which in turn influences Goal Setting<sub>2</sub>, which in turn influences Performance<sub>2</sub>. This complex interrelationship between self-efficacy, other self-regulatory variables, and performance is not displayed in the younger adults' model.

Both models indicate two direct effects of self-regulatory variables on Block 2 Performance (Younger Adults: Strategy Use and Performance Satisfaction; Older Adults: Strategy Use and Goal Setting). Although it was expected that Strategy Use would exert a direct effect on performance, it was unexpected that the remaining effects would be different depending on participants' age group. Performance Satisfaction appears to play an important role in younger adults' performance because it influences Block 2 Performance directly as well as indirectly through Strategy Use. The older adults' model does not display the same type of effect for Performance Satisfaction. However, older adults' Performance Satisfaction, measured at Block 2,

does influence Goal Setting and Performance Satisfaction measured at Block 3. With respect to this age difference, it appears that earlier in the task, younger adults' self-reported Performance Satisfaction has a greater influence on subsequent performance (both directly and indirectly), whereas older adults Performance Satisfaction has more of an effect on other self-regulatory variables (e.g., Goal Setting<sub>3</sub> and Performance Satisfaction<sub>3</sub>, which do not influence subsequent performance.

Again, focusing on the left side of the models, both models indicate a direct influence of Self-Efficacy on Mood. However, Mood only influences Block 2 Performance indirectly. This indirect influence is through Performance Satisfaction (for younger adults) and through Goal Setting (for older adults). These differential effects reinforce the suggestion that Performance Satisfaction has a more influential effect on younger adults' early decision processes (Block 2 Performance), whereas Goal Setting has a stronger effect on older adults' early (Block 2) performance.

With respect to the right side of the models, the variables that influence Block 3 Performance are quite different depending on participants' age group. The younger adults Block 2 Performance directly influences their Block 3 Performance. With experience then, the self-regulatory variables drop out of the decision process and prior performance becomes the determining factor. The only exception is a weak (nonsignificant), but direct influence of Block 2 Performance Satisfaction on Block 3 Performance. Although this path is not significant, the LISREL VII modification indices suggested it should remain rather than be dropped from the model altogether.

Regarding older adults' Block 3 Performance, the opposite trend was found. Self-regulatory factors exerted significant direct influences on Block 3 Performance, whereas prior performance did not influence latter performance. In particular, Self-Efficacy measured at Block 3 exerted a significant and direct influence on Block 3 Performance. Block 3 Self-Efficacy was only influenced by earlier (Block 2) ratings of Self-Efficacy. In addition, Goal Setting measured at Block 2 exerted a direct and significant influence on Block 3 Performance. In an attempt to promote interconnection between self-regulatory variables measured at Block 3 and Block 3 Performance, a path between Block 3 Goal Setting and Performance was attempted, but was not statistically significant and the fit of the model was not improved. A path between Performance Satisfaction (Block 3) and Block 3 Performance was also attempted, but it too was not significant. It is important to note, however, that the relationships between the older adults' self-regulatory variables (Self-Efficacy at Block 3 and Goal Setting at Block 2) and Block 3 Performance are counter-intuitive. The results indicate that older adults with higher self-efficacy at Block 3 and higher goals at Block 2 performed worse on the decision-making task at Block 3.

### **Collateral Analyses**

#### **General Beliefs and Self-Regulatory Factors**

What were participants' beliefs regarding their general locus of control and intellectual functioning prior to performing the experimental task and receiving social comparison information? In order to examine this question within the present investigation, participants' self-reported beliefs with respect to their (a) locus of

control, (b) intellectual functioning, and (c) pre-experimental self-regulatory factors were examined in a 2 X 2 (Age X Gender) MANOVA. In particular, the analysis was conducted on (a) Levenson's Internal, Chance, and Powerful Others Scales, (b) PIC Internal, Morale, Achievement, and Anxiety Scales, and (c) initial task specific measures of SEL, SEST, Goals, Goal Commitment, Performance Satisfaction, and Mood obtained after practice but prior to administration of the social comparison manipulation.

The analysis resulted in a main effect of Age,  $F(15,119) = 14.73, p < .001$ . The univariate tests revealed significant effects for Levenson Powerful Others,  $F(1,133) = 6.73, MS_e = 28.35, p = .01$ , PIC Internal,  $F(1, 133) = 4.70, MS_e = 37.13, p < .05$ , PIC Morale,  $F(1,133) = 42.95, MS_e = 117.44, p < .001$ , SEL,  $F(1,133) = 11.15, MS_e = 3.20, p = .001$ , SEST  $F(1,133) = 5.51, MS_e = 230.32, p < .05$ , and Mood  $F(1,133) = 37.32, MS_e = 9.01, p < .001$ . The means for all the measures are shown in Table 3. In particular, the results indicated that younger adults reported more concern with powerful others, more internal locus of control with respect to intellectual situations, less age-related concerns with intellectual functioning (higher morale), higher level of task specific SEL and SEST, and less positive mood with respect to the particular decision-making task. No other effects were statistically significant.

#### **Correlations between General Beliefs and Performance Measures**

Correlational analyses were conducted to examine Lachman's (1983) suggestion that domain specific measures of beliefs (i.e., intellectual self-efficacy) should correlate more highly with particular measures of ability than more general measures

of beliefs. Accordingly, the results were expected to show that the PIC and task performance measures resulted in a greater number of significant correlations than those obtained using the Levenson measure.

In order to compare correlational patterns between the age groups, the analyses were conducted separately for younger and older adults' data. Self-report measures included Levenson scales (Internal, Chance and Powerful Others) and PIC scales (Internal, Morale, Achievement, and Anxiety). The task variables included each trial block score for overall performance and time taken to make decisions. The change scores included in the analysis were the difference between Block 3 scores and Block 1 scores (i.e., Performance<sub>(3-1)</sub> and Decision Time<sub>(3-1)</sub>). Each block score and change score is identified by the appropriate subscript as outlined above.

The results of the analyses were different depending on the age group examined. The analysis conducted on younger adults' data only resulted in one significant correlation. The correlation between PIC Anxiety and Decision Time<sub>3</sub> was statistically significant ( $r = .25, p < .05$ ). The older adults' data suggested that their general beliefs about their intellectual functioning (PIC scores) were much more influential in their task performance than younger adults' beliefs. Although no significant correlations were obtained with the self-report measures and overall performance, many significant correlations were obtained with decision-making time and changes in decision-making time. These results are shown in Table 4 which indicate that older adults self-reported Morale, Achievement and Anxiety correlated with the first two Block measures of Decision-Making Time and the Changes in Decision-Making

Time<sub>(3-1)</sub>. All the correlations are in the expected direction. The higher one's Morale and Achievement motivation, the less time it takes individuals to make their decision and the faster they become with task experience. With regard to Anxiety, the results are also in the expected direction given that the lower one's self-rated anxiety, the faster the decision time and the faster they become with task experience. No significant correlations were obtained with the Levenson measure.

#### **Correlations between General Beliefs and Self-Regulatory Measures**

This analysis was conducted to examine the suggestion of Hertzog et al. (1990b) that general beliefs should correlate most highly with initial measures of task-specific self-efficacy, but after the acquisition of task experience such correlations should diminish significantly in magnitude. According to this suggestion then, general beliefs should be driving task-specific estimates of one's capabilities prior to acquiring task-specific information about one's performance on the task. Within the context of the present study, one would expect to obtain the highest correlations between questionnaire measures and task-specific self-efficacy measures acquired after practice, but before the experimental task had begun.

To explore this suggestion, Pearson correlations were computed for the questionnaire measures and the task-specific self-efficacy variables (SEL, SEST). Each block score was used with the subscripts 1, 2, and 3 indicating scores for Blocks 1, 2, and 3 respectively. The subscript W (Warm-up) denotes the first self-efficacy measures obtained after practice, but before the experimental trials had begun. The correlational analyses were again conducted separately for younger and older adults to

examine potential age differences in correlational patterns. The results for the younger adults are shown in Table 5 and the results for the older adults are shown in Table 6.

The results of the analysis conducted on the younger group's data indicate that the PIC questionnaire resulted in 11 significant correlations with task-specific self-efficacy measures, whereas the Levenson scale only resulted in 2 significant correlations. Five significant correlations were obtained between the PIC questionnaire and the initial task-specific self-efficacy measures, whereas none obtained with the Levenson scale. Post-hoc tests were conducted to examine whether there was a significant decrease between initial task-specific self-efficacy scores and Block 3 scores. These tests indicated that the degree of change between  $SEST_w$  and  $SEST_3$  was significant ( $p < .025$ , one-tailed) only for the PIC Internal Scale ( $t(67) = 2.24$ ).

The correlations calculated on the older adults' data were somewhat surprising. Contrary to expectation, the results indicated that the Levenson scale resulted in a total of 9 significant correlations with task-specific self-efficacy, whereas the PIC questionnaire only results in 2 significant correlations. Post-hoc tests were again conducted on the differences between the correlations obtained after the practice trials and those obtained in Block 3. The results indicated that the changes in the SEL correlations for the Levenson Chance scale ( $t(68) = -4.44$ ), and the Powerful Others scale ( $t(68) = 7.91$ ) were both significant ( $p < .005$ , one-tailed). In addition, the changes in the SEST correlations were also significant ( $p < .005$ , one-tailed) for the Levenson Chance scale ( $t(68) = 2.60$ ), the PIC Morale and Anxiety scales ( $t(68) = 2.63$  and  $t(68) = -4.11$ , respectively).

### **Post-Experimental Questionnaire**

Participants' responses to the post-experimental questionnaire were first examined in a 2 X 2 X 3 (Age by Gender by Condition) MANOVA conducted on all six questions. The six questions on the Participant Survey related to (1) playing a similar computer game but managing a shoe factory instead of a furniture factory, (2) playing a similar computer game but choosing the type of business to manage, (3) evaluating how someone else is running a business in real-life, (4) giving general advice on management, (5) giving personal advice on everyday problem solving and decision making (e.g., buying a new home), and (6) solving puzzles and performing memory tasks. The survey was created so that some tasks would be more similar to the experimental task (e.g., questions 1 and 2), others would be related to the general domain of management (e.g., questions 3 and 4) and other questions would be related to the most general domain of intellectual testing (e.g., questions 5 and 6). This analysis resulted in a significant Age by Gender effect,  $F(6,120) = 3.50$ ,  $p < .01$ . Univariate tests revealed significant effects for only the last two questions pertaining to personal advice on everyday problem solving,  $F(1,125) = 6.08$ ,  $MS_e = 1.40$ ,  $p < .05$ , and solving puzzles and performing memory tasks,  $F(1,125) = 14.25$ ,  $MS_e = 1.54$ ,  $p < .001$ . The means for both questions indicated that younger females reported slightly more interest in giving personal advice on everyday problem solving (question 5) and solving puzzles/memory tasks (question 6) ( $M = 3.74$ ,  $SD = 1.02$ ;  $M = 3.88$ ,  $SD = 1.23$ , respectively) than younger males ( $M = 3.32$ ,  $SD = 1.22$ ;  $M = 3.59$ ,  $SD = 1.26$ , respectively), whereas older males indicated slightly more interest ( $M = 3.97$ ,  $SD =$

1.20;  $M = 4.03$ ,  $SD = 1.20$ , respectively) than older females ( $M = 3.38$ ,  $SD = 1.18$ ;  $M = 2.71$ ,  $SD = 1.31$ , respectively). There were no other significant effects.

To examine whether participants' task-specific self-efficacy influenced their self-reported interest to participate in other psychology studies that varied in similarity to the present one, Pearson correlations were computed between a measure of younger and older adults' self-efficacy and responses to the six questions on the Participant Survey. It was hypothesized that task-specific self-efficacy would correlate most strongly with self-reported interest to participate in studies most similar to the experimental task, and correlate least strongly with self-reported interest to participate in more general studies using intelligence tasks. For the purposes of this analysis, a composite self-efficacy score was used which was composed of summing the Block 3 SEL score and Block 3 SEST score. Block 3 scores were used to comprise the composite scores because these were the last measures of self-efficacy to be obtained during the experimental session. This composite score was then correlated with each of the questionnaire responses. In addition to an overall composite score based on both age group's data, composite self-efficacy scores were also computed separately for younger and older adults.

The results of the correlational analysis, shown in Table 7, indicate that the overall self-efficacy composite score correlated significantly with questions 1 through 4 on the participant survey and did not correlate significantly with questions 5 and 6. These results support the hypothesis that task-specific self-efficacy should correlate with self-reported interest to participate in studies which are similar to the present one,

and not correlate with those that are perceived to be different. However, when the correlations for each age group are examined separately, different correlational patterns are observed. Younger adults' composite self-efficacy score correlated significant with the first survey question, whereas the older adults' score did not. In addition, the older adults' self-efficacy score did not correlate significantly with survey question 3, whereas the younger group's self-efficacy score did result in a significant correlation.

## Chapter Five

### DISCUSSION

The framework of this investigation contains two areas of focus. First, the fundamental intention of this study was to examine younger and older adults' self-regulatory factors and their performance on a complex cognitive task while manipulating social comparison information. The active role that self-regulatory factors played in adults' cognitive processes was central to this investigation. Collateral interests focused on providing extensions of previous research on the relations between (a) general beliefs and task-specific self-regulatory factors, and (b) task-specific self-efficacy and behaviour.

#### Performance and Self-Regulation

Before the relation between younger and older adults' self-regulatory factors and their decision-making performance can be discussed in full, one must consider age differences in performance. Self-regulatory factors and performance are hypothesized to be intricately interconnected (Bandura, 1986; 1989), therefore making it difficult to discuss them separately. However, an attempt must be made to examine factors related to performance on the experimental task because consideration of these influences may lead to different interpretations of the relations between social and cognitive processes.

#### Performance

On average, younger adults' performed better (i.e., made more efficient decisions) than older adults. From a cognitive perspective, this outcome is not surprising given

that the task is very complex and requires a heavy load on working memory. To complete a trial, participants were asked to make several different decisions (allocation of three employees to particular jobs, assigning a performance goal for each employee, deciding the type of and degree of feedback to give an employee, and deciding what type of reward to give an employee). These decisions were made for each employee with no specific feedback given for each employee's performance on a trial.

Participants had to carefully monitor their own performance, remember what allocations they made on a previous trial, and test hypotheses that might lead to an improvement in overall performance on the next trial. Thus, multiple demands were made on participants' cognitive abilities and, in particular, a heavy load was placed on their working memory capacity. Past research has indicated that the elderly typically show age-related declines in speed of processing and working memory abilities (e.g., Hultsch, Hertzog, Small, McDonald-Miszczak, & Dixon, 1992). Thus, one would expect age-related performance differences to occur due to the heavy demands placed on participants' basic cognitive abilities.

Given that age differences in the amount of managerial experience favoured the elderly, it is somewhat surprising that younger adults performed the task better than older adults. This raises the possibility that the participants in the present investigation did not have the particular task skills to perform the task at a high level. Indeed, it is likely that one must have certain skills to exert control over task performance, especially for social comparison information to influence an individual's performance. For example, an individual who receives positive performance feedback

must have certain task skills in order to use such information in a performance enhancing manner.

With a sample of MBA students, Bandura and Jourden (1991) did obtain a significant Condition X Block interaction for performance. In particular, participants assigned to their Progressive condition showed an initial decline between Blocks 1 and 2, but then increased their performance between Blocks 2 and 3, whereas individuals assigned to the Stable and Decline conditions did perform at declining levels across the three trial blocks (Bandura & Jourden, 1991). Such an effect was not significant in the present investigation.

### **Self-Regulation**

Although the manipulation of social comparison information did not result in significantly different performance levels, the results of the present investigation indicated that some self-regulatory measures did reflect the manipulation of social comparison information. Individuals assigned to the positive feedback conditions (Progressive and Stable Conditions) used a greater number of optimal strategies and rated their mood more positively than participants in the Decline Condition. In addition, the Condition by Block effects for SEL indicated that individuals who received positive feedback information decreased their SEL ratings less than those who received negative feedback information. A similar trend was also obtained for condition effects on performance satisfaction across the course of the experimental session. Although participants generally became less satisfied with their performance over the course of the experiment, social comparison information influenced these

ratings. Participants who received progressively positive social comparison information became increasingly dissatisfied, but to a lesser degree than participants in the other conditions. Participants who received progressively negative social comparison information (Decline Condition) initially rated their performance satisfaction higher than the other groups (probably due to receiving positive comparative information during the first block), but then became most dissatisfied between Blocks 2 and 3. Thus, the results of the present investigation indicate that the use of social comparison information did successfully manipulate certain self-regulatory factors, at least to some degree, but the differences were not robust (i.e., self-efficacy measures did not result in a significant main effect of Condition).

Interestingly, the Bandura and Jourden (1991) study indicated that individuals in the Progressive and Decline Conditions also rated their self-efficacy strength according to their performance level (Decline Condition resulted in poor performance and the Progressive Condition results in good performance). However, individuals who received stable social comparison information (Stable Condition) rated their self-efficacy strength quite inaccurately. In this latter condition, individuals' performance consistently declined across blocks, but self-efficacy strength consistently increased. This result is inconsistent with the hypothesized relation between self-efficacy and performance. It appears that the MBA students who were assigned to the stable condition in the Bandura and Jourden (1991) study were using the social comparison information to drive their efficacy ratings, but were ignoring previous levels of performance.

Although the results of the present study might be superficially interpreted as less robust than previous research using social comparison information to manipulate self-efficacy (see Bandura & Jourden, 1991), the present results are actually more consistent with the theory of self-regulation than previous findings. That is, one's mean-level ratings of self-efficacy should coincide with an appraisal of past performance. Because social comparison information had been hypothesized to influence performance, it was initially expected that the direction of the manipulation would result in a significant relation with self-regulatory measures. However, the participants in the present investigation obviously found the task to be quite difficult to master (i.e., due to a lack of particular managerial skills). Due to the task difficulty, it is possible that the social comparison information did not exert a strong influence on performance levels. Consequently, their mean-level self-efficacy judgements did coincide with performance levels. Performance declined and so did self-efficacy scores. At least at the mean-level, this result is consistent with studies of age differences in memory predictions. Previous studies found that both younger and older adults are able to accurately monitor and adjust predictions of their memory performance as they gained task experience (Hertzog et al., 1990b; McDonald-Miszczak et al., 1994). Thus, on the surface at least, these results support the relation between performance and self-regulatory estimates outlined in Bandura's theory of self-regulation (1989).

However, the mean-level results treat self-efficacy as a passive (i.e., isolated) construct, and do not take into account the role that self-efficacy may play in the self-

regulatory process and how this process might influence performance. Thus, although these results are consistent with previous research (i.e., performance predictions), adults' accurate monitoring of their performance is only inferred. Path analyses were conducted to examine the complex relation between self-efficacy, self-regulation, and performance more closely.

### **The Role of Self-Regulatory Factors in Cognitive Processes**

Path analyses resulted in some similarities with as well as differences from the model suggested by Bandura and Jourden (1991) and other path models using this complex decision paradigm (Bandura & Wood, 1989; Cervone et al., 1991; Wood & Bandura, 1989). Between Blocks 1 and 2, both younger and older adults' path models reflect the general complexity outlined in Bandura's (1986) theory of self-regulation. Previous performance influenced self-efficacy, which in turn influences other self-regulatory variables. This finding supports previous research indicating the links between self-regulatory factors and performance (e.g., Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone et al., 1991; Wood & Bandura, 1989).

The latter part of the models (between Blocks 2 and 3) is drastically different from the model depicted in Bandura and Jourden's (1991) study and other studies examining self-regulation and complex decision-making (Bandura & Wood, 1989; Cervone et al., 1991; Wood & Bandura, 1989). In general, the present models might be categorized as simpler in the latter stages of the experiment than those depicted in previous research, because fewer variables were required. In addition, the models depicted in the present study are different depending on the participants' age. Use of

self-efficacy as a motivational variable in the latter part of the experiment is depicted in the older adults' model, whereas the relation between Block 2 Performance and Block 3 Performance is depicted in the younger adults' model. In this way, one might summarize the present results as generally replicating the findings of Bandura and Jourden (1991), but with certain factors replicated in the younger adults' model and other factors in the older adults' model. For example, the importance of past performance in the latter stages of Bandura and Jourden's (1991) path model is depicted in the younger adults' data, whereas the importance of self-efficacy is depicted in the older adults' model. Taken together then, the results of the present study are somewhat consistent with previous research, but show a distinct delineation of effects on the basis of participants' age.

#### **The Use of Self-Efficacy as a Motivator of Performance**

The increasing influence of self-efficacy as a motivational aspect of performance was found in the older adults' model thereby providing partial support for the results of Bandura and Jourden's (1991) study. Because the MBA students, tested in the earlier study (Bandura & Jourden, 1991), were more similar in age to the younger group in the present investigation than the older group, a simplistic explanation focusing on age (i.e., decision making processes associated with a particular cohort) is not adequate. One potential explanation for the similarity observed between the samples might stem from older adults and the MBA students having some experience within the domain of management. This is not to suggest that particular experiences or skills are the root of the similarity. However, having some experience within the

task domain may influence one's use of self-regulation while performing a complex task, especially when performance is declining.

Fifty individuals in the present study reported that they had acquired managerial experience from employment (range 1 to 36 years experience). Of these, forty-three older adults reported that they had been hired strictly as a manager (range 1 to 36 years), whereas only 7 younger individuals reported such managerial experience (range 1 to 4 years). It is important to note that participants' self-reported managerial experience did not, for the most part, correlate with task performance, but did correlate with many self-regulatory factors that have been identified as important determinants of behaviour (Bandura, 1986). These results indicate that although adults' managerial experience did not aid their overall task performance, it was related to self-regulatory factors that may potentially play an important role in performance. This finding might suggest that given their level of previous experience, older adults might have relied on their self-efficacy and self-regulatory aspects of performance to drive their performance in the latter part of the experiment.

Self-rated quality of managerial experiences (total, paid, and strict) all correlated significantly with SEL<sub>3</sub> ( $r = .33, p < .01, r = .33, p < .01, r = .26, p < .05$ , respectively), and with SEST<sub>3</sub> ( $r = .35, p < .01, r = .32, p < .01, r = .24, p < .05$ , respectively). It appears then that Block 3 measures of self-efficacy (both SEL and SEST) were indeed related to self-reported managerial experiences, which may indicate that older participants may have been using such experience as the basis for

their self-efficacy judgements rather than task specific feedback. None of these correlations were significant for the younger adults.

Although self-efficacy played a significant role in both studies, the relation between self-efficacy and performance in the older participants' model was counter-intuitive. The higher older adults' self-efficacy beliefs, the poorer their performance (i.e., the higher the percentage of actual time compared with budgeted time). This result does not support comments made by Bandura and Jourden (1991) who stated that in difficult demanding situations, individuals are most effect when they use positive motivation (higher efficacy) than negative motivation (lower efficacy). They suggested that using negative motivation in the demanding situation might take attentional resources away from a very demanding task. Considering the hypothesized age-related declines in processing resources, such negative beliefs should tremendously impair older adults' performance. In the present study, older adults who reported lower levels of self-efficacy may have actually judged the difficulty of the task more accurately and therefore prepared themselves to concentrate on performing that task.

Again, older adults' previous managerial experience may have influenced the relation between self-efficacy and their performance on the experimental task. Older adults may have been able to maintain a high level of efficacy and relied on such efficacy to perform the task, even though their performance was poor. In essence, they may have chosen to rate their self-efficacy based on their beliefs about their previous managerial experiences, but ignored present task performance levels. This may have been due to their perception that the task was becoming an invalid indicator

of managerial ability. In short, because these participants were not recruited on the basis of possessing particular managerial skills, their managerial self-efficacy did not necessarily coincide with their task performance or their ability to improve performance. Consequently, older adults who rated their self-efficacy higher may have used such positive ratings to drive performance, even though they performed the task more poorly. To explore this suggestion further, albeit in a post hoc fashion, the same path model was tested on a subsample (i.e., 55 older adults) who reported having at least 10 years of managerial experience that was acquired in a paid employment situation (not necessarily a managerial position). This post hoc analysis replicated the model conducted on all older adults' data ( $\chi^2(39) = 47.17, p > .05$ ).

#### **The Role of Previous Performance**

Both the results of the present investigation and those of Bandura and Jourden's (1991) study showed that younger adults used previous performance to guide future performance. Younger adults' performance in the present investigation, did indeed rely more heavily on performance evaluations (prior performance) throughout the study (i.e., Blocks examined in the path analysis), but this influence became especially clear in the latter stages.

Perhaps younger adults' reliance on performance evaluation stems from their choice to improve their future performance by focusing on previous performance. One might suggest that such a focus is a particularly useful strategy to improve performance when individuals are performing a task poorly. By focusing on objective feedback in order to improve one's performance, one might capitalize on previously

successful decisions and avoid previously poor decisions. Basically, younger adults might have chosen to ignore self-regulatory aspects of performance in the latter part of the experimental session because they were performing the task poorly and did not have previous managerial experience to draw upon (e.g., What good is motivation if you do not know what you are doing?).

In contrast, the results of previous research using the complex decision paradigm (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone et al., 1991; Wood & Bandura, 1989) indicated that MBA students may have used both performance feedback and self-regulatory factors in an more optimal fashion. In particular, the participants in the Bandura and Jourden (1991) study appeared to rely on objective performance feedback and their self-regulatory factors to drive performance, but used these aspects somewhat independently of one another (i.e., no direct path between Block 2 Performance and Block 3 Self-Efficacy). In this way, their performance might have benefitted from objective performance feedback and self-regulatory factors reflecting (at least to some degree) self-efficacy regarding previous experiences within the experimental domain. If this is indeed the case, the two age groups in the present study might have used such elements of the cognitive process in isolation due to their differences in self-reported management experience and strategy choices.

#### **Perceptions of the Experimental Task**

In addition, particular collateral correlational analyses, conducted on participants' PIC and Levenson questionnaire scores and their task-specific self-regulatory ratings, might add some insight to this discussion. The shortened version of the PIC and the

Levenson Scale were included in the present study in order to measure domain specific and nonspecific efficacy beliefs, respectively. The PIC questionnaire, used in the present investigation, included four scales (Internal, Morale, Anxiety, Achievement) which focused on beliefs about intellectual functioning. Levenson's (1974) Locus of Control instrument includes Internal, External, and Powerful Others scales that either do not mention a particular domain or encompass multiple domains within a single scale. The general expectation was that the PIC would correlate more consistently with all participants' task-specific self-regulatory factors because it is a domain specific measure of locus of control, whereas the Levenson scale is more general (i.e., domain nonspecific). However, the present study resulted in very different correlational patterns depending on participants' age. The results of the younger adults' analysis were consistent with the general expectation (e.g., the PIC Morale Scale consistently correlated with task-specific measures of self-efficacy and mood), whereas the opposite trend was observed with the older adults' data (e.g., the Levenson Chance and Powerful Others Scales correlated significantly with measures of task-specific self-efficacy strength, mood, and goal commitment).

One explanation, although speculative, might stem from age differences in how adults viewed the managerial simulation. Older adults may not have perceived the experimental task as a problem solving task (a task which would be subsumed within the domain of intelligence tests), but as a task involving people skills, human resources management, or even business knowledge. Each of these alternative perceptions of the task would be less likely to correlate with one's perceptions of their

ability in intellectual situations. Moreover, if older adults viewed the task as outside of or at least more general than the domain of intellectual tasks, then one might expect that the Levenson scales would correlate more highly and more consistently with their task-specific self-regulatory ratings than the PIC scales. It is interesting that younger adults, according to this line of reasoning, may have viewed the computer simulation more simply as a problem solving task much like other types of intelligence tasks. One possible explanation for younger adults' perception of the task might stem from their familiarity with using computers in a school type setting to solve problems (i.e., complete assignments for a particular class). Such age differences in perceptions of the experimental task may lead to the correlational patterns found in this study.

### **Collateral Findings**

#### **General Efficacy Beliefs**

Analyses conducted on the questionnaire data resulted in some similarities as well as inconsistencies with previous research. The mean-level results for the questionnaire data indicated that younger adults reported more concern with powerful others, more internal locus of control with respect to intellectual situations, and less age-related concerns with intellectual functioning. Age differences on the PIC were in the expected direction with younger adults' rating their internal locus of control higher and their concern with intellectual aging lower than older adults. However, the age differences on the Levenson Powerful Others scale were somewhat surprising. The results of the present study indicated that younger adults have a more general external locus of control with respect to powerful others than older adults even though they

have a higher internal locus of control for intellectual situations and perceived less change in their intellectual functioning than older adults.

The questionnaire measures (Levenson scale or PIC questionnaire) were not expected to correlate significantly with task performance. Numerous studies have shown that questionnaire measures of adults' perceptions of their cognitive abilities (either within a particular cognitive domain or encompassing several domains) do not typically correlate highly with performance on a particular cognitive task (see Herrmann 1982; Gilewski & Zelinski, 1986 for reviews). Past research has found some statistically significant correlations between perceptions of ability and performance (e.g., West et al., 1986), but such correlations are typically modest in magnitude. Thus, for the most part, the present findings are consistent with past research.

Analyses conducted on older adults' data resulted in significant correlations between PIC Morale, Achievement, and Anxiety scale scores and the time it took participants to make their decisions. Older adults who reported more concern about intellectual functioning, higher achievement motivation, and less anxiety took less time on each trial block and became faster with experience. Because decision-time might also be conceptualized as an indirect measure of self-regulation (i.e., effort) rather than a performance outcome variable, one might expect that beliefs about intellectual functioning to correlate significantly with decision-time.

In addition, the questionnaire data also allowed for examination of the relation between general self-efficacy (i.e., PIC and Levenson measures) and task-specific self-

efficacy before and after task experience (see Hertzog et al., 1990b). Hertzog et al. (1990b) suggested that general beliefs should correlate more highly with initial task-specific self-efficacy than with subsequent measures of task-specific self-efficacy. Generally, many of the correlations between general self-efficacy questionnaire measures and task-specific measures decreased in magnitude as participants proceeded through the simulation. Such changes were especially apparent in the older adults' data. Post-hoc tests indicated that changes in only some correlations were statistically significant. Thus, some support was obtained for the Hertzog et al. (1990b) suggestion regarding the relation between general efficacy beliefs and task-specific self-efficacy, but the older adults' data provided stronger overall support than the younger adults' data.

#### **Post-Experimental Questionnaire**

The results of the correlational analysis, shown in Table 8, indicate that the self-efficacy composite score correlated significantly with subjects' self-reported interest to participate in future studies within the domain of management (i.e., questions 1 through 4 on the participant survey), and did not correlate significantly with self-reported interest to participate in studies outside the domain of management (i.e., questions 5 and 6 on the survey). These results support the hypothesis that task-specific self-efficacy correlates with self-reported interest to participate in studies which are similar to the present one, but not with those that are perceived to be different (i.e., outside the task domain).

When examining the correlations for each age group, different correlational patterns are observed. Younger adults' self-efficacy (composite score) correlated significantly with the first survey question, whereas the older adults' score did not. These differences might suggest that running a shoe factory is simply not an appealing task to older adults. The lack of relationship then, might stem from differences in personal interest related to shoes and shoemaking rather than on running a computer simulation of a business. Again, this suggestion is supported by both groups' self-efficacy scores correlating with survey question 2 which allows participants to choose the business for the simulation. In addition, it is also important to note that older adults' self-efficacy score did not correlate significantly with survey question 3 pertaining to participating in a study requiring them to evaluate how a real-life business is run, whereas the younger group's self-efficacy score did. Because this particular correlation measured the relation between individuals' task-specific self-efficacy and their interest in evaluating a real-life business (i.e., outside a laboratory setting), one possible explanation might stem from age differences in participants' comfort with applying their task-specific self-efficacy gained within a particular experimental setting to situations outside the laboratory. Older adults might be less comfortable with applying their laboratory related self-efficacy to a real-life situation than younger adults. However, both age groups appear to be comfortable with applying their task-specific efficacy to giving general advice on management. In short, it might be the case that older adults do not acknowledge the relation between their task-specific efficacy and evaluations of specific real-life situations, but do

acknowledge the relation with general advice giving (i.e., what characteristics make a good manager). Older adults' experimental experience might have clarified certain characteristics that may be generally associated with management skills. However, there may be age differences in how individuals apply such characteristics to a particular "real-life" manager.

### Conclusion

Consistent with previous research, the present study found that both younger and older adults' decision making processes showed self-regulatory activity in the earlier stage of the experimental task (e.g., between blocks 1 and 2) (see Figures 9 and 10). Self-efficacy did indeed influence other self-regulatory factors which, in turn, influenced performance (i.e., Block 2). The only age difference observed in the earlier stage was that performance satisfaction played a significant role in younger adults' decision performance (Block 2), whereas goal-setting played a significant role in older adults' performance (Block 2). These differences may be due to different managerial experiences in these groups. Because older adults' reported significant amounts of managerial experience, they may have determined that they possessed knowledge of how that task should be performed so that motivation would be key to improving performance levels. Alternatively, younger adults reported significantly less managerial experience, so they may have determined that performance evaluation was the best strategy to learn about the task and improve their performance, rather than focusing on motivation. Despite this slight difference, the results indicated there was

tremendous similarity in younger and older adults' self-regulatory processes in the early stage of the study.

Age differences in adults' cognitive processes were greatest in the latter part of the study (see Figures 9 and 10). It was suggested that this pattern of results (e.g., age differences in the path models) stemmed from age-related differences in managerial experiences. Given that previous research sampled members of a more homogeneous population (i.e., MBA university students) (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone et al., 1991; Wood & Bandura, 1989), differences in task interpretation were probably not as great a concern as in the present context.

According to the mean-level results, the present experimental task was very complex and participants probably had difficulty understanding the intricacies of the task and gauging what particular aspects of their decisions should be modified. Such ambiguity probably allowed participants to attribute their performance to a variety of factors which may have varied with age (i.e., managerial experience). This increasing uncertainty in the latter phase of the study may have resulted in the observed age differences.

The effects of the social comparison information manipulation were not robust in the present study. Such information was designed to differentially influence self-regulatory factors which, in turn, should influence performance. Although some significant influences were found with respect to self-regulatory factors (e.g., performance satisfaction and SEL), performance was not significantly affected. The lack of a robust effect probably stemmed from participants lacking the particular skills

to perform the experimental task. As a result, the social comparison information provided an accurate match for some participants' actual performance levels, and inaccurate match for others' performance. Although participants' were not aware of the true performance mean for their comparison group, receiving information that was consistent with one's performance may have maintained efficacy, whereas an overestimate may have improved efficacy, and an underestimate may have decreased efficacy. Because participants did not have the required managerial skills (e.g., to improve their performance with experience), an eradication of the effect of the social comparison information may have occurred as a result of matches and mismatches between feedback and performance.

The collateral results also pointed to the importance of task experience and domain specificity in understanding the relation between age, self-regulation, and complex cognition. The questionnaire results suggested that the present task may have been viewed differently depending on participants' age. Older adults' may have perceived the experimental task as a measure of managerial ability, whereas the younger adults may have viewed it as a problem solving task. Such perceptions may also stem from age differences in participants' managerial experience. In addition, task-specific self-efficacy correlated with participants' interest to participate in future studies, but only if such studies were within the domain of management. Interest to participant in studies outside the domain of management (i.e., studies involving general problem-solving and memory tasks) did not correlate with efficacy within the

present experimental context. These results suggest that task-specific self-efficacy is domain specific.

In sum, the results of the present investigation support previous research suggesting that task evaluation is an important element in the self-regulatory process and in cognitive performance (Dittman-Kohli et al., 1991; Rebok & Balcerak, 1989; West et al., 1986) . Research is required to examine the relation between age, adults' knowledge base, task evaluation, and the self-regulatory process. Future studies might include younger and older expert managers (i.e., equivalent in knowledge) to examine age-related differences in the role that self-efficacy and self-regulation play in complex cognition.

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## APPENDIX

Now that we are finished the session, I would like to tell you some things about the study that you have just participated in.

First of all, I would like to thank you for participating in this study. Without individuals such as yourself, researchers interested in developmental psychology would not be able to examine many important issues.

The purpose of this research was to see whether there are age differences in how people make complex decisions. That is why I asked both younger and older adults to participate in this study. Moreover, because I am interested in complex decision-making, you were asked to play a very difficult computer game. Not much is known about how people make decisions, and even less is known about how decision-making changes across the life-span. I hope that the data from this study will help clarify some issues.

It is thought that one very important aspect of decision-making is something called "self-efficacy". This is our belief about our own capability to do different things. For example, how capable each of us feels to do math problems correctly, or remember stories from the newspaper. Researchers in this area think that if we believe that we can do something, there is a greater chance that we will and that we will be successful. One thing that researchers aren't sure of though, is how our beliefs change as we get older and how such changes might affect our performance on different kinds of tasks. This is why you were asked to complete a few questionnaires and provide estimates of the levels of performance that you believed you could achieve on the

computer task. In addition, I asked you how you were feeling at various points in the study. I asked you to set a performance goal for yourself. Finally, I asked you how satisfied you were with your performance. The reason you were asked all these questions is because this information is thought to be related to your beliefs about how capable you feel to perform the computer task and to your decision-making performance.

Now there is a very important aspect of this study that you **MUST** understand. In order to understand how adults' decision-making ability is influenced by their beliefs, I gave you some information that was **NOT TRUE**. Remember when you were told how you were performing relative to your peers and were asked to graph this information? Well, this information is **NOT ACCURATE**. Everyone was asked to graph this information and everyone in your condition has **EXACTLY THE SAME GRAPH**. One-third of all the people in this study were told that they were improving with time, another third were told they were getting worse, and the other third were told that they were performing at about average.

I want to apologize for having to give you this false information. **THIS INFORMATION DOES NOT REFLECT YOUR ACTUAL PERFORMANCE**. The reason that I gave you this information was to see how people's decision-making ability changes when they have positive, negative or stable beliefs about their capability to perform this computer task. You were randomly assigned to

**receive one type of information. There is no reason why you received one particular type of performance information.**

I expect the people who were told their performance was declining would perform at lower levels than people who were informed they were performing at a stable level or improving levels relative to their peers. After all, if we believe that we are becoming less and less capable to run the computer task, we will probably set lower goals and become satisfied with worse performance.

I want to commend you on performing a very difficult task. Some of you may not be too familiar with a computer, but you all did a great job -- otherwise you could not have participated in this study. Finally, I want to thank you again for participating in this study. I hope that you found it an interesting experience. I would like to remind you that I am available after the session if anyone has any questions or concerns.

**Thanks Again!**

Leslie

Table 1

Mean sample Characteristics (with standard deviations in parentheses) as a function of participants' age group.

Characteristic	Age Group	
	Young	Old
Years of Education	15.14 (1.15)	14.15 (2.23)
Self-Rated Health <sup>a</sup>	1.67 (0.71)	1.92 (1.17)
Depression <sup>b</sup>	14.12 (10.46)	5.30 (6.11)
Total Years of Management Experience	5.21 (11.78)	29.89 (14.03)
Quality of Total Management Experience <sup>c</sup>	3.71 (1.03)	3.84 (0.87)

<sup>a</sup>Self-rated overall health rated on a 6-point Likert scale ranging from 1 (very good) to 6 (very poor)

<sup>b</sup>Depression was measured using the CES-D scale with a maximum score of 60.

<sup>c</sup>Quality of management experience was rated by participants on a 5-point Likert scale ranging from 1 (very poor) to 5 (excellent).

Table 2

Younger and older adults' mean scores on performance and self-regulatory variables across all three blocks of trials.

	Younger Adults			Older Adults		
	1	2	3	1	2	3
Performance	1.24	1.36	1.40	1.29	1.43	1.50
SD	.13	.18	.21	.11	.12	.13
Decision-Time	491.64	374.37	281.35	722.24	512.89	376.84
SD	182.39	158.53	98.24	207.56	172.37	116.28
SEL	7.34	6.86	6.66	6.98	6.67	6.33
SD	.98	1.13	1.24	.96	.86	1.10
SEST	47.37	40.09	36.31	42.45	36.92	32.54
SD	17.30	18.52	19.85	15.39	13.98	16.04
Strategy Use	5.90	4.70	5.33	6.50	5.71	6.25
SD	2.21	1.84	2.07	2.13	1.84	1.94
Mood	12.16	11.93	11.03	13.82	13.07	12.54
SD	3.21	3.65	3.51	2.95	3.69	3.86
Performance Satisfaction	10.75	12.62	12.93	10.23	11.85	12.62
SD	3.84	4.02	4.03	3.86	4.07	4.21
Goal Setting	5.56	4.78	4.72	5.35	5.03	4.61
SD	1.82	1.92	2.26	1.62	1.49	1.89
Goal Commitment	6.87	6.50	6.25	6.72	6.52	6.27
SD	1.86	2.18	2.20	1.84	1.76	2.15

Table 3

Mean initial scores for questionnaire and self-regulatory measures (with standard deviations in parentheses) as a function of age group.

Measures	Age Group			
	Young		Old	
<b>Levenson Scale</b>				
Internal	37.15	(4.72)	38.29	(4.43)
Chance	20.59	(5.23)	19.13	(5.54)
Powerful Others	21.38	(5.34)	19.04	(5.49)
<b>PIC Questionnaire</b>				
Internal	63.88	(5.70)	61.72	(6.40)
Morale	59.63	(9.10)	47.68	(12.80)
Achievement	62.41	(5.20)	61.51	(6.95)
Anxiety	28.46	(12.44)	28.66	(11.76)
<b>Self-Regulatory Variables</b>				
SEL	7.55	(0.99)	7.04	(0.80)
SEST	49.60	(17.04)	43.54	(13.30)
Mood	10.15	(3.20)	13.18	(2.81)
Performance Satisfaction	11.09	(3.10)	10.69	(3.35)
Goal Setting	5.35	(1.95)	5.25	(1.67)
Goal Commitment	6.81	(1.60)	6.90	(1.37)

Table 4

Correlations between younger and older adults' PIC questionnaire scales, decision time scores for each block, and change in decision-time across blocks.

Measure	PIC			
	Internal	Morale	Achievement	Anxiety
Decision Time <sub>1</sub>				
Younger Adults	.08	-.13	.05	.20
Older Adults	-.23	-.31**	-.30*	.36**
Decision Time <sub>2</sub>				
Younger Adults	.16	-.13	.05	.09
Older Adults	-.17	-.33**	-.25*	.34**
Decision Time <sub>3</sub>				
Younger Adults	.16	-.20	.02	.25*
Older Adults	-.15	-.18	-.14	.17
Decision Time <sub>(3-1)</sub>				
Younger Adults	.01	.03	-.05	-.09
Older Adults	.16	.24*	.25*	-.31*

\*p < .05    \*\*p < .01

**Table 5**

**Correlations between younger adults' questionnaire scores and the task-specific self-regulatory variables.**

	Pitt				Levenson		
	Internal	Morale	Achievement	Anxiety	Internal	Chance	Powerful Others
SEL <sub>w</sub>	.19	.32**	-.26*	-.01	-.12	-.06	-.20
SEL <sub>1</sub>	.14	.26*	.20	-.14	-.22	-.07	-.26*
SEL <sub>2</sub>	.26*	.29*	.24	-.17	-.26*	-.02	-.21
SEL <sub>3</sub>	.21	.27*	.28*	-.16	-.21	-.01	-.21
SEST <sub>w</sub>	.26*	.31*	.33**	-.10	.04	-.17	-.16
SEST <sub>1</sub>	.14	.28*	.17	-.12	-.18	-.12	-.20
SEST <sub>2</sub>	.18	.27*	.22	-.10	-.18	-.13	-.22
SEST <sub>3</sub>	.11	.23	.24	-.05	-.15	-.09	-.18

\*p < .05 \*\*p < .01

**Table 6**

Correlations between older adults' questionnaire scores and the task-specific self-regulatory variables.

	PIC				Levenson		
	Internal	Moralc	Achievment	Anxiety	Internal	Chance	Powerful Others
SEL <sub>w</sub>	.09	.20	.09	-.19	-.01	-.26*	-.28*
SEL <sub>1</sub>	.11	.07	-.07	-.13	.08	-.23	-.21
SEL <sub>2</sub>	.04	.11	-.04	-.18	.21	-.23	-.18
SEL <sub>3</sub>	-.09	-.01	.04	.03	.25*	-.15	-.11
SEST <sub>w</sub>	.14	.28*	.14	-.25*	.11	-.31*	-.28*
SEST <sub>1</sub>	.12	.13	-.07	-.15	.14	-.27*	-.26*
SEST <sub>2</sub>	.11	.16	-.00	.19	.34*	-.29*	-.16
SEST <sub>3</sub>	-.02	.07	.04	.06	.22	-.15	-.12

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

Table 7

The relation between task-specific self-efficacy and self-reported interest to participate in further psychology studies.

	Shoc Factory	Any Factory	Real-Life Evaluation	General Advice	Advise Decisions	Memory Tasks
<b>Both Age Groups' Self-Efficacy Composite Score</b>	.18*	.32**	.26**	.31**	.04	-.04
<b>Younger Adults' Self-Efficacy Composite Score</b>	.36**	.33**	.37**	.32**	.05	-.03
<b>Older Adults' Self-Efficacy Composite Score</b>	.00	.29*	.13	.30*	.05	-.07

\*p < .05    \*\*p < .01

Figure 1  
Decision making performance as a function of age  
group and trial block

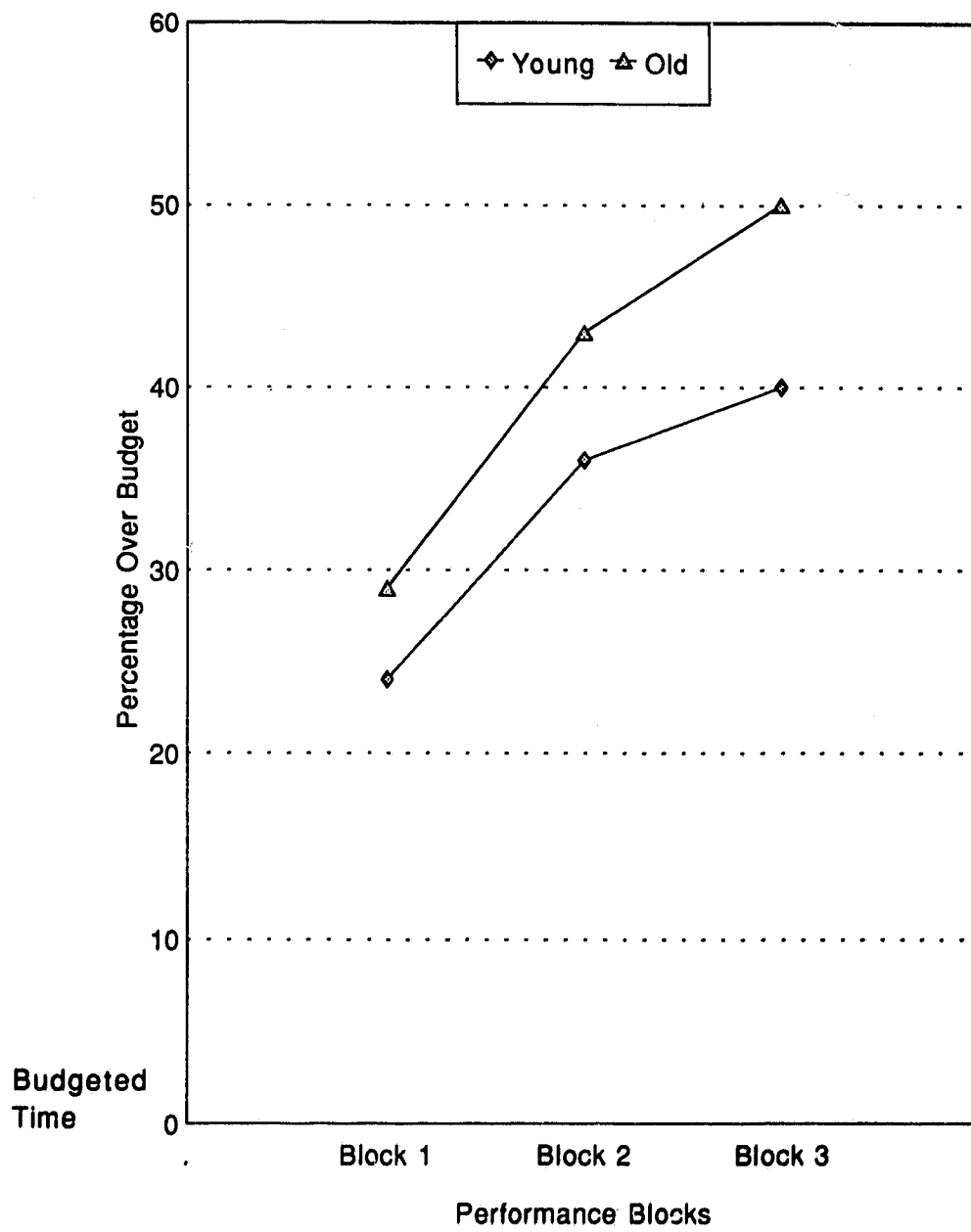


Figure 2  
Decision making time as a function of age group  
and trial block

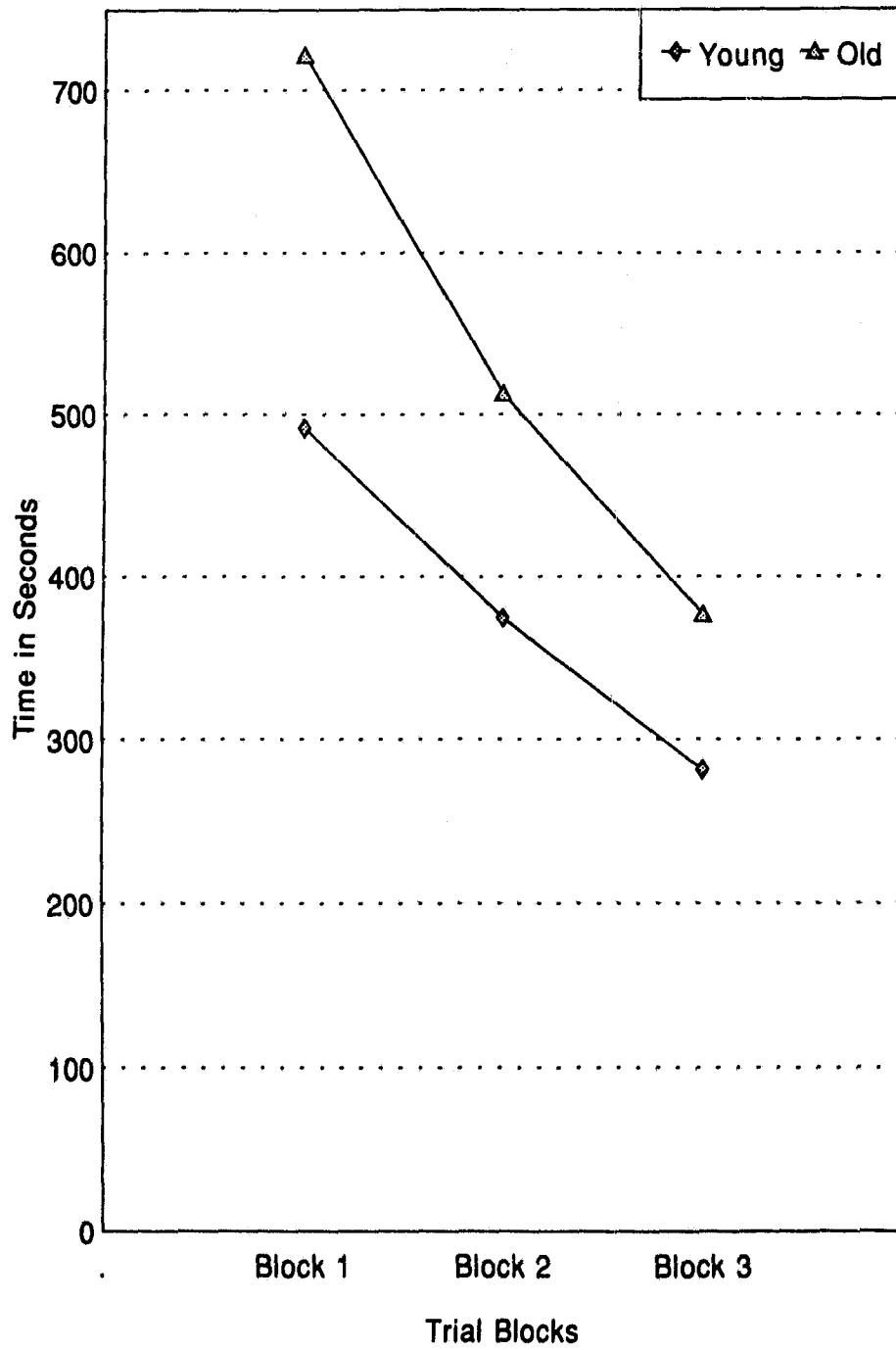


Figure 3  
Strategy use as a function of age group and  
trial block

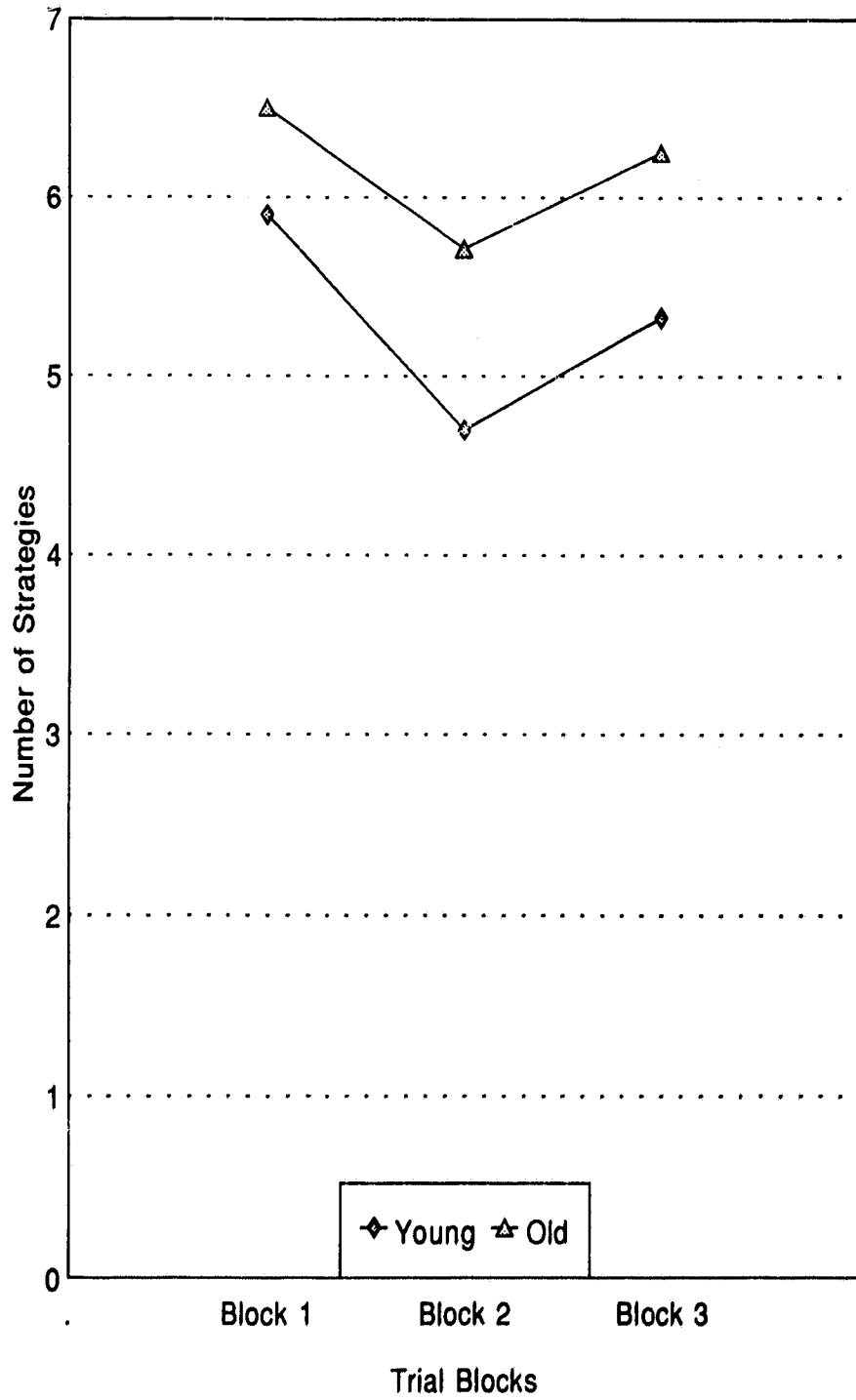


Figure 4  
Goal setting as a function of age group  
and trial block

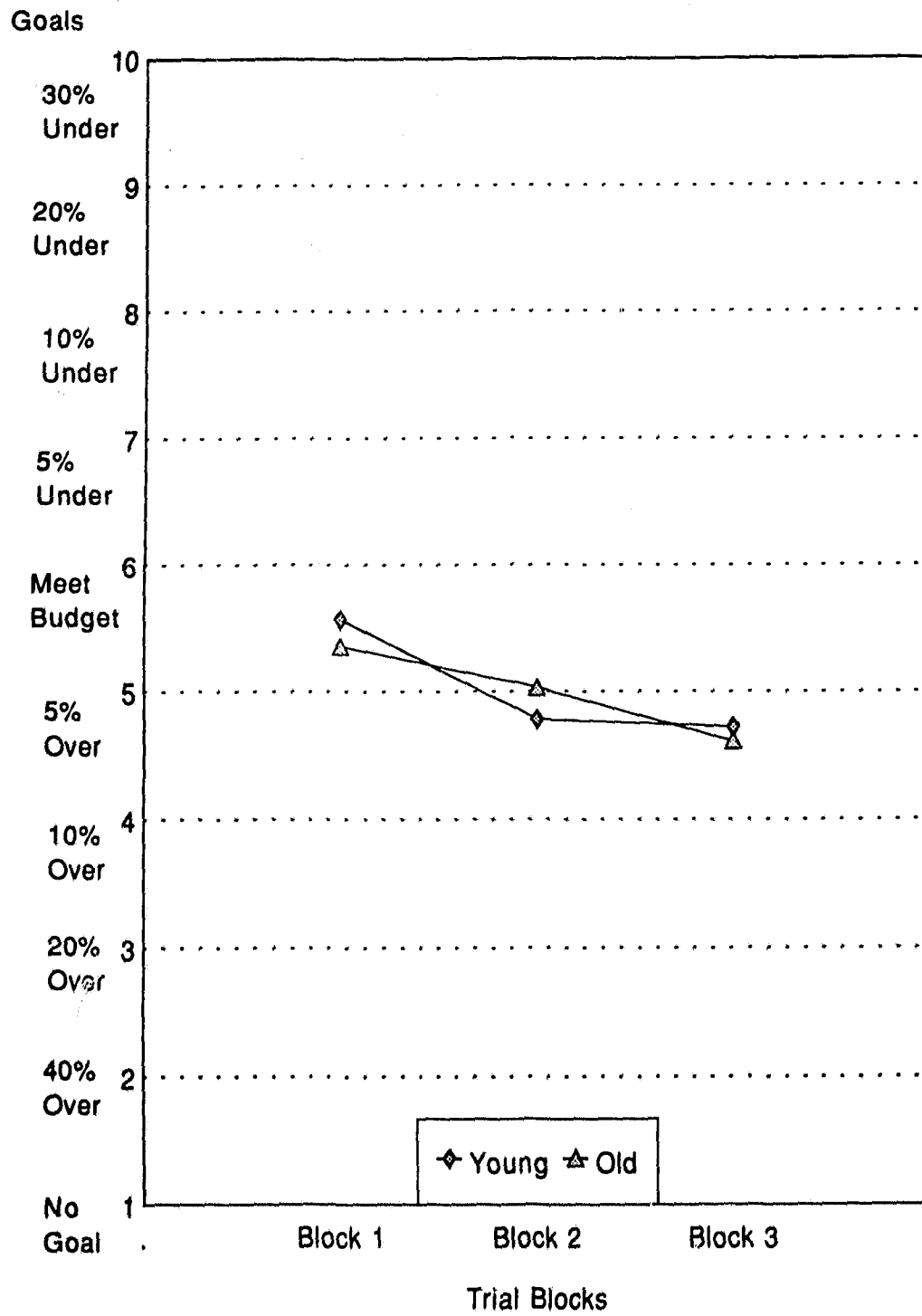
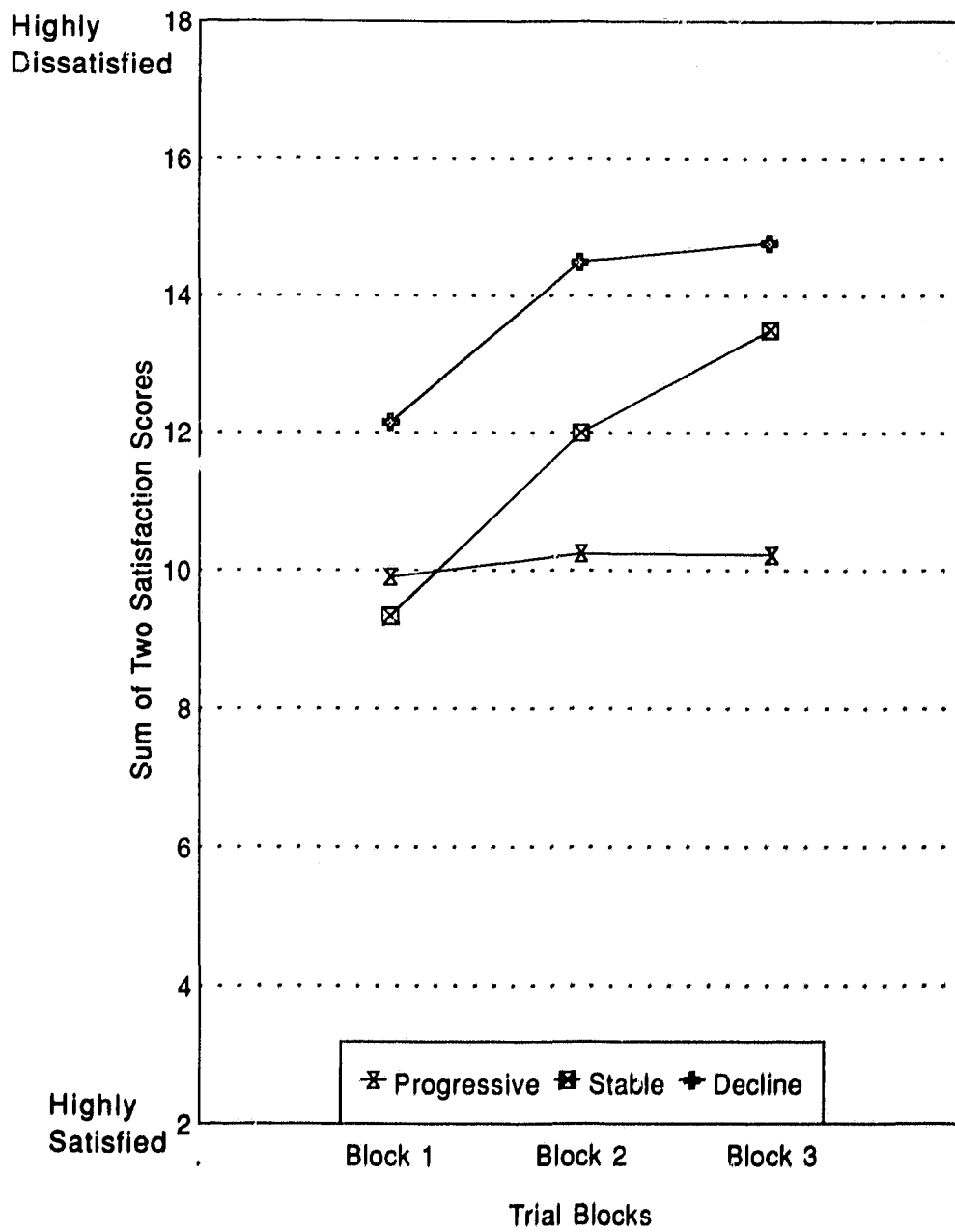
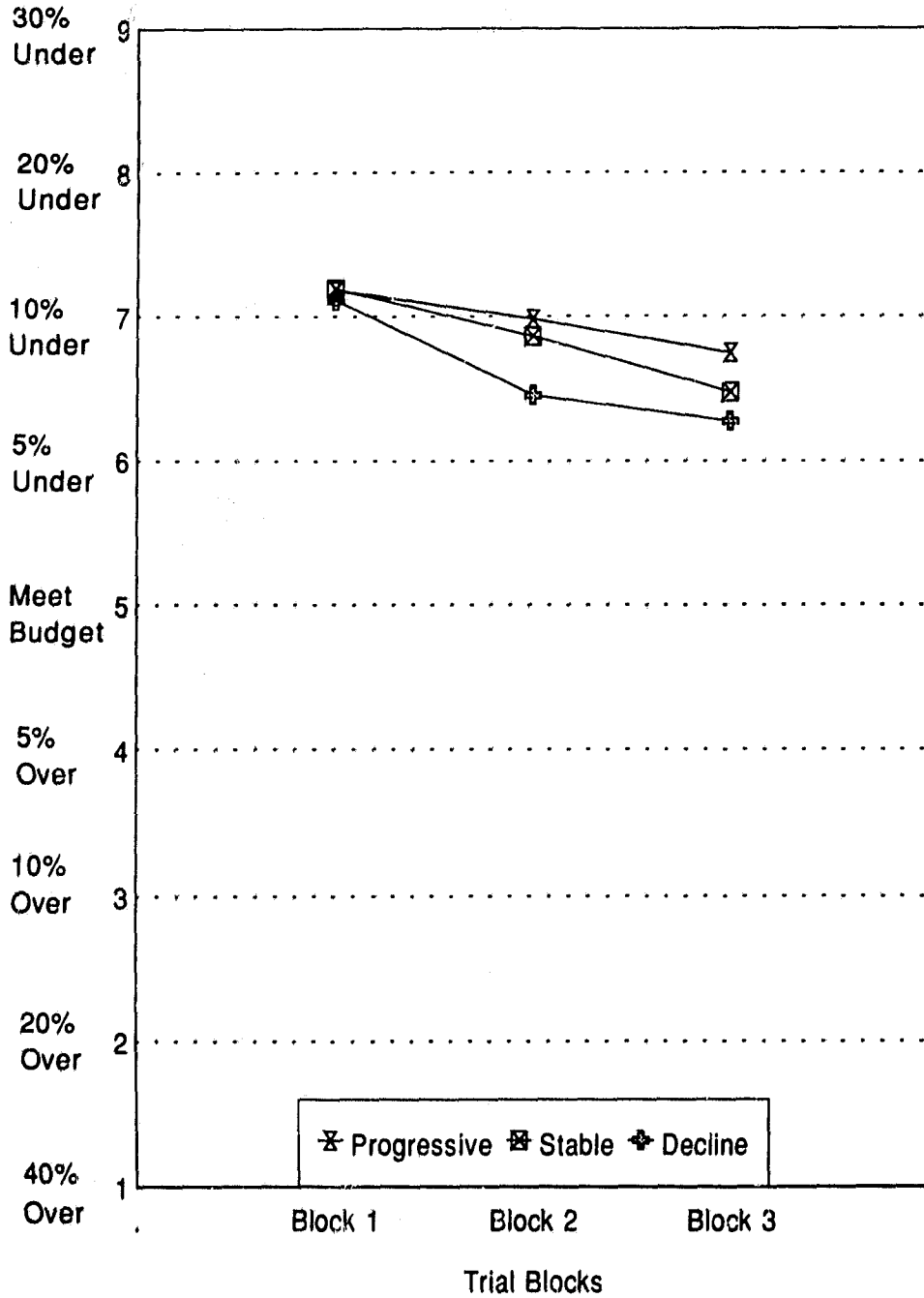


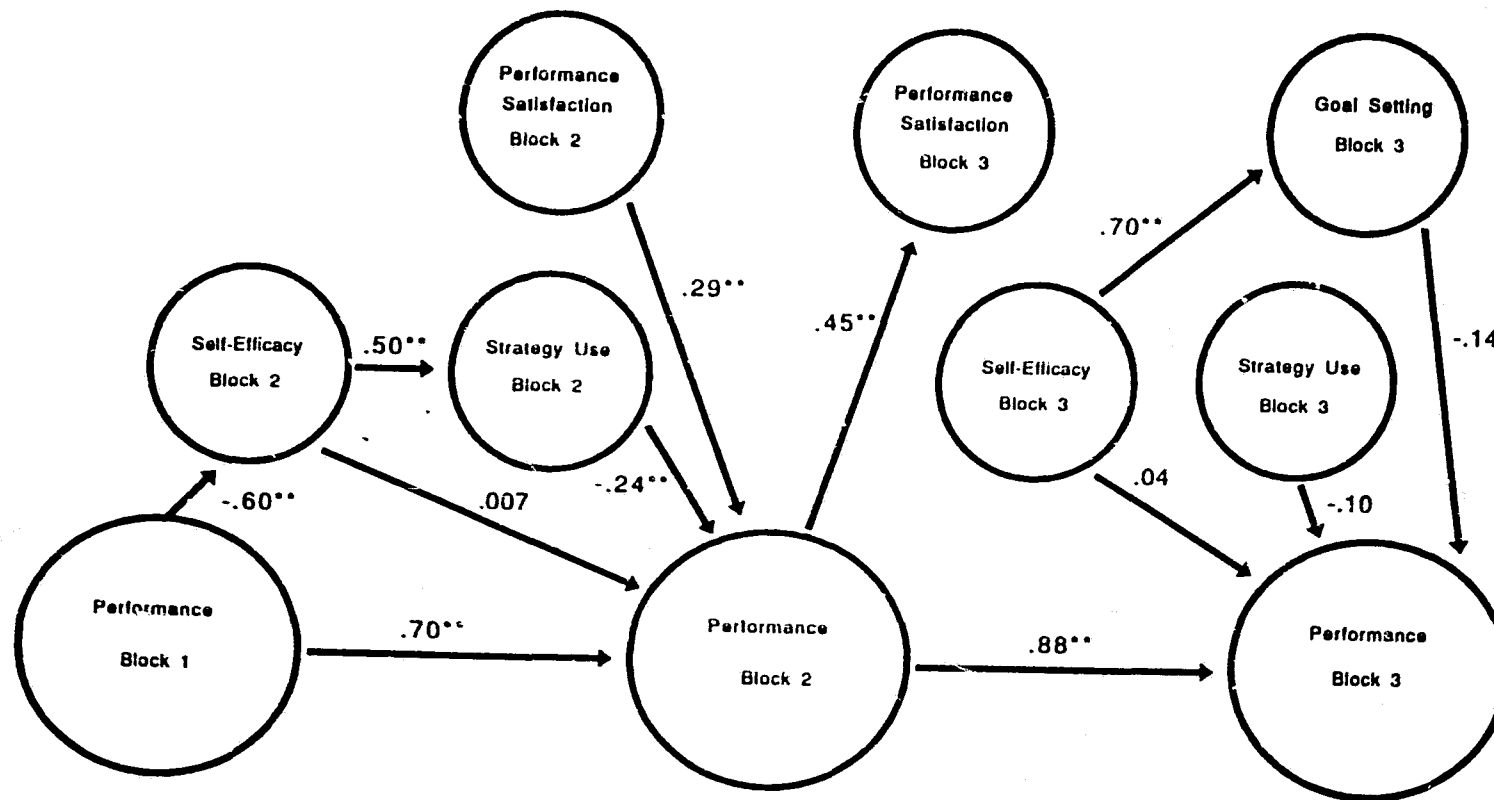
Figure 5  
Performance satisfaction as a function of  
social comparison information condition  
and trial block



**Figure 6**  
**Self-efficacy levels as a function of social comparison information condition and trial block**



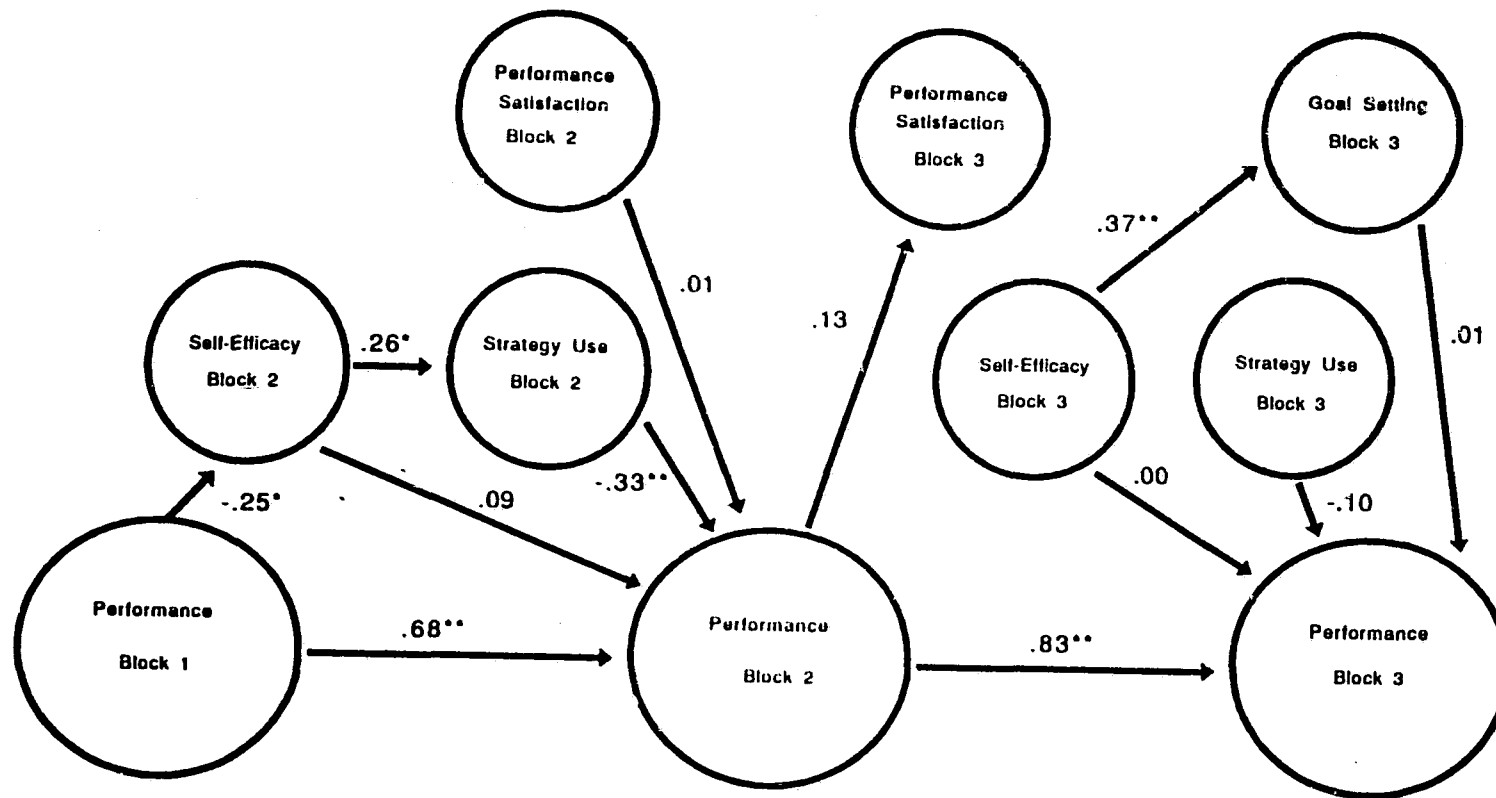
**Figure 7**  
**Path model testing Bandura and Jourden's (1991) model on the younger adults data.**



Chi sq.(33) = 282.37,  $p < .001$

Paths indicate standardized Betas  
 $*p < .05$   $**p < .01$

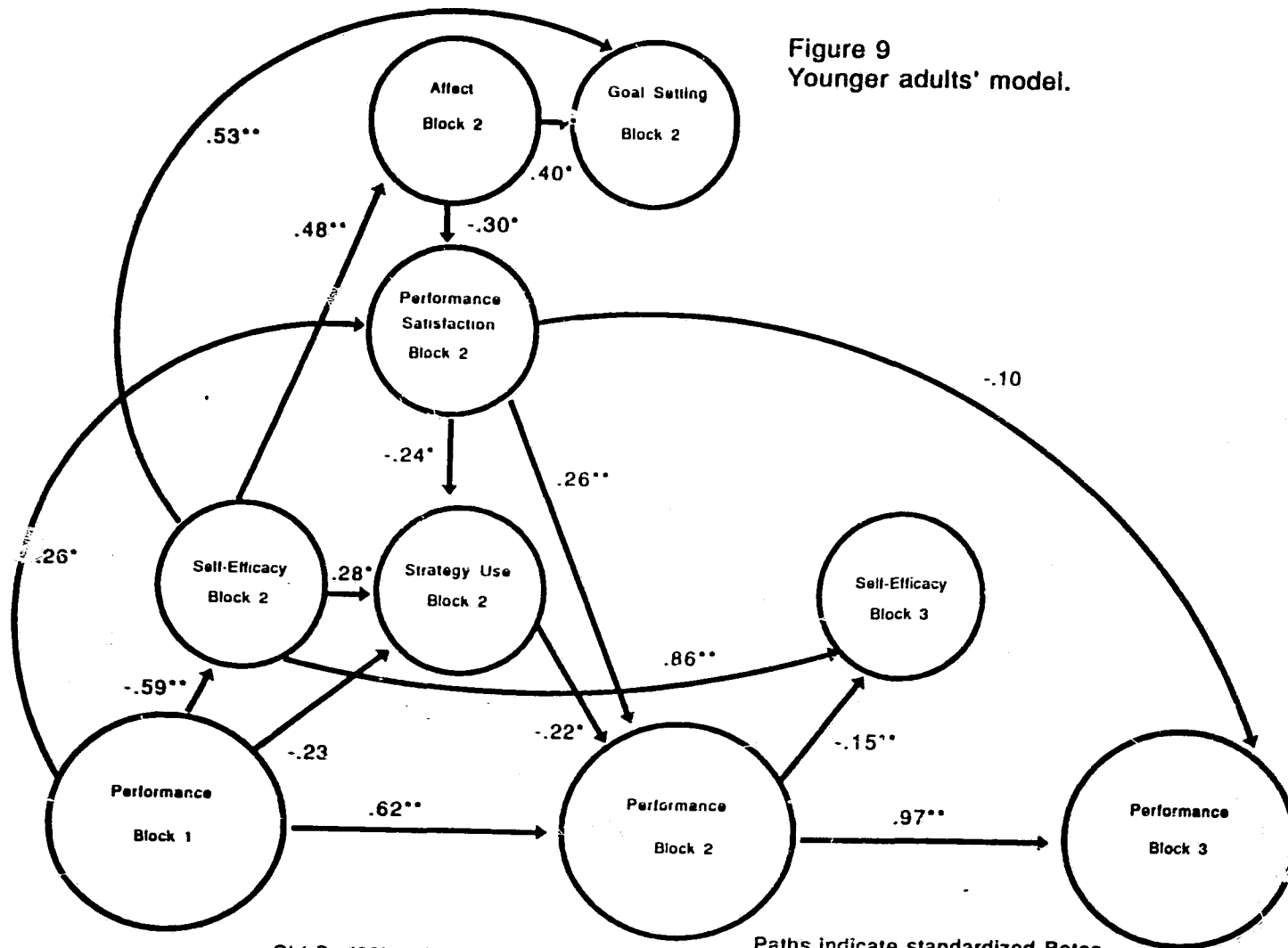
**Figure 8**  
 Path model testing Bandura and Jourden's (1991) model on the older adults' data.



Chi sq.(33) = 223.63,  $p < .001$

Paths indicate standardized Betas  
 $^*p < .05$   $^{**}p < .01$

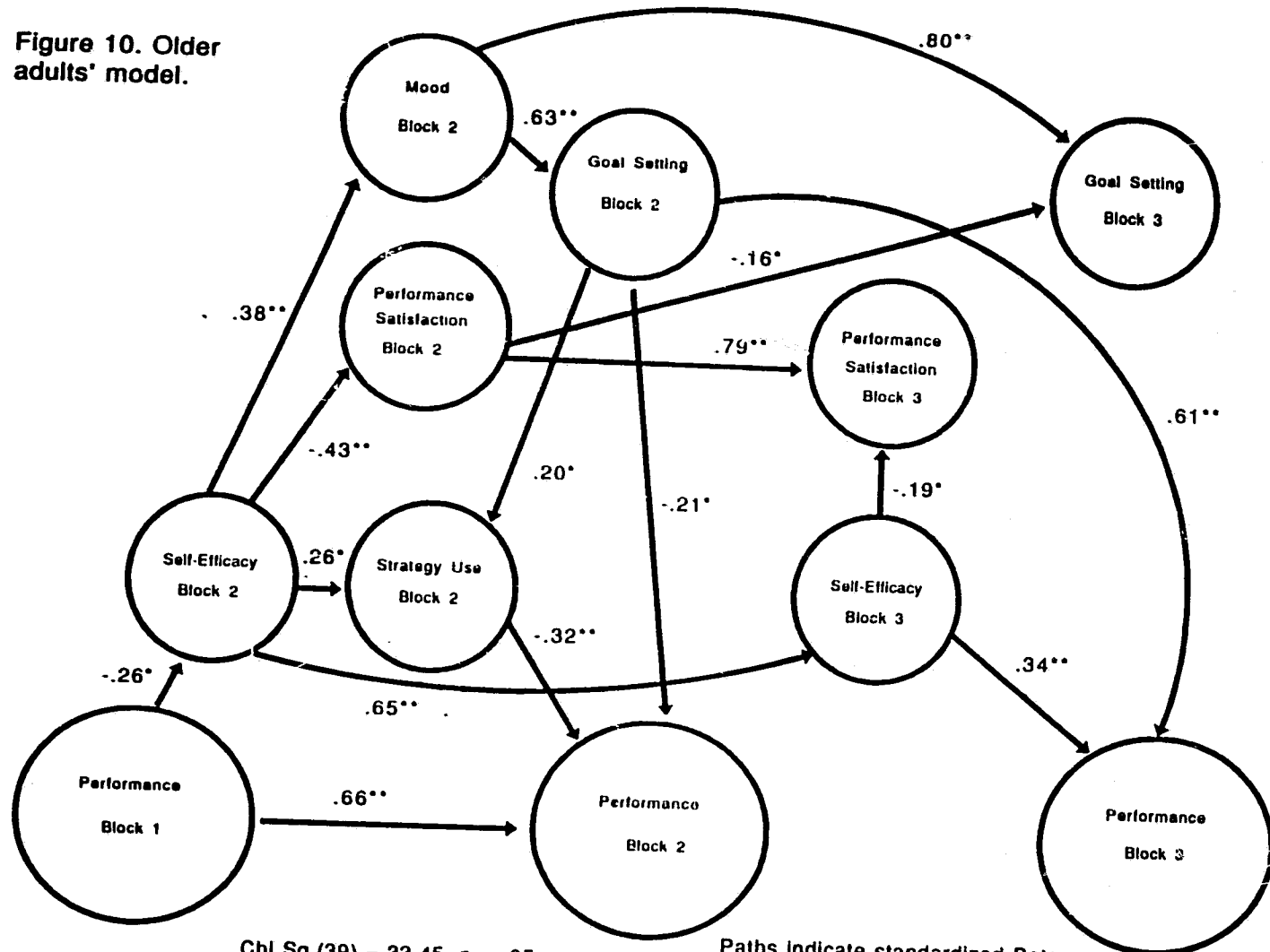
Figure 9  
Younger adults' model.



Chi Sq.(20) = 5.12,  $p > .05$

Paths indicate standardized Betas  
\* $p < .05$  \*\* $p < .01$

Figure 10. Older adults' model.



Chi Sq.(39) = 33.45,  $p > .05$

Paths indicate standardized Betas  
 $*p < .05$   $**p < .01$

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Younger and Older Adults.

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