Aging and Memory Control Beliefs: Performance in Relation to Goal Setting and Memory Self-Evaluation

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We examined memory control beliefs in relation to memory performance and beliefs in the context of goal setting. Control beliefs showed significant effects on performance and self-efficacy. Higher goals were set by high-control younger adults than by older adults and low-control younger adults. Individuals with a high sense of control performed higher and maintained performance over trials regardless of whether they set explicit goals. Those with low control (primarily older adults) performed lower, but they achieved increased performance when motivated by goals. These results emphasized that performance limitations associated with low control can be overcome with goals, even in older adults. As with previous studies, however, younger adults showed a more positive response to goals than older adults.

From a social learning perspective, our beliefs and affective responses are self-regulatory factors that can influence performance as much as, or more, than ability does (Bandura, 1997; Schunk, 1994). Beliefs about ability, such as self-efficacy, implicit theories, stereotypes, and control beliefs, can serve to impair or enhance performance (Berry, 1999; Cavanaugh, Feldman, & Hertzog, 1998; Miller & Lachman, 1999; Ryan & Kwong-See, 1993). That is, cognitions about performance on a specific task can direct attention to or away from a task, provide motivation to enhance performance, or create anxieties that interfere with performance. Self-regulatory beliefs might explain, for instance, how a highly intelligent person could fail an intelligence test, for example, if the test conditions led to increased stereotype threat (e.g., Hess, Auman, Colcombe, & Rahhal, 2003). The relationship between self-regulatory factors and performance may be especially important for older adults (cf. Berry, 1999; Hertzog, Dixon, & Hultsch, 1990; Luszcz & Hinton, 1993; Riggs, Lachman, & Wingfield, 1997). For example, low perceived control over one’s abilities could lead an older person to avoid challenging situations and become dependent on others (Fry, 1989). Acceptance of stereotypes about memory aging could lead an older person to perform less well in situations that emphasize memory testing or memory problems (Levy, 1996; Rahhal, Hasher, & Colcombe, 2001). A number of related belief constellations are important for self-regulation of memory performance (Berry & West, 1993; Miller & Lachman, 1999), and the current research focuses on the role of control beliefs.

Perceived control is the belief that outcomes in the environment can be regulated or influenced by personal intentions or actions. Related to this are the attributions that individuals make about factors that cause specific outcomes to occur—for instance, we could attribute outcomes to personal characteristics or to external factors, such as luck, that are out of our control. Control can be measured at a number of levels. One common approach is to examine a more global expectancy such as locus of control (Rotter, 1966), that is, the extent to which an individual believes that most events are controlled by outside forces or personal, internal factors. Aging research has shown no clear pattern with respect to age-related changes in overall locus of control (Baltes & Baltes, 1986; Fry, 1989; Fung, Abeles, & Carstenson, 1999; Lachman, 1986, 1989), but it does appear that sense of control over cognitive outcomes is related to age. When scholars examine sense of control with respect to cognition, they are assessing domain-specific feelings of control (Lachman, Ziff, & Spiro, 1994). Older adults appear to be at risk for increased external control beliefs in relation to mental skills (Grover & Hertzog, 1991; Lachman & Leff, 1989; Rebok & Balcerak, 1989). A considerable body of literature has examined intellectual control beliefs (for recent reviews, see Lachman, 2000; Miller & Lachman, 1999), but the particular focus of the present research is memory. Relative to younger adults, older adults were more likely to endorse low memory control or view memory ability as uncontrollable (Dixon & Hultsch, 1983; Fry, 1989; Hultsch, Hertzog, & Dixon, 1987; Lachman, Bandura, Weaver, & Elliott, 1995; Lineweaver & Hertzog, 1998), and memory-related sense of control was more predictive of memory performance for older than for younger adults (Dixon & Hultsch, 1983).

Similarly, memory performance appears to be related to specific performance attributions (Lachman, Steinberg, & Trotter, 1987; Langer, Rodin, Beck, Weinman, & Spitzer, 1979; Luszcz, 1993; Willis, Jay, Diehl, & Marsiske, 1992). For example, those with external attributions (e.g., luck determines memory scores) perform worse than those with internal attributions (e.g., ability determines memory scores) on many memory tasks (Devolder & Pressley, 1992; Riggs et al., 1997; Stine, Lachman, & Wingfield, 1993). Furthermore, the impact of control beliefs on performance may be related to specific adaptive attributions. Lachman and colleagues (1987) examined how individual differences in memory performance among older adults related to intellectual control beliefs, attributions, and memory self-assessment. Intellectual control beliefs were only marginally related to memory performance, but attributing memory success to internal, stable, and global causes was associated with greater accuracy in self-assessment and with increased memory performance over trials (Lachman et al., 1987). Devolder and Pressley (1992) also provided evidence for the importance of adaptive attributions. They found that younger participants generally attributed performance to
controllable factors, such as strategy use and effort, whereas older adults tended to attribute performance to uncontrollable factors, such as ability and age. For the young, controllable attributors used more strategies than uncontrollable attributors. What is most important is that, in this research, both young and old controllable attributors outperformed same-age uncontrollable attributors on most tasks (Devolder & Pressley, 1992).

These results suggest a mixed pattern of findings for control beliefs and memory. For example, the relationship of strategic memory processing to perceived control differences has been mixed (cf. Hertzog, McGuire, & Lineweaver, 1998; Riggs et al., 1997; Stine et al., 1993). One possible reason may be variations in measures of control. The most common approach is to use an established inventory, such as the Personality in Intellectual Contexts (PIC) inventory (Lachman, Baltes, Nesselroade, & Willis, 1982), as an indicator of domain-specific control beliefs and then to relate the PIC scores to specific memory test scores. However, scores on the PIC inventory predict memory performance less well than specific memory beliefs predict memory scores (see, e.g., Lachman et al., 1995). Furthermore, control beliefs appear to be affected by task variations. Age trajectories in control beliefs vary as a function of domain (e.g., Fung et al., 1999; Lachman, 1986; Lachman & Weaver, 1998), and the influence of control beliefs on performance may vary with situation (Blanchard-Fields, 1996; Stine et al., 1993) and specific task requirements (e.g., Devolder & Pressley, 1992; Hertog, Lineweaver, & McGuire, 1999; Lachman et al., 1995; Luszcz, 1993; Miller & Lachman, 2000). Although several previous studies have examined attributions with respect to specific memory tasks (Devolder & Pressley, 1992; Lachman et al., 1998; Hertog et al., 1998; Rebok & Balcerak, 1989), to our knowledge almost no studies have examined beliefs about the controllability of memory per se. In most of the literature, internal attributions (e.g., attributions about ability or knowledge) are assumed to reflect controllable causes. However, several investigators have noted that separation of locus (internal vs. external) and control can be informative (Cavanaugh & Green, 1990; Lachman et al., 1995). For example, older adults may attribute age-related declines in health to internal, personal characteristics and, at the same time, view these as uncontrollable (Cavanaugh & Green, 1990).

A focus on control, per se, has heuristic value. Perceived control is likely to be higher for internal characteristics than for external environmental factors, but that is not to say that all internal characteristics are equally perceived as controllable. In recent research by Hertzog and colleagues, internal-skill attributors reported higher levels of control than internal-ability attributors, even when age was controlled for (Hertzog et al., 1998). Even though ability is generally viewed as an internal characteristic—normally categorized as “controllable”—some ability attributors reported that they could never achieve 100% correct, no matter how many times they saw a list (Devolder & Pressley, 1992). To better understand beliefs about control in this study, we did not infer controllability from attributions but rather asked participants directly about their perceived control over memory. Control beliefs can be distinguished from self-efficacy—a rating of one’s performance capability or potential (see Berry & West, 1993; Welch & West, 1995). For example, I may feel that my performance is determined by my use of strategies and that no external factors such as luck or power-ful others control my strategy usage. At the same time, I can feel that I am very good at using strategies, and that my performance will be high. In this example, I show high self-efficacy and high control. In contrast, you could believe that you have high ability on a particular task and would then have high self-efficacy. At the same time, you could believe that ability is a fixed entity, that is, it is not under your control. Although high self-efficacy is believed to be associated with perceptions of internal control ( Abeles, 1990; Bandura, 1997; Cavanaugh, 1996; Miller & Lachman, 1999; Welch & West, 1995), self-efficacy and control do not always covary.

In this study, we examined control beliefs in a goal-setting situation. Goal setting provides an excellent paradigm for looking at the impact of control beliefs, because responses to goals typically involve motivated, active task engagement (Locke & Latham, 2002). In a sense, participants take control over the task to raise performance to a goal level, whether the goal is set by an experimenter or by the individual person (Bandura, 1997). Baseline levels of performance on any task should be affected by ability factors (e.g., intelligence, attention, and memory skill) as well as self-regulatory beliefs such as self-efficacy and perceived control. At the same time, each subsequent performance trial influences, and is influenced by, the beliefs that the participant holds when that trial occurs, as well as other factors (Berry & West, 1993). When goal setting is requested by an external source (e.g., a teacher, an experimenter, or an employer is the source of goal setting), higher goals are set by those with more positive beliefs (Schunk, 1994). When goals are not specified by the experimenter, they can still be set spontaneously by the individual (Locke & Latham, 1990). Individuals with high self-efficacy and high control, most often younger adults, are more likely to set challenging goals for themselves, with or without external encouragement to do so.

Once goals are set, the initial response to goals is increased motivation, effort, and goal-directed behavior (Bandura, 1997; Locke & Latham, 1990). This initial response to a goal may or may not be maintained over multiple goal trials, depending on the individual’s self-regulatory beliefs and any feedback that the person might receive or infer. If adults evaluate themselves positively on a goal-relevant task, then continued efforts are likely. If performance is not high, the results on subsequent trials depend on self-regulatory beliefs (Bandura, 1996). High-control younger adults should believe that it is possible for them to take control, activate effective strategies, and raise their scores. Such beliefs should lead to increased task-directed effort and higher performance ( Bandura & Cervone, 2000; Schunk & Zimmerman, 1996). In contrast, older individuals typically have reduced self-efficacy and a lack of strategy acumen, as compared with younger adults. When combined with low control beliefs, these characteristics should lead older individuals to become easily discouraged by signs of difficulty and to withdraw effort (Bandura & Cervone, 2000; Welch & West, 1995).

This investigation was designed to evaluate some aspects of this relationship between self-regulatory beliefs and memory performance. In particular, we examined the impact of control beliefs on performance with and without goal setting. To our knowledge, there have been no previous examinations of goal setting and memory performance as a function of age and control. One previous study, with older adults only, looked at
attributions in relation to memory performance change over trials (Lachman et al., 1987), but it did not assess goal setting. In that investigation, stronger internal attributions were associated with more positive self-assessment change and more positive performance change across trials (Lachman et al., 1987). Using younger adults only, Bandura and Wood (1989) led participants to believe that organizations were difficult to control (low control) or amenable to control (high control). Participants in the high-control condition maintained a stronger sense of self-efficacy, set more challenging goals, and had higher performance. That is the result expected here, especially for the younger adults. Because they believe that they can modify their performance, younger adults with high perceived control were expected to show higher self-efficacy, set higher personal goals, and show higher performance levels than older adults, and younger adults with low perceived control (Bandura & Wood, 1989). In contrast, people with low control beliefs for memory were not expected to persist actively across a set of memory trials, because they would not believe that they could influence the outcome (Miller & Lachman, 1999). Because they were likely to have lower self-efficacy, older adults in the low-control group were expected to be the least likely group to show performance gains over time without a goal, and we predicted that they would show the lowest scores on all measures.

What would be the impact of differing goal conditions? Challenging, specific goals typically lead individuals to focus their attention on a task and to persist in task-directed effort over time (Locke & Latham, 1990). Groups without goals were expected to show little change across trials. On the basis of past research, we expected to find that younger adults would show a more positive response to goals than older adults (West, Welch, & Thorn, 2001), and that older adults would set lower personal goals than younger adults (West & Thorn, 2001). With respect to control beliefs, we predicted that high-control individuals would maintain their scores over trials regardless of external factors such as task difficulty or specific goal instructions (Bandura, 1997; Cavanaugh et al., 1998), and that the effects of goal condition effects would be minimal for high-control participants. Given the lack of specific literature on this issue, we made only tentative hypotheses about the response to goals by the low-control group. It was not evident whether low-control individuals would respond positively and work to achieve a self-set goal. They might have responded to goals quite well, if the goal conditions established here were highly motivating. Alternatively, their low sense of control could inhibit goal-directed effort. If the low-control group did respond to goals, earlier research suggests that this response would have been stronger for the younger adults than for the older adults (see West, Thorn, & Bagwell, 2003).

**Methods**

**Participants**

The participants were 64 students (18 men and 46 women) and 70 older adults (21 men and 49 women). The students were high school seniors and college freshmen participating for course credit, and the older adults were volunteers recruited from an education program based at a hospital in a nearby metropolitan area. The young adults ranged from 18 to 22 years of age ($M = 18.8, SD = 1.1$). The older adult age range was 62 to 80 years ($M = 71.2, SD = 4.8$). On average, the young had fewer years of education ($M = 12.4, SD = 1.4$) than the old ($M = 13.1, SD = 2.5$), $F(1, 132) = 4.1, p < .05, \omega^2 = .03$. Participants rated their health status on a scale from 1 (excellent health) to 10 (poor health), with younger adults ($M = 2.6, SD = 1.2$) rating themselves as significantly healthier than older adults ($M = 3.5, SD = 2.0$), $F(1, 132) = 9.9, p < .005, \omega^2 = .07$. On the basis of a brief health questionnaire, we removed three older adults from the sample because they had significant health problems that might affect memory (e.g., recent stroke or use of anticholinergic medicines).

**Overall Design**

We conducted testing sessions in age-segregated groups (varying from 4 to 13 people). We compared a baseline memory test for a 24-item shopping list with a final test trial on a new, matched 24-item list. We randomly assigned half of the participants to a goal condition and half to a control condition. Participants in the goal condition set their own percentage goals for performance on all trials after baseline. After the baseline trial and again after the final trial, participants rated their performance and completed several memory beliefs measures. To assess control beliefs at baseline, participants reported on the most important factor affecting their memory and decided whether it could be personally controlled. Participants scoring above and below the midpoint on this item at baseline defined the two control beliefs groups—perceived high control (HC) and perceived low control (LC). We examined baseline and final trial scores as a function of age group, goal condition, and control beliefs group.

**Materials and Procedures**

**Memory performance.**—We constructed the shopping lists from a pool of over 1,000 possible items that might be purchased at a store (West et al., 2001). For the critical baseline and final trial lists, we presented partially categorized lists of 24 items, using categories such as “fruits” or “health and beauty products” as well as miscellaneous items that fit no particular category. Lists were organized randomly and category labels were not provided. Category size varied from 4 to 5 items. The lists were printed in 16-point type on a single page. Participants were limited to 2-min study times and 5-min recall times. Half of the participants received List A at baseline and List B for the final trial, and the other half learned these lists in the opposite order. We designed three intervening trials, varying in list length, to provide an opportunity for those in the goal condition to practice goal setting and to become motivated to achieve their goals. List length varied to ensure that participants actively considered their goals on each trial (Locke & Latham, 1990) rather than set a goal to achieve the same level as the previous trial. Although the purpose of these intervening trials was related to goal setting, all participants in both conditions completed lists of the same type on three intervening trials. The dependent measures were the number of items correctly recalled at the baseline and final trials.

**Self-efficacy.**—We assessed memory self-efficacy after the first trial and again after the last trial, using three scales of the Memory Self-Efficacy Questionnaire (MSEQ; Berry, West, &
Dennehy, 1989). The MSEQ is a domain-specific measure of memory self-efficacy, evaluating five different levels of performance for several memory tasks. Individuals responded yes or no to indicate whether they could perform each of the tasks at the described level, and then they were provided a confidence rating for yes responses (a no response = 0 confidence). This version measured self-efficacy for remembering word lists, names, and grocery lists. Factor analyses of the MSEQ typically yield one factor, and age differences occur across all tasks (Berry, 1999), so the general practice is to combine items across scales. As an overall indicator of memory self-efficacy, the dependent measure was self-efficacy strength, calculated as the average confidence rating across the three scales, with separate measures for baseline and final trial. Scores ranged from 0 to 100, with high internal consistency (α = .90) at baseline and at the final trial (α = .93).

At the final trial, just as at baseline, we examined the beliefs measures after performance. There is considerable evidence that beliefs can be changed significantly by exposure to test trials. To eliminate the confounding of this “exposure” effect (see West, Dennehy-Basile, & Norris, 1996) with the impact of goal setting, we examined beliefs after performance on the first trial. To make the baseline and final trials more comparable, we examined beliefs after performance in both cases. These are the procedures typically followed in our goal-setting research (see West et al., 2003).

General memory self-evaluation.—We assessed self-rated memory, at baseline and at final trial, for “the shopping list memory task you just completed.” Three questions were answered on a Likert scale from 1 to 7. These questions asked the adults to rate their memory compared with that of their peers, as much better or much worse, to rate their performance from poor to excellent, and to report their overall satisfaction with their performance, from “very satisfied” to “very unsatisfied.” Responses to the three items were highly correlated, with correlations ranging from .53 to .73 at baseline, and from .58 to .76 at final trial (all ps < .001), with an average intercorrelation of .68, so we summed the three scores. The combined scale had a range of 3 to 21 and showed good internal consistency reliability on the baseline assessment (α = .85) and on the final assessment (α = .86).

Attributions.—We asked participants, “What one thing had the most influence on your memory performance?” Following this open-ended question (designed to encourage participants to think about their own performance attributes), individuals reviewed a checklist of 26 possible causes, including ability (e.g., “I have an excellent memory” or “I have a poor memory”), task difficulty, memory techniques (e.g., “I used memory techniques” or “I did not use memory techniques”), effort, and the like. They selected up to four factors that influenced their memory performance and then chose the “number 1 cause” of their memory performance. In identifying the primary cause of their memory performance, younger adults most often mentioned memory techniques (48%), concentration (22%), and effort (10%). Older adults most often mentioned memory techniques (37%), ability (20%), concentration (18%), effort (11%), and age (8%). Other responses on the checklist were endorsed by few participants. Notice that these factors endorsed as primary causes are factors generally considered to represent internal characteristics. After they identified the primary cause of their memory performance, we asked participants to report how much control they had over this factor (endpoints of “no control” or “complete control”), to say how global it was in its effects (endpoints of “affects all aspects” of their lives or “only affects memory”), and to report whether it was stable, that is, whether it “always” or “never” affected their memory. All responses were made on a Likert scale of 1 to 7. Global and stable items are sometimes combined with internal control items (e.g., Lachman et al., 1987), but these three items were not highly correlated, with pairwise correlations ranging from –.02 to .20, and an average intercorrelation of .10, so we did not combine them into one scale. We utilized the responses to the control question at baseline to divide the sample into HC and LC groups, according to whether responses were above or below the midpoint (4) of the Likert scale.

Although we used a single item to divide respondents into HC and LC groups, this single item does show reliability and validity. Responses to the same control question showed good test–retest reliability across four trials in previous studies, with correlations of .64 (West et al., 2001) or .73 (West, Dark-Freudeman, & Bagwell, 2003) from baseline to final trial for a control group. To examine the validity of this single item control rating, independent raters identified those attributions that reflected internal control (a method commonly used in the aging literature), such as “I used memory techniques.” We then counted the number of these attributions endorsed by participants as a function of control group and found a significantly higher number of internal control attributions endorsed by the HC group as compared with the LC group, \( F(1, 131) = 102.4, p < .001, \omega^2 = .44 \).

Goals.—A goal is an objective standard for rate, quality, or level of performance, which may be set by an experimenter or by the individual. In this study, a goal was requested by the experimenter, and the goal itself was selected by the participant, using a self-set goal methodology. Before each trial except the first, participants selected a goal for percentage correct for the next trial. Goals were not set at baseline, so that participants received task experience before choosing a goal. After baseline, participants in the goal condition selected a performance goal for each trial. In the no-goal condition, participants completed all test trials without explicit goal setting. Goal-condition participants were asked to set a goal “which will be difficult, but not impossible, for you to achieve.” After being informed about the number of list items on the next trial, participants selected a goal from a list of possible percentage values, varying from 10% to 100% correct. The dependent measure was the goal set on the last trial, after several trials of experience with goal setting for memory tasks of varying list lengths.

RESULTS

Preliminary Analyses

Because years of education and health varied as a function of age group, a preliminary analysis examined the impact of
education and health on all critical variables (control beliefs, recall, self-efficacy, self-rated memory, and goals) by carrying out the primary analyses (described in the paragraphs that follow) with these two variables as covariates. Neither covariate showed significance in any of these analyses, so the education and health variables were not incorporated in the primary analyses. In another preliminary analysis, list length variations on the intervening trials were not significantly related to final trial results, so they were not considered further.

We examined the group distribution for control ratings to confirm that the midpoint division for the control beliefs groups resulted in a reasonable distribution of beliefs across age groups. A cross-tabulation of the division of the age groups into HC and LC groups approached significance because there was a larger number of older adults in the LC group (59% in the LC group vs. 41% for the HC group); Pearson $\chi^2(N = 134, df = 1) = 3.6$, Cramer’s $V = .16$, $p = .06$. An analysis of variance confirmed that there were significant differences in control ratings between the HC ($M = 6.0, SD = .73$) and LC ($M = 5.0, SD = 1.0$) groups, $F(1, 132) = 36.1, p < .001$, $\omega^2 = .29$. As we expected, those assigned to the goal ($M = 4.4, SD = 1.7$) and no-goal ($M = 4.6, SD = 1.8$) groups showed similar ratings of control, $F(1, 130) < 1, p > .40$, $\omega^2 < .01$. There was no significant Age Group × Goal Condition interaction, $F(1, 130) = 2.3, p > .10$, $\omega^2 = .01$, and no significant age variation (younger adult, $M = 4.6, SD = 1.8$; older adult, $M = 4.4, SD = 1.7$), $F(1, 130) < 1, p > .40$, $\omega^2 < .01$, in control ratings.

Primary Analyses

All analyses examined factors of age (young, old), condition (goal, no goal), and control beliefs (LC, HC), except analyses of self-set goals, which included factors of age and control beliefs only. Repeated measures analyses comparing baseline and final trial performance were evaluated. The significant group differences noted in the text were based on 95% confidence intervals for cell means, calculated by SPSS. Regression analyses were also conducted to further explore the relationship between beliefs and performance.

Memory performance.—For memory performance, we compared the percentage correct across baseline and final trials. The analysis revealed that younger adults remembered more list items than older adults, $F(1, 126) = 29.3, p < .001$, $\omega^2 = .19$, higher recall occurred on the final trial, $F(1, 126) = 9.4, p < .005$, $\omega^2 = .07$, and the HC group showed higher recall than the LC group, $F(1, 126) = 14.8, p < .001$, $\omega^2 = .11$ (see means in Table 1). Significant interactions of Trial × Condition, $F(1, 126) = 10.7, p < .001$, $\omega^2 = .08$, and Trial × Condition × Control Beliefs, $F(1, 126) = 6.8, p < .01$, $\omega^2 = .05$, qualified these results. There were no significant differences between the two goal conditions at baseline, as we expected, but at the final trial, the no-goal condition performed significantly below the goal condition. The HC group showed a significant score advantage over the LC group at baseline and still performed significantly higher than the LC no-goal group at the final trial. The LC group showed significant gains across trials in the goal condition, achieving a score that was not significantly different from the HC group on the final trial (see Table 1). These results confirmed the hypothesis that HC participants would maintain their scores over trials, even without goals. Both age and control beliefs had a substantial impact on list recall, and the effects of goal condition and control beliefs were similar for both age groups. No other results were significant.

Self-efficacy.—Younger adults showed higher memory self-efficacy than older adults, $F(1, 126) = 36.7, p < .001$, $\omega^2 = .23$, and self-efficacy was highest for the HC group, $F(1, 126) = 5.3, p < .025$, $\omega^2 = .04$. There was no significant difference in self-efficacy between the goal conditions for the older adults, whose overall self-efficacy strength was low, approximately 40% confidence on average, but the goal condition showed higher self-efficacy than the no-goal condition for the younger adults, resulting in an Age × Condition interaction, $F(1, 126) = 7.8, p < .01$, $\omega^2 = .06$. The interaction of Trial × Goal Condition was also significant. As we expected, there were no significant goal condition differences at baseline, but self-efficacy was significantly higher for the goal group on the final trial, $F(1, 126) = 5.1, p < .025$, $\omega^2 = .04$. These results were further qualified by a Trial × Condition × Control interaction. In the HC group, there were no efficacy differences based on goal condition at baseline or final trial. In contrast, the LC group showed no goal condition differences at baseline, but this group demonstrated higher self-efficacy in the goal condition than the no-goal condition on the final trial, $F(1, 126) = 8.8, p < .005$, $\omega^2 = .07$. In the no-goal condition, the HC and LC groups became more differentiated in terms of self-efficacy over trials, whereas in the goal condition, the HC and LC groups became more similar in self-efficacy over trials (see Table 1). No other results were significant.

General memory self-evaluation.—The memory self-rating showed higher scores by the HC group than the LC group, $F(1, 126) = 18.4, p < .001$, $\omega^2 = .13$, and higher scores for the younger adults than the older adults, $F(1, 126) = 4.0, p < .05$, $\omega^2 = .03$. As seen in Table 1, there were control beliefs group differences at baseline in both the goal and no-goal conditions, and at final trial in the no-goal condition, but not at final trial in the goal condition, $F(1, 126) = 7.9, p < .01$, $\omega^2 = .06$. A decrease over trials in the LC no-goal condition and an increase over trials in the LC goal condition resulted in a significant self-rated memory difference between these two groups at the final trial, when there had been no difference at baseline. No other results were significant.

Attributions.—We evaluated the control, global, and stable items as a function of age, goal condition, and control beliefs. The analysis for the control question is reported in the aforementioned preliminary analysis section. The global attribution question showed no significant age, $F(1, 126) < 1, p > .50$, $\omega^2 < .01$, or condition differences, $F(1, 126) < 1, p > .25$, $\omega^2 < .01$. Differences between the HC ($M = 4.8, SD = 1.7$) and LC groups ($M = 4.2, SD = 1.9$) approached significance, $F(1, 126) = 3.6, p = .06$, $\omega^2 = .03$. On the stable attribution question, the HC ($M = 5.2, SD = 1.4$) and LC groups ($M = 4.6, SD = 1.5$) were significantly different, $F(1, 126) = 5.0, p < .05$, $\omega^2 = .04$. The interaction of age and control beliefs approached significance, as a result of somewhat higher
stability ratings by the older HC group than by the younger HC group and somewhat lower stability ratings by the older LC group, $F(1, 62) = 3.0, p = .09, \omega^2 = .02$. No other results were significant.

**Goal selection.**—We examined goals on the final trial as a function of age and control (this analysis only includes participants assigned to the goal condition). Older goal participants ($M = 58.8, SD = 17.9$) set lower goals than younger goal participants ($M = 66.2, SD = 16.8$), with this difference approaching significance, $F(1, 62) = 3.0, p = .09, \omega^2 = .05$. The impact of control beliefs on goals approached significance, $F(1, 62) = 3.3, p = .07, \omega^2 = .05$, and age interacted significantly with control beliefs. Younger HC participants set higher goals than any other group (average goal of 74%), $F(1, 62) = 5.8, p < .025, \omega^2 = .09$, with older adults in both control beliefs groups and younger LC participants all setting comparable goals that were significantly lower, at 57–60%. No other results were significant.

**Regression.**—One important question is the relative influence of beliefs on performance, and vice versa. Theoretically, beliefs and performance were changing together over trials, which is, as performance improved, beliefs should have become more positive also (Schunk & Zimmerman, 1996), so that beliefs and performance on the final trial should be related. Because our specific interest was the impact of beliefs, we treated performance as the dependent variable in our regression analysis, although we recognize that causality is bidirectional in this case. Age is typically a significant predictor of both beliefs and performance, so we examined the impact of beliefs on performance, including recall scores and goal condition (a dichotomous dummy variable, with no goal = 0 and goal = 1) in the model, with age entered first. For purposes of comparison, we completed similar regression analyses for the baseline and final trial, although goals were not requested for the baseline trial so they were not included in the baseline analysis. For these analyses, we developed a single indicator of beliefs by summing the standard scores ($z$ scores) for self-efficacy, control, and self-rated memory because these measures form a constellation of related beliefs theoretically. We examined multicollinearity to ensure that the analysis was stable and not biased as a result of high correlations among variables; all tolerance values were acceptable. (Initial analyses included education and health as variables in the regressions, but neither variable was significant, so they were dropped from the analyses reported here.)

On the baseline trial, we entered age and the composite beliefs score to predict recall performance. Age was entered first and was significant, $F(1, 130) = 32.0, \beta = -.44, p < .001$, with an adjusted $R^2$ value of .19. Although it remained a significant predictor of baseline performance, the impact of age, $\beta = -.24, p < .01$, was reduced after we added the beliefs composite measure, $\beta = -.59, p < .001$, to the regression. Together, age and beliefs contributed to an adjusted $R^2$ value of .50, $F(2, 129) = 66.6, p < .001$. Correlations among the variables at the baseline trial, with age variance removed, are shown in Table 2.

When we predicted the final trial performance, the impact of age, entered first, was significant, $F(1, 130) = 30.7, \beta = -.44, p < .001$, with an adjusted $R^2$ value of .18. However, age was no longer significant, $\beta > .02, \beta = -.08$, when the other variables were entered first, suggesting that there was no unique age variance for predicting final trial performance. Together, the independent variables contributed to an adjusted $R^2$ value of...

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### Table 1. Dependent Measures as a Function of Age, Control Beliefs, Goal Condition, and Trial

<table>
<thead>
<tr>
<th>Group Condition</th>
<th>Recall</th>
<th>Self-Efficacy</th>
<th>Self-Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Final</td>
<td>Baseline</td>
</tr>
<tr>
<td>Younger adults</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High control</td>
<td>64.3 (16.4)</td>
<td>67.5 (18.8)</td>
<td>53.9 (12.4)</td>
</tr>
<tr>
<td>No goal</td>
<td>70.7 (13.7)</td>
<td>71.2 (17.6)</td>
<td>54.9 (12.7)</td>
</tr>
<tr>
<td>Goal</td>
<td>72.1 (13.7)</td>
<td>70.8 (16.1)</td>
<td>52.4 (11.0)</td>
</tr>
<tr>
<td>Low control</td>
<td>69.1 (14.0)</td>
<td>71.6 (19.6)</td>
<td>57.9 (14.2)</td>
</tr>
<tr>
<td>No goal</td>
<td>55.4 (15.8)</td>
<td>62.5 (19.6)</td>
<td>52.6 (12.2)</td>
</tr>
<tr>
<td>Goal</td>
<td>56.6 (17.5)</td>
<td>55.2 (20.0)</td>
<td>49.5 (16.3)</td>
</tr>
<tr>
<td>Goal</td>
<td>54.4 (14.9)</td>
<td>68.3 (17.7)</td>
<td>55.1 (7.2)</td>
</tr>
<tr>
<td>Older adults</td>
<td>48.5 (16.3)</td>
<td>51.4 (15.2)</td>
<td>40.0 (12.6)</td>
</tr>
<tr>
<td>High control</td>
<td>53.2 (17.3)</td>
<td>56.2 (17.2)</td>
<td>42.9 (12.0)</td>
</tr>
<tr>
<td>No goal</td>
<td>52.4 (18.5)</td>
<td>55.9 (17.7)</td>
<td>46.5 (14.0)</td>
</tr>
<tr>
<td>Goal</td>
<td>53.7 (17.0)</td>
<td>56.4 (17.4)</td>
<td>40.4 (10.0)</td>
</tr>
<tr>
<td>Low control</td>
<td>45.1 (14.9)</td>
<td>48.0 (12.6)</td>
<td>37.9 (12.7)</td>
</tr>
<tr>
<td>No goal</td>
<td>45.8 (17.3)</td>
<td>44.1 (12.3)</td>
<td>39.3 (12.8)</td>
</tr>
<tr>
<td>Goal</td>
<td>44.1 (11.1)</td>
<td>53.4 (11.3)</td>
<td>35.9 (12.8)</td>
</tr>
<tr>
<td>All participants</td>
<td>56.0 (18.1)</td>
<td>59.1 (18.8)</td>
<td>46.7 (14.3)</td>
</tr>
<tr>
<td>High control</td>
<td>63.0 (17.6)</td>
<td>64.6 (18.8)</td>
<td>49.7 (13.7)</td>
</tr>
<tr>
<td>No goal</td>
<td>64.7 (18.2)</td>
<td>65.2 (18.0)</td>
<td>50.2 (12.3)</td>
</tr>
<tr>
<td>Goal</td>
<td>61.4 (17.2)</td>
<td>64.0 (19.8)</td>
<td>49.1 (15.0)</td>
</tr>
<tr>
<td>Low control</td>
<td>49.2 (16.0)</td>
<td>53.7 (17.2)</td>
<td>43.7 (14.4)</td>
</tr>
<tr>
<td>No goal</td>
<td>49.4 (17.9)</td>
<td>47.8 (15.9)</td>
<td>42.7 (14.6)</td>
</tr>
<tr>
<td>Goal</td>
<td>49.0 (13.8)</td>
<td>60.4 (16.3)</td>
<td>44.9 (14.2)</td>
</tr>
</tbody>
</table>

**Note:** Table shows means, with standard deviations given parenthetically.
.64, F(4, 127) = 60.4, p < .001. Goal condition had a direct and significant relationship to performance on the final trial (β = .14, p < .01). The strongest relationships were for baseline performance (β = .54, p < .001) and beliefs (β = .32, p < .001). The beliefs composite predicted 10% of the variance even after all other variables were entered, and it was more highly related to final trial performance than was age. These results bolster the social learning theory view that beliefs as well as goals can operate as self-regulatory influences on performance over trials. Correlations among variables at the final trial, with age variance removed, are shown in Table 2.

**DISCUSSION**

Variations in perceived control over memory, alone or in combination with goal-condition differences, were significantly related to memory performance, memory self-efficacy, and general memory self-ratings. These findings support the view that particular beliefs are central to successful task performance (Miller & Lachman, 1999). As we expected, the high perceived control adults had higher scores at baseline and were able to maintain their scores and their positive beliefs over trials, with and without goals. In addition, minimal change occurred across trials for the low control groups without goals. They performed more poorly overall, with the lowest scores by the older low control group, as we expected. The most striking finding was that the low perceived control groups responded very well to goal setting, especially the younger adults. These results supported the notion that high control is associated with less responsiveness to contextual testing factors such as goal setting (Cavanaugh et al., 1998). At the same time, the results demonstrated the significant impact that goal setting can have (Latham & Lee, 1986) for adults with low perceived control.

As we hypothesized, the younger high control participants showed signs of self-regulated learning—performing well even without externally set goals, positively rating their own performance, setting higher goals, and improving or maintaining performance across trials. The younger low control participants were able to raise their final trial performance to the level of the high control younger adults only when they had a goal in mind.

We had predicted that the older low control group would show the lowest scores, and this was indeed the case. For the older adults, we had also expected that the low control group without goals would show the lowest performance gains over trials, but, in fact, the younger and older low control groups without goals responded similarly, with no real score gains over trials.

Both age groups showed higher performance after goal setting, but the response was more positive by the younger adults, as we predicted. There were significant age interactions with the goal conditions for self-efficacy, with only the younger adults showing a significant difference in self-efficacy between goal and no-goal conditions. In fact, no older adult group showed increased self-efficacy after goal setting. It is possible that older adults, because they have a reduced self-efficacy overall, are less responsive than younger adults to performance shifts. Older adults responded differentially to goals in another way as well. There was a significant age interaction with control beliefs for goal selection, with significant differences based on control beliefs for the younger and not the older adults. The high control older adults did not set higher goals for themselves than the low control older adults. Because of lower overall self-efficacy, older adults may be unwilling to set high goals. Alternatively, as suggested by earlier research, it is possible that older adults do not understand how to set appropriate goals for themselves (West & Thorn, 2001). On the other hand, the selected level of one’s goal does not seem to be as important here as the fact of setting a goal. For the older adults who set goals, the goal level did not vary as a function of perceived control. Both the high and low control older groups set their goals near 60%. However, those older adults in the low control no-goal group revealed lower scores on the final trial on all measures. If the selection of a particular goal level was the critical determining factor, we would have expected to find interactions of age and control on other measures, but we did not. These data are consistent with other recent investigations of memory-related goal setting and aging; goal setting appears to have a larger and more reliable impact on younger adults than on older adults (e.g., West & Thorn, 2001; West et al., 2001, 2003).

Goal theory suggests that goal-setting can play a motivational role, as it did here, pushing people to perform better (in the case of the poorer performing low control group) or to maintain effort (in the case of the high control group) across challenging test trials (Lee, Locke, & Latham, 1989; Mento, Steel, & Karren, 1987). Our results confirm the general impact of goals on performance and related beliefs about performance. In addition, there is some suggestion in the social learning and goal literature that higher levels of self-direction can be associated with higher goals and greater commitment to those goals (Bandura & Wood, 1989; Locke, Frederick, Lee, & Bobko, 1984; Schunk, 1991), although little is known about the relationship between goal selection and control beliefs, per se, and no earlier aging studies have been found on this issue. Here, a significant effect of control beliefs on self-selected goals was found for younger adults, who have higher memory ability, whereas older adults set their goals fairly low regardless of perceived control, confirming previous evidence showing that goal choice is predicted by both ability and beliefs (e.g., Locke et al., 1984).

The regression evidence points to the interrelationship of beliefs and performance, although the causal direction of this relationship cannot be specified unequivocally. On the baseline trial, age and beliefs showed a significant relationship to performance. Other influences on performance could also be important—for example, processing capacity factors such as working memory or specific memory techniques. In the regression for the final trial, baseline ability was a “stand-in” to represent such capacity factors. Nevertheless, goal condition and beliefs still showed a strong relationship to memory with baseline scores and age variance removed, supporting the view

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control</th>
<th>Recall</th>
<th>Self-Efficacy</th>
<th>Self-Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recall</td>
<td>.32* (.34**)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>.21* (.15)</td>
<td>.45** (.33**)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-rating</td>
<td>.41** (.35**)</td>
<td>.55** (.66**)</td>
<td>.46** (.28*)</td>
<td></td>
</tr>
<tr>
<td>Goals</td>
<td>.32*</td>
<td>.40**</td>
<td>.31*</td>
<td>.44**</td>
</tr>
</tbody>
</table>

Notes: All correlations have age variance removed; baseline trial correlations are shown parenthetically. *p < .05; **p < .005.
that performance across trials could reflect the combined influence of basic ability, and self-regulatory beliefs that may operate to maintain, raise, or lower effortful processing over trials (Bandura, 1995). At the same time, it is also possible, given the methodology used here, that performance influenced beliefs as much as the reverse. A study of these factors, using a trial-by-trial analysis, would be necessary to clearly identify the patterns of causality.

Other limitations of this research include the fact that no specific mechanisms that may drive goal effects were measured; these lists and procedures were not amenable to analyses of attention, effort, or strategies. In addition, no baseline individual difference variables, such as intelligence or verbal ability, were assessed. However, it is unlikely that the results can be explained by such differences. For instance, if intellectual ability were driving the results, we would expect to find few effects of control or condition. Future investigations of goal setting in relation to control beliefs should examine mechanisms, such as strategy usage, that might explain performance changes for particular groups. For instance, it might be that the high control groups maintained high levels of strategy usage throughout the investigation, whereas the low control groups might have employed strategies primarily when motivated by a goal. There is considerable literature to suggest that goals can increase the use of effective strategies (Bandura, 1997; Locke & Latham, 1990).

One interesting issue has to do with the potential moderating impact of control beliefs on goal effects; for example, do high and low perceived control groups respond to goal-setting conditions in the same way? In this investigation, they did not. Furthermore, in research by Bandura and Wood (1989), using manipulated control beliefs for a specific task, the high and low control groups did not respond in the same way. In that particular study, however, all groups received goals, and a stronger response was found by the high control group than by the low control group. Our effects were the opposite, possibly as a result of greater task complexity in Bandura and Wood’s study (1989) or a greater number of trials (18 trials). The evidence in this study suggests that goals were not required for high levels of performance, nor did goals enhance performance, for the high perceived control participants. For the low perceived control participants, goals were necessary for them to show performance gains over time. In the no-goal condition, the low perceived control group had difficulty maintaining scores on most measures, showing slight declines on all variables at the final trial. We would anticipate that, over an extended series of trials without goals, the low control participants would have shown even greater declines over time, and that those declines would be more likely among the older group because of their lower self-efficacy. In this study, participants set their own goals and may not have made them especially challenging. An interesting variation on this research would be to have the experimenters set the goals and set them for high challenge. Under those circumstances, we would expect to find the kind of results reported in Bandura and Wood (1989), with a better response to goals by the high control groups. Further investigation of this phenomenon could add to our theoretical knowledge about the interrelationship of self-regulatory beliefs with goals.

The present results may have implications for memory intervention studies for older adults. These results provide theoretical support for intervention studies targeting beliefs about memory along with memory performance. Memory beliefs are significantly related to performance, and more so after a series of test trials. Mixed results have occurred in intervention studies attempting to manipulate beliefs (Best, Hamlett, & Davis, 1992; Caprio-Prevette & Fry, 1996; Lachman, Weaver, Bandura, Elliott, & Lewkowicz, 1992; Schmidt, Zwart, Berg, & Deelman, 1999). However, few investigators considered the possibility of differential intervention effects as a function of a priori beliefs. Goal setting had a particularly important impact on performance for the low perceived control participants here. In addition, our results suggest that interventions that train participants to set motivating performance goals may be successful in raising performance outcomes, and this approach has yet to be tested in intervention studies.

These results emphasized the impact of self-regulatory factors on memory, specifically control beliefs and goal setting. A possible direction for future research might be to examine beliefs and goal conditions in relation to broader concepts in the adult social cognition literature as recommended by Berry (1999). Researchers in the area of social cognition have long recognized the dynamic, multidimensional character of self-representations (Klein & Loftus, 1993; Markus & Wurf, 1987). As a way to broaden the investigation of control beliefs and memory aging, personal beliefs about the self as a memorizer could be assessed in the context of more general efficacy scales (e.g., Rodin & McAvay, 1992) or broader conceptions of the self (Filipp & Klauer, 1986; Markus & Herzog, 1991). It would be interesting to examine age differences in the salience or schematicity of memory beliefs—that is, their importance to the individual as central beliefs predicting overall self-representation (Berry & West, 1993; Cavanaugh et al., 1998). There is accumulating evidence in the empirical literature that the relationship between memory scores and memory beliefs (whether they are general complaints or self-regulatory beliefs assessed in the context of a specific task situation) might be different for older adults than for younger adults (Berry, 1999).

In our research, for example, significant changes in performance after goals occurred for the older adults but did not lead to corresponding changes in self-efficacy, as it did for the young (also see West & Thorn, 2001; West et al., 2001, 2003). In other investigations, the relationship of beliefs to performance was stronger for the older group (Berry, 1999). It may be the case that older adults’ beliefs about their memory skill, or lack thereof, are strongly held and less responsive to experimental conditions. The power of one’s memory beliefs to shape one’s total view of the self may influence reactions to experimental manipulations such as goal setting, affecting a person’s ability to regulate performance under changing task conditions.

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