Longitudinal Change and Prediction of Everyday Task Competence in the Elderly

SHERRY L. WILLIS
Pennsylvania State University
GINA M. JAY
University of Michigan
MANFRED DIEHL
State University of New York, Albany
MICHAEL MARSISKE
Pennsylvania State University

The present study examined longitudinal change in everyday task competence in a sample of 102 community-dwelling older adults from central Pennsylvania. Subjects were assessed on cognitive abilities, intellectual control beliefs, and everyday task competence in 1979 and 1986. The results indicated significant mean level decline on everyday task competence. However, wide individual differences were apparent in the timing and rate of decline; 62% of the sample remained stable or improved in competence over this seven-year period. Structural equation analyses were conducted to examine lagged relationships among the ability, intellectual control, and everyday task competence constructs. Fluid reasoning ability was a significant longitudinal predictor of subsequent everyday task competence. Everyday task competence was a significant longitudinal predictor of subsequent self-efficacy beliefs regarding intellectual aging. The results suggest that mean level decline in everyday task competence may not represent the intraindividual developmental trajectory of many subjects. Prior level of fluid ability influences subsequent everyday task competence, and prior level of everyday task competence influences levels of self-efficacy beliefs.

Although an increasing number of studies (Poon, Rubin, and Wilson 1989; Sinnott 1989) have examined the elderly's functioning on tasks of daily living, there has been virtually no longitudinal research

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examining age-related changes in competence and limited research on the antecedents of everyday cognition. Research on everyday cognition is of importance from both basic and applied perspectives. With regard to theories of cognitive aging, the study of the relationship between basic units of cognition (e.g., mental abilities) and complex forms of behavior (e.g., everyday activities) is of interest. From an applied perspective, the ability of the old to perform activities considered important for independent living becomes of increasing concern as the age structure of the society shifts upward.

This study addresses three major questions:

1. What pattern(s) of age-related change on tasks of daily living are exhibited by older adults? What proportion of older adults show reliable change in everyday task competence, when individual change trajectories are examined, rather than change at the level of mean scores?
2. What are the most salient antecedents or predictors of competence on everyday tasks?
3. What is the directionality of influence among the variables studied?

With respect to the first question, two somewhat differing perspectives on the adequacy of older adults' functioning on everyday tasks are present in the literature. Some researchers consider older adults to be functioning relatively well in their daily lives and question the discrepancy between older adults' poor scores on traditional cognitive measures, as compared to their performance in activities of daily living (Rabbitt 1977). Salthouse (1990) states: "One of the greatest challenges in the field of psychology and aging is to account for the discrepancy between the inferred cognitive status of older adults based on their performance in psychometric testing situations and cognitive laboratories and that derived from observations of their successful functioning in everyday situations" (p. 310). On the other hand, studies of everyday problem solving have reported that seniors perform more poorly on everyday tasks, compared to the performance of middle-aged adults (Camp, Doherty, Moody-Thomas, and Denney 1989; Cornelius & Caspi 1987).

The second question, concerning antecedents of everyday tasks, is related to several issues in the study of cognitive aging. First, there is debate over the role of chronological age in accounting for individual differences in everyday tasks competence. A number of cross-sectional studies have focused on age as the primary independent variable in examining group differences in practical problem solving (see Sinnott 1989). The lower performance of the old, when compared to younger age groups, is often interpreted as representing age-related decline. However, age is an index variable, and has little or no explanatory value per se in defining the particular processes or experiences that are related to change in functioning.

The search for more meaningful predictors of everyday problem solving has led to consideration of the relationship between the more traditional approaches to the study of intelligence and performance on tasks of daily living. Several theorists (Baltes, Dittmann-Kohli, and Dixon 1984; Sternberg 1985) have suggested that intelligent behavior involves multiple forms of intelligence. Baltes et al. (1984), for example, distinguish between the "mechanics" of intelligence, involving basic mental abilities and information-processing skills, and the "pragmatics" of intelligence, which are concerned with complex, practical problem solving. There is the question of the extent to which the laboratory ability and processing tasks traditionally studied by psychologists represent the mechanics underlying the pragmatic tasks of daily living. In line with the mechanics versus pragmatics distinction in the study of intelligence, a hierarchical model is proposed for investigating the relationship between traditional abilities and processes and various domains of everyday problem solving (Willis 1987, 1991; Willis and Marsiske 1991; Willis and Schaie 1986). Basic abilities and mental processes are the cognitive mechanics underlying everyday task performance and thus are important predictors of older adults' everyday tasks competence. From this perspective, basic abilities and processes are considered to be universal across cultures. When nurtured and directed by a particular context, the abilities are reflected in domain-specific competencies, including proficiency in tasks of daily living. Because everyday tasks are complex, it is assumed that more than one ability is involved in task performance; however, the specific subset of abilities related to a particular domain of everyday competence must be determined empirically. Furthermore, effective functioning on basic abilities is seen as a *necessary but not sufficient condition* for the successful solution of practical problems; affective and social components are also involved in everyday competence.

Although prior research has examined only concurrent ability correlates, findings from several studies indicate that performance on psychometric abilities is significantly related to everyday task competence. Camp et al. (1989) reported a positive relationship between inductive reasoning ability and the generation of effective solutions to household problems (e.g., what to do when the refrigerator breaks down). In two studies, higher scores on fluid and crystallized intelligence measures were associated with the solution of interpersonal conflict problems (Cornelius and Caspi 1987; Cornelius, Kenny, and Caspi 1989). In prior research (Willis and Marsiske 1991; Willis and Schaie 1986), the authors found positive concurrent relationships between fluid and crystallized abilities, educational level, and performance on everyday tasks involving printed materials (e.g., medicine bottle labels, bus schedules, guarantee forms), with fluid intelligence being the strongest correlate of task competence. These findings on the relationship between traditional abilities and everyday competence are especially encouraging, because the relationship was found when examining different domains of everyday competence and using different procedures for assessing everyday functioning.

Virtually all of the prior research on everyday tasks has been cross-sectional in design. Longitudinal studies are needed both for examining the individual trajectories of age-related change and for explicating long-term predictors of everyday task performance in old age. A longitudinal approach is particularly critical in examining a hierarchical model of the relationship between performance on traditional abilities and everyday problem solving. Our hierarchical perspective assumes not only a significant relationship between laboratory processes and everyday tasks, but also defines the directionality of influence among the variables over time—the third question of the study. If functioning on basic abilities is an important antecedent of subsequent everyday task competence, then the temporally lagged paths from abilities to everyday task competence should be significantly greater than the reciprocal path.

Our hierarchical perspective also suggests that factors other than cognitive abilities are related to everyday task competence. Few studies have examined the relationship of self-efficacy and intellectual control beliefs to everyday task competence. Although the relationship between traditional abilities and personal control beliefs in regard to intellectual aging has been studied recently (Lachman and Leff 1989; Willis and Jay 1989a), it is unclear how performance on everyday tasks is related to perceptions of intellectual competence. Fluid ability has been found to be a significant predictor of internal and external control beliefs regarding intellectual aging; however, intellectual control beliefs were not significant predictors of fluid or crystallized abilities (Lachman and Leff 1989). There has been virtually no research on whether the elderly's beliefs regarding their intellectual competence are predictive of subsequent everyday task competence, or whether their ability to perform tasks of daily living subsequently affects their intellectual control beliefs.

The present study addresses these issues by examining longitudinal change in everyday task competence using data from the Adult Development and Enrichment Project (ADEPT). The ADEPT project is a short-term longitudinal study assessing change in cognitive abilities and control beliefs over a seven-year interval. In the present study several issues were examined. First, age-related change on a measure of everyday tasks was assessed. Second, predictors of everyday task competence were examined, not only by the more typical multiple regression analyses, but also by employing cross-lagged correlational analysis (Kenny 1979) and structural equation analyses (see Hanushek and Jackson 1977) in order to examine the temporal direction of the relationships among abilities, intellectual control beliefs, and everyday task competence.

Method

SUBJECTS

The sample was comprised of 102 White community-dwelling older adults (16 males, 86 females) from rural, central Pennsylvania. All subjects had participated in the first phase of the ADEPT study in 1979 and were retested in 1986. The mean age of the sample ($N = 102$) in 1986 was 76.9 years (Range = 69-93; $SD = 5.74$), with no significant gender difference in age. Mean educational level was 12.08 years

(Range = 6-22; *SD* = 3.25); men had a significantly higher level of education (*M* = 13.56 years) than women (*M* = 11.80; $t[100] = 4.08$, $p < .05$). The average annual income was $9,200 (Range = $1,000 – $28,000). The majority of the sample were widowed (55%), while 36% were married, and 9% were single or divorced. On average, subjects rated their health as good, and reported themselves as being moderately happy.

Sample attrition. In 1979 a total of 237 subjects (51 males, 186 females) had participated in the ADEPT study. Of the 135 participants who did not return in 1986, 38.5% were deceased; 27.4% were ill or had sensory problems that prohibited their continued participation; 5.9% were living in nursing homes; 16.3% had moved and could not be contacted; and 11.9% were not interested in continuing.

In 1979, returnees and dropouts did not differ significantly in age, educational level, self-rated vision or hearing, or in number of doctor visits during the previous year. However, significant differences between returnees and dropouts were found in self-reported health status ($p < .004$), with returnees rating themselves in better health. Significant differences between returnees and dropouts were found for three of the ability factors (fluid, crystallized, and speed), with returnees' scoring higher on the factors. It should be noted that the reduced sample for this study is still representative of noninstitutionalized older adults in terms of educational level and income; the median educational level for older adults in the United States is 12.0 years (Kominski 1988), and the mean per capita family income of households headed by a person over age 65 is $9,080 (Palmore 1988).

PROCEDURE

Testing procedures in 1986 were very similar to those employed in 1979. Subjects were assessed in small groups of 3-12 persons by a young adult tester and a proctor. Individual testing was required for a few subjects, due to sensory limitations or transportation problems. The test battery was administered in two 3-hour sessions with multiple rest breaks per session. The two testing sessions were usually held within a 10-day period. Tests were administered in an invariant order within each testing session. All testing was conducted in facilities (e.g., senior citizen center) in the communities where the subjects resided.

MEASURES

Ability battery. The same psychometric ability battery was administered in 1979 and 1986. The battery was developed within the fluid (Gf) and crystallized (Gc) model of intelligence (Cattell 1971) and included multiple marker tests of four broad, second-order dimensions of intelligence: Fluid intelligence (Gf), crystallized intelligence (Gc), memory (Ms), and perceptual speed (Ps) (see Table 1). This four-factor ability structure was identified via confirmatory factor analyses in 1979 (Baltes, Cornelius, Spiro, Nesselroade, and Willis 1980). Longitudinal invariance of the factor structure from 1979 to 1986 was established (Willis and Jay 1989b). The seven-year test-retest stabilities of the four ability factors were: Gf = .88; Gc = .83; Ps = .64; Ms = .40.

The primary abilities of Figural Relations (CFR) and Induction (I) were selected to represent fluid intelligence. The marker tests of these abilities require subjects to discern a pattern of relationships within an array of figures, letters, and numbers. Crystallized intelligence was represented by the primary abilities of Experiential evaluation (EMS) and Verbal Comprehension (V). The EMS measures required subjects to generate solutions to problems of a social nature. The verbal measures represented recognition vocabulary tests of varying difficulty level. Measures of Semantic Relations (CMR), which require subjects to select words to complete verbal analogies, marked both fluid and crystallized intelligence. Memory was represented by the primary mental ability of Memory Span (Ms); marker tests assessed the number of digits subjects could hold in memory, in forward and backward order. The dimension of Speed was represented by the primary ability of Perceptual Speed (Ps); measures assessed the speed with which subjects made simple visual discriminations.

All but two of the measures were adapted versions of published psychometric ability tests. Adaptation of the measures took two forms: (a) enlargement of test stimuli to facilitate administration to elderly subjects, and (b) reduction of the number of test items to facilitate administration of the battery in two sessions. The ADEPT Figural Relations Test and the ADEPT Induction Test were developed during the 1979 phase of the study (Blieszner, Willis, and Baltes 1981; Willis, Blieszner, and Baltes 1981). The alpha reliabilities for the 17 tests ranged from .96-.72, with two exceptions: the Verbal Analogies (alpha =

TABLE 1
The ADEPT Ability Battery: Second-Order Dimensions, First-Order Primary Mental Abilities, and Marker Tests

General Dimension	*Primary Ability*	*Test*	*Source*
Gf	CFR	Culture Fair Test (Scale 2, Form A) and Power Matrices (scale 3, Form A, 1963 ed., and Form B, 1961 ed.)	Cattell and Cattell (1957, 1961, 1963)
	CFR	ADEPT Figural Relations Diagnostic Test (Form A)	Plemons, Willis, and Baltes (1978)
	CFR	Raven's Advanced Progressive Matrices (Set II)	Raven (1962)
Gf	I	ADEPT Induction Diagnostic Test (Form A)	Blieszner, Willis, and Baltes (1981)
	I	Induction Standard Test	Ekstrom, French, Harman, and Derman (1976) Thurstone (1962)
Gf/Gc	CMR	Verbal Analogies I	Guilford (1969a)
	CMR	Word Matrix	Guilford (1969b)
Gc	EMS	Social Translations (Form A)	O'Sullivan and Guilford (1965) O'Sullivan, Guilford, and de Mille (1965)
	EMS	Social Situations	Horn (1967)
Gc	V	Verbal Meaning (9-12)	Thurstone (1962)
	V	Vocabulary (V-2, V-3, V-4)	Ekstrom et al. (1976)
Ms	Ms	Visual Number Span	Ekstrom et al. (1976)
	Ms	Auditory Number Span	After Ekstrom et al. (1976)
	Ms	Auditory Number Span—Delayed Recall	After Ekstrom et al. (1976)
Ps	Ps	Finding A's	Ekstrom et al (1976)
	Ps	Number Comparisons	Ekstrom et al. (1976)
	Ps	Identical Pictures	Ekstrom et al. (1976)

NOTE: This table presents the hypothesized relationship among broad-second order dimensions, primary mental abilities, and specific marker tests, as expressed in the Gf/Gc theory of intelligence (e.g., Cattell 1971). Hypothesized broad dimensions include fluid intelligence (Gf), crystallized intelligence (Gc), Memory (Ms) and Speed (Ps). Hypothesized primary mental abilities include Figural Relations (CFR), Induction (I), Verbal Comprehension (V), Experiential Evaluation (EMS), Semantic Relations (CMR), Memory Span (Ms), and Perceptual Speed (Ps).

.69) and Word Matrix (alpha = .50) tests. It should be noted that factor scores, rather than individual test scores, were used in the present analyses. Because only the shared variance in the common factor space was used to define the ability variables, factor scores have higher reliabilities than the individual tests, although the reliability of factor scores cannot be directly computed.

Everyday task measure. The measure of everyday task competence was the Educational Testing Service's *Test of Basic Skills* (ETS 1977). This 65-item measure assessed the subjects' ability to comprehend everyday tasks involving printed materials, such as charts and forms (e.g., weight chart), labels (e.g., medicine bottle label), technical documents (e.g., guarantee), and text materials (e.g., letter to newspaper editor). In the absence of a well-established conceptual model with which to define the domain of everyday tasks (Willis forthcoming), a content analysis of the ETS Basic Skills items was undertaken to determine the proportion of items that represented Instrumental Activities of Daily Living (IADLs) (Lawton and Brody 1969). The IADLs represent task domains (e.g., shopping, food preparation, transportation, ability to handle finances) in which effective functioning is considered essential to live independently in our society. More than 58% of the items represented tasks associated with the IADLs. The ETS Basic Skills score is the total number of items answered correctly. The test-retest stability of the measure was .82.

Intellectual control beliefs measure. Intellectual control beliefs were assessed by the Personality-in-Intellectual-Aging Contexts (PIC) inventory. The PIC was developed in the first ADEPT phase to measure older adults' beliefs and attributions regarding their own cognitive functioning (Lachman 1983, 1986). The PIC is of particular interest with regard to everyday task performance in the elderly, because the items tap the elderly's own perception of their competence in performing everyday activities. A typical PIC item is "When paying in a restaurant for meals or in a store for clothes, I am able to understand the bill." The PIC has six scales. Three PIC Locus of Control scales (internal, chance, powerful others) assess evaluations of one's capabilities and attributions regarding control of intellectual competence. A PIC achievement scale examines the perceived importance and meaning of intellectual competence. A PIC anxiety scale assesses affective reactions to intellectually demanding tasks, and a PIC morale scale examines degree of perceived change in intellectual competence with age. Prior confirmatory factor analyses (Lachman 1983; Willis and Jay 1989a) identified two second order factors:

Intellectual self-efficacy (SE), marked by the internal control scale and achievement, and concern about intellectual aging (CA), marked by the chance and powerful others control scales, and the anxiety and morale scales.

Results

The study findings are reported in three sections. First, age-related change in everyday task competence is reported. Second, the longitudinal predictors of everyday task competence are examined. Third, the 1979-1986 reciprocal relationships among abilities, intellectual control beliefs, and everyday task competence are assessed.

Derivation of scores. Factor scores were calculated for the four ability dimensions (Gf, Gc, Ps, Ms), and the two second-order PIC factors (SE, Ca) in 1979 and 1986. The factor weights, in both instances, were derived from the factor loadings of longitudinal confirmatory factor analyses examining the stability of the two structures (Willis and Jay 1989a, 1989b). The 1979 and 1986 ability and control factor scores and the ETS scores were scaled, using the 1979 score as the base (M = 50; SD = 10) to facilitate comparison of the magnitude of change across the two occasions. The total sample in 1979 (N = 237) served as the standardization base, so that scores reflect the relative magnitude of positive attrition effects.

The ability and control factor scores and the t-scores for the ETS Basic Skills measure were used in the correlational and structural analyses described below. The intercorrelations among the ability, intellectual control, and ETS Basic Skills constructs for 1979 and 1986 are presented in Table 2 and Table 3. The correlations corrected for reliability are shown in parentheses.

LONGITUDINAL CHANGE IN EVERYDAY TASK COMPETENCE

Mean change in ETS Basic Skills scores and ability factors. The mean scores on the ETS Basic Skills test in 1979 and 1986 were 53.88 (SD = 8.42) and 50.72 (SD = 8.96), respectively. The mean decline of .30 SD units over the seven-year interval was significant ($t[101]$ = –6.09, p < .0001). Significant mean decline (p < .05) was also found

TABLE 2
Ability and Basic Skill Construct Intercorrelations

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1. Gf 1979	--									
2. Ms 1979	.32	--								
3. Gc 1979	.83	.35	--							
4. Ps 1979	.51	.35	.51	--						
5. ETS 1979	.87	.36	.83	.64	--					
6. Gf 1986	.88	.30 (.38)	.71 (.65)	.48 (.49)	.80 (.76)	--				
7. Ms 1986	.59 (.47)	.40	.49 (.36)	.31 (.25)	.51 (.39)	.70	--			
8. Gc 1986	.75 (.82)	.15 (.20)	.82	.41 (.46)	.74 (.77)	.76	.58	--		
9. Ps 1986	.64 (.62)	.26 (.32)	.52 (.47)	.64	.66 (.61)	.75	.61	.66	--	
10. ETS 1986	.81 (.85)	.26 (.34)	.70 (.68)	.52 (.56)	.82	.88	.69	.82	.76	--

NOTE: Correlation coefficients larger than .18 are significant at $p < .05$. Values in parentheses represent correlations corrected for reliability. Abbreviations are used as follows: fluid intelligence (Gf), crystallized intelligence (Gc), memory (Ms), and speed (Ps). ETS stands for the Educational Testing Service's *Test of Basic Skills.* The years, 1979 and 1986, indicate when the tests were recorded.

TABLE 3
Control and Basic Skill Construct Intercorrelations

	1	*2*	*3*	*4*	*5*	*6*
1. PIC SE 1979	--					
2. PIC CA 1979	–.64	--				
3. ETS 1979	.33	–.46	--			
4. PIC SE 1986	.59 (–.39)	–.43 (.54)	.52	--		
5. PIC CA 1986	–.50 (–.55)	.61	–.51 (–.59)	–.72	--	
6. ETS 1986	.30 (.29)	–.39 (–.34)	.82	.49	–.56	--

NOTE: Correlation coefficients larger than .18 are significant at $p < .05$. Values in parentheses represent correlations corrected for reliability. Abbreviations are as follows: intellectual self = efficacy as measured by the Personality in Intellectual Aging Contexts (PIC) inventory (PIC SE), concern about intellectual aging as measured by the PIC inventory (PIC CA), and score on the Educational Testing Service's *Test of Basic Skills* (ETS). The years indicate when the results were recorded.

for the ability factors of fluid (1979 M = 52.12, SD = 7.79; 1986 M = 49.36, SD = 7.90) and crystallized intelligence (1979 M = 51.42, SD = 8.07; 1986 M = 49.57, SD = 9.08), and perceptual speed (1979 M = 51.27, SD = 7.80; 1986 M = 46.68, SD = 8.31). No decline was found for memory span (1979 M = 52.21, SD = 7.99; 1986 M = 53.34, SD = 9.08).

Proportion of subjects exhibiting change in ETS Basic Skills competence. Assessment of change in terms of mean score level is subject to shifts in interindividual variability across occasions, as represented by the standard deviation; however, these parameters do not provide information on intraindividual change trajectories. As an assessment of intraindividual change, the proportion of subjects who had remained stable versus those who exhibited reliable change on the everyday task measure was examined. The statistical criterion for the definition of intraindividual change was one standard error of measurement (SEM) or greater over the 1979-1986 interval (Dudek 1979; Schaie and Willis 1986). Subjects were first classified by defining a 1 SEM confidence interval about their observed 1979 score. If their 1986 score fell below this interval, they were characterized as having decline. Subjects' whose 1986 score fell within + 1 SEM of their 1979 score were classified as stable on everyday task performance. Subjects' whose 1986 score was more than 1 SEM above their 1979 score were classified as having reliably improved in performance. The majority of the sample (57%) exhibited stability in everyday task competence, while 38% had declined and 5% had improved.

LONGITUDINAL PREDICTORS OF EVERYDAY TASK COMPETENCE

Both 1979 personal and ability variables were examined as predictors of 1986 ETS Basic Skills competence, using simultaneous multiple regression analysis. The 1979 personal variables included age, educational level, and subject's self-rating of general health. More than 70% of the variance in 1986 Basic Skills competence was accounted for by the predictor variables, with 52% of the variance being accounted for by the 1979 fluid intelligence ability factor (Table 4). Note that personal factors accounted for a relatively small proportion of the variance; age accounted for 5% and educational level

TABLE 4
Simultaneous Multiple Regression of Everyday Task Competence

Predictor	*beta*	t*[1]*	*Partial* R^2	R^2
Gf 1979	.643***	6.062	.520	
Gc 1979	.161	1.469	.114	
Ps 1979	.124	1.791	.066	
Ms 1979	–.023	–0.367	(.006)[a]	
Education 1979	–.112	–1.380	(.058)	
Age 1979	–.162**	–2.650	.048	
Health 1979	–.053	–0.853	.016	.70

NOTE: Values in parentheses represent negative estimates for variance terms. Abbreviations are as follows: fluid intelligence (Gf), crystallized intelligence (Gc), speed (Ps), and memory (Ms). Years indicate when results were recorded.
a. Partial R^2 terms were computed according to Hays (1963).
**$p < .01$; ***$p < .001$.

accounted for 6% of the variance. Partial variance components were computed according to Hays (1963).

RECIPROCAL RELATIONS AMONG ABILITIES, INTELLECTUAL CONTROL, AND ETS BASIC SKILLS COMPETENCE

Findings from the preceding regression analysis indicated that intellectual ability factors were the most salient predictors of everyday task competence. However, this analysis, as well as prior research involving concurrent ability correlates, is based on assumptions regarding the directionality of relationships among the criterion and predictor variables. In this section, findings of analyses are reported which examined whether the path from 1979 ability and control variables to 1986 everyday task competence was significantly greater than the reciprocal paths.

Because ability, control, and everyday task measures were administered in 1979 and 1986, it was possible to examine reciprocal relationships among the measures across the seven-year interval. Reciprocal relationships were studied employing two procedures, cross-lagged correlational analyses and structural equation analyses. Cross-lagged correlational analyses permitted examination of the reciprocal relationships separately for each ability and control factor. The structural equation analyses provided an overall assessment of the relative strength of relationships between abilities and the ETS in a single model. Likewise, the reciprocal relationships between intellectual control dimensions and the ETS were examined in a single model.

Cross-lagged correlational analyses. A series of cross-lagged correlational analyses were conducted to examine whether there were significant cross-lagged differences in correlations, adjusted for reliability (Kenny 1979). First, cross-lagged analyses were conducted to examine significant differences in the correlation between each ability in 1979 and each of the abilities in 1986. The correlation between fluid ability in 1979 and ETS Basic Skills in 1986 was significantly larger than the correlation between the ETS in 1979 and fluid ability in 1986 ($z = 2.4$; $p < .01$). In contrast, the correlation between the ETS Basic Skills in 1979 and crystallized ability in 1986 was significantly greater than the correlation between crystallized ability in 1979 and ETS in 1986 ($z = 1.75$; $p < .05$). In addition, the correlations between fluid ability in 1979 and crystallized and perceptual abilities in 1986 were significantly larger than the correlations between these abilities in 1979 and fluid ability in 1986 ($z = 3.21$; $p < .001$; $z = 1.75$; $p < .05$, respectively).

Differences in magnitude of correlations were also examined between control dimensions and the ETS. The correlations between the ETS in 1979 and both the intellectual self-efficacy and concern about intellectual aging factors in 1986 were significantly larger than the correlations between intellectual self-efficacy and concern about intellectual aging in 1979 and ETS in 1986 ($z = 2.88$; $p < .05$; $z = 2.91$; $p < .01$, respectively). In addition, the correlation between 1979 intellectual self-efficacy and 1986 concern about intellectual aging was significantly larger than the correlation between 1979 concern about intellectual aging and 1986 intellectual self-efficacy ($z = 1.91$; $p < .05$).

Structural equation analyses. Two sets of structural equation models were tested, using LISREL VI (Jöreskog and Sörbom 1984). The first set of models examined the pattern of reciprocal relationships from 1979 to 1986 between the four ability factors (fluid and crystallized intelligence, perceptual speed, memory span) and the ETS Basic Skills. The order of models tested was based on findings from the cross-lagged correlational analyses reported above. The first model in this set examined autoregressions for the ability and ETS Basic Skills

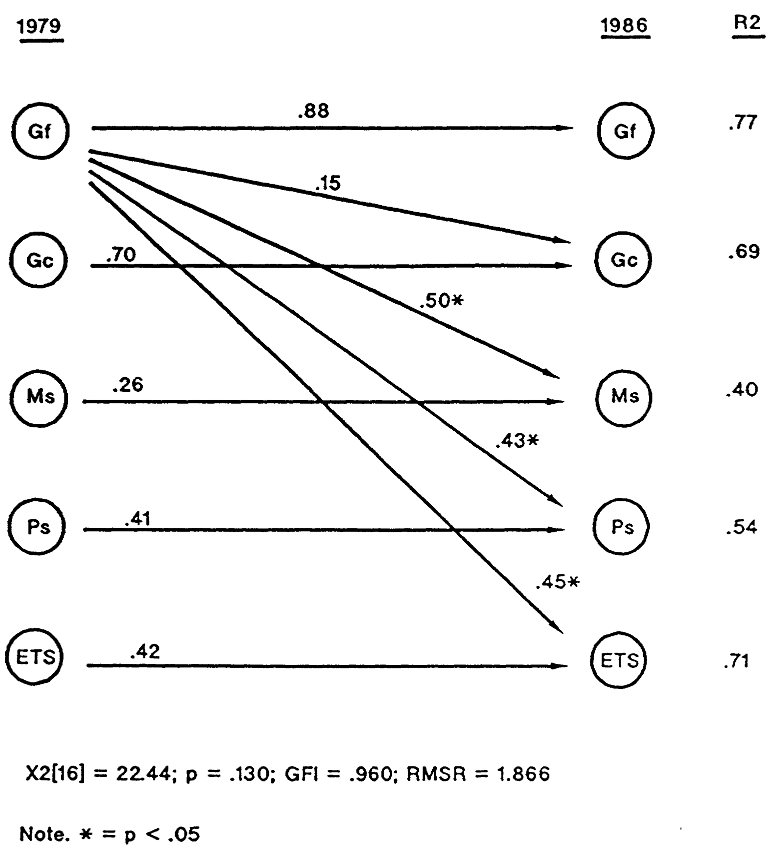

Figure 1: Lagged Relationships Among Cognitive Ability and Everyday Task Competence Constructs from 1979 to 1986.

constructs ($X^2[20] = 72.97$; $p = .000$; $GFI = .889$; $RMSR = 14.989$). Based on findings from cross-lagged analyses, the second model examined the paths between the 1979 fluid intelligence factor (Gf) and all 1986 constructs (the three ability factors Gc, Ps, Ms, and ETS), in addition to the autoregressions. The 1979 fluid intelligence factor was found to be a significant predictor of 1986 performance for the two ability factors of memory span (Ms) and perceptual speed (Ps) and for 1986 ETS performance ($X^2[16] = 22.44$; $p = .130$; $GFI = .960$; $RMSR =$

1.866); however, the path from 1979 fluid intelligence to crystallized intelligence in 1986 failed to reach the level of statistical significance ($t = 1.89; p > .05$). The results from this model are shown in Figure 1.

Because the cross-lagged analyses indicated that the correlation between the 1979 ETS and 1986 crystallized ability was significantly larger than the reciprocal correlation, the third model tested an additional path from the 1979 ETS factor to the 1986 crystallized ability factor. However, this model modification did not result in a significant change in the overall fit of the model ($X^2[15] = 22.40; p = .098; GFI = .960; RMSR = 1.879$); the path from 1979 ETS performance to 1986 crystallized ability failed to reach the level of statistical significance ($t = .20; p > .05$). Thus, the model shown in Figure 1 was accepted as the final model. Greater fluid ability in 1979 was predictive of greater fluid, memory span, and perceptual speed ability and higher ETS Basic Skills scores in 1986.

The second set of models examined the pattern of relationships between the two intellectual control dimensions, intellectual self-efficacy (SE) and concern about intellectual aging (CA), and the ETS. The first model in the set examined autoregressions for the intellectual control dimensions and the ETS ($X^2[6] = 24.84; p = .000; GFI = .931; RMSR = 9.980$). Because the cross-lagged analyses indicated that the correlations between the 1979 ETS and 1986 control dimensions were significantly larger than the reciprocal correlations, the second model examined paths from 1979 ETS to the 1986 control factors, in addition to the autoregressions. The paths from 1979 ETS to the 1986 self-efficacy and concern about aging factors were significant ($t = 14.40$ and $t = -3.78$ respectively, $p < .05$) and contributed to a significant improvement of the overall goodness of fit of the model ($X^2[4] = .99; p = .911; GFI = .997; RMSR = 1.277$). Based on findings from the cross-lagged correlational analyses, the third model tested an additional path from the 1979 self-efficacy factor to the 1986 concern about intellectual aging factor. This path, however, failed to reach the level of statistical significance ($t = -.565; p > .05$) and therefore the model shown in Figure 2 was accepted as the final model. Higher performance on the ETS in 1979 was predictive of higher intellectual self-efficacy beliefs in 1986 and lower scores on concern about intellectual aging in 1986.

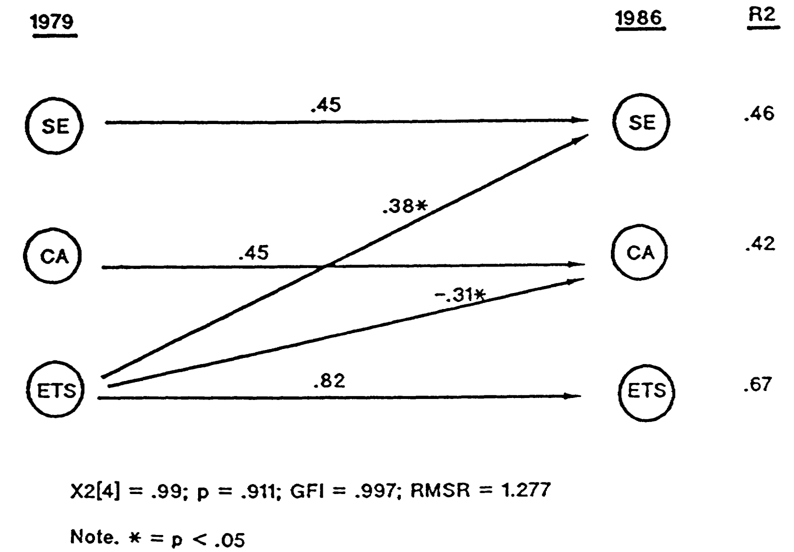

Figure 2: Lagged Relationships Among Intellectual Control Beliefs and Everyday Task Competence Constructs from 1979 to 1986.

Discussion

This study assessed change over a seven-year interval in older adults' everyday task competence and examined the antecedents of competence in these tasks of daily living. Change occurring over this period was of particular interest, because subjects, on average, progressed from young-old to old-old age, a transition that prior longitudinal research indicates is marked by decreases in performance on traditional abilities for many older adults (Schaie 1990).

The study findings on age-related change must be viewed at two levels. First, when assessed at the level of mean scores, older adults' competence in tasks of daily living declined significantly, a magnitude of .30 standard deviation units over the seven-year interval. The findings, when viewed at this level, seem to support previous cross-sectional research in which significant age differences in everyday task performance between young, middle-aged, and older adults have been interpreted as reflecting age-related decline (Camp et al. 1989; Denney and Palmer 1981; Denney, Pearce, and Palmer 1982).

The findings, however, also strongly indicate that study of change solely at the level of mean scores can seriously distort one's understanding of the phenomenon, if it is assumed that change in mean scores reflects the pattern of change experienced by most individuals. Change at the mean score level could be interpreted as suggesting that most individuals experience linear decline in everyday task performance over the seven-year interval. However, the data clearly show that linear decline is not the most common pattern of change for most subjects. These are wide individual differences in the rate and timing of change. When the trajectories of individual subjects were examined, 62% of the sample were classified as showing no reliable decline, while 38% were classified as having reliably declined over the study period. Our finding that mean score change often does not accurately reflect individual trajectories is not unique to this study or the domain of everyday tasks. A similar pattern of findings has been reported for more traditional psychometric abilities in another study (Schaie and Willis 1986). Although significant decline in inductive reasoning ability occurred over a seven-year interval, 63% of the subjects had not declined reliability when change was assessed at the intraindividual level; 37% of the subjects had declined.

While most older adults would be expected to decline in competence in everyday tasks, if they lived into advanced old age, these findings indicate that decline for most individuals does not occur in a linear manner, in direct relation to increasing chronological age. This is reflected in our finding that age accounts directly for relatively little of the variance (5%) in subjects' everyday task competence. It is not the increase in years per se that leads to change in everyday task competence but a concomitant change in the underlying abilities. Both maturational and contextual influences may contribute to cognitive changes in late life.

A major objective of this study was to examine factors that influenced everyday functioning more directly than age per se. In a hierarchical model, it was proposed that basic cognitive abilities and processes are one subset of salient antecedents of everyday functioning. These hypotheses were confirmed. Of the 70% of the variance in everyday competence accounted for in the regression analyses, most of the variance was associated with ability factors. The fluid ability factor alone accounted for 52% of the variance; crystallized ability accounted for an additional 11% of the variance.

This study advances our understanding of the role of ability factors as predictors in three ways:

1. Abilities were studied at the level of latent constructs, rather than in terms of a single measure of an ability. Thus, the predictor variables in this study represented the variance common to the ability construct, rather than test-specific variance.
2. Longitudinal, rather than concurrent predictors, were examined.
3. The directionality of the relationship between basic abilities and everyday task performance was assessed.

The findings on the directionality of influence between abilities and competence in everyday tasks are of interest from both basic and applied perspectives. First, the findings provide additional empirical data to complement prior theoretical work on multiple intelligences (Baltes et al. 1984). A hierarchical perspective of basic abilities as cognitive mechanics underlying the pragmatics of everyday functioning was supported. From a clinical perspective, the findings suggest that the older adults' current level of performance on traditional measures of intelligence may be very useful in predicting later functioning on IADL-type tasks considered critical to ability to live independently. The findings support and extend prior applied studies that have reported significant concurrent relationships between traditional clinical and neuropsychological diagnostic measures and older adults' self-report of functioning on tasks of daily living (Fillenbaum and Smyer 1981; Heaton and Pendleton 1981).

The data also provide some insight into the perceived discrepancy between performance on laboratory tasks and functioning in daily life. Research cited as supporting this discrepancy has typically been single occasion studies, comparing high functioning older adults' performance in an area of expertise with their performance on laboratory measures. In very homogeneous, advantaged older samples, restriction in score range will result in lower correlations among variables. However, even in more heterogeneous samples, older adults' may perform at a much higher level on everyday tasks than on ability measures, yet the rank ordering of individuals on the variables may be quite similar, as evidenced by the high positive correlations found in this study. Furthermore, the pattern of age-related change may be quite similar for the two variables, although change is occurring from a higher baseline level for the everyday tasks than for the abilities.

Why have several studies, including this one, reported fluid ability to be a significant correlate of everyday competence? Two characteristics of fluid ability, which at first appear incongruent with everyday problem solving, must be considered. First, fluid ability is employed in the solution of new or novel problems. Although the elderly report being familiar with the domains of tasks included in studies of everyday problem solving, the particular problem presented in the testing situation involves unfamiliar elements or features. For example, most elderly regularly take prescription medications, but they probably have not encountered the particular medicine bottle label presented by the researcher. The subject must adapt previously learned solution strategies and knowledge to the current problem. Everyday problems may, in fact, be particularly troublesome for the elderly, if they attempt to apply routinized or stereotypical responses to the research problem. Second, fluid ability involves skills and processes that are not domain-specifc. As the name implies, the skills are "fluid" and apply in the solution of diverse problems. Thus, it is reasonable that fluid abilities would be relevant to the solution of everyday tasks involving different spheres of daily living. Solution of everyday problems also involves specialized knowledge (i.e. crystallized intelligence). However, crystallized ability has typically been assessed via a vocabulary test, which may not represent the domain-specific knowledge base of greatest relevance to a particular everyday problem. The role of crystallized abilities, thus, may have been underestimated in prior research.

Findings from the structural equation analyses support and extend previous research on the relationship between intellectual control beliefs and cognitive performance. While previous studies (Lachman and Leff 1989; Willis and Jay 1989a) focused on the relationship between basic mental abilities and intellectual self-efficacy, this study examined the reciprocal relationship between control beliefs and practical aspects of cognition. In all of these studies, cognitive performance, whether represented by basic abilities or everyday cognition, is a more salient predictor of control beliefs than vice versa. In this study, the significant paths from 1979 ETS Basic Skills to 1986 self-efficacy and concern about intellectual aging indicated that older adults' competence in performing everyday tasks is predictive of their subsequent self-efficacy beliefs. Older adults who perform well on tasks of daily living are likely in the future to believe themselves to be competent. This finding is important in that it suggests that older adults may rely on their everyday task performance as an indicator of their perceived level of intellectual competence.

Two caveats to the interpretation of these findings should be noted. First, the ETS Basic Skills test is not a comprehensive measure of everyday task performance but concentrates on tasks involving printed materials. Second, the Basic Skills test is administered as a paper-and-pencil measure with standard time limits; some older adults do not complete the measure within the time limits. Thus, older adults' performance on the ETS test represents their performance under time-limited conditions, as sometimes occurs in everyday life; a higher level of performance may be expected under untimed conditions.

In summary, findings from this study provide insight into the nature of developmental change in everyday task competence in later adulthood. Research on everyday task competence, as a form of practical intelligence, is relatively recent in the study of cognition. Most studies have been cross-sectional in design, with relatively little consideration of everyday task competence from a developmental perspective. Yet design of comprehensive theories of practical intelligence will require study of the patterns of developmental change in everyday task competence and of the antecedents and influences on developmental change. This study represents an initial attempt to examine these issues.

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Sherry L. Willis is Professor of Human Development at Pennsylvania State University. Her current research focuses on cognitive training in later adulthood and ability correlates of everyday task performance.

Gina M. Jay is a Postdoctoral Research Fellow in Public Health and Aging at the University of Michigan. Her current research examines older adults' adaptation to technological change.

Manfred Diehl is currently a Research Associate at the Ringel Institute of Gerontology at the State University of New York at Albany. His research interests examine everyday problem solving in older adults.

Michael Marsiske is a Predoctoral Research Fellow in the Department of Human Development and Family Studies at Pennsylvania State University. His current research interests examine the latent dimensions of everyday problem solving. *He was partially supported by NIA Training Grant T32-AG-00048 awarded to the Pennsylvania State University.*