Age Difference Patterns of Psychometric Intelligence in Adulthood: Generalizability Within and Across Ability Domains

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Abstract

This paper reports cross-sectional data from the fifth (1984) wave of the Seattle Longitudinal Study that bear on the issue of generalizability of age differences in psychometric intelligence within and across ability domains. Subjects were 1628 community-dwelling individuals drawn from a Pacific Northwest health maintenance organization. Age difference patterns of nine groups from mean age 29 to mean age 88 are examined for the domains of Verbal Ability, Spatial Orientation, Inductive Reasoning, Numeric Ability, Verbal Memory and Perceptual Speed. Each ability is marked by three or four observed variables. Differential generalizability of age patterns in psychometric abilities to a survey of everyday tasks are also reported.

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Introduction

There has been much emphasis on a paradigm-shift from cognitive products to cognitive processes as is evidenced in the extensive information processing literature. However, there has also been some recent recognition that there may well be a number of different aspects of intelligence that require attention particularly if we wish to understand the basic parameters of adult intellectual development (cf. Baltes, 1987; Baltes, Dittman-Kohli, & Dixon, 1984; Berg and Sternberg, 1985; Sternberg & Berg, 1987). A hierarchichal model of different aspects of cognitive functioning would lead from the processes that represent the mechanics of cognitive processes through the products represented by psychometric abilities to the everyday tasks that some refer to as practical intelligence. The latter would represent the situationally constrained exercise of various combinations of intellectual products. When we wish to generalize from laboratory studies to those behaviors that are most likely to be found in a person's everyday tasks, it may be suggested therefore that cognitive products as represented in performance on tests of psychometric intelligence are likely to show greater promise than more basic process-oriented measures (cf. Schaie, 1987; Willis, 1987; Willis and Schaie, 1986).

The vast literature on the course of psychometric intelligence over the adult life span has made us familiar with the finding that most abilities tend to peak in early midlife, plateau until the late fifties or early sixties, and then show decline, initially at slow pace, but accelerating as the late seventies are reached (Botwinick, 1977; Cunningham, 1987; Labouvie-Vief, 1985; Schaie, 1980). There remains some controversy, however, on the specific ages at which certain abilities peak and on the ages at which significant decline can first be detected (Botwinick, 1977; Schaie, 1983; Willis, 1985). Data from cross-sectional studies usually draw relatively pessimistic conclusions for those variables where positive cohort trends have been observed, and unduly optimistic conclusions for those variables where cohort trends have been negative. Age-comparative work is often flawed, moreover, because of the fact that it is difficult or impossible to match samples differing widely in age with respect to other variables that might critically effect the dependent variable of interest. Longitudinal studies are consequently often called for, because they control for cohort effects and, of course, allow within-subject comparisons. Nevertheless, longitudinal studies may also yield under- or over-estimates of mean age changes, depending upon whether the longitudinal panel has been exposed to favorable or unfavorable attrition and reactivity effects (Schaie, 1988a). Most of the major existant longitudinal studies of adult development (e.g., Eichorn et al., 1981; Schaie, 1983; Shock et al., 1984; Siegler, 1983; Schmitz-Schertzer & Thomae, 1983) thus far have only very limited data that speak to the issues of generalization of findings within and across domains in the area of intellectual functioning. For the purposes of this workshop, where the emphasis is on the generalizability of experience, cross-sectional data may actually be quite instructive, because such data allows us to draw concurrent comparisons of age difference patterns within and across domains, without requiring attention to the thorny methodological issues of comparisons across time (cf. Schaie, 1977, 1988a).

Although we have argued repeatedly that group comparisons submerge the vastindividual differences within age/cohorts that exceed age differences across age/cohorts by far, we will confine our discussion here to patterns that depict group averages. We do so because the study of intra-individual differences requires repeated measurement data which as yet are not available for all of the ability markers to be considered in this paper. However, individual differences data on those observed variables for which longitudinal data are at hand have been reported elsewhere (cf. Schaie, in press).

The position that we take in this paper and that we will document with empirical data is that there are likely to be substantial life stage differences in adulthood in the degree of congruence that is to be expected both within and across behavioral domains, and moreover that there may well be pronounced differences in the manner in which basic ability components relate to more complex behaviors occurring in everyday circumstances. To do so we will first examine the extent to which patterns of age differences are congruent within a particular ability domain by examining age difference patterns of operational definitions for six psychometric abilities. The abilities to be examined, in turn, broadly sample higher order constructs such as those espoused by Horn (1982). Thus fluid intelligence is represented by the abilities of Inductive Reasoning and Spatial Orientation, while Verbal Ability and Numeric Ability stand as representatives of crysttallized intelligence. Verbal Memory and Perceptual Speed are examined as ability samplars for the memory and speed domains, respectively. We will then consider the congruence of age difference patterns across domains. To explore generalization to more practical issues, we will then examine age differences in a measure of everyday tasks and consider the age difference patterns in the regressions that estimate the proportions of variance in the everyday tasks that can be accounted for by the individuals' level on the psychometric abilities.

Characteristics of the Data Base

The Subject Population

Our inquiry into adult cognitive functioning began some 30 years ago by randomly sampling 500 subjects equally distributed by sex and age across the range from 20 to 70 years from the approximately 18,000 members of a health maintenance organization in the Pacific Northwest (Schaie, 1983; Schaie & Hertzog, 1986). The survivors of the original sample were retested and additional panels were added in seven-year intervals. The sampling frame represents a broad distribution of educational and occupational levels, covering the upper 75 per cent of the socio-economic spectrum. The population frame from which we have been sampling repeatedly has grown to a membership of over 300,000 individuals, but the general characteristics remain very comparable.

The primary data to be examined here include the 1628 community- dwelling individuals (741 males and 887 females) who were examined in the fifth SLS cycle during 1983/85 (see Table 1 for a breakdown by age/cohort). These individuals had an average educational level of 14.3 years (*SD* = 3.06;Range: 1 to 20 years); their family income averaged $23,200 (*SD* = $9,606; Range: $1,000 to $50,000+). Occupational levels were rated on a scale from 0 for unskilled to 9 for professional occupations. Those individuals gainfully employed at the time of assessment averaged an occupational level of 6.8 (*SD* = 1.87). Most frequent occupations represented involve skilled trades, clerical, sales, managerial and semi-professional jobs (also see Schaie, 1988b).

Insert Table 1 about here

The Measurement Variables

The original SLS psychometric ability battery was expanded to permit structural analyses that require multiple measures to mark each ability factor. The longitudinal markers included in this battery of necessity (i.e., for consistency across succesive test administrations), employ the test booklet and answer sheet format used since the beginning of the SLS (Thurstone & Thurstone, 1949). All other forms use disposable booklets upon which answers are marked directly (cf. Ekstrom, French, Harman, & Derman, 1976; Schaie, 1985). Table 2 lists the measures, the primary ability that they mark, their sources, and their test-retest correlations over a two-week interval for a group of 172 subjects. A brief description of the primary abilities and the measures marking them is given below:

Insert Table 2 about here

Inductive Reasoning. This is the ability to educe novel concepts or relationships.

PMA Reasoning. The subject is shown a series of letters (e.g., a b c c c b a d e f f e) and is asked to identify the next letter in the series.

ADEPT Letter Series. This is a parallel form to the PMA Reasoning test.

Word Series. The subject is shown a series of words (e.g., January, March, May) and is asked to identify the next word in the series. Positional patterns used in this test are identical to the PMA Reasoning test.

Number Series. The subject is shown a series of numbers (e.g., 6, 11, 15, 18, 20) and is asked to identify the next number that would continue the series.

Spatial Orientation. The ability to visualize and mentally manipulate spatial configurations, to maintain orientation with respect to spatial objects, and to perceive relationships among objects in space.

PMA Space. The study participant is shown an abstract figure and is asked to identify which of six other drawings represents the model in two-dimensional space.

Object Rotation. The subject is shown a line drawing of a meaningful object (e.g., an umbrella) and is asked to identify which of six other drawings represent the model rotated in two-dimensional space

Alphanumeric Rotation. The subject is shown a letter or number and is asked to identify which six other drawings represent the model rotated in two-dimensional space.

Test stimuli in the Object and Alphanumeric Rotation tests have the same angle of rotation as the abstract figures in the PMA Space test.

Cube Comparisons. In each item, two drawings of a cube are presented; the subject is asked to indicate whether the two drawings are of the same cube, rotated in three-dimensional space.

Verbal ability. Language knowledge and comprehension is measured by assessing the scope of a person's recognition vocabulary.

PMA Verbal Meaning. A four-choice synonym test.

ETS Vocabulary II. A five-choice synonym test.

ETS Vocabulary IV. A five-choice synonym test consisting mainly of difficult items.

Numeric Ability. The ability to understand numerical relationships and compute simple arithmetic functions.

PMA Number. The subject checks whether additions of simple sums shown are correct or incorrect.

Addition. This is a test of speed and accuracy in adding three single or two-digit numbers.

Subtraction and Multiplication. This is a test of speed and accuracy with alternate rows of simple subtraction and multiplication problems.

Verbal memory. The ability to encode, store and recall meaningful language units.

Immediate Recall. Subjects study a list of 20 words for 3 1/2 minutes. They are then given an equal period of time to recall the words in any order.

Delayed Recall. Subjects are asked to recall the same list of words as in Immediate Recall after an hour of intervening activities (other psychometric tests).

PMA Word Fluency. The subject freely recalls as many words as possible according to a lexical rule within a five minute period.

Perceptual speed. The ability to find figures, make comparisons and carry out other simple tasks involving visual perception, with speed and accuracy.

Identical Pictures. The subject identifies which of five numbered shapes or pictures in a row are identical to the model at the left of the row.

Finding A's. In each column of 40 words, the subject must identify the five words containing the letter "a".

Number Comparison. The subject inspects pairs of multi-digit numbers and indicates whether the two numbers in each pair are the same or different.

Tasks of everyday living. A 65-item Basic Skills Assessment test developed at the Educational Testing Service (1977), simulates "real life" tasks. Examples of such tasks included in the test involve reading a bus schedule, identifying locations on a road map, interpreting a medicine bottle label, finding information on the yellow pages of the telephone book, etc. (Test-retest correlation for this measure over a two-week interval is .916).

The Assessment Procedure

The measures described above were administered to small groups of subjects as part of a broader battery that originally required approximately two hours in a single session, but has since grown to a 5-hour battery spread over two sessions. The tests are administered in a standard format and order by an examiner assisted by a proctor. Testing locations are at familiar sites close to the homes of our participants. Subjects first were tested in 1956 and survivors were retested in 1963, 1970, 1977 and 1983/85. The data discussed here, however, are restricted to those obtained in 1983/85.

Statistical Procedures

All scores on the observed variables were rescaled into T score form (*M* = 50; *SD* = 10) using parameters for the total sample. Factor scores for the six intellectual abilities were then computed using factor regression weights based on a previously determined best-fitting factor model (Schaie, Willis, Hertzog, & Schulenberg, 1987; Schaie, Willis, Jay, & Chipuer, 1987). These regression weights are reported in Table 3.

Insert Table 3 about here

Results

We will first consider the congruence of age difference patterns within the specific ability domains, then examine generalizability of age difference patterns for the latent ability factors,and finally report the age difference patterns in regression of the everyday task measure upon the ability factors.

Age Difference Patterns Within Ability Domains

Means and standard deviations for the age difference patterns in the six primary ability factors are reported in Table 4. Results with respect to congruencies among the patterns for the different operations measuring these abilities are described in the following:

Insert Table 4 about here

Induction. This ability has consistently shown the most dramatic cohort effects (cf. Schaie, 1983; in press). However, age differences between the youngest and oldest cohort in our study vary from approximately 1 1/2 SD for the Number Series to almost 2 1/2 SD for the Word Series measures. Although there is close convergence among the different measures from the mid-forties to the mid-seventies, statistically significant differences occur for both the two youngest and two oldest cohorts. The number series test appears to be significantly easier than the word series measure for the young adults, while the reverse situation maintains in advanced old age. The two measures involving letter series fall in between at both ends of the age spectrum (see Figure 1).

Insert Figure 1 about here

Spatial Orientation. Extreme age differences on this ability also differ from about 1 1/2 SD for the three dimensional cube comparison test to approximately 2 1/4 SD for the alphamnumeric rotation test, which contains the most familiar stimulis among the measures involving two-dimensional rotation. No statistically significant differences were found within cohorts, except for the two oldest groups. Here average performance remains relatively higher for the most complex representation of the ability, the cube comparison test (cf. Figure 2).

Insert Figure 2 about here

Verbal Ability. Substantial differences among measures are observed for this crystallized ability. The PMA verbal meaning measure shows age differences exceeding 2 SD similar in magnitude to those observed for measures of fluid abilities. The age differences for the vocabulary tests from the ETS, on the other hand, amount to less than 1/3 SD. For the highly speeded PMA measure, the negative cohort trend begins in the fifties, while for the more difficult vocabulary tests from the ETS factor kit a peak is actually observed for the 67 year old group. Statistically significant differences between these measures are observed for all but the 60 and 67 year-old groups. The younger groups perform relatively better on the speeded measure, while the older groups do better on the power tests of verbal ability (see Figure 3). Note also the increase in within-group variability that is greater for the power tests than for the speeded vocabulary measure.

Insert Figure 3 about here

Numeric Ability. Differences are also seen between indicators of numeric ability. Although the age difference between the youngest cohort is roughly equivalent across the three measures, approximately 1 SD, there are noteworthy discrepancies between the two operational definitions of addition, and the measure of subtraction and multiplication. The latter measure attains a higher level in early middle age, while it appears to be relatively more difficult for the three oldest groups (cf. Figure 4).

Insert Figure 4 about here

Verbal Memory. Age differences for this ability range from about 1 1/2 SD for the free recall measure to approximately 2 SD for the measures involving list learning. Free recall appears to be relatively more difficult for the three yungest cohorts, while it is relativey easier for the three oldest cohorts (see Figure 5).

Insert Figure 5 about here

Perceptual Speed. Wide age differences are found also for the measures of perceptual speed ranging from little over 1 SD for the simplest task, that of finding and canceling A's, to 2 3/4 SD for the Identical Picture test. As would be expected, the simpler task shows signficantly better performance for the three oldest cohorts, while the opposite findings prevail for the young adults (see Figure 6).

Insert Figure 6 about here

Age Difference Patterns Across Abilities

Substantial differences among age difference patterns were also observed for the derived ability factor scores. Their means and standard deviations are reported in the last columns of Table 4. The magnitude of the age difference between the youngest and oldest cohort varies from about 3/4 SD for Verbal Ability to over 2 1/2 SD for Perceptual Speed. Differences are also observed in the ages of the cohort obtaining peak performance levels. Performance is highest for the youngest cohort for the fluid measures, Verbal Memory and Perceptual Speed. By contrast, highest performance is shown at age 39 for Verbal Ability and at 46 for Numerical Ability. Age differences begin become statistically significant for the former abilities by the fifties, while the latter shown such significant differences only by the late sixties. Within age cohorts there is substantial congruence of age difference patterns within the two ability groupings. In advanced age, however, verbal ability clearly remains the relatively best maintained ability, while perceptual speed appears most reduced (see Figure 7).

Insert Figure 7 about here

Relation of Abilities with a Measure of Everyday Task Performance

Means and standard deviations for the age difference pattern for the Basic Skills test, our measure of everyday task performance, are shown in Table 5. For this measure only modest differences are observed until the sixties are reached, but rather dramatic differences follow thereafter. In fact, there is a difference in excess of 2 SD between ages 67 and 88 (see Figure 8). Note also the iancrease in within=group Variability for this measure with increasing age.

Insert Table 5 and Figure 8 about here

We next examine the relationship of the Basic Skills measure to the ability domain. The correlations of the ability factor scores with the everyday tasks measure are shown in Table 6. With the exception of the young-adult group, there is generally a systematic increase with age in these correlations. This trend is also reflected in the increasing values of $\underline{R}^2$. The common individual difference variance of the practical intelligence measure and the basic ability comstructs increases from a low of 16 per cent at age 39 to a high 75 per cent at age 88. Of greater interest, however, are shifts in the pattern of regression weights. In young adulthood, perceptual speed and verbal ability seem to be the most important predictors of performance on the everyday tasks. While verbal ability remains important throughout, inductive reasoning becomes increasingly important. Perceptual speed is of little relevance throughout midlife, but again enters as a significant predictor in advanced age. Numeric ability enters as an important predictor only for the oldest age group. Spatial Orientation and Verbal Memory do not seem to play an important part in this particular set of tasks (see Table 7).

Insert Tables 6 and 7 about here

Discussion and Conclusions

How are the data we have just presented relevant to the issue of generalizing from experience? We began this paper by arguing that there are likely to be substantial life stage differences in adulthood in the degree of congruence that is to be expected both within and across behavioral domains, and moreover that there may well be pronounced differences in the manner in which basic ability components relate to more complex behaviors occurring in everyday circumstances. Although we need to exercise caution in our inferences since for once we rely entirely upon cross-sectional data (Baltes, Cornelius, & Nesselroade, 1979; Schaie, 1977), we suggest nevertheless that the data presented here provide strong empirical evidence for our position.

We would note that although it may be quite plausible to argue for both within and across domain congruence of age difference patterns in midlife, that there are substantial discrepancies both in young adulthood and in advanced old age. The discrepancies in age difference patterns within abilities are clearly a function of the extent to which markers differ qualitatively. Because of centralized and ability specific behavioral slowing (cf. Salthouse, 1985) that affects most cognitive operations, markers that differ along the dimension from highly speeded to virtually unspeeded power test will also show different age profiles. Likewise age profiles will differ for marker variables that vary in task meaningfulness (Gonda, Quayhagen, & Schaie, 1981), or in familiarity and task complexity (Cornelius, 1984; Gardner & Monge, 1977; Salthouse, 1987). When age difference comparisons are made across ability constructs, more adverse age profiles are found for constructs that involve fluid ability, memory and speed than for constructs that are primarily crystallized in nature (cf. Horn, Donaldson, & Ekstrom, 1981).

One of the immediate consequences of the lack of congruency of age difference patterns among the markers of ability constructs is a reinforcement of the argument that valid cross age comparisons of psychometric ability need to be conducted at the construct level; that is, comparison of factor scores based on multiple markers (cf. Schaie, Willis, Jay & Chipuer, 1987). In the latter case, construct extraneous factors that have differential effect on the individual markers can be averaged out by sampling markers that differ broadly on response characteristics that may also be differentially affected by the aging process. Comparison of the age difference patterns for the derived constructs, however, call attention to the lack of generalizability of age functions across different ability domains.

When we examine the generalizability of age difference patterns in psychometric abilities to a measure of everyday task performance, we note that the age difference pattern for the latter reflects the fact that everyday tasks require a composite pattern of proficiency on basic abilities. Thus performance on the basic skills test reflects the age difference pattern for the crystallized abilities until the late sixties are reached, but thereafter appear more similar to the age difference pattern shown by fluid abilities and perceptual speed. An examination of the correlations of the ability factor measures with the basic skill test shows increasing convergence of everyday task with the ability factor space suggesting the possibility of increasing integration of fluid and crystallized intelligence in old age (cf. also Baltes, Cornelius, Spiro, & Willis, 1980). Comparison of the age differences in the regression of everyday tasks upon the ability domain suggest, not only that individual differences in everyday task become increasinly dependent upon performance level on the basic abilities, but also, that fluid abilities become more salient components with advancing age.

From a developmental perspective we would conclude then that different markers of abilities are differentially effective measures of their underlying ability constructs, and that different abilities are differentially effective in generalizing to measures of practical intelligence at different life stages. Broad theories of cognitive functioning therefore need to generalize not only across different aspects of intelligence, but must also offer a framework that can accommodate relationships within their hierarchichal structures that differ across laife stages (cf. Schaie, 1977/78).

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Table 1

Sub-Samples Entering the Age Difference Analyses

Group	SLS Cohort	Date of Birth	N			Mean Age
			M	F	T	
1	1-2	1886 - 1899	18	23	41	88
2	3	1900 - 1906	63	74	137	81
3	4	1907 - 1913	120	140	260	74
4	5	1914 - 1920	137	154	291	67
5	6	1921 - 1927	127	135	262	60
6	7	1928 - 1934	92	102	194	53
7	8	1935 - 1941	62	92	154	46
8	9	1942 - 1948	53	71	124	39
9	10-11	1949 - 1962	71	94	165	29
Total Sample			743	885	1628	59

Note - Following the convention used in all reports from the SLS, lower cohort numbers represent earlier-born (older) subjects.

Table 2
Psychometric Intelligence Measurement Battery

Primary Ability	Test	Source	Test-Retest Correlation
Inductive Reasoning	PMA Reasoning (1948)	Thurstone & Thurstone, 1949	.884
	ADEPT Letter Series (Form A)	Blieszner et al., 1981	.839
	Word Series	Schaie, 1985	.852
	Number Series	Ekstrom et al., 1976	.833
Spatial Orientation	PMA Space (1948)	Thurstone & Thurstone, 1949	.817
	Object Rotation	Schaie, 1985	.861
	Alphanumeric Rotation	Willis & Schaie, 1983	.820
	Cube Comparisons	Ekstrom, et al., 1976	.951
Numerical Ability	PMA Number (1948)	Thurstone & Thurstone, 1949	.875
	Addition (N-1)	Ekstrom et al., 1976	.937
	Subtraction & Multiplication (N-3)	Ekstrom et al., 1976	.943
Verbal Ability	PMA Verbal Meaning (1948)	Thurstone & Thurstone, 1949	.890
	ETS Vocabulary (V-2)	Ekstrom et al., 1976	.928
	ETS Advanced Vocabulary (V-4)	Ekstrom et al., 1976	.954
Perceptual Speed	Identical Pictures	Ekstrom et al., 1976	.814
	Finding A's	Ekstrom et al., 1976	.860
	Number Comparison	Ekstrom et al., 1976	.865
Verbal Memory	Immediate Recall	Zelinski et al., 1979	.820
	Delayed Recall	Zelinski et al., 1979	.732
	PMA Word Fluency	Thurstone & Thurstone, 1949	.896

Table 3

Normalized Regression Weights for the Ability Factor Scores

Variable	Factor					
	I	S	V	N	M	Ps
PMA Reasoning	.267					
ADEPT Letter Series	.261					
Word Series	.265					
Number Series	.207					
PMA Space		.276				
Object Rotation		.307				
Alphanumeric Rotation		.276				
Cube Comparison		.141				
PMA Verbal Meaning			.085			.251
ETS Vocabulary II			.460			
ETS Vocabulary IV			.455			
PMA Number				.292		
Addition				.366		
Subtr/Mult				.311		
PMA Word Fluency					.220	
Immediate Recall					.392	
Delayed Recall					.388	
Finding A's						.159
Number Comparison				.030		.191
Identical Pictures						.399

I = Induction, S = Spatial Orientation, V = Verbal Ability, N = Numeric Ability, M = Verbal Memory, Ps = Perceptual Speed

Table 4

Means and Standard Deviations for Six Psychometric Ability Domains for Mean Ages 29 to 88 Years in T Score Units (M = 50, S.D. = 10)

Induction

	PMA Verbal Meaning		ADEPT Letter Series		Word Series		Number Series		Induction Factor	
Age	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
29	58.57	7.76	59.30	8.65	58.25	7.71	57.29	8.29	59.07	8.02
39	57.75	6.95	59.46	8.19	58.40	7.37	56.30	8.60	58.41	7.05
46	56.10	7.58	56.74	8.00	56.95	7.16	55.84	8.91	56.71	6.94
53	54.09	8.10	52.90	7.95	54.15	7.00	52.02	9.26	53.52	7.51
60	51.29	8.02	50.68	9.03	51.42	7.47	51.16	8.92	51.12	7.99
67	47.38	8.17	47.86	8.26	48.11	8.52	48.51	9.24	47.65	8.16
74	43.41	7.49	43.87	7.03	44.23	8.44	44.71	8.40	43.52	7.44
81	38.60	6.25	40.07	6.40	38.98	7.99	41.14	6.48	38.40	6.34
88	36.58	6.24	39.18	5.25	34.76	6.74	40.76	5.52	36.53	5.12

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Table 4 (Continued)

Means and Standard Deviations for Six Psychometric Ability Domains for Mean Ages 29 to 88 Years in T Score Units (M = 50, S.D. = 10)

Spatial Orientation

	PMA Space		Object Rotation		Alphanumeric Rotation		Cube Comparison		Spatial Factor	
Age	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
29	55.86	9.27	56.68	7.75	57.58	6.45	57.78	10.11	57.11	8.69
39	55.23	10.42	55.58	8.24	56.03	7.79	57.21	10.19	56.48	8.31
46	55.62	9.50	56.18	7.47	56.52	6.60	56.76	9.25	56.73	7.60
53	53.47	9.33	53.53	7.91	53.28	8.24	53.32	8.64	53.93	7.74
60	51.42	8.79	52.31	8.20	52.16	8.19	51.22	8.19	51.99	8.08
67	48.26	8.66	48.85	8.72	48.50	8.99	47.07	8.03	48.06	8.24
74	44.71	7.65	44.46	8.64	44.52	8.90	44.16	7.10	43.68	7.81
81	41.65	6.43	39.67	8.53	40.24	9.05	42.71	7.42	39.31	7.16
88	37.71	5.05	35.00	6.27	35.34	7.22	42.03	8.30	34.83	5.61

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Table 4 (Continued)

Means and Standard Deviations for Six Psychometric Ability Domains for Mean Ages 29 to 88 Years in T Score Units (M = 50, S.D. = 10)

Verbal Ability

	PMA Verbal Meaning		ETS Vocabulary II		ETS Vocabulary I		Verbal Factor	
Age	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
29	54.42	7.73	48.38	9.17	47.63	9.09	50.44	9.08
39	56.13	6.52	51.65	8.68	51.92	9.42	52.32	8.51
46	55.62	7.88	51.51	8.01	51.23	9.04	51.71	8.25
53	52.81	7.42	50.91	9.94	50.41	9.35	50.87	8.91
60	52.60	8.18	50.70	9.62	50.44	9.08	50.65	9.49
67	49.39	8.77	51.30	9.81	51.44	9.58	51.05	9.57
74	44.51	8.73	49.37	10.81	49.14	10.55	48.37	10.48
81	39.34	8.69	46.87	13.41	48.19	11.87	45.54	12.63
88	32.34	8.60	45.58	12.17	46.61	11.21	43.02	12.59

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Table 4 (Continued)

Means and Standard Deviations for Six Psychometric Ability Domains for Mean Ages 29 to 88 Years in T Score Units (M = 50, S.D. = 10)

Numric Ability

	PMA Number		ETS Addition		Subtraction/ Multiplication		Numeric Factor	
Age	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
29	50.07	10.04	50.52	9.05	50.78	10.08	50.40	9.42
39	51.36	9.33	51.63	8.75	54.18	8.86	52.67	8.69
46	51.79	8.87	52.70	10.64	54.24	10.20	53.18	10.04
53	50.96	10.54	50.61	9.90	51.52	9.49	51.10	9.75
60	52.29	10.77	51.63	9.79	51.72	9.72	52.09	10.06
67	50.70	9.67	50.42	10.12	50.02	9.92	50.46	9.88
74	48.80	9.23	49.34	9.06	47.72	8.29	48.55	8.80
81	44.22	9.19	44.09	10.11	43.05	9.19	43.18	9.02
88	41.24	8.70	40.38	8.64	39.37	7.90	39.58	8.27

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Table 4 (Continued)

Means and Standard Deviations for Six Psychometric Ability Domains

for Mean Ages 29 to 88 Years in T Score Units (M = 50, S.D. = 10)

Verbal Memory

	PMA Word Fluency		Immediate Recall		Delayed Recall		Memory Factor	
Age	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
29	55.02	9.89	57.87	8.00	59.22	8.33	57.68	8.16
39	54.86	10.08	57.87	7.97	57.90	8.32	57.38	7.47
46	53.57	9.01	55.65	8.41	55.67	8.97	55.19	8.38
53	52.52	9.45	52.15	8.39	52.46	8.91	52.30	8.18
60	50.19	9.87	50.54	8.78	50.19	9.02	50.10	8.71
67	48.65	8.72	48.85	9.73	48.79	9.64	48.61	9.11
74	46.58	9.86	45.03	8.41	44.18	7.74	44.52	7.61
81	43.49	9.01	42.23	8.67	41.56	7.72	41.10	8.41
88	40.48	7.70	39.51	9.48	39.36	7.50	38.59	7.92

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Table 4 (Continued)

Means and Standard Deviations for Six Psychometric Ability Domains for Mean Ages 29 to 88 Years in T Score Units (M = 50, S.D. = 10)

Perceptual Speed

	Identical Pictures		Number Comparison		Finding A's		Speed Factor	
Age	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
29	60.60	6.96	56.66	9.24	54.45	11.30	58.84	6.94
39	59.24	6.90	57.40	8.86	53.86	9.04	58.73	6.26
46	57.29	6.72	55.22	9.74	53.07	10.47	56.92	6.90
53	54.10	6.66	52.23	8.15	51.48	9.71	53.86	6.28
60	50.64	6.92	50.99	8.81	49.66	10.00	51.23	7.22
67	46.99	7.02	48.64	8.43	49.50	9.71	47.92	7.63
74	42.79	6.53	45.71	8.34	47.30	8.33	43.35	7.47
81	38.43	7.35	40.83	8.56	44.98	8.71	38.02	8.33
88	33.42	5.64	37.83	7.35	43.66	7.46	32.39	7.50

Table 5

Means and Standard Deviations for the Basic Skills Test for Mean Ages 29 to 88 Years in T Score Units (M = 50, S.D. = 10)

Age	Mean	S.D.
29	55.72	4.38
39	55.84	2.26
46	55.00	3.86
53	53.91	4.01
60	52.69	5.53
67	50.50	8.36
74	45.12	10.28
81	37.43	12.90
88	28.18	11.98

Table 6

Correlations of Ability Factor Scores

With the Everyday Tasks Measure

	Factor					
Age	I	S	V	N	M	Ps
29	.432***	.301**	.596***	.247**	.395***	.625***
39	.351***	.168	.289**	.175	.249**	.208*
46	.336***	.159*	.459***	.194*	.228**	.284***
53	.463***	.138	.632***	.252***	.309***	.368***
60	.537***	.277***	.600***	.312***	.406***	.427***
67	.666***	.396***	.678***	.497***	.518***	.575***
74	.709***	.392***	.723***	.475***	.401***	.581***
81	.717***	.580***	.704***	.673***	.561***	.747***
88	.761***	.582***	.676***	.733***	.456**	.731***
Total Sample	.709***	.575***	.578***	.486***	.578***	.710***

I = Induction, S = Spatial Orientation, V = Verbal Ability,

N = Numeric Ability, M = Verbal Memory, Ps = Perceptual Speed

*p < .05; **p < .01; ***p < .001.

Table 7

Regression of the Everyday Task Measure

Upon the Ability Factor Scores (Beta Weights)

	Factor						
Age	I	S	V	N	M	Ps	R^2
29	-.084	.117	.349***	-.128	.058	.428***	.491
39	.230*	.059	.170	.038	.098	-.053	.160
46	.183*	.039	.402***	.036	-.002	-.017	.254
53	.236**	-.106	.520***	.040	.060	-.002	.452
60	.202**	.054	.401***	.050	.112*	-.004	.423
67	.215***	.046	.406***	.081	.108*	.094	.584
74	.334***	.064	.446***	.053	.026	.043	.646
81	.233***	.114*	.315***	.102	.037	.223**	.711
88	.434**	.047	.241*	.417**	-.227*	.036	.749
Total Sample	.210***	.123***	.275***	.033	.085**	.258***	.626

I = Induction, S = Spatial Orientation, V = Verbal Ability,

N = Numeric Ability, M = Verbal Memory, Ps = Perceptual Speed

*p < .05; **p < .01; p < .001.

Figure Captions

Figure 1. Age difference patterns for markers of Inductive Reasoning ability.

Figure 2. Age difference patterns for markers of Spatial Orientation ability.

Figure 3. Age difference patterns for markers of Verbal ability.

Figure 4. Age difference patterns for markers of Numerical ability.

Figure 5. Age difference patterns for markers of Verbal Memory.

Figure 6. Age difference patterns for markers of Perceptual Speed.

Figure 7. Age difference patterns for the intellectual ability constructs.

Figure 8. Age difference pattern for the measure of everyday task performance.