

Cognitive Change in Adults as Predicted by Demographic
Characteristics: A Stepwise Regression Analysis

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Recent studies suggest that generational differences which reflect socio-cultural change may be more important than age to account for the differences in cognitive functioning which are observed in various age groups (e.g., Kuhlen, 1963, Schaie, Labouvie and Buech, 1973; Schaie and Labouvie, in press). Only a few studies, however, have attempted to determine some of these socio-cultural factors. One which has been found by several investigators to differentiate performance on specific subtests of various intelligence tests is socio-economic status (Fozard, Nuttall and Waugh, 1972; Nuttall and Fozard, 1970; Owens, 1953), although not all investigators have found this variable to be a significant effect (Eisdorfer, Busse and Cohen, 1959). Education has also been found to be a factor; again, however, only on specific subtests (Owens, 1953).

The objective of the present study is to expand the number of demographic variable under observation and to determine which are most associated with cognitive change measured over three testing times at seven year intervals.

American Psychological Association, New Orleans, 1974

Method

Subjects

Ss were initially sampled from a population base consisting of the approximately 18,000 members of a prepaid medical plan in a Pacific Northwest metropolitan area. The sampling procedure has been reported earlier (Schaie, 1959). Repeated measurement data for three measurement points (1956, 1963, 1970) are available for 161 subjects ranging in age from 21 to 84 years. The age-sex distribution at first testing is presented in Table 1.

The attrition rate data for the entire period have been reported previously (Schaie, Labouvie, Barrett, 1973). The retested subjects scored significantly higher at base point than did the retest resisters; however, this bias was equally true for all cohorts. The attrition rate seemed to be random with regard to the socio-economic variables.

Most of the demographic characteristics were fairly well distributed with the exception of marital status, where only 32 were unmarried; change of residence, where only 39 had moved one or more times during the past five years; change of employment, where only 17 had changed employment more than once; change of profession where most had changed once, with 45 claiming no change and 13 two or more changes; and life satisfaction and job satisfaction where few evidenced negative attitudes, but on a five point semantic differential the first three breakdowns were fairly even.

Measurement Variables

A socio-economic status questionnaire, the SRA Primary Mental Abilities Test (Thurstone & Thurstone, 1949), the Test of Behavioral Rigidity (Schaie, 1960) and a survey on satisfaction with the medical plan were administered to groups of from 10 to 50 subjects. The present study reports on the socio-economic status questionnaire from the 1970 testing and three of the subtests from the Primary Mental Abilities Test, Verbal Meaning, Space and Word Fluency. Information from the socio-economic questionnaire include questions on sex, marital status (unmarried, married), number of children, age at first marriage, occupational status (10 categories from unskilled to professional), income, years of education, number of residence changes, number of employment changes, number of profession changes, life satisfaction, job satisfaction, and cohort (1= oldest to 7= youngest cohort). The dependent variables were the change scores from 1956 to 1963 and from 1963 to 1970 on Verbal Meaning, Space and Word Fluency.

Design and Data Analysis

For purposes of analysis, samples were organized into seven-year cohorts with mean birth years ranging from 1889 to 1938. All raw scores were transformed into T scores with a mean of 50 and a standard deviation of 10. Change scores were then derived by subtracting the score on the previous test from that of the subsequent test and adding a constant factor of 50 to eliminate negative scores. This resulted in change scores on each subtest for the 1956 to 1963 testing and for the 1963 to 1970 testing.

The data were analyzed by a stepwise multiple regression procedure with the socio-economic variables forming the predictor variables for each of our sex dependent measures. Few missing data were encountered, but when data was lacking the subject was assigned the median score for that variable.

Results

General Findings

Summary results of the stepwise regression are presented in Tables 2-7. Only those variables whose combined F test reached a significance level of .05 are included. Accordingly, the various subtests may have not only a different number, but also a different set of predictors. Consequently, the results will be discussed separately for each subtest.

Each table shows the predictor variable ranked in order of $\beta \times r$. Since the sum of the $(\beta \times r)$ equals R^2 , $(\beta \times r)/R^2$ is the contribution of each variable to the accountable variance. All tables include each of these values.

Ability-specific Patterns

Verbal Meaning

Summary tables for the regression equation for verbal change for the 1956 to 1963 period and the 1963 to 1970 period are found in tables 2 and 3, respectively.

The change in performance on the Verbal Meaning subtest from the 1956 to the 1963 testing is predicted from a three variable regression equation with a multiple correlation of .26. These

three predictors; marital status, cohort and number of children account for 53, 32 and 15 percent of the accountable variance, respectively. To put the outcome more clearly, this shows that subjects who increase their scores are from the younger cohorts, married, and have few children.

In looking at verbal change for the second seven year period, that is, the change from the 1963 testing to the 1970 testing, one finds the variables which made up the regression equation are also included in this regression with age at first marriage added (multiple correlation = .39). The variables cohort, number of children, marital status and age at first marriage account respectively for 76, 29, 3 and 1% of the accountable variance. Note, however that marital status and number of children variables change direction. To summarize, decrement in performance on the verbal meaning subtest is found in the older cohorts who are married, with fewer children and who married at an earlier age.

Space

Tables 4 and 5 include the summaries of the regression analysis for the two times of measurement for the Space subtest. The 1956 to 1963 change for the Space subtest is measured by one variable only with a multiple correlation of .15. This variable is age at first marriage. Across all cohorts then, marrying at an earlier age results in positive change for the Space variable.

The regression equation for Space change from 1963 to 1970, however, is a 4 variable equation including years of education, cohort, marital status and occupational status; the multiple correlation value is .31 with 32, 30, 23 and 15% of the accountable

variance accounted for by the four variables respectively. Note years of education is negatively associated with spatial change. More clearly, it is the subjects from the younger cohorts, who are married, have fewer years of education yet high occupational status who exhibit positive change in performance in this measure of spatial ability.

Word Fluency

For summary of regression results for the Word Fluency subtest see Tables 6 and 7. For the change in Word Fluency from marital status and the change of residence variable make up the regression equation with a multiple correlation of .25. They account for 70 and 30% of the accountable variance, respectively. A positive change in Word Fluency from 1956 to 1963 was exhibited by those subjects who were married and changed their place of residence at least once.

A completely different regression equation is found for the change in Word Fluency from 1963 to 1970 which is made up of three variables. These variables are age at first marriage, number of children and job adjustment. Their multiple correlation is .28 and they account for 46, 28 and 26 percent of the accountable variance, respectively. It was found then that those subjects who married earlier, had a greater number of children and who also had higher job adjustment manifested a positive change in the Word Fluency test from 1963 to 1970.

Discussion

This study is one of a sequence of studies dealing with

cognitive change in adulthood which spans a fourteen year period (Schaie, Labouvie and Buech, 1973; Schaie and Labouvie, in press), however, this is the first systematic attempt to deal with the effects of the demographic characteristics of the sample upon change in cognitive functions. Since these studies have amply demonstrated that socio-cultural change has a significant effect upon age differences in cognitive functioning, the necessity of studying the life characteristics of the individual can no longer be ignored. It should be particularly noted that previous analyses of these data have shown a significant main effect for cohort over the 2 seven-year periods, i.e., 1956 to 1963 and 1963 to 1970, for the three subtests, Verbal Meaning, Space and Word Fluency. However, with cohort included as one of the demographic variables, our results indicate that other variables were often more predictive than cohort membership in differentiating the change scores, e.g., marital status accounted for more of the accountable variance for change in Verbal Meaning from 1956 to 1963 (53%) than did Cohort (32%). In fact, marital status was a consistently high predictor for the three subtests, as was age at first marriage.

While we can show statistically significant differences between gross demographic variables and cognitive change, the amount of variance accounted for is relatively modest (See Tables 2-7 for R^2). It may well be that a greater amount of the variance could be accounted for if more detailed data specific to individual life circumstances are available. Studies bearing upon this issue are now in progress.

References

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Table 1

<u>Mean Age</u>	1956 - 1963 - 1970	
	<u>Males</u>	<u>Females</u>
25	10	11
32	11	15
39	11	15
46	17	15
53	13	15
60	3	12
67	7	6

Note.--Ages at first testing are given. Each age level spans a seven-year interval with the age level indicating the mean age for that interval.

Table 2
 Three Variable Regression equation predicting
 Verbal Change from 1956 to 1963.

Variable	Beta	r	Beta x r	Beta xr/R ²	F
Marital Status	.19	.19	.04	.53	5.02
Cohort	.15	.15	.02	.32	2.87
Number of Children	-.18	-.06	.01	.15	4.20

R (multiple correlation) = .26

R² (accountable variance) = .07

Table 3

Four Variable Regression equation predicting Verbal Change
from 1963 to 1970.

Variable	Beta	r	Beta x r	Beta x r/R ²	F
Cohort	.36	.32	.11	.76	16.29
Number of Children	.18	.24	.04	.29	4.74
Marital Status	-.17	.03	.005	.03	4.40
Age at First Marriage	.16	-.01	.002	.01	3.81

R = .39

R² = .15

Table 4
 One Variable Regression equation predicting Space Change
 from 1956 to 1963

Variable	Beta	r	Beta x r	Beta x r/R ²	F
Age at First Marriage	-.15	-.15	.02	1.00	3.77

R = .15

R² = .02

Table 5

Four Variable Regression equation predicting Space Change
from 1963 to 1970

Variable	Beta	r	Beta x r	Beta x r/R ²	F
Years of Education	-.29	-.10	.03	.32	8.23
Cohort	.15	.18	.03	.30	3.31
Marital Status	.13	.16	.02	.23	2.60
Occupational Status	.23	.06	.01	.15	5.40

R = .31

R² = .09

Table 6

Two Variable Regression equation predicting Word Fluency Change
from 1956 to 1963

Variable	Beta	r	Beta x r	Beta x r/R ²	F
Marital Status	.22	.19	.04	.71	8.04
Change of Residence	.15	.12	.02	.30	3.92

R = .25

R² = .06

Table 7

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Three Variable Regression equation predicting Word Fluency Change
from 1963 to 1970

Variable	Beta	r	Beta x r	Beta x r/R ²	F
Age at First Marriage	-.19	-.19	.035	.46	5.29
Number of Children	.13	.16	.02	.28	2.71
Job Adjustment	.17	.12	.02	.26	4.70

R = .28

R² = .08