

DOCUMENT RESUME

ED 148 895

TH 006 835

AUTHOR Schaie, K. Warner; Gribbin, Kathy
TITLE The Impact of Environmental Complexity upon Adult Cognitive Development.
PUB DATE Jul 75
NOTE 27p.; Paper presented at the Biennial Conference of the International Society for the Study of Behavioral Development (3rd, Guildford, England, July 13-17, 1975) ; Some pages are marginally legible due to print quality

EDRS PRICE MF-\$0.83 HC-\$2.06 Plus Postage.
DESCRIPTORS Adjustment (to Environment); *Adults; *Age Differences; Behavior Patterns; *Cognitive Ability; *Environmental Influences; Family Environment; *Individual Characteristics; Individual Development; Individual Differences; Life Style; Measurement Techniques; Mental Development; *Older Adults; Personality; Physical Environment; Social Environment; Social Status; Socioeconomic Influences; Test Construction; Trend Analysis

IDENTIFIERS *Life Complexity Inventory (Schaie and Gribbin)

ABSTRACT

Recent investigations have demonstrated greater variance in change in intellectual performance between different generations or age groups than is true for generalized developmental change across chronological age. Such findings have led to a careful investigation of certain environmental factors which might account for such change. A new instrument, the Life Complexity Inventory (LCI), was developed to measure both current and retrospective characteristics of the individual's life style and microenvironment. The LCI was completed by 140 individuals ranging in age from 40 to 88, whose intellectual and personality functioning had been measured in 1956, 1963, and 1970. Initial analysis of this instrument resulted in eight distinct environmental item clusters, which represent particular patterns of life style or experiences, family relationship, or relationship to the environment. Moderate correlations were found between environmental cluster scores and change in cognitive function over two consecutive seven-year periods. These changes in cognitive function were measured by The Primary Mental Abilities Test and the Test of Behavioral Rigidity. The grouping of individuals according to these eight item clusters resulted in the identification of four modal subject types; these types differ in their pattern of change in cognitive function over time. (Author/MV)

THE IMPACT OF ENVIRONMENTAL COMPLEXITY UPON ADULT COGNITIVE DEVELOPMENT¹

K. Warner Schaie and Kathy Gribbin

University of Southern California

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

K. Warner Schaie

Introduction

BEST COPY AVAILABLE

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM"

A series of studies conducted by the senior author and his associates over the past twenty years has shown rather conclusively that within-generation stability across the adult life span, at least into the sixties, is the rule rather than the exception on crystallized measures of intelligence such as the Primary Mental Abilities (Schaie, 1974; Schaie & Gribbin, 1975). This program of studies has shown that for a given cohort under consideration, there is little within cohort age decrement, but that there are substantial differences in level between successive cohorts, earlier-born cohorts performing at lower levels than do cohorts who have entered a progressively enriched environment at a later point in historical time (e.g. Schaie & Labouvie-Vief, 1974).

Despite such strong generalizations, we have also accumulated evidence which shows that individual patterns of change over time may reflect increment, decrement or maintenance of intellectual level, regardless of cohort membership, even though maintenance or increment is more characteristic of the more recent than the older cohorts. Such evidence suggests that we must continue to monitor the impact of socio-cultural change upon cognitive performance, but also, that we must begin to determine the nature of that impact as it bears upon patterns of individual change.

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

¹ Paper presented as part of a symposium on "Ecological change at different stages of development", at the 3rd Biennial Conference of the International Society for the Study of Behavioral Development, Guildford, England, July 13-17, 1975.

ED148895

M006 835

Many parameters could be investigated along these lines (cf. Baltes & Labouvie, 1973), but we have elected to approach the problem by examining the individual's micro-environment. By that term we mean to imply that we propose to investigate successively those variables present in the day-to-day experience of adults which may be assumed to make a difference in the maintenance of cognitive functions. As the most proximal parameter, we first investigated the impact of physical health and resultant well-being upon cognitive function over both seven and fourteen year time intervals (Schaie, 1973a; Parham, et.al., 1975). But surprisingly little variance is accounted for by a quantitative assessment of cumulative health trauma, even though there still remains some promise in pursuing the effects of specific chronic conditions. We have thereupon moved to a more far-reaching examination of a variety of other individual characteristics moving from the most proximal to more strictly environmental parameters.

Examination of micro-environmental factors has proven useful in research on child development. For example, factors such as the availability of reading material, the presence of cultural amenities, and socio-economic status were found to correlate positively with childrens' intellectual performance (Bayley, 1970). In a less differentiated manner, this question has also been studied in adults. Investigators of adult intellectual performance have for some time attempted to study the relation of performance on various intelligence tests with factors such as socio-economic status and years of education. Significant effects were found by some (Fozard, Nuttall & Waugh, 1972; Nuttall & Fozard, 1970; Owens, 1953) but not by others (Eisdorfer, Busse & Cohen, 1959). Our own work has shown that demographic variables are indeed powerful predictors of

cognitive change over time, and in fact may be better predictors than either chronological age or cohort membership (Gribbin, Parham & Schaie, 1974).

Most of the studies cited do not sufficiently refine their criteria to permit identification of the specific components of the individual's micro-environment which would account for observed cognitive change. Some recent progress in this respect is presented, however, in a study by Honzik and MacFarlane (1973) who included much information on life complexity issues in their assessment of personality characteristics and intellectual functions. Regrettably, their particular longitudinal design limits the generalizability of their findings to a specific cohort (cf. Schaie, 1972). Schoenfeldt (1973) recently reported a study of life experience as it relates to changes in mental abilities. On the basis of responses to a life experience inventory, five factors were then used to form subgroups to examine differences on the Army Alpha intelligence test over a 42-year period. These factors: Socio-economic success, sensitive intelligence, physical vigor, introversion and ego-centric dependence were found to be successful in differentiating performance on the ability tests and in predicting changes in function for a matched sample. Similarly, Jarvik, Bennett and Blummer (1973) developed a comprehensive life history schedule which covered such items as health, institutional or residential settings, activities, socialability, education, familial and genetic variables.

Studies such as those just mentioned support our contention that the micro-environmental approach to the study of change in intellectual function in adulthood presents a viable approach. None of these studies, however, have addressed the issue of investigating cognitive change rather

than correlation with present cognitive status. Consequently, we felt it necessary to develop our own assessment technique, the Life Complexity Inventory (LCI), which permits both current and retrospective assessment of client status, and is thus more suitable for the type of sequential analyses we have advocated (Schaie, 1973b). It is the purpose of this presentation to describe the construction of our new inventory and to present results from a study in which the LCI was administered to 140 subjects whose intellectual functioning has been under study over a fourteen-year period.

The Life Complexity Inventory (LCI)

Construction of a questionnaire designed to survey individuals' micro-environment requires certain initial assumptions to delimit its scope and to provide suitable exclusion rules. We decided to eliminate most experiential and subjective aspects of life, with the exception of overall ratings of life and job satisfaction, which had been found useful in our earlier work (Schaie, 1959). This decision was made, not on the basis of an implicit prejudice regarding indicators of subjective experience, but because we felt that more objective criteria have in the past been neglected, and nevertheless might be the very ones which, if found to be relevant, might be amenable to intervention. But above all we were concerned with criterion relevance. For example, we felt that the number of hours an individual spends reading and writing at his job would be more critical in determining maintenance of intellectual abilities than to pose the question as to how much the same individual enjoys to read and write!

Beyond the above initial limiting criterion, we decided to include as many aspects of life experience (both current and retrospective) as

could conveniently be covered in a two-hour interview. The literature was next searched to identify questionnaires which surveyed various aspects of an individual's micro-environment and which had been designed or used for the study of adult behavior. After fairly exhaustive search we included as our major topics: Individual work circumstances, travel experiences, job and personal mobility, friends and social interactions, physical environment such as type of dwelling, noise level, etc., in addition to covering more common items such as marital status, birth order, number of children and places lived. A section specifically designed for the housewife, similar to the work section, was developed. This aspect responded to the feeling that the role of the homemaker has been ignored traditionally, even though a major share of many women's time is devoted to home-making activities, which for all purposes represent the equivalent of a full-time job. A retrospective section was included to enable the subject to describe his or her life circumstances at the time their intellectual function had previously been monitored in our studies.

Once the specific topics selected for coverage were identified, we then examined in detail those existing questionnaires containing items relevant to our purposes. The work section from the study described by Kohn (1969) in Class and Conformity was extremely helpful, as was the activity check list used in the Langley-Porter investigations of adult life transitions (Lowenthal, 1971; Lowenthal, Spence & Thurnher, 1973). Certain social indicators prepared by the Human Resources Planning Institute (1972) were included in the section on the physical environment. Construction of the homemaker section required a local pilot study since none of the published literature covered this subject in a useful

manner. The personal data page of the LCI, as well as its retrospective portion, consists of a set of items that has been used in our longitudinal study over all test occasions (cf. Schaie, 1959).

The completed questionnaire was pilot-tested with a small number of subjects from young adulthood to old age to determine whether the LCI had face validity in covering most important areas of individuals' micro-environment at all life stages. Attention was also given at that time to more technical aspects such as the precise wording of questions (to permit applicability over a wide range of literacy levels), time taken to administer, (less than two hours) etc. The LCI was then administered as a structured interview schedule in the home of subjects for a sample of 140 adults. The LCI has, in the mean time been administered also as a questionnaire to more than a thousand additional subjects. The present paper, however, will report only the analysis of data obtained from the initial interview administration of the instrument.

The Sample

Our subjects were originally sampled from the 18,000 members, in 1956, of a health maintenance plan in the Pacific Northwest of the United States, stratified by age and sex. Five hundred subjects evenly divided by sex and year of birth, were sampled over the range of birth years from 1886 to 1934. At first test, these subjects covered the age range from 22 to 70 years of age (Schaie, 1959). Three hundred and one subjects were retested in 1963, and of the 161 were tested a third time in 1970 (see Schaie & Labouvie-Vief, 1974 for further details). During the Spring of 1974, one hundred and forty of the subjects who had been tested at all three points were interviewed with the Life Complexity Inventory. Test data for these subjects was available for the Primary

Mental Abilities and the Test of Behavioral Rigidity obtained in 1956, 1963 and 1970. Subjects at interview ranged in age from 40 to 88 years. For convenience of analysis, subjects were divided into seven seven-year cohorts, since we wish to report the relation of environmental factors to change in cognitive function measured over two seven year periods (from 1956 to 1963 and from 1963 to 1970). The sex by cohort breakdown is shown in Table 1.

Preliminary Analysis of the LCI

For purposes of initial analysis, responses from the 140 interview schedules were transcribed to computer tape and grouped into two sets of 34 activity items (present and retrospective) and the 85 other remaining items. The activity items were factored by the principal axis method, and four activity factors were derived from each set after oblique rotation. The factors identified from the present activities were: Solitary home activities, experience-expanding activities, passive activities and social participation. The four factors grouping the retrospective (ten years previous) activity pattern were: Upper middle class life style, home-related activities, solitary activities and social participation.

Factor scores for the above eight factors were entered together with the remaining 85 items into a clustering routine (Institute for Social Research, 1971) with the constraint that items required a minimum correlation of .30 to initiate a cluster and an average correlation of .22 ($p < .01$) with all other items in the cluster to be retained in that particular cluster. This procedure resulted in eight item clusters accounting for 50 of the 93 items. Our further preliminary analyses will describe a number of findings utilizing cluster scores obtained on the basis of these clusters, which will next be described.

The Item Clusters

Of the eight clusters one represents subjective dissatisfaction with life status, a second represents the level of social status, a third represents a particular environmental hazard (noise), a fourth describes the dimension from being embedded in a nuclear family unit to family dissolution, and the remaining four clusters describe activity patterns which run the gamut from disengagement to active maintenance of acculturation. In order of extractions these clusters and items loading on them are as follows:

A. Female homemaker. This is a set of items, high scores on which seem to identify the micro-environment characteristic of the traditional female role (although in our sample, with a mean age of approximately 64 years, this pattern is represented primarily by widows). Items high on this cluster are: female, younger than spouse, widowed, spends most time in home-making activities, solitary home activities, never in military service, now and previously spent most time working with hands, now and retrospectively high on unnecessary conversation:

B. Social status. This cluster provides a comprehensive social status assessment. Items included are present and previous occupation, education and income level, number of rooms in home, number of magazines read, and perceived time pressure.

C. Dissatisfaction with life status. It should be noted here that the scale actually used by our subjects ranged from average to high satisfaction. Low scorers on this cluster are therefore to be viewed as relatively but not absolutely dissatisfied with their status. The cluster includes present and retrospective satisfaction with life and job, as well as number of friends (low for the dissatisfied).

D. Disengagement. This cluster represents a micro-environment which is characteristic of low involvement with the larger environment. Items included are high passive activities, retrospective solitary activities, present and past uninvolved in work activities, low involvement with people-related activities, few past and present hours spent reading, few changes in professional roles, and relatively high age.

E. Semi-engagement. Somewhat difficult to interpret is a cluster which seem to characterized a transition from previous heavy environmental engagement to a more restricted pattern. Here are included retrospective upper middle-class life-style, present home-related activities, and high number of friends with diverse interests.

F. Noisy Environment. This cluster represents what on the one hand may be hazardous environment, but may on the other represent closeness and access to many activities. Items included are: living now and previously close to freeways, airports and the like, in an environment described as noisy in general, and presently full of traffic noise in particular.

G. Family dissolution. This cluster characterized the move from a well-integrated nuclear family to a more isolated existence characteristic of many of the elderly. Items with high scores here are: number of changes of household, number spouses lost by death, living in multiple unit dwelling, not married or widowed, living in a neighborhood with a largely elderly population.

H. Maintenance of acculturation. Involvement in the ongoing concerns of our society by active involvement seem characteristic here. Items scored high here are: number of books and non-fiction books read, number of university and or adult education courses taken, and number of weeks

spent in educational activities.

Mean cluster scores by cohort and sex are reported in Table 2. These scores were scaled so as to produce a Mean of 50 and a standard deviation of 10 for the entire sample. Note correlations with chronological age reported at the bottom of Table 2. There is, as expected, a significant negative correlation between age and social status and a positive correlation with disengagement and family dissolution patterns. But it seems far more noteworthy that no correlation was found either with home-maker role, dissatisfaction with life status, or even more importantly, with the maintenance of acculturation.

Relation of Environmental Pattern to Cognitive Change

Cluster scores were next correlated with two sets of scores describing change in mental abilities over the two seven year periods from 1956 to 1963 and from 1963 to 1970. Such change scores were available for Verbal Meaning (V), Space (S), Reasoning (R), Number (N), Word Fluency (W), and summary scores for Intellectual ability (IQ), and Educational aptitude (EQ) from the Primary Mental Abilities Test (Thurstone & Thurstone, 1949) and the Motor-cognitive Rigidity (MCR), Personality-perceptual Rigidity (PPR) and Psychomotor Speed (PS) scores from the Test of Behavioral Rigidity (Schaie, 1955; Schaie & Parham, 1975). Table 3 provides these correlations. Positive correlations should be interpreted to indicate that the particular cluster is associated with an increment in ability or increase in flexibility over the specific seven-year time period.

The reported correlations are of limited magnitude, but they reflect clearly more than chance relationships and suggest that we are beginning to get a more differentiated understanding of the specific impact of environmental variables. In particular it is quite clear that a micro-

environment characteristic for disengagement and family dissolution seems associated with cognitive decrement, while dissatisfaction with life status appears to have positive value. Further analysis of the relation between the cluster scores and absolute level of intellectual function by age and sex have been reported elsewhere (Gribbin, Schaie & Parham, 1975).

Micro-environment patterns

A further preliminary analysis to be reported here involved the clustering of our 140 subjects by considering the distance function among their profiles on the eight cluster scores. Our clustering program identified eight clusters of individuals having four or more members. Eighty-six subjects fell into four clusters of sufficient size to permit interpretation. Table 4 presents the breakdown of these subjects by age and sex and Table 5 provides score means for each subject type on the eight environmental cluster scores.

Type 1 subjects are predominantly male, of average social status, with largely intact families, at an average level of maintained acculturation, live in a relatively noise-free environment, who are quite engaged, but who voice relative dissatisfaction with their life status. Type 2 subjects have high social status, are well-satisfied with their life status, with intact families, slightly above average maintenance of acculturation, and who live in a relatively noisy and accessible environment. Type 3 subjects are almost exclusively women. They are home-makers of average social status, with average satisfaction of life-status, who are in intact family situations. These subjects are above the average on disengagement items and low on maintenance of acculturation. But they also live in noisy but accessible environments and have

the highest mean on the semi-engagement pattern. Type 4 subjects are also, with one exception, all female. They are similar to Type 3 in being home-makers, but are quite dissimilar in all other characteristics. These subjects are older, have low social status, report dissatisfaction with their life status, are the highest on disengagement items, without showing the semi-engagement pattern; they live in noise-free but probably inaccessible environments, and are the highest on family disorganization.

In terms of favorable environmental complexity it is clear that our typology goes from the high-status engaged (Type 2), through the average status engaged (Type 1), to semi-engaged home-makers (Type 3) and disengaged homemakers (Type 4). It is noteworthy that our two oldest cohorts are not represented in types 1 and 2, while the two youngest cohorts are not represented in type 4. On the other hand, Type 3 subjects are distributed across the entire age/cohort range (see Table 4).

Subject Type and Cognitive Change

Our final analysis is concerned with the question whether or not significant differences by subject type can be found for change in cognitive function over time. To test this hypothesis the cognitive change scores described earlier in this paper were compared for the four subject types in a set of one-way ANOVAs. Results of these analyses are summarized in Table 6, with the associated means reported in Table 7.

Statistically significant differences in cognitive change by subject type are found for Verbal meaning over the second time period ($P < .01$), for Number over the first time period ($P < .05$), for intellectual ability over the first time period ($P < .01$) and for Educational Aptitude over the second time period ($P < .05$). Examination of Table 7, moreover, shows a clear trend with patterns of change following the proposed subject status hierarchy.

It should be noted that a score of 50 in that table represents no change, a score below 50 indicates increment and a score above 50 decrement. For further clarity, cumulative fourteen-year mean score changes on the cognitive variables are shown in Table 8. The subject type hierarchy appears even more convincingly from the latter table.

Summary and Conclusions

The result of studies which demonstrate greater variance in change in intellectual performance between cohorts and within the membership of cohorts than is true for generalized ontogenetic change across chronological age has induced us to investigate more carefully environmental factors which might account for such change more parsimoniously. Our study of individual's micro-environments resulted in the construction of a new instrument, the Life Complexity Inventory. Initial analysis of this instrument produced eight distinct environmental item clusters. Moderate correlations in the expected direction were found between environmental cluster scores and change in cognitive function over two seven-year periods. Clustering of individuals resulted in the identification of four modal subject types who differ in their pattern of change in cognitive function over time.

We suspect that the larger data base now under analysis will result in the identification of further environmental factors and additional subject types differing in their pattern of intellectual performance. It is clear, however, from these data that the relation between micro-environmental factors and change in intellectual function in adulthood and old age has been established and should be a fruitful topic for further more detailed investigation.

References

- Baltes, P.B., & Labouvie, G.V. Adult development of intellectual performance: Description, explanation, modification. In C. Eisdorfer & M.P. Lawton (Eds.). The psychology of adult development and aging. Washington, D.C.: American Psychological Association, 1973.
- Bayley, N. Development of mental abilities. In P.H. Mussen (Ed.), Carmichael's manual of child psychology. New York: Wiley, 1970.
- Eisdorfer, C., Busse, E.W., and Cohen, L.O. The WAIS performance of an aged sample: The relationship between verbal and performance IQ's. Journal of Gerontology, 1959, 14, 197-201.
- Fozard, J.L., Nuttall, R.L., & Waugh, N.C. Age-related differences in mental performance. Aging and Human Development, 1972, 3, 19-43.
- Gribbin, K., Parham, I.A., & Schaie, K.W. Cognitive change in adults as predicted by demographic characteristics: A stepwise regression analysis. Paper presented at the Annual Meeting of the American Psychological Association, New Orleans, 1974.
- Gribbin, K., Schaie, K.W., & Parham, I.A. Life complexity and maintenance of intellectual abilities. Paper presented at the 10th International Congress of Gerontology, Jerusalem, Israel, 1975.
- Human Resources Planning Institute. Social indicators survey of the aging. Report prepared for the Office on Aging, Department of Social and Health Services, State of Washington, Seattle, Washington, 1972.
- Institute for Social Research. OSIRIS II: Organized set of integrated routines for investigations with statistics, University of Michigan, 1971.
- Jarvik, L.F., Bennett, R., & Blumner, B. Design of a comprehensive life history interview schedule. In L.F. Jarvik, C. Eisdorfer & J.E. Blumner

- (Eds.), Intellectual functioning in adults. New York: Springer, 1973.
- Honzik, M.P., & MacFarlane, J.W. Personality development and intellectual functioning from 21 months to 40 years. In L.F. Jarvik, C. Eisdorfer & J.E. Blum (Eds.), Intellectual functioning in adults. New York: Springer, 1973.
- Kohn, M.L. Class and conformity: A study in values. Homewood, Ill.: Dorsey, 1969.
- Lowenthal, M.F. Intentionality: Toward a framework for the study of adaptation in adulthood. Aging and Human Development, 1971, 2, 79-95.
- Lowenthal, M.F., Spence, D.L., & Thurnher, H. Interplay of personal and social factors at transitional stages. In I. Rosow (Ed.), Socialization to old age. Washington, D.C.: National Institutes of Health, 1973.
- Nuttall, R.L., and Fozard, J.L. Age, socio-economic status and human abilities, Aging and Human Development, 1970, 1, 161-169.
- Owens, W.A. Age and mental abilities: A longitudinal study. Genetic Psychology Monographs, 1953, 48, 3-52.
- Parham, I.A., Gribbin, K., Hertzog, C., & Schaie, K.W. Health status assessment by age and implications for cognitive change. Paper presented at the 10th International Congress of Gerontology, Jerusalem, Israel, 1975.
- Schaie, K.W. A test of behavioral rigidity. Journal of Abnormal and Social Psychology, 1955, 51, 604-610.
- Schaie, K.W. Cross-sectional methods in the study of psychological aspects of aging. Journal of Gerontology, 1959, 14, 209-215.

- Schaie, K.W. Can the longitudinal method be applied to psychological studies of human development? In F.Z. Moenks, W.W. Hartup & J. deWit (Eds.), Determinants of human behavior. New York: Academic Press, 1972.
- Schaie, K.W. Cumulative health trauma and age changes in cognitive behavior. Paper presented at the Annual Meeting of the American Psychological Association, Montreal, 1973 (a).
- Schaie, K.W. Methodological problems in descriptive developmental research on adulthood and aging. In J.R. Nesselroade & H.W. Reese, (Eds.), Life-span developmental psychology: Methodological issues. New York: Academic Press, 1973 (b).
- Schaie, K.W. Translations in Gerontology-From lab to life: Intellectual functioning. American Psychologist, 1974, 29, 802-807.
- Schaie, K.W., & Gribbin, K. Adult development and aging. Annual Review of Psychology, 1975, 26, 65-96.
- Schaie, K.W., & Labouvie-Vief, G. Generational versus ontogenetic component of change in adult cognitive behavior: A fourteen-year cross-sequential study. Developmental Psychology, 1974, 10, 305-320.
- Schaie, K.W., & Parham, I.A. Manual for the Test of Behavioral Rigidity. 2nd Revised Edition. Palo Alto, Calif.: Consulting Psychologists Press, 1975.
- Schoenfeldt, L.F. Life history subgroups as moderators in the prediction of intellectual change. In L.F. Jarvik, C. Eisdorfer & J.E. Blum (Eds.), Intellectual functioning in adults. New York: Springer, 1973.
- Thurstone, L.L., & Thurstone, T.G. SRA Primary Mental Abilities Test. Chicago: Science Research Associates, 1949.

Table 1. Number of Subjects by Cohort and Sex

	Mean age:	Mean Year of Birth:	Male	Female	Total
Cohort 1	(85;	1889)	7	5	12
Cohort 2	(78;	1896)	2	12	14
Cohort 3	(71;	1903)	8	14	22
Cohort 4	(64;	1910)	16	14	30
Cohort 5	(57;	1917)	10	12	22
Cohort 6	(50;	1924)	10	13	23
Cohort 7	(43;	1931)	7	10	17
Total			60	80	140

Table 2. Mean Scores on Clusters by Cohort and Sex

		Clusters								
		N	A	B	C	D	E	F	G	H
Cohort 1	Male	7	37.8	39.5	46.7	66.5	44.3	52.9	56.6	47.7
	Female	5	56.6	45.7	48.0	62.4	48.9	49.9	56.4	45.0
	Total	12	45.6	42.1	47.3	64.8	46.2	51.6	56.5	46.6
Cohort 2	Male	2	34.1	53.5	50.2	59.7	51.1	59.3	45.2	49.0
	Female	12	60.2	38.5	51.6	60.6	47.7	50.1	67.4	50.8
	Total	14	56.5	40.6	51.4	60.4	48.1	51.5	64.2	50.5
Cohort 3	Male	8	40.2	45.3	50.6	50.6	45.8	48.8	48.4	50.2
	Female	14	58.8	45.5	50.0	55.1	53.8	55.4	50.1	50.4
	Total	22	52.0	45.4	50.2	53.5	50.9	53.0	49.5	50.3
Cohort 4	Male	16	41.7	52.4	50.0	44.3	45.4	53.3	48.9	45.2
	Female	14	57.5	54.0	48.4	47.8	52.2	49.3	48.7	55.3
	Total	30	49.1	53.2	49.3	46.0	48.6	51.4	48.8	49.9
Cohort 5	Male	10	41.6	51.8	52.3	44.0	50.0	42.6	45.1	49.1
	Female	12	56.3	46.8	54.1	46.6	54.2	48.3	49.1	48.0
	Total	22	49.6	49.0	53.3	45.5	52.3	45.7	47.3	48.5
Cohort 6	Male	10	38.0	57.5	51.1	40.7	51.4	45.6	46.4	47.6
	Female	13	54.6	57.6	46.5	49.1	50.8	49.8	45.9	54.1
	Total	23	47.4	57.6	48.5	45.4	51.0	47.9	46.1	51.3
Cohort 7	Male	7	42.9	57.4	45.3	39.5	53.1	47.2	45.4	50.3
	Female	10	56.4	52.8	52.5	49.9	49.8	51.2	45.0	53.3
	Total	17	50.8	54.7	49.5	45.6	51.2	49.5	45.2	52.0
Correlations with chronological age			.10	-.50*	-.01	.58*	-.13	.14	.42*	.08

*Significant at or beyond the 1% level of confidence.

Table 3. Correlations of Environmental Cluster Scores from the ICI with Scores from the Primary Mental Abilities and the Test of Behavioral Rigidity (N=140)

		A Female Homemaker	B Social Status	C Dissatisfaction with life status	D Disengage- ment	E Semi- engagement	F Noisy environment	G Family dissolution	H Maintenance of acculturation
Verbal Meaning:	1956	-.02	.42**	-.14	-.25**	.03	.05	-.10	.19*
	1963	-.09	.51**	-.13	-.36**	.01	.03	-.13	.17*
	1970	-.07	.52**	.03	-.48**	-.02	-.04	-.21**	.12
Space:	1956	-.15*	.31**	-.13	-.34**	.03	.11	-.13	-.05
	1963	-.22**	.35**	-.01	-.38**	-.04	.10	-.14	.01
	1970	-.16*	.33**	.06	-.43**	-.01	.01	-.18*	-.12
Reasoning:	1956	-.00	.45**	-.10	-.31**	.03	.06	-.11	.13
	1963	.00	.53**	-.13	-.38**	.06	.03	-.20**	.16*
	1970	.02	.55**	-.10	-.46**	.09	-.02	-.21**	.11
Number:	1956	-.04	.28**	-.19*	-.19*	.03	.16*	-.01	.06
	1963	-.07	.27**	-.19*	-.24**	-.01	.11	-.04	.02
	1970	-.03	.32**	-.13	-.28**	.03	.08	-.08	.00
Word Fluency:	1956	.17*	.22**	-.11	-.14*	-.07	.24**	-.00	.14
	1963	.11	.32**	-.13	-.22**	-.09	.20**	-.01	.22**
	1970	.13	.34**	-.02	-.22**	.07	.15*	-.10	.25**
Intellectual Ability:	1956	-.02	.45**	-.19*	-.32**	.01	.17*	-.08	.12
	1963	-.07	.53**	-.18*	-.42**	-.01	.13	-.13	.15*
	1970	-.03	.54**	-.06	-.48**	.05	.05	-.20**	.09
Educational Aptitude:	1956	-.02	.46**	-.14	-.28**	.03	.06	-.11	.16*
	1963	-.07	.55**	-.14*	-.37**	.03	.03	-.16*	.16*
	1970	-.05	.55**	-.00	-.49**	.01	-.04	-.22**	.12
Motor Cognitive Rigidity:	1956	-.04	.39**	-.03	-.25**	-.09	.13	-.13	.08
	1963	-.17*	.30**	.18*	-.42**	-.02	.08	-.15*	-.00
	1970	-.01	.38**	.05	-.32**	-.02	.08	-.14	.13
Personality Perceptual Rigidity:	1956	-.00	.19*	-.09	-.12	.04	.03	.09	.21**
	1963	.05	.32**	-.02	-.24**	.11	.02	-.07	.16*
	1970	.04	.32**	-.08	-.28**	.17	.04	-.08	.19*
Psychomotor Speed:	1956	.18*	.44**	-.09	-.14*	.06	.13	-.12	.16*
	1963	.16*	.50**	-.13	-.28**	.02	.05	-.18*	.17*
	1970	.18*	.53**	-.10	-.31**	.10	.07	-.25**	.19*

20 Significant at or beyond the 5% level of confidence. **Significant at or beyond the 1% level of confidence.

Table 4. Subject Types by Cohort and Sex (N=86)

Cohort		Type 1 High-status engaged	Type 2 Average-status engaged	Type 3 Semi-engaged homemakers	Type 4 Disengaged homemakers
Cohort 1 (85; 1889)	Male	0	0	0	0
	Female	0	0	1	3
	Total	0	0	1	3
Cohort 2 (78; 1896)	Male	0	0	0	0
	Female	0	0	0	10
	Total	0	0	0	10
Cohort 3 (71; 1903)	Male	3	1	0	0
	Female	0	1	6	2
	Total	3	2	6	2
Cohort 4 (64; 1910)	Male	4	6	1	1
	Female	3	3	3	0
	Total	7	9	4	1
Cohort 5 (57; 1917)	Male	3	3	0	0
	Female	1	1	3	1
	Total	4	4	3	1
Cohort 6 (50; 1924)	Male	3	5	0	0
	Female	1	3	2	0
	Total	4	8	2	0
Cohort 7 (43; 1931)	Male	2	3	0	0
	Female	1	3	3	0
	Total	3	6	3	0
All Cohorts	Male	15	18	1	1
	Female	6	11	18	16
	Total	21	29	19	17

Table 5. Score Means on the Environmental Cluster Scores from the LCI for the Four Modal Subject Types

Item Cluster	Type 1 (N=21)	Type 2 (N=29)	Type 3 (N=19)	Type 4 (N=17)	All Types (N=86)
A. Female homemaker	45.3	44.9	57.7	58.3	50.5
B. Social status	50.0	57.7	48.4	39.6	50.1
C. Dissatisfaction with life status	59.7	44.0	48.2	55.7	51.1
D. Disengagement	44.2	44.3	54.6	60.1	49.7
E. Semi-engagement	44.4	48.7	51.7	46.8	47.9
F. Noisy environment	42.8	53.0	55.7	47.9	50.1
G. Family dissolution	48.6	45.5	46.5	65.8	50.5
H. Maintenance of acculturation	47.0	48.6	44.9	48.6	47.4

Table 6

Summary of Analysis of Variance: Significant F Ratios

	V	S	R	N	W	I.Q.	E.Q.	MCR	PPR	PS
Type (T)	9.82**	4.06*	6.78**		3.25**	8.00**	9.63**	7.85**	7.65**	7.26**
Repeated Measure (R)					28.88**	6.71**				14.96**
T x R	3.98**					4.29**	4.59**			3.06**

(N=140; degrees of freedom, T=(3,82); R=(2,164); TxR=(6,164) * p<.05 **p<.01

Mean Scores by Cluster

	V	S	R	N	W	I.Q.	E.Q.	MCR	PPR	PS	
Type 1: 1956 (N=21)	52.81	52.52	53.00	49.24	54.67	52.52	53.05	52.14	48.10	50.29	
1963	53.90	53.90	53.57	51.00	49.57	52.81	54.14	54.71	47.71	47.38	
1970	56.38	53.48	52.81	50.24	51.00	53.05	55.81	53.38	48.86	49.57	
Type 2: 1956 (N=29)	57.83	56.14	56.86	53.07	57.21	57.48	58.03	54.66	57.45	57.55	
1963	59.59	56.07	57.41	55.55	54.00	58.17	59.66	56.28	56.90	55.43	
1970	59.21	55.03	57.93	53.83	53.03	57.28	59.38	54.14	56.90	56.38	
Type 3: 1956 (N=19)	53.74	51.26	56.47	52.11	61.05	56.00	54.74	51.47	49.37	53.89	
1963	52.95	51.89	55.42	50.79	53.79	53.53	53.84	51.68	51.68	51.63	
1970	53.53	52.79	54.63	51.16	54.89	54.16	54.11	53.16	51.53	53.21	
Type 4: 1956 (N=17)	49.53	46.53	49.47	49.24	52.71	49.53	49.53	45.35	51.65	52.59	
1963	48.12	47.29	46.94	47.71	49.41	47.18	47.82	48.53	50.47	45.53	
1970	45.12	46.41	46.29	47.59	47.12	45.59	45.18	45.24	48.82	44.88	
All Types (N=86)	1956	54.06	52.28	54.37	51.16	55.55	54.37	54.41	51.50	52.23	53.99
1963	54.47	52.83	53.97	51.84	51.97	53.66	54.69	53.35	52.23	50.70	
1970	54.48	52.45	53.65	51.13	51.78	53.24	54.53	51.98	52.16	51.74	

Table 7. Means for Change Scores on Cognitive Variables by Subject Type

Verbal meaning	1956-63	48.9	48.2	50.8	51.4	49.6
	1963-70	47.5	50.4	49.4	53.0	50.0
Space	1956-63	48.6	50.1	49.4	49.2	49.4
	1963-70	50.4	51.0	49.1	50.9	50.4
Reasoning	1956-63	49.4	49.4	51.1	52.5	50.4
	1963-70	50.8	49.5	50.8	50.6	50.3
Number	1955-63	48.2	47.5	51.3	51.5	49.3
	1963-70	50.8	51.7	49.6	50.1	50.7
Word Fluency	1956-63	55.1	53.2	57.3	53.3	54.6
	1963-70	48.6	51.0	48.9	52.3	50.2
Intellectual ability	1956-63	49.7	49.3	52.5	52.4	50.7
	1963-70	49.8	50.9	49.4	51.6	50.4
Educational aptitude	1956-63	48.9	48.4	50.9	51.7	49.7
	1963-70	48.3	50.3	49.7	52.6	50.2
Motor-cognitive rigidity	1956-63	47.4	48.4	49.8	46.8	48.2
	1963-70	51.3	52.1	48.5	53.3	51.4
Personality-perceptual rigidity	1956-63	50.4	50.6	47.7	51.2	50.0
	1963-70	48.9	50.0	50.1	51.6	50.1
Psychomotor speed	1956-63	52.9	52.1	52.2	57.1	53.3
	1963-70	47.8	49.1	48.5	50.6	49.0

Table 8. Cumulative Mean Score Change on Cognitive Variables over a 14-year Period by Subject Type in T-score Points
 (+ denotes incremental change; - denotes decremental change)

	Type 1	Type 2	Type 3	Type 4	All
Verbal meaning	+ 3.6	+ 1.4	- 0.2	- 4.4	+ 0.4
Space	+ 1.0	- 1.1	+ 1.5	- 0.1	+ 0.7
Reasoning	- 0.2	+ 1.1	- 1.9	- 3.1	- 0.7
Number	+ 1.0	+ 0.8	- 0.9	- 1.6	-
Word fluency	- 3.5	- 4.2	- 6.2	- 5.6	- 4.4
Intellectual ability	+ 0.5	- 0.2	- 1.9	- 4.0	- 1.4
Educational aptitude	+ 2.8	+ 1.3	- 0.6	- 4.3	+ 0.2
Motor-cognitive rigidity	+ 1.3	- 0.5	+ 1.7	- 0.1	+ 0.4
Personality-perceptual rigidity	+ 0.7	- 0.6	+ 2.2	- 2.8	- 0.3
Psychomotor speed	- 0.7	- 1.2	- 0.7	- 7.7	- 2.6