

LIFE COMPLEXITY AND MAINTENANCE OF INTELLECTUAL ABILITIES¹

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More sophisticated methodological approaches have enabled current researchers to seriously challenge the long-held beliefs that intelligence necessarily declines with age. Such work supports the contention that observed adult age differences in ability are not attributable to decline in capacity, but rather are the result of generational (or cohort) differences in abilities. In a series of studies Schaie and his associates (e.g., Schaie, Labouvie-Vief, 1974; Schaie, Labouvie, & Buech, 1973) have shown that for a given cohort, there is little within cohort age decrement, but that there are substantial differences in levels between successive cohorts. Furthermore, these studies demonstrate that individual patterns of change over time may show increment, decrement or maintenance of intellectual level. Although maintenance or increment is more characteristic for younger than for older cohorts, these patterns are found for all cohorts. Such evidence suggests that we must begin to determine the nature of environmental impact as it relates to patterns of individual change as well as to continue monitoring the impact of socio-cultural change upon cognitive function.

Although many parameters could be investigated (cf. Baltes & Labouvie, 1973), we decided to approach the problem by examining the individual's micro-environment; i.e., 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.

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Examination of factors such as the availability of reading material, presence of cultural amenities and socio-economic status have been found to correlate positively with children's intellectual performance (Bayley, 1970); however, until recently few such studies were found in research with adults. However, recently several investigators have reported studies involving the relationship between life complexity issues and intellectual functioning (e.g., Honzik & Macfarlane, 1973; Jarvik, Bennett and Blumner, 1973; Schoenfeldt, 1973).

Such studies support our contention that the study of micro-environmental factors in relation to change in intellectual functioning in adulthood is a reasonable approach. However, none of the studies cited have addressed the issue of investigating cognitive change rather than correlation with present cognitive status. Therefore, we developed a 29-page questionnaire, the Life Complexity Inventory (LCI) (described in detail in Schaie and Gribbin, 1975). The present paper reports the characteristic life styles which lead to increase, decrease or maintenance of intellectual functioning over time.

METHOD

Subjects

Subjects were initially sampled from a population base consisting of the approximately 18,000 members of a prepaid medical plan in the northwestern area of the United States. A more detailed description of the sampling procedure has been reported earlier (Schaie, 1959). Repeated measurement data for the Primary Mental Abilities and the Test of Behavioral Rigidity obtained in 1956, 1963, and 1970 were available for 161 subjects ranging in age from 22 to 70 years at time of first testing (see Schaie

& Labouvie-Vief, 1974, for further details).

During the spring of 1974, 140 of these subjects were interviewed with the LCI. Subjects (60 men and 80 women) at that time ranged in age from 40 to 88 years. For convenience of analysis, subjects were divided into seven-year cohorts, since the relationship between environmental factors and cognitive function measured over two seven-year periods (from 1956 to 1963 and from 1963 to 1970) will be reported. The sex by cohort breakdown is shown in Table 1.

RESULTS AND DISCUSSION

LCI Preliminary Analysis

Preliminary analysis of the 140 interview schedules has been reported elsewhere (Schaie & Gribbin, 1975). However, a short summary will be presented here in order to describe more clearly the present investigation.

The initial analysis of the LCI resulted in eight item clusters representing: 1) subjective dissatisfaction with the life status; 2) level of social status; 3) a noisy environment; 4) the dimension from being embedded in a nuclear family unit to family dissolution; 5) disengagement; 6) semi-engagement; 7) maintenance of acculturation; and 8) female homemaker activities.

Mean cluster scores by cohort and sex are reported in Table 2. These scores were scaled to produce a Mean of 50 and a standard deviation of 10 for the entire sample. The bottom of Table 2 shows correlations of cluster scores with age. As expected, there is a significant negative correlation between age and social status and a positive correlation with disengagement and family dissolution patterns. Far more noteworthy, however, is that no correlation with age was found for homemaker role,

dissatisfaction with life status, or with the maintenance of acculturation.

Relationship between Environmental Pattern and Cognitive Functioning.

Cluster scores were then correlated with the cognitive functioning data describing our subjects' in 1956, 1963, and 1970. 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 for Motor-cognitive Rigidity (MCR), Personality-perceptual Rigidity (PPR), and Psychomotor Speed (PS) from the Test of Behavioral Rigidity (Schaie, 1955; Schaie & Parham, 1975). These correlations are presented in Table 3. Positive correlations should be interpreted to indicate that the particular cluster is associated with higher ability or greater flexibility.

The reported correlations show appreciable consistency. The social status cluster is positively correlated with all test scores over all measurement periods (correlations ranging from .19 to .55), while the reverse is true for the disengagement cluster (correlations ranging from -.12 to -.49). Results for the other clusters are not as striking; however, all clusters except semi-engagement show a consistent relationship across time with at least one ability measure. Maintenance of acculturation is positively correlated with Verbal Meaning, Word Fluency, Educational Aptitude, Personality-perceptual Rigidity, and Psychomotor speed, while Family Dissolution is negatively correlated with Reasoning, Educational Aptitude, and Psychomotor Speed (for the 1963 and 1970 assessments). Female homemaker role is negatively correlated with Space and Psychomotor Speed; Dissatisfaction with Life status is negatively correlated with Intellectual

Ability and Number (at least for the 1956 and 1963 assessments); while Noisy Environment shows a positive relationship with Word Fluency. Although other significant relationships were found, they are of low magnitude and were relatively inconsistent; hence we would prefer to wait for replication with larger samples before attempting to interpret what might be spurious results.

Our findings suggest that we are beginning to get a more differentiated understanding of the specific impact of environmental variables on cognitive functioning in adults.

Micro-Environment Patterns.

As the next step, scores on the item clusters were used as variables to cluster our 140 subjects by considering the distance function among their profiles on the eight cluster scores. The clustering program identified eight clusters of individuals containing four or more members. Eighty-six subjects fell into four clusters, sufficiently large to permit interpretation. The breakdown of these subjects by age and sex are presented in Table 4, while Table 5 provides mean scores for each subject type on the eight environmental cluster scores.

Subjects in Type 1 are mostly male, of average social status, who live in a relatively noise-free environment, have largely intact family units, maintain an average level of acculturation, are quite engaged, but who voice strong dissatisfaction with their life status. Type 2 subjects have high social status, are well satisfied with their life status, have intact families, are slightly above average maintenance of acculturation and live in a relatively noisy and accessible environment. Women almost exclusively comprise Type 3. They are homemakers of average social status, have average satisfaction with life status and are in intact family

situations. These subjects are low on maintenance of acculturation and live in noisy and accessible environments. They are above the average on disengagement and have the highest mean on the semi-engagement pattern. Nearly all subjects in Type 4 are women and are similar to Type 3 in being homemakers; however, they are dissimilar in all other respects. These subjects are older, have low social status, are dissatisfied with their life status, are highest on disengagement items, but do not show the semi-engagement pattern. They live in noise-free but probably inaccessible environments and are the highest on family dissolution.

It is clear that our typology goes from the high status engaged (Type 2), through the average status engaged (Type 1), to semi-engaged homemakers (Type 3) and the 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 Level of Cognitive Ability over Time

Our final analysis concerns the question whether or not significant differences by subject type can be found for levels of cognitive ability over time. To examine this question, the four subject types were used as independent variables in a repeated measure (1956, 1963, 1970) ANOVA for each of the 10 measures of cognitive functioning. Results of these analyses and the associated means are presented in Table 6.

Statistically significant differences in cognitive abilities by subject type were found for all abilities except Number. As would be expected from the item cluster correlations, Type 2 (the high status engaged) was consistently high on all abilities, while the reverse was

true for Type 4 (the female disengaged) (see Table 6). Type 3 (the semi-engaged) was fairly average on all tests, showing consistency over time, with the exception of Word Fluency and intellectual ability, where there was evidence of decrement. Type 1 (the average status engaged) was also fairly consistent across testing periods; however, in general, their scores were average or slightly below.

Significant repeated measure effects were found for Word Fluency, Intellectual Ability and Psychomotor Speed. As can be seen in Table 6, these effects resulted from a decrease in scores on Word Fluency over time, and a decrease in Intellectual Ability, primarily attributable to decreases by Type 4 as evidenced by the Type by repeated measures interaction. A decrease in Psychomotor Speed was also noted, again primarily attributable to decreases by Type 4, although losses suffered by Types 1, 2, and 3 from 1956 to 1963 were for the most part regained from 1963 to 1970. As before this Type by repeated measures interaction was statistically significant.

Other significant Type by repeated measures interactions included Verbal Meaning and Educational Aptitude where Types 1 and 2 increased, Type 3 remained stable and Type 4 decreased. The pattern of our results obviously follows the proposed status hierarchy.

It should be noted that scores on all ability tests are T scores (Mean=50; s.d.=10) which were originally standardized on the entire population from which this sample was selected. Examination of the mean scores for all types show that this sub-sample is obviously a select group; nevertheless, the patterns still clearly emerge. Further investigation with a more heterogeneous sample, which is now in progress, should lead to even more convincing findings.

Summary and Conclusions.

Results from studies which demonstrate greater variance in intellectual performance between cohorts and within members of the same cohorts than is found for generalized ontogenetic trend across chronological age has led us to investigate environmental factors which might increase our understanding of such differences. Initial analysis of our data produced eight distinct environmental item clusters. Correlations in the expected direction were found between environmental cluster scores and scores on tests of cognitive function over three time periods. Subject types, resulting from the clustering of individuals by their cluster profiles, differ in their level of cognitive functioning and in the change of such functioning over time.

Results of the present investigation provide strong evidence that the relation between micro-environmental factors and level of intellectual functioning in adulthood and old age is a fruitful area for more detailed investigation.

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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	47.0
	Female	13	54.6	57.6	46.5	49.1	50.8	49.8	45.9	54.0
	Total	23	47.4	57.6	48.5	45.4	51.0	47.9	46.1	51.0
Cohort 7	Male	7	42.9	57.4	45.3	39.5	53.1	47.2	45.4	50.0
	Female	10	56.4	52.8	52.5	49.9	49.8	51.2	45.0	53.0
	Total	17	50.8	54.7	49.5	45.6	51.2	49.5	45.2	52.0
Correlations with			.10	-.50*	-.01	.58*	-.13	.14	.42*	.10
chronological age										

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

Table 3. Correlations of Environmental Cluster Scores from the LCI 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	.18*
1963	-.07	.55**	-.14*	-.37**	.03	.03	-.16*	.18*
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	.18*
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*

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

Cohort		Type 1 <i>High</i> status engaged	Type 2 <i>Average</i> 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 8

Summary of Analysis of Variance: Significant F Ratios

Type (T)	V	S	R	N	W	I.Q.	E.Q.	MCR	PPR	PS
	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

Type	V	S	R	N	W	I.Q.	E.Q.	MCR	PPR	PS
Type 1: 1956	52.81	52.52	53.00	49.24	54.67	52.52	53.05	52.14	48.10	50.29
(N=21) 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	57.83	56.14	56.86	53.07	57.21	57.48	58.03	54.66	57.45	57.55
(N=29) 1963	59.59	56.07	57.41	55.55	54.00	58.17	59.66	56.28	56.90	55.48
1970	59.21	55.03	57.93	53.83	53.03	57.28	59.38	54.14	56.90	56.38
Type 3: 1956	53.74	51.26	56.47	52.11	61.05	56.00	54.74	51.47	49.37	53.89
(N=19) 1963	52.95	51.89	55.42	50.79	53.79	53.53	53.84	51.68	51.68	51.68
1970	53.53	52.79	54.63	51.16	54.89	54.16	54.11	53.16	51.58	53.21
Type 4: 1956	49.53	46.53	49.47	49.24	52.71	49.53	49.53	45.35	51.65	52.59
(N=17) 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	54.06	52.28	54.37	51.16	56.55	54.37	54.41	51.50	52.23	53.99
Types	54.47	52.88	53.97	51.84	51.97	53.66	54.69	53.35	52.23	50.70
(N=86) 1970	54.48	52.45	53.65	51.13	51.78	53.24	54.53	51.98	52.16	51.74