A FACTOR ANALYSIS OF THE ECHELLE D'INTELLIGENCE OTTAWA-WECHSLER

by Arthur M. Bolle

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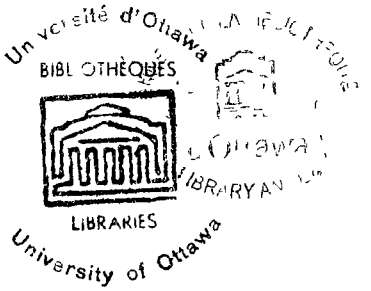

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INTRODUCTION

In this thesis, an attempt will be made to discover the functional unities underlying performance on the Echelle d'Intelligence Ottawa Wechsler[1]. To do this, Thurstone's Centroid Method of Factor Analysis will be used[2].

The following chapters progress from the Statement of the Problem in chapter I, to The actual Naming of the factors extracted in chapter IV.

In chapter II, we see the population and the method used in the Experimental Design. Thurstone's Method is briefly described and the terminology used therein is defined.

The first and second factor analyses of the data are commented upon in chapter III, and reasons are given for the second analysis. The reasons for not going further on to a third factor are also given in both cases.

Chapter IV is concerned with the actual names attached to the two extracted factors after the process of factor analysis.

The Conclusions bring together all the data found in chapters III and IV. Besides this are a number of

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[1] The French version of the Wechsler Bellevue Intelligence Scale to be used in this study.

[2] Guilford, J. P., Psychometric Methods, New York, McGraw-Hill, 1936, p. 471 - 513.

suggestions of research which may be carried on in the continuance of the work on this problem.

CHAPTER ONE

STATEMENT OF THE PROBLEM

Although intelligence acts as though it were a single factor, it has been found to be made up of a number of independent dimensions acting in unison. This statement is fundamental in this undertaking. The statistical instrument called factor analysis, is used in extracting unitary traits from the multiplex mental life of the human being. In Psychology, as in the other sciences, it is essential to know the least number of factors in operation at any given time, or during any given function, and to state these in their simplest terms.

The need of research in this region will become more and more evident as time progresses. Fundamental variables operating in any field of research lead us to our ultimate aim in science -- truth. It would seem, therefore, that in the comparatively new science of psychology, we should strive to find the essentials of every operation of the human personality. The seemingly insignificant aspects, when adequately ordered and described, bring us to a better understanding of man and his response mechanisms.

A second consideration is in that of test construction. Little is known of the real validity of any test until we have actually inspected the means an individual uses in working out the problems placed before him. It is essential to know this before we can construct tests, and so that we can be sure it

is intelligence we are testing and not some other facet in the personality.

From this latter perception follows a third question. Do we really know what intelligence is? There have been numerous definitions of intelligence put forth by psychologists. No two are entirely alike. Since we cannot know exactly what it is, and it is impossible to ascertain what it is by simply asking an individual, it is necessary to discover its factors of operation in a posterieri investigations. This enables us to see its effects, and, knowing these, we will be able to apply them to the human being who uses them. Thus, in this way, we approach the truth.

These three considerations point out the importance of the use of factor analysis in psychological research.

> "By factor analysis, we can accomplish three ends: (1) we can determine the smallest number of independent abilities that must be postulated in order to account for the table of intercorrelations; (2) we can determine how much of each independent ability is represented by each test; (3) we can set up regression equations by which an individual's amount of any primary ability can be estimated from the tests that depend upon that ability."[1]

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[1] Guilford, J. P., Psychometric Methods, New York, McGraw-Hill, 1936, p. 471 - 513.

The field of factor analysis will gain importance as more and more research workers make use of it.

The Wechsler-Bellevue Intelligence Scale was found to make good use of factor analysis because of the subtests within the scale. This valuable approach to intelligence has given us important facts on which further research may be based.

Three important studies have been made so far, using factor analysis on the Wechsler-Bellevue Intelligence Scale. Jacob Cohen[1], working with an abnormal group, tested their performance on the above-mentioned test. The purpose of this research was to discover and compare the factorial structures underlying the schizophrenic, psychoneurotic, and brain-damaged male veteran patients on a standard battery of intellectual tests (i.e. the Wechsler-Bellevue Scale). The subjects were selected from the records of the Psychological Service Section of the Bronx Veterans' Administration Hospital. The criterion for the selection was according to the Definition of Terms for the three groups. The selected groups consisted of one hundred individuals each, and were equated approximately for their means and standard deviations.

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[1] Cohen, Jacob, A Comparative Analysis of Factors Underlying Intelligence Test Performance of Different Neuropsychiatric Groups: Multiple Factor Analysis of the Wechsler-Bellevue Intelligence Scale Performance of Schizophrenics, Psychoneurotics, and Brain Damaged Groups, Microfilmed PhD. Thesis, University of New York, 1950, p. vii - 162.

The significant loadings for factor A were as follows: Vocabulary .68; Information .595; Comprehension .57; Similarities .43; and Picture Completion .41. This was called the Verbal Factor.

For factor B the loadings were: Object Assembly .71; Block Design .44; Picture Completion .44; and Picture Arrangement .36. Cohen chose to call this the Non-Verbal Organization Factor rather than use "performance", as used by D. Wechsler.

The C factor loadings were: Digits forward .52; Digits backward .51; Arithmetic .45; Digit Symbol .44; and Block Design .36. This was the Distractibility Factor because, according to Cohen, it depends on the interference with the subject's ability to attend to the material, and whether the subject retains or loses the element during the course of manipulation.

The three Common factors were found to be the same in each of the three populations, although somewhat different in content.

F. Balinsky[1], interested in finding out if any changes in mental factors occurred during the advance of age, worked on different age groups using the Wechsler-Bellevue Intelligence Scale. He selected the following age groups: 9, 12, 15,

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[1] Balinsky, B., "An Analysis of the Mental Factors of Various Age Groups from Nine to Sixty", in Genetic Psychology Monographs, Vol. 23, first half, Feb. 1941, p. 191 - 234.

25-29, 35-44, and 50-59 years. These were drawn from the standardization group of the Wechsler-Bellevue Scale, and 600 cases were used.

A verbal factor, a performance factor, a memory factor, a factor of seeing relationships in social situation, a reasoning factor, a factor called "restriction in solution", and a factor which was not clearly distinguished were discovered. Although the factors did not always appear in each age group, the verbal and performance factors were fairly consistent. Age groups 25-29, and 35-40 were the only ones containing the memory factor.

Balinsky concluded that the "mental traits change and undergo reorganization over a span of years. Therefore, when interpreting tests of intelligence, it is important to take into consideration the age of the individual."

The third investigation was made by Wechsler, Israel and Balinsky[1]. These men compared the subtest scores of 82 borderline and 45 mentally defective cases. They found that all but the digit span and object assembly tests discriminated effectively between the two groups. Block design and similarities tests were the most effective.

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[1] Wechsler, D. H. Israel, and B. Balinsky, "A Study of the Sub-Tests of the Bellevue Intelligence Scale in Borderline and Mental Defective Cases", in American Journal of Mental Deficiency, Vol. 45, No. 4, April 1941, p. 555 - 558.

The two groups did better on the performance tests than on the verbal, and discrimination was better in the ages from 1[illegible] - 19.

The test to be used in this research is the "Echelle d'Intelligence Ottawa-Wechsler. It is the French edition of the Wechsler-Bellevue Intelligence Scale.

> "The Ottawa-Wechsler Intelligence Scale is prepared for the bilingual centers where the Wechsler-Bellevue has already been used. It was felt that those centers needed an instrument that (1) would use the same materials as the original, and (2) would furnish results comparable to those of the original. Hence in this French version (1) the materials of the performance subtests have been used and also standardized on the French Canadian population of Ottawa, and (2) norms have been tentatively drawn up that would be comparable to those obtained on the Wechsler."[1]

The question can now be asked whether the findings of the authors mentioned above also hold for the Echelle d' Intelligence Ottawa-Wechsler. With this question in mind, we form the following hypothesis: The Ottawa-Wechsler measures constant factors in the various age groups from 15 to 59 inclusive.

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[2] Chagnon, M., Manuel et Normes de l'Echelle d'Intelligence Ottawa-Wechsler, University of Ottawa, 1953, p. 3.

CHAPTER II

THE EXPERIMENTAL DESIGN

1. The Population.

The material used in this thesis was drawn from the standardization group of the Ottawa-Wechsler. The following is a description of how the population was gathered for this standardization:

> A l'aide des données du Rapport du Recensement canadien, il était facile de trouver quel pourcentage de sujets était requis dans chacune des classes de l'échantillon. Avant de distribuer les sujets selon les niveaux occupationnels, il fallait reclassifier toutes les occupations du recensement canadien dans l'échelle de Goodenough. Pour subdiviser les sujets du groupe "aux études" selon l'occupation du père, nous n'avons pas fondé nos calculs sur la distribution des occupations de toute la population mâle, mais nous avons utilisé le groupe de 35 à 70 ans, dans l'hypothèse que cette section de la population représenterait mieux les pères d'étudiants et d'étudiantes de 15 à 24 ans.
>
> Les principes de stratification devaient nous permettre d'atteindre toutes les sections de la population et surtout d'obtenir des sujets de tous les niveaux intellectuels. Les strata qui nous permettaient d'atteindre ce but étaient les suivants: 1° les groupes d'âges; 2° les sexes; 3° les occupations, et 4° les niveaux socio-économiques, ainsi que les niveaux d'éducation et d'occupation.
>
> Le premier stratum divisa la population de 15 à 59 ans en huit groupes d'ages, comme suit:

15 ans	25-34 ans
16-17 ans	35-44 ans
18-19 ans	45-54 ans
20-24 ans	55-59 ans

Le deuxième stratum subdivisa chaque groupe d'âge en un groupe masculin et un groupe féminin, selon les pourcentages d'hommes et de femmes dans l'univers outaouais. Le troisième stratum subdivisait les hommes et les femmes de deux façons différentes: d'abord les groupes d'âges de 15 à 24 ans en trois catégories, les gens aux études, les gens au travail, les gens à la maison; et ensuite les groupes d'âges de 24 à 59 ans en deux catégories, les gens au travail et les gens à la maison. Le quatrième stratum subdivisait encore les catégories selon leurs niveaux socio-économiques, leurs niveaux d'éducation et leurs niveaux d'occupation.

Il convient de donner un mot d'explication sur les gens aux études, au travail, à la maison.

1. Les gens "aux études" - On s'attend bien à retrouver ceux-ci a tous les âges de 15 à 24 ans. Il est assez facile de tracer le niveau scolaire des jeunes entre 15 et 18 ans; mais la chose devient impossible au-dela de 18 ans. Comme il fallait trouver une base commune pour tous les groupes de 15 à 24 ans, il nous a semblé préférable d'utiliser la classification de Goodenough et de subdiviser les gens aux études en niveaux socio-économiques, d'après l'occupation de leur père. Cette classification a maintes fois servi dans la standardisation de tests d'intelligence: témoin, l'échelle de vocabulaire preparée par le Dr. L. T. Dayhaw.

2. Les gens "au travail" - La classification générale des occupations du recensement canadien se fait d'après les domaines industriels. Comme dans chacun de ces domaines il y a des sujets de tous les niveaux intellectuels, il pourrait arriver qu'un échantillon soit fidèle aux données du recensement sans toutefois représenter les niveaux d'intelligence. Il fallait donc choisir de préférence une classification fondée sur la distribution des capacités mentales, comme celle preparée par Goodenough. Elle échelonne les gens "au travail" en sept classes différentes.

3. Les gens "à la maison" - Dans les cas où le nombre de sujets le permettait, nous avons subdivisé ces groupes en quatre catégories selon les années de scolarité; sans scolarité, école primaire,

école secondaire, collège et université.

> Une dernière question: combien de sujets faut-il inclure dans chaque stratum? Comme les échelles de Q.I. pour les groupes d'âges sont indépendantes l'une de l'autre, dans le procédé de Wechsler, il n'est pas necessaire de choisir un nombre proportionnel de sujets pour chacun des groupes d'âges. Il nous a donc paru suffisant, pour notre première série de normes, de les calculer sur une base de 100 sujets pour tous les groupes d'âges, à l'exception du dernier, celui des gens de 55 à 59 ans. Ici il n'y a que 60 sujets à cause des difficultés rencontrées à trouver un nombre suffisant de gens pour certaines subdivisions.

The method of choosing the population for the sample population is shown in Tables I to VIII. The divisions or stratification, as fully described in the population description above, can be clearly seen in those tables. The tables are by age groups, and are subdivided into each stratum with its particular subdivisions.

2. The Method.

This will be presented in two steps. In this factor analysis of the intellectual performance on the Ottawa-Wechsler, Thurstone's Centroid Method of factor analysis will be used. To date, there have been many methods of factor analysis expounded by such men as Spearman, Hotelling, Kelley, Holzinger, etc. The reason for using Thurstone's method is that, "These methods have been supplied with a very complete rational basis in the mathematics of matrix theory and they

AND EXPERIMENTAL DESIGN

Table I. Proportional Distribution (in Percentage) of the Stratified Parent Population and Sample for the 15 Years Old Age Group Use in Factor Analysis of the Ottawa-Wechsler.

Sex	Categories	Percentage in Stratified Parent Population	Number in Sample	Percentage in Sample
M		49.84	50	50.00
	At Work	5.55	3	6.00
	III	4.4		
	V	26.5	1	33.33
	VI	54.4	2	66.67
	VII	14.7		
	At School	89.47	45	90.00
	I	9.54	4	8.89
	II	15.28	7	15.56
	III	20.00	9	20.00
	IV	.15		
	V	38.85	18	40.00
	VI	7.39	3	6.67
	VII	8.78	4	8.89
	At Home	4.98	2	4.00
		50.16	50	50.00
	At Work	4.46	2	4.00
	III	3.6		
	V	94.5	2	100.00
	VII	1.8		
	At School	88.24	44	88.00
	I	9.54	4	9.09
	II	15.28	7	15.91
	III	20.00	9	20.45
	IV	.15		
	V	38.85	17	38.64
	VI	7.39	3	6.82
	VII	8.78	4	9.09
	At Home	7.30	4	8.00

Table II. Proportional Distribution (in Percentage) of the Stratified Parent Population and Sample for the 16-17 Years Old Age Group Use in Factor Analysis of the Ottawa-Wechsler.

Sex	Categories	Percentage in Stratified Parent Population	Number in Sample	Percentage in Sample
M		48.06	48	48.00
	At Work	33.54	16	33.33
	I	.70		
	II	.35		
	III	11.01	2	12.50
	V	52.34	9	56.25
	VI	27.63	4	25.00
	VII	7.96	1	6.25
	At School	58.48	28	58.33
	I	9.54	3	10.71
	II	15.28	4	14.29
	III	20.00	6	21.43
	V	38.85	11	39.29
	VI	7.29	2	7.14
	VII	8.78	2	7.14
	At Home	7.98	4	3.33
F		51.94	52	52.00
	At Work	25.02	13	25.00
	I	.14		
	II	.14		
	III	25.60	3	23.08
	V	70.55	9	69.23
	VI	.71		
	VII	2.84	1	7.69
	At School	59.27	31	59.62
		9.54	3	9.68
		15.28	5	16.13
		20.00	6	19.35
		.15		
		38.85	12	38.71
		7.39	2	6.45
		8.78	3	9.68
	At Home	15.71	8	15.38

Table III. Proportional Distribution (in Percentages) of the Stratified Parent Population and Sample for the 18-19 Years Old Age Group Use in Factor Analysis of the Ottawa-Wechsler.

Sex	Categories	Percentage in Stratified Parent Population	Number in Sample	Percentage in Sample
M		45.79	46	46.00
	At Work	58.68	27	58.70
	I	1.16		
	II	2.25	1	3.70
	III	15.67	4	14.81
	V	59.43	16	59.26
	VI	13.11	4	14.81
	VII	8.38	2	7.41
	At School	30.80	14	30.44
	I	9.54	1	7.14
	II	15.28	2	14.29
	III	20.00	3	21.43
	IV	.15		
	V	38.85	6	42.86
	VI	7.39	1	7.14
	VII	8.78	1	7.14
	At Home	10.52	5	10.87
F		54.21	54	54.00
	At Work	62.06	33	61.11
	I	.60		
	II	.32		
	III	37.07	12	36.36
	V	59.53	20	60.61
	VI	.37		
	VII	2.11	1	3.03
	At School	18.04	10	18.52
	I	9.54	1	10.00
	II	15.28	1	10.00
	III	20.00	2	20.00
	IV	.15		
	V	38.85	4	40.00
	VI	7.39	1	10.00
	VII	8.78		10.00
	At Home	19.67	11	20.37

Table IV. Proportional Distribution (in Percentage) of the Stratified Parent Population and Sample for the 20-24 Years Old Age Group Use in Factor Analysis of the Ottawa-Wechsler.

Sex	Categories	Percentage in Stratified Parent Population	Number in Sample	Percentage in Sample
M		44.52	45	45.00
	At Work	78.96	35	77.78
	I	4.35	2	5.71
	II	5.38	2	5.71
	III	24.17	8	22.86
	V	54.56	19	54.29
	VI	4.73	2	5.71
	VII	6.78	2	5.71
	At School	13.00	6	13.33
	I	9.54	1	16.67
	II	15.28	1	16.67
	III	20.00	1	16.67
	IV	.15		
	V	38.85	2	33.33
	VI	7.39		
	VII	8.78	1	16.67
	At Home	8.04	4	8.89
F		55.48	55	55.00
	At Work	70.81	39	70.91
	I	2.76	1	2.56
	II	.74		
	III	40.42	16	41.03
	V	54.20	21	53.85
	VI	.28		
	VII	1.59	1	2.56
	At School	3.62	2	3.64
	I	9.54		
	II	15.28		
	III	20.00	1	50.00
	IV	.15		
	V	38.85	1	50.00
	VI	7.39		
	VII	8.78		
	At Home	25.57	14	25.45

Table V. Proportional Distribution (in Percentage) of the Stratified Parent Population and Sample for the 25–34 Years Old Age Group Use in Factor Analysis of the Ottawa-Wechsler.

Sex	Categories	Percentage in Stratified Parent Population	Number in Sample	Percentage in Sample
M		44.56	45	45.00
	At Work	96.21	43	95.56
	I	10.00	4	9.30
	II	10.53	5	11.63
	III	16.55	7	16.28
	V	44.08	20	46.51
	VI	10.07	4	9.30
	VII	6.66	3	6.98
	At Home	3.79	2	4.44
F		55.46	55	55.00
	At Work	44.01	24	43.64
	I	6.57	2	8.33
	II	1.66		
	III	36.98	9	37.50
	V	52.56	13	54.17
	VI	.41		
	VII	1.82		
	At Home	55.99	31	56.36
	Nil.	.53		
	Prim.	28.42	9	29.03
	Sec.	55.09	17	54.84
	Coll.	15.96	5	16.13

Table 11. Proportional Distribution (in Percentage) of the Stratified Parent Population and Sample for the 35-44 Years Old Age Group Use in Factor Analysis of the Ottawa-Wechsler.

Sex	Categories	Percentage in Stratified Parent Population	Number in Sample	Percentage in Sample
M		45.18	45	45.00
	At Work	95.32	43	95.56
	I	9.99	4	9.30
	II	14.65	6	13.95
	III	19.09	8	18.61
	IV	.10		
	V	40.67	18	41.86
	VI	7.87	4	9.30
	VII	7.48	3	6.98
	At Home	4.68	2	4.44
F		54.82	55	55.00
	At Work	32.11	18	32.73
	I	2.01		
	II	8.20	1	5.56
	III	30.93	6	33.33
	IV	.14		
	V	53.42	10	55.56
	VI	.54		
	VII	4.75	1	5.56
	At Home	67.89	37	67.27
	Nil.	.88		
	Prim.	36.12	13	35.14
	Sec.	50.35	19	51.35
	Coll.	12.64	5	13.51

Table VII. Proportional Distribution (in Percentage) of the Stratified Parent Population and Sample for the 45-54 Years Old Age Group Use in Factor Analysis of the Ottawa-Wechsler.

Sex	Categories	Percentage in Stratified Parent Population	Number in Sample	Percentage in Sample
M		47.14	47	47.00
	At Work	93.14	44	93.62
	I	9.31	4	9.09
	II	15.79	7	15.91
	III	19.90	9	20.45
	IV	.17		
	V	39.81	17	38.64
	VI	6.49	3	6.82
	VII	8.52	4	9.09
	At Home	6.86	3	6.38
F		52.86	53	53.00
	At Work	25.75	14	26.42
	I	7.67	1	7.14
	II	4.53	1	7.14
	III	23.00	3	21.43
	IV	0.00		
	V	53.55	8	57.14
	VI	.67		
	VII	10.57	1	7.14
	At Home	74.25	39	73.58
	Mil.	1.80	1	2.56
	Prim.	39.17	15	38.46
	Sec.	46.13	18	46.15
	Coll.	12.89	5	12.82

Table VI.I. Proportional Distribution (in Percentage) of the Stratified Parent Population and Sample for the 55-59 Years Old Age Group Use in Factor Analysis of the Ottawa-Wechsler.

Sex	Categories	Percentage in Stratified Parent Population	Number in Sample	Percentage in Sample
M		24.00	24	24.00
	At Work	18.03	18	75.00
	I	1.69	2	11.11
	II	2.84	3	16.67
	III	3.64	4	22.22
	IV	.02		
	V	6.66	6	33.33
	VI	1.22	1	5.56
	VII	1.93	2	11.11
	At Home	5.97	6	25.00
F		26.00	26	26.00
	At Work	6.05	6	23.08
	I	.40	1	16.67
	II	.21		
	III	1.06	1	16.67
	IV	0.00		
	V	3.27	3	50.00
	VI	.06		
	VII	.99	1	16.67
	At Home	19.95	20	76.92

can be made to lead to significant, meaningful variables".[1]

Three ends can be accomplished by the use of factor analysis:

> "(1) we can determine the smallest number of independent abilities that must be postulated in order to account for the table of inter-correlations; (2) we can determine how much of each independent ability is represented by each test; (3) we can set up regression equations by which an individuals amount of any primary ability can be estimated from tests that depend upon that ability."[2]

The second step will be the comparison of results between age groups. This will be done simply by the method of inspection. This is the finding and naming of clusters of tests at each age group. Graphical representations were used to determine these clusters. It is here that our hypothesis will be checked.

It may be convenient at this time to define the main terms that will be used with this method. The most important item to be defined is factor analysis. It is "Any method of analysis of the inter-correlations or covariances of a set

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[1] Guilford, J. P., Psychometric Methods, New York, McGraw-Hill, 1936, p. 471.

[2] Id, Ibid., p. 472

of variables by which the proportions of the variances of each variable which are associated with each of the factors may be determined."[1] More specifically, we have used the intercorrelations of the ten subtests of the Ottawa-Wechsler.

The second technique to be defined is that of reflection.

> Whenever there are a large number of negative signs in some of the columns, we must proceed to reflect some of the test variables. By this we mean changing signs throughout some of the columns (and through the corresponding rows) so as to maximize the number of plus signs in the new correlation matrix.[2]

Two other important items are factor loadings and communality. Factor loadings refer to the "weight" or size of the coefficient, according to the importance the factor plays in a test. Communality, symbolized by h^2k, is simply the sum of the squares of the factor loadings. This sum should equal 1 if the test is perfect (no errors of measurement) and there are no specific factors.

These are the four most important definitions given here. Other terms will be defined as they occur in the text.

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[1] Kurtz, A. K., and H. A. Edgerton, Statistical Dictionary, New York, Wiley, 1939, p. 60.

[2] Guilford, Psychometric Methods, New York, McGraw-Hill, 1936, p. 482.

CHAPTER III

THE FACTOR ANALYSIS

The steps in this factor analysis were followed from the outline given by J. P. Guilford.[1]

1. The First Factor Analysis.

The first factor analysis revealed only two factors. The second factor residuals were low, and the highest of these that were greater than .100 were distributed as follows:

Age Group	I:	.104
" "	II:	.157, .121, .100
" "	III:	--
" "	IV:	.109, .115
" "	V:	.142, .120
" "	VI:	.135, .114, .103, .120
" "	VII:	.106, .104, .100, .123
" "	VIII:	--

None of these residuals were found significant at the 1% level of significance, using the formula 2.58 x σ. The average standard deviation (σ) of the original intercorrelations was approximately .07. Therefore, the residuals must be greater than .191. Inspection reveals none higher than .157. From these results, it was concluded that there was no point

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[1] Guilford, J. P., Psychometric Methods, New York, McGraw-Hill, 1936, p. 471 - 513.

Table IX. A Comparison of the Estimated and Computed Communalities Obtained in the First Factor Analysis of the 10 Subtests of the Ottawa-Wechsler.

Group		1	2	3	4	5	6	7	8	9	10
1	Estimated	.613	.611	.376	.504	.613	.427	.471	.504	.504	.460
	Computed	.6536	.5094	.2252	.3807	.6123	.2486	.4221	.6088	.3620	.3436
	Discrepancies	-.0406	+.1016	+.1508	+.1233	+.0007	+.1784	+.0489	-.1048	+.1420	+.1164
2	Estimated	.698	.568	.342	.653	.680	.432	.577	.541	.480	.698
	Computed	.7727	.4160	.1907	.5444	.6201	.2516	.5873	.4669	.3561	.4045
	Discrepancies	-.0747	+.1520	+.1513	+.1086	+.0599	+.1804	-.0103	+.0741	+.1239	+.2935
3	Estimated	.696	.613	.461	.645	.698	.518	.606	.502	.455	.518
	Computed	.7095	.6233	.3143	.5863	.5998	.4439	.5275	.4429	.3686	.5760
	Discrepancies	-.0115	-.0103	+.1467	+.0587	+.0982	+.0741	+.0785	+.0591	+.0864	-.0580
4	Estimated	.740	.492	.340	.639	.740	.520	.577	.587	.519	.587
	Computed	.6946	.2554	.1844	.6634	.6184	.4374	.4895	.5368	.3610	.4727
	Discrepancies	+.0454	+.2366	+.1556	-.0244	+.1216	+.0826	+.0875	+.0502	+.1580	+.1143
5	Estimated	.720	.584	.520	.720	.718	.496	.631	.627	.524	.437
	Computed	.7541	.5125	.3598	.6922	.6801	.3355	.5445	.6206	.3526	.4233
	Discrepancies	-.0341	+.0715	+.1602	+.0278	+.0379	+.1605	+.0865	+.0064	+.1714	+.0137
6	Estimated	.763	.628	.541	.763	.740	.533	.715	.648	.513	.610
	Computed	.8327	.4549	.4916	.6951	.5999	.3664	.6453	.5955	.4286	.4896
	Discrepancies	-.0697	+.1731	+.0494	+.0679	+.1401	+.1666	+.0697	+.0525	+.0844	+.1204
7	Estimated	.752	.644	.601	.723	.712	.610	.752	.649	.587	.565
	Computed	.7586	.6124	.5177	.7065	.6757	.5272	.7049	.6157	.4798	.4818
	Discrepancies	-.0066	+.0316	+.0853	+.0165	+.0363	+.0828	+.0471	+.0333	+.1072	+.0832
8	Estimated	.838	.778	.775	.838	.890	.739	.890	.716	.612	.701
	Computed	.8559	.7464	.6465	.7875	.7643	.6803	.8167	.7250	.3881	.5746
	Discrepancies	-.0179	+.0316	+.1285	+.0505	+.1257	+.0587	+.0733	+.0090	+.2239	+.1264

in going on to a third factor, as the residuals were probably only chance values.

2. The Second Factor Analysis.

A comparison of the estimated and computed communalities, as shown in Table IX, reveals very large discrepancies. It was decided, from this, to go over the whole process of factor analysis for the second time. It can be seen from Tables XVIII to XLI in the Appendix that the communalities used from the first analysis approximate more closely those computed in the second analysis.

It was found in this second factor analysis that it was advisable to stop after the extraction of the second factor for the following reasons:

1. There is only one residual (.130 in Table XLI, Age Group VIII) out of 45 in this age group, or 360 in the eight age groups that appears to be significant;
2. Even the "t" is of doubtful value: the formula $\sigma r = 1 - r^2 / \sqrt{N}$ is a good enough approximation of the standard error only when N is large and r is small. In our case, neither of these conditions is fulfilled, since N is small and r is large.

The factor loadings and communalities as obtained from the second factor analysis are found in Tables X to XVII.

It will be noted that the second factor (k_2) is small in each age group. This is especially true of Age Groups VI and VII.

We must now explain why the process of rotation was not applied to our data. Since all of the tests are located within a rather acute sector, the use of orthogonal axes would place the tests close to one of the axes and none at the other axes. Orthogonal axes were therefore not used. This high correlation between test clusters was especially noticeable in Age Groups VI and VII.

It was also not deemed feasible to resort to oblique axes, at least for the purpose of computing new factor loadings, because: (1) interpretation of these axes is uncertain; and (2) we might come to the danger of extreme obliqueness.

The idea of oblique vectors was, however, used for the purpose of identifying the clusters of tests that were furthest apart in the graphical representations.

The graphical representation was the only means left to use in the final interpretation of the factors. The product of the inspection of these clusters is shown in the following chapter.

Table X. Factor Loadings (k) and Communalities (h^2_k) for the 10 Subtests of the Ottawa-Wechsler in Age Group I

Test	k_1	k_2	h^2_k
1	.7769	+.2654	.6740
2	.6344	+.2795	.4806
3	.3936	+.0073	.1550
4	.5636	+.0947	.3266
5	.7241	+.2748	.5998
6	.4539	-.2248	.2565
7	.6339	-.1473	.4235
8	.7222	-.2691	.5940
9	.5153	-.2727	.3399
10	.5457	-.0859	.3052

Table XI. Factor Loadings (k) and Communalities (h^2_k) for the 10 Subtests of the Ottawa-Wechsler in Age Group II

Test	k_1	k_2	h^2_k
1	.8879	+.3136	.8867
2	.5778	+.1421	.3541
3	.3939	+.1380	.1742
4	.6768	+.1827	.4915
5	.7298	+.2578	.6091
6	.4274	-.1724	.2124
7	.7191	-.3422	.6342
8	.6451	-.2837	.4967
9	.5159	-.2908	.3508
10	.5958	+.1153	.3683

Table XII, Factor Loadings (k) and Communalities (h^2_k) for the 10 Subtests of the Ottawa-Wechsler in Age Group III

Test	k_1	k_2	h^2_k
1	.7892	+.3078	.7175
2	.6917	+.3944	.6340
3	.5349	-.0777	.2921
4	.7308	+.2040	.5757
5	.7428	+.1733	.5818
6	.5884	-.2967	.4342
7	.7087	+.1140	.5153
8	.6507	-.1131	.4362
9	.5191	-.2950	.3565
10	.6903	-.3667	.6110

Table XIII. Factor Loadings (k) and Communalities (h^2_k) for the 10 Subtests of the Ottawa-Wechsler in Age Group IV

Test	k_1	k_2	h^2_k
1	.8308	-.0609	.6939
2	.4604	+.1524	.2352
3	.3520	+.1141	.1369
4	.7976	+.1996	.6760
5	.7630	+.1316	.5995
6	.6197	+.2018	.4247
7	.6439	-.3049	.5076
8	.7299	-.2544	.5975
9	.5181	+.1283	.2849
10	.6365	-.2758	.4812

Table XIV. Factor Loadings (k) and Communalities (h^2_k) for the 10 Subtests of the Ottawa-Wechsler in Age Group V

Test	k_1	k_2	h^2_k
1	.8388	+.2707	.7769
2	.6256	+.1851	.4257
3	.5748	+.0561	.3335
4	.8077	+.2639	.7220
5	.7715	+.2253	.6460
6	.5554	+.0406	.3101
7	.7217	-.1750	.5515
8	.7595	-.2644	.6467
9	.5438	-.2978	.3844
10	.5484	-.2900	.3848

Table XV. Factor Loadings (k) and Communalities (h^2_k) for the 10 Subtests of the Ottawa-Wechsler in Age Group VI

Test	k_1	k_2	h^2_k
1	.9150	+.1394	.8566
2	.6284	-.1857	.4294
3	.6632	-.1373	.4587
4	.8156	+.1404	.6849
5	.7404	+.2561	.6138
6	.5787	+.1913	.3715
7	.7841	-.2052	.6569
8	.7367	-.2150	.5889
9	.6054	-.2289	.4189
10	.6439	+.2453	.4748

Table XVI. Factor Loadings (k) and Communalities (h^2_k) for the 10 Subtests of the Ottawa-Wechsler in Age Group VII

Test	k_1	k_2	h^2_k
1	.8629	+.1154	.7579
2	.7311	+.0695	.5393
3	.7094	-.1252	.5109
4	.8302	+.1563	.7136
5	.7889	+.2168	.6694
6	.7129	-.1129	.5209
7	.8329	+.1055	.7048
8	.7565	-.2528	.6362
9	.6319	+.0499	.4018
10	.6070	+.0180	.3687

Table XVII. Factor Loadings (k) and Communalities (h^2_k) for the 10 Subtests of the Ottawa-Wechsler in Age Group VIII

Test	k_1	k_2	h^2_k
1	.9236	+.2599	.9205
2	.8165	+.1080	.6784
3	.7837	+.1369	.6329
4	.8422	+.3506	.8322
5	.8543	-.0057	.7371
6	.8069	-.1647	.6782
7	.8927	+.0361	.7982
8	.8085	-.2304	.7068
9	.5598	+.0646	.3176
10	.6898	-.3601	.6055

CHAPTER IV

THE FACTORS

In this chapter, we will handle the factors extracted in the previous chapters in two ways. First we will name the factors found in each age group. An explanation will also be given for the clusters that are close to, or approach either of the two factors.

Secondly, attention will be paid to the distribution of these factors. If these factors are constant from age group to age group will also be seen.

Before the description of these factors, it will be necessary to give a list of the components in each of the subtests of the Ottawa-Wechsler. This rationale is based on Rapaport[1], and an analysis by us.

Information: recall, past learning, words, ability to pick up information, and memory.

Comprehension: recall, past learning, words, evaluation, social intelligence, and ability to pick up information.

Digit Span: recall, immediate learning, numbers, attention, and immediate memory.

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[1] Rapaport, D., Diagnostic Psychological Testing, Vol. I, Chicago, Year Book Publishers, 1946, p. 44 - 318.

Arithmetic: recall, past learning, words and numbers, evaluation, concentration, ability to pick up information, and memory.

Similarities: recall, past learning, words, evaluation, concentration, ability to pick up information, and memory.

Picture Arrangement: learning, evaluation, social intelligence, pictorial, planning, and ability to pick up information.

Picture Completion: recall, past learning, evaluation, pictorial, concentration, and visual memory.

Block Design: evaluation, pictorial, planning, visual-motor co-ordination, and ability to pick up information.

Object Assembly: evaluation, planning, visual-motor co-ordination, and visual memory.

Digit Symbol: immediate learning, evaluation, concentration, visual-motor co-ordination, ability to pick up information, and memory.

This list of components acted as a guide in naming the clusters of tests given below.

In the description below, the word "evaluation" is used a number of times. In this thesis it will mean the ability to recognize and establish relationships. The rest of the terms used are self-explanatory.

1. The Factors in Each Age Group.

In the following list of factors in each age group, we have named the first and second factors A and B respectively. As in the majority of the age groups, there were clusters of tests which gravitated either towards the first or second factors. If these clusters tended towards A, they were listed as A^1, and if the tendency was towards B they were called B^1. The reasons for this gravitation are given in each case.

In Age Group I, the factors found were as follows:

Factor A: ability to acquire and use knowledge of a verbal nature.

Factor B: ability to evaluate and organize visual material.

A^1: gravitates towards A because of learning

B^1: gravitates towards B because of evaluation of visual material.

In Age Group II:

Factor A: ability to acquire and use knowledge. This is factor A + A^1 of Age Group I.

Factor B: this is the same as factor B - B^1 Age Group I, less subtest 10.

A^1: this is subtest 10, and it gravitates towards A because of learning component.

In Age Group III:

Factor A: ability to acquire and use knowledge of a verbal nature.

Factor B: ability to evaluate visual material

A^1: subtest 3 gravitates towards A because of acquired knowledge.

B^1: subtest 8 gravitates towards B because of evaluation.

In Age Group IV:

Factor A: ability to acquire and use knowledge.

Factor B: ability to evaluate visual material

A^1: subtest 1 gravitates towards A because of use of knowledge.

In Age Group V:

Factor A: ability to acquire and use knowledge.

Factor B: ability to evaluate visual material.

A^1: subtests 6 and 3 gravitate towards A because of evaluation of knowledge.

In Age Group VI:

Factor A: ability to acquire and use knowledge.

Factor B: unidentifiable because subtest 2 prevents using evaluation, and subtests 8 and 9 prevent using learning.

In Age Group VII:

Factor A: ability to acquire and use knowledge.

Factor B: unidentifiable.

A^1: subtests 9 and 10 gravitate towards A because of learning.

B^1: unidentifiable.

In Age Group VIII:

Factor A: ability to acquire and use knowledge.

Factor B: ability to evaluate visual material.

A^1: subtest 7 gravitates towards A because of use of knowledge.

B^1: subtests 5, 6 and 8 gravitate towards B because 5 uses conceptual evaluation, 6 uses practical evaluation, and 8 uses inspectional evaluation.

2. The Distribution of Factors.

From the inspection of the factors, it may readily be seen that Factor A is constant in each age group. This factor is the ability to acquire and use knowledge. Age Groups I and III delimit this, in that they add a verbal component to the use and acquisition of knowledge.

Factor B, on the other hand, is unidentifiable in Age Groups VI and VII. The reasons for this are stated in

the list of factors. The evaluation of visual material is called Factor B in Age Groups I, II, III, IV, V, and VIII. The organization component is added to the evaluation and use of visual material only in Age Group I.

CONCLUSIONS

From the findings in Chapter IV, we may make the following conclusions. Factor A is found in each of the eight age groups. This factor is called: the ability to acquire and use knowledge. Age Groups I and III limit this factor with an additional verbal component.

Factor B is constant in Age Groups I, II, III, IV, V, and VIII, but it is unidentifiable in the other two groups. Although no conclusive data has been found to support it, it may be that, after 35 years of age, this factor does not enter into the solution of problems in the Ottawa-Wechsler.

These were the only two factors found in this factor analysis. Future work on this problem, as suggested below, may reveal additional group factors besides the discovery of specific factors.

There are a number of possibilities left for further work on this problem. A very important step open to inquiry at this point is the finding of the reliability of the Ottawa-Wechsler. With this data the factor loadings could be computed, and together with this, the regression equations. This would provide us with a ready-to-use measure once we have a raw score and the age of the subject.

Another important area of investigation after the

reliability has been computed, is that of the identification of specific factors.

The actual process of factor naming could be checked, and probably enhanced, by the factor analysis of the performance of an abnormal population on the Ottawa-Wechsler. In the abnormal groups we already know what mental functions are deteriorated, and hence, we would notice the negative, rather than the positive aspects of the function of different factors in each subtest.

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(This article, an incomplete report of Factor Analysis on the Wechsler-Bellevue, was used to identify the factors found at different age groups)

Chagnon, M., Manuel et Normes de l'Echelle d'Intelligence Ottawa-Wechsler, University of Ottawa, 1953, p. 3.

(From this was taken a complete description of the process of stratification of the population used in the present factor analysis)

Cohen, J., "A Comparative Analysis of Factors Underlying Intelligence Test Performance of Different Neuropsychiatric Groups: Multiple Factor Analysis of the Wechsler-Bellevue Intelligence Scale Performance of Schizophrenics, Psychoneurotics and Brain Damaged Groups", Microfilmed Ph.D. Thesis, New York University, 1950, p. vii - 162.

(Using an abnormal population, the writer computes the factor loadings for components of each common factor)

Guilford, J. P., Psychometric Methods, New York,

McGraw-Hill, 1936, p. 471 - 513.

(In this text we followed the step by step description of Thurstone's Centroid Method of Factor Analysis)

Rapaport, D., Diagnostic Psychological Testing, Vol. I, Chicago, Year Book Publishers, 1946, P. 44 - 318.

(From this book was abstracted the description of the rationale of the subtests)

Wechsler, D., H. Israel, and B. Balinsky, "A Study of the Sub-Tests of the Bellevue Intelligence Scale in Borderline and Mental Defective Cases", in American Journal of Mental Deficiency, Vol. 45, No. 4, April 1941, p. 555 - 553.

(An incomplete report of factor analysis of the performance of an abnormal population on the Wechsler-Bellevue)

Table XVIII. Intercorrelations of the 10 Subtests of the Echelle d'Intelligence Ottawa-Wechsler and Computation of the First Factor Loadings in Age Group I

	1	2	3	4	5	6	7	8	9	10	Σ rak
1	.654	.506	.364	.504	.613	.318	.423	.477	.382	.387	4.633
2	.506	.509	.250	.332	.611	.262	.471	.332	.175	.335	3.783
3	.364	.250	.225	.176	.195	.081	.235	.376	.197	.248	2.347
4	.504	.332	.176	.381	.440	.225	.325	.418	.302	.258	3.361
5	.613	.611	.195	.440	.612	.350	.416	.394	.300	.387	4.318
6	.318	.262	.081	.225	.350	.249	.427	.303	.242	.250	2.707
7	.428	.471	.235	.325	.416	.427	.422	.434	.323	.299	3.780
8	.477	.332	.376	.418	.394	.303	.434	.609	.504	.460	4.307
9	.382	.175	.197	.302	.300	.242	.323	.504	.362	.286	3.073
10	.387	.335	.248	.258	.387	.250	.299	.460	.286	.384	3.254
Σ rka	4.633	3.783	2.347	3.361	4.318	2.707	3.780	4.307	3.073	3.254	Σr = 35.563
k_1	.7769	.6344	.3936	.5636	.7241	.4539	.6339	.7222	.5153	.5457	$\sqrt{\Sigma r}$ = 5.9635
k_1^2	.6036	.4025	.1549	.3176	.5243	.2060	.4018	.5216	.2655	.2978	$1/\sqrt{\Sigma r}$ = 0.16769

Check: $k_\bullet$ = 5.9636

Table XIX. First Factor Residuals and the Computation of the Second Factor Loadings of the 10 Subtests of the Echelle d'Intelligence Ottawa-Secnsler in Age Group I.

		+1	+2	+3	+4	+5	+6	+7	-8	-9	-10	Σ rik
+	+1	.050 +.084	+.013	+.053	+.066	+.050	+.035	+.065	+.084	+.010	+.037	.510
+	+2	+.013	.107 +.152	+.000	-.026	+.152	+.026	-.069	+.126	+.152	+.011	.537
+	+3	+.058	+.000	.070 +.098	-.046	-.090	+.098	+.015	-.092	+.064	-.033	.011
+	+4	+.066	-.026	-.046	.063 +.066	+.032	+.031	+.032	-.011	-.012	+.050	.174
+	+5	+.050	+.152	-.090	+.032	.088 +.152	-.021	+.043	+.129	+.073	+.008	.528
+	-6	+ +.035	+ +.026	+ +.098	+ +.031	- -.021	.043 +.139	- +.139	+ -.025	- +.006	+ +.002	.432
+	-7	- +.065	+ -.069	+ +.015	+ +.032	+ +.043	- +.139	.020 +.139	- -.024	+ -.010	+ -.047	.283
+	-8	- +.084	- +.126	+ -.092	+ -.011	- +.129	+ -.085	- -.024	.087 +.132	+ -.132	+ +.066	.517
+	-9	- +.018	- +.152	- +.006	+ -.012	- +.073	+ +.008	- +.010	+ +.132	.097 +.152	+ +.005	.524
+	-10	- +.037	- +.011	+ -.033	- +.860	- +.008	+ +.002	- +.047	+ -.066	+ -.005	.046 +.066	.165
Σ_o		-.002	.000	-.002	-.001	.000	-.002	-.008	.000	-.005	-.001	$\frac{\Sigma r_{ik}}{\sqrt{\Sigma r_{ik}}}$=3.692
Σr_{ik}		.510	.537	.011	.182	.528	.432	.283	.517	.524	.165	$\sqrt{\Sigma r_{ik}}$=1.9215
s_2		+.2654	+.2795	+.0073	+.0947	+.2748	-.2248	-.1473	-.2691	-.2727	-.0859	$I/\sqrt{\Sigma r_{ik}}$=0.52043
k_2^2		.0704	.0781	.0001	.0090	.0755	.0505	.0217	.0724	.0744	.0074	Check: Σk^2=1.9215

Table XX. Second Factor Residuals of the 10 Subtests of the Echelle d'Intelligence Ottawa-Wechsler in Age Group I

	+ 1	+ 2	+ 3	+ 4	+ 5	- 6	- 7	- 8	- 9	- 10
+ 1	+ .014 **.061**	- .061	+ .056	+ .041	- .023	- .025	+ .026	+ .013	- .054	+ .014
+ 2	- .061	+ .074 **.110**	- .002	- .053	+ .075	- .037	- .110	+ .051	+ .076	- .013
+ 3	+ .056	- .002	+ .098 **.096**	- .047	- .092	+ .096	+ .014	- .094	+ .004	- .034
+ 4	+ .041	- .053	- .047	+ .057 **.053**	+ .006	+ .010	+ .018	- .037	- .038	+ .042
+ 5	- .023	+ .075	- .092	+ .006	+ .077 **.092**	- .083	+ .003	+ .055	- .002	- .016
- 6	- .025	- .037	+ .096	+ .010	- .083	+ .089 **.106**	+ .106	- .086	- .053	- .017
- 7	+ .026	- .110	+ .014	+ .018	+ .003	+ .106	+ .117 **.110**	- .064	- .050	- .060
- 8	+ .013	+ .051	- .094	- .037	+ .055	- .086	- .064	+ .060 **.094**	+ .059	+ .043
- 9	- .054	+ .076	+ .004	- .038	- .002	- .053	- .050	+ .059	+ .078 **.076**	- .018
- 10	+ .014	- .013	- .034	+ .042	- .016	- .017	- .060	+ .043	- .018	+ .059 .060
Σ_o	.001	.000	-.001	-.001	.000	.000	.000	.000	.002	.000

Table XXI. Intercorrelations of the 10 Subtests of the Echelle d'Intelligence Wechsler and Computation of the First Factor Loadings in Age Group II

	1	2	3	4	5	6	7	8	9	10	Σr_{ak}
1	.773	.568	.317	.653	.680	.266	.577	.511	.435	.698	5.478
2	.568	.416	.273	.355	.511	.229	.376	.328	.245	.264	3.565
3	.317	.273	.191	.342	.275	.123	.261	.271	.171	.256	2.430
4	.653	.355	.342	.544	.587	.243	.416	.397	.305	.334	4.176
5	.680	.511	.275	.587	.620	.326	.397	.395	.298	.414	4.503
6	.266	.229	.123	.243	.326	.252	.432	.270	.199	.297	2.637
7	.577	.376	.261	.416	.397	.432	.587	.541	.453	.397	4.437
8	.511	.328	.271	.397	.395	.270	.541	.467	.480	.320	3.980
9	.435	.245	.121	.305	.298	.199	.453	.480	.356	.291	3.183
10	.698	.264	.256	.334	.414	.297	.397	.320	.291	.405	3.676
Σr_{ka}	5.478	3.565	2.430	4.176	4.503	2.637	4.437	3.980	3.183	3.676	Σr =38.065
k_1	.8879	.5778	.3939	.6768	.7298	.4274	.7191	.6451	.5159	.5958	$\sqrt{\Sigma r}$ = 6.1697
k_1^2	.7884	.3339	.1552	.4581	.5326	.1827	.5171	.4162	.2662	.3550	$\frac{1}{\sqrt{\Sigma r}}$ = 0.16208
											Check Σk_1 = 6.1695

Table XXII. First Factor Residuals and the Computation of the Second Factor Loadings of the 10 Subtests of the Echelle d'Intelligence Ottawa-Wechsler in Age Group II.

		+1	+2	+3	+4	+5	-6	-7	-8	-9	+10	Σ_{rak}
+	+1	.015 +.169	+.055	-.033	+.052	+.032	+.111	+.062	+.062	+.083	+.169	.702
+	+2	+.055	.082 +.089	+.045	-.036	+.089	+.018	+.040	+.045	+.053	-.080	.318
+	+3	-.033	+.045	.036 +.082	+.075	-.013	+.045	+.022	-.017	+.032	+.021	.309
+	+4	+.052	-.036	+.075	.086 +.093	+.093	+.046	+.071	+.040	+.044	-.069	.409
+	+5	+.032	+.089	-.013	+.093	.087 +.128	-.014	+.128	+.076	+.079	-.021	.577
+	-6	+.111	+.018	+.045	+.046	-.014	.069 +.125	+.125	-.006	-.022	-.042	.386
+	-7	+.062	+.040	+.022	+.071	+.128	+.125	.070 +.128	+.077	+.082	+.031	.766
+	-8	+.062	+.045	-.017	+.040	+.076	-.006	+.077	.051 +.147	+.147	+.064	.635
+	-9	+.023	+.053	+.082	+.044	+.079	-.022	+.082	+.147	.090 +.147	+.016	.651
+	+10	+.169	-.080	+.021	-.069	-.021	-.042	+.031	+.064	+.016	.050 +.169	.258
Σe		-.002	-.001	-.001	.000	-.002	-.002	.000	-.001	.000	-.001	Σ_r=5.011
Σr^2_{ak}		.702	.318	.309	.409	.577	.386	.766	.635	.651	.258	$\sqrt{\Sigma r}$=2.2385
k_2		+.3136	+.1422	+.1380	+.1827	+.2578	-.1724	-.3422	-2837	-.2908	+.1153	$1/\sqrt{\Sigma r}$=0.4467
k_2^2		.0983	.0202	.0190	.0334	.0665	.0297	.1171	.0805	.0846	.0133	Check: Σk_2^2=.2386

XXIII

Table . Second Factor Residuals of the 10 Subtests of the Echelle d'Intelligence Ottawa-Wechsler in Age Group II

		+ 1	+ 2	+ 3	+ 4	+ 5	- 6	- 7	- 8	- 9	+ 10
+	1	+ .071 **.133**	+ .010	- .076	- .005	- .049	+ .057	- .045	- .027	- .068	+ .133
+	2	+ .010	+ .069 **.096**	+ .025	- .062	+ .052	- .007	- .009	+ .005	+ .012	- .096
+	3	- .076	+ .025	+ .063 **.076**	+ .050	- .049	+ .021	- .025	- .056	+ .042	+ .005
+	4	- .005	- .062	+ .050	+ .060 **.090**	+ .046	+ .015	+ .009	- .012	- .009	- .090
+	5	- .049	+ .052	- .049	+ .046	+ .062 **.058**	- .058	+ .040	+ .003	+ .004	- .051
-	6	+ .057	- .007	+ .021	+ .015	- .058	+ .095 **.072**	+ .066	- .055	- .072	- .062
-	7	- .045	- .009	- .025	+ .009	+ .040	+ .066	+ .011 **.066**	- .020	- .018	- .009
-	8	- .027	+ .005	- .056	- .012	+ .003	- .055	- .020	+ .067 **.065**	+ .065	+ .031
-	9	- .068	+ .012	+ .042	- .009	+ .004	- .072	- .018	+ .065	+ .062 **.072**	- .018
+	10	+ .133	- .096	+ .005	- .090	- .051	- .062	- .009	+ .031	- .018	+ .156 **.133**
Σ_o		.001	-.001	.000	.002	.000	.000	.000	.001	.000	-.001

Table XXIV. Intercorrelations of the 10 Subtests of the Echelle d'Intelligence Ottawa-Wechsler and Computation of the First Factor Loadings in Age Group III

	1	2	3	4	5	6	7	8	9	10	Σrak
1	.710	.613	.363	.485	.698	.374	.557	.502	.267	.516	5.245
2	.613	.623	.316	.566	.562	.319	.606	.406	.303	.353	4.597
3	.363	.316	.314	.461	.394	.301	.351	.351	.303	.397	3.555
4	.485	.566	.461	.586	.562	.368	.523	.475	.260	.391	4.857
5	.698	.562	.394	.562	.600	.373	.470	.461	.334	.403	4.937
6	.374	.319	.301	.368	.373	.448	.361	.430	.403	.518	3.911
7	.557	.606	.351	.523	.470	.361	.528	.421	.414	.475	4.710
8	.502	.406	.351	.475	.461	.430	.421	.443	.342	.454	4.325
9	.267	.303	.303	.260	.334	.403	.414	.342	.369	.415	3.450
10	.516	.353	.397	.391	.403	.518	.475	.454	.455	.526	4.588
Σrak	5.245	4.597	3.555	4.857	4.937	3.911	4.710	4.325	3.450	4.588	Σr = 44.175
k_1	.7092	.6217	.5369	.7884	.7420	.5284	.7037	.6507	.5201	.6973	$\sqrt{\Sigma r}$ = 6.6464
k_1^2	.6223	.4736	.2881	.5341	.5518	.3482	.4953	.4234	.2705	.4863	$\frac{1}{\sqrt{\Sigma r}}$ = 0.150446
											Check Σk. = 5.6166

Table IV. First Factor Residuals and the Computation of the Second Factor Loadings of the 10 Subtests of the Echelle d'Intelligence Ottawa-Wechsler in Age Group III.

		+1	+2	-3	+4	+5	-6	+7	-8	-9	-10	Σr_{ik}
+	+1	.087 +.143	+.067	+.059	+.068	+.112	+.090	-.002	+.012	+.143	+.029	.721
+	+2	+.067	.145 +.195	+.054	+.061	+.048	+.088	+.116	+.044	+.056	+.195	.924
+	-3	+.059	+.054	.028 +.070	-.070	+.003	-.014	+.024	+.003	+.027	+.028	.182
+	+4	+.068	+.061	-.070	.052 +.119	+.019	+.042	+.005	+.001	+.119	+.114	.478
+	+5	+.112	+.048	+.003	+.019	.048 +.112	+.064	-.056	+.022	+.052	+.030	.406
+	-6	+.090	+.088	-.014	+.042	+.064	.098 +.112	+.056	+.047	+.096	+.112	.695
+	+7	-.002	+.116	+.024	+.005	-.056	+.056	.026 +.116	+.040	-.046	+.014	.267
+	-8	+.012	+.044	+.003	+.001	+.022	+.047	+.040	.020 +.047	+.004	+.045	.265
+	-9	+.143	+.056	+.025	+.119	+.052	+.098	-.046	+.004	.100 +.143	+.097	.691
+	-10	+.029	+.195	+.028	+.114	+.030	+.112	+.014	+.045	+.097	.100 +.195	.859
Σ_0		-.001	.000	.000	-.001	.000	-.001	-.001	.000	.000	.000	Σr=5.488
Σr_{ik}		.721	.924	.182	.478	.406	.695	.267	.265	.691	.859	$\sqrt{\Sigma r}$=2.3427
k_2		+.3078	+.3944	-.0777	+.2040	+.1733	-.2967	+.1140	-.1131	-.2950	-.3667	$1/\sqrt{\Sigma r}$=0.42686
k_2^2		.0947	.1556	.0060	.0416	.0300	.0880	.0130	.0128	.0870	.1345	Check Σk^2=2.3427

Table XXVI. Second Factor Residuals of the 10 Subtests of the Echelle d'Intelligence Ottawa-Dechsler in Age Group III

		+ 1	+ 2	− 3	+ 4	+ 5	− 6	+ 7	− 8	− 9	− 10
+	1	+ .048 .034	− .054	+ .035	+ .005	− .059	− .001	− .037	− .023	+ .052	− .084
+	2	− .054	+ .039 .071	+ .023	− .020	− .020	− .029	+ .071	− .001	− .060	+ .050
−	3	+ .035	+ .023	+ .064 .086	− .086	− .011	− .037	+ .015	− .006	+ .002	− .001
+	4	+ .005	− .020	− .086	+ .077 .086	− .016	− .019	− .018	− .022	+ .059	+ .039
+	5	+ .059	− .020	− .011	− .016	+ .082 .076	+ .013	− .076	+ .002	+ .001	− .034
−	6	− .001	− .029	− .037	− .019	+ .013	+ .024 .037	+ .022	+ .013	+ .011	+ .003
+	7	− .037	+ .071	+ .015	− .018	− .076	+ .022	+ .103 .080	+ .027	− .080	− .028
−	8	− .023	− .001	− .006	− .022	+ .002	+ .013	+ .027	+ .034 .029	− .029	+ .004
−	9	+ .052	− .060	+ .002	+ .059	+ .001	+ .011	− .080	− .029	+ .056 .060	− .011
−	10	− .084	+ .050	− .001	+ .039	− .034	+ .003	− .028	+ .004	− .011	+ .061 .034
Σ_o		.000	−.001	−.002	−.001	.000	.000	−.001	−.001	.001	−.001

Table XXVII. Intercorrelations of the 10 Subtests of the Echelle d' ntelligence ttawa-Wechsler and Computation of the ...t Factor Loadings in Age Group IV

	1	2	3	4	5	6	7	8	9	10	Σrak
1	.694	.325	.320	.637	.740	.460	.577	.551	.414	.542	5.277
2	.325	.255	.086	.381	.492	.265	.312	.204	.204	.297	2.721
3	.320	.086	.164	.305	.206	.273	.077	.340	.161	.196	2.236
4	.639	.381	.305	.663	.554	.520	.465	.559	.519	.461	5.066
5	.740	.492	.206	.554	.616	.472	.440	.460	.324	.460	4.846
6	.460	.265	.273	.520	.472	.437	.352	.444	.360	.322	3.936
7	.577	.312	.077	.465	.440	.352	.490	.572	.374	.431	4.090
8	.551	.204	.340	.559	.460	.444	.572	.537	.302	.587	4.636
9	.414	.204	.161	.519	.324	.360	.374	.302	.361	.272	3.291
10	.542	.297	.196	.461	.460	.322	.431	.587	.272	.473	4.043
Σrak	5.447	2.924	2.236	5.062	4.846	3.936	4.090	4.636	3.291	4.043	Σr = 40.505
k_1	.5306	.4604	.3522	.7576	.7630	.5197	.6435	.7279	.5181	.6365	$\sqrt{\Sigma r}$ = 6.3518
k_1^2	.6902	.2120	.1239	.6362	.5822	.3440	.4140	.5320	.2684	.4051	$1/\sqrt{\Sigma r}$ = 0.15742

Chec Σk. = 6.3519

Table XXVIII. First Factor Residuals and the Computation of the Second Factor Loadings of the 10 Subtests of the Echelle d'Intelligence Ottawa-Mesdmer in Age Group IV.

	-1	+2	+3	+4	+5	+6	-7	-8	+9	-10	Σ_{rak}
-1	.005 +.106	+.058	-.034	+.024	-.106	+.047	+.042	-.055	+.016	+.013	.111
+2	+.053	.043 +.141	-.076	+.014	+.141	+.003	-.016	+.052	-.035	-.004	.278
+3	-.034	-.076	.060 +.150	+.024	+.017	+.055	+.150	-.083	-.021	+.026	.206
+4	+.024	+.014	+.024	.027 +.106	-.055	+.026	+.049	+.023	+.106	+.047	.364
+5	-.106	+.141	+.017	-.055	.036 +.141	-.001	+.051	+.097	-.071	+.026	.240
+6	+.047	+.003	+.055	+.026	-.001	.053 +.072	+.047	+.008	+.039	+.072	.368
-7	+.042	-.016	+.150	+.049	+.051	+.047	.075 +.150	+.102	-.040	+.021	.556
-8	-.055	+.052	-.083	+.023	+.097	+.008	+.102	.004 +.122	+.076	+.122	.464
+9	+.016	-.035	-.021	+.106	-.071	+.039	-.040	+.076	.093 +.106	+.058	.234
-10	+.013	-.004	+.026	+.047	+.026	+.072	+.021	+.122	+.058	.068 +.122	.503
Σ_o	.000	+000	.000	-.001	-.001	-.001	-.001	.000	-.001	-.001	Σ_r=3.326
Σr_{ik}	.111	.278	.208	.364	.240	.368	.556	.464	.234	.503	$\sqrt{\Sigma r}$=1.8237
k_2	-.0609	+.1524	+.1141	+.1996	+.1316	+.2018	-.3049	-.2544	+.1283	-.2758	$1/\sqrt{\Sigma r}$=0.548344
k_2^2	.0037	.0232	.0130	.0398	.0173	.0407	.0930	.0647	.0165	.0761	Check: Σk^2=1.8238

Table XXIX. Second Factor Residuals of the 10 Subtests of the Echelle d'Intelligence Otterm-Wechsler in Age Group IV

		1	2	3	4	5	6	7	8	9	10
-	1	+ .102 .114	+ .049	- .041	+ .012	- .114	+ .035	+ .023	- .071	+ .008	- .004
+	2	+ .049	+ .118 .121	- .093	- .016	+ .131	- .028	- .063	+ .013	- .057	- .046
+	3	- .013	- .093	+ .137 .115	+ .001	+ .002	- .032	- .115	- .112	- .036	- .006
+	4	+ .022	- .016	+ .001	+ .066 .081	- .081	- .014	- .012	- .028	+ .030	- .008
+	5	- .114	+ .121	+ .002	- .081	+ .121 .121	- .028	+ .011	+ .064	- .033	- .010
+	6	+ .035	- .028	+ .032	- .014	- .028	+ .011 .043	- .015	- .043	+ .013	+ .016
-	7	+ .023	- .063	+ .115	- .012	+ .011	- .015	+ .057 .115	+ .024	- .079	- .063
-	8	- .071	+ .013	- .112	- .028	+ .064	- .043	+ .024	+ .057 .112	+ .043	+ .052
+	9	+ .008	- .055	- .036	+ .000	- .033	+ .013	- .079	+ .043	+ .090 .086	+ .023
-	10	- .004	- .046	- .006	- .008	- .010	+ .016	- .063	+ .052	+ .023	+ .046 .063
Σ_e		−.001	.000	−.001	.000	.001	−.001	−.002	−.001	−.001	.000

Table XXX. Intercorrelations of the 10 Subtests of the Echelle d'Intelligence Ottawa-Wechsler and Computation of the First Factor Loadings in Age Group V

	1	2	3	4	5	6	7	8	9	10	Σrak
1	.754	.584	.460	.720	.718	.496	.631	.577	.407	.312	5.659
2	.584	.513	.262	.565	.581	.310	.423	.387	.331	.265	4.221
3	.460	.262	.360	.520	.453	.359	.301	.460	.305	.398	3.878
4	.720	.565	.520	.692	.653	.470	.563	.549	.361	.356	5.449
5	.718	.581	.453	.653	.680	.361	.487	.555	.370	.347	5.205
6	.496	.310	.359	.470	.361	.336	.471	.402	.218	.324	3.747
7	.631	.423	.301	.563	.487	.471	.545	.627	.384	.437	4.869
8	.577	.387	.460	.549	.555	.402	.627	.621	.524	.422	5.124
9	.407	.331	.305	.361	.370	.218	.384	.524	.353	.416	3.669
10	.312	.265	.398	.356	.347	.324	.437	.422	.416	.423	3.700
Σrka	5.659	4.221	3.878	5.449	5.205	3.747	4.869	5.124	3.669	3.700	Σr =45.521
k_1	.8388	.6256	.5748	.8077	.7715	.5554	.7217	.7595	.5438	.5484	$\sqrt{\Sigma r}$ = 6.7469
k_1^2	.7036	.3914	.3304	.6524	.5952	.3085	.5209	.5768	.2957	.3007	$1/\sqrt{\Sigma r}$ = 0.14822
											Check:Σk. = 6.7472

Table XXII. First Factor Residuals and the Computation of the Second Factor Loadings of the 10 Subtests of the Echelle d'Intelligence Ottawa-Wechsler in Age Group V.

		+1	+2	+3	+4	+5	+6	-7	-8	-9	-10	Σ_{rik}
+	+1	.050 +.148	+.059	-.022	+.043	+.071	+.030	-.026	+.060	+.049	+.148	.560
+	+2	+.059	.122 +.098	-.098	+.060	+.098	-.038	+.029	+.088	+.009	+.078	.383
+	+3	-.022	-.098	.030 +.114	+.056	+.010	+.040	-.114	-.023	+.008	-.083	.116
+	+4	+.043	+.060	+.056	.040 +.087	+.030	+.021	-.020	+.064	+.078	+.087	.546
+	+5	+.071	+.098	+.010	+.030	.085 +.098	-.068	+.070	+.031	+.050	+.076	.466
+	+6	+.030	-.038	+.040	+.021	-.068	.028 +.084	-.070	+.020	+.084	-.019	.084
+	-7	-.026	+.029	+.114	+.020	+.070	-.070	.024 +.114	+.079	-.009	+.041	.362
+	-8	+.060	+.088	-.023	+.064	+.031	+.020	+.079	.044 +.111	+.111	+.006	.547
+	-9	+.049	+.009	+.008	+.078	+.050	+.084	-.009	+.111	.057 +.118	+.118	.616
+	-10	+.148	+.078	-.083	+.087	+.076	-.019	+.041	+.006	+.118	.122 +.148	.600
Σc		-.000	-.001	-.000	-.001	-.001	-.002	-.002	.000	-.001	.000	$\Sigma r=4.280$
Σr_{ik}		.560	.383	.116	.546	.466	.084	.362	.547	.616	.600	$\Sigma r=2.0688$
k_2		+.2707	+.1851	+.0561	+.2639	+.2253	+.0406	-.1750	-.2644	-.2978	-.2900	$1/\sqrt{\Sigma r}=0.48337$
k_2^2		.0733	.0343	.0031	.0696	.0508	.0016	.0306	.0699	.0887	.0841	Check: $\Sigma k2=2.0689$

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Table . Second Factor Residuals of the 10 Subtests of the Échelle d'Intelligence Ottawa-Séguin in Age Group V

	+ 1	+ 2	+ 3	+ 4	+ 5	+ 6	- 7	- 8	- 9	- 10
+ 1	+ .075 .073	+ .009	- .037	- .093	+ .010	+ .019	- .073	- .012	- .032	+ .070
+ 2	+ .009	+ .004 .108	- .108	+ .011	+ .056	- .046	- .003	+ .039	- .046	+ .024
+ 3	- .037	- .108	+ .111 .108	+ .041	- .003	+ .038	+ .104	- .038	- .009	- .099
+ 4	- .028	+ .011	+ .041	+ .017 .041	- .030	+ .010	- .026	- .006	- .001	+ .011
+ 5	+ .010	+ .056	- .003	- .030	+ .047 .077	- .077	+ .031	- .029	- .017	+ .011
+ 6	+ .019	- .046	+ .038	+ .010	- .077	+ .082 .077	- .077	+ .009	+ .072	- .031
- 7	- .073	- .003	+ .104	- .026	+ .031	- .077	+ .083 .104	+ .033	- .061	- .010
- 8	- .012	+ .039	- .038	- .006	- .029	+ .009	+ .033	+ .041 .071	+ .032	- .071
- 9	- .032	- .046	- .009	- .001	- .017	+ .072	- .061	+ .032	+ .029 .072	+ .032
- 10	+ .070	+ .024	- .099	+ .011	+ .011	- .031	- .010	- .071	+ .032	+ .064 .099
Σ_o	.001	.000	.000	−.001	−.001	−.001	.001	−.002	−.001	.001

XXXIII

Table . Intercorrelations of the 10 Subtests of the Echelle d'Intelligence Ottawa-Wechsler and Computation of the First Factor Loadings in Age Group VI

	1	2	3	4	5	6	7	8	9	10	Σrak
1	.633	.628	.541	.763	.740	.533	.715	.631	.513	.610	6.507
2	.628	.455	.441	.550	.477	.271	.560	.434	.395	.258	4.469
3	.541	.441	.492	.480	.461	.369	.472	.527	.461	.472	4.716
4	.763	.550	.480	.695	.644	.508	.620	.562	.455	.523	5.800
5	.740	.477	.461	.644	.600	.449	.537	.438	.397	.522	5.265
6	.533	.271	.369	.508	.449	.366	.518	.404	.261	.436	4.115
7	.715	.560	.472	.620	.537	.518	.645	.648	.498	.363	5.576
8	.631	.434	.527	.562	.438	.404	.648	.596	.495	.504	5.239
9	.513	.395	.461	.455	.397	.261	.498	.495	.429	.401	4.305
10	.610	.258	.472	.523	.522	.436	.363	.504	.401	.490	4.579
Σrka	6.507	4.469	4.716	5.800	5.265	4.115	5.576	5.239	4.305	4.579	Σr =50.571
k_1	.7150	.6234	.6632	.8156	.7404	.5737	.7841	.7367	.6054	.6439	$\sqrt{\Sigma r}$ = 7.1114
k_1^2	.5372	.3949	.4398	.6652	.5482	.3349	.6148	.5427	.3665	.4146	$1/\sqrt{\Sigma r}$ = 0.14062

Check: Σk_1 = 7.3316

Table XXXIV. First Factor Residuals and the Computation of the Second Factor Loadings of the 10 Subtests of the Echelle d'Intelligence Ottawa-Wechsler in Age Group VI.

	+1	-2	-3	+4	+5	+6	-7	-8	-9	+10	Σr_{ik}
+1	.004 +.066	-.053	+.0[illegible]	+.017	+.063	+.004	+.003	+.043	+.041	+.021	.271
-2	-.053	.060 +.147	+.021	-.038	-.012	+.093	+.067	-.029	+.015	+.147	.361
-3	+.066	+.021	.057 +.066	+.061	+.030	+.015	-.048	+.038	+.060	-.045	.267
+4	+.217	-.035	+.041	.030 +.061	+.040	+.036	+.020	+.039	+.039	-.002	.273
+5	+.063	-.012	+.0[illegible]	+.040	.052 +.108	+.021	+.044	+.108	+.051	+.045	.498
+6	+.004	+.093	+.0[illegible]	+.036	+.021	.031 +.093	-.064	+.022	+.089	+.063	.372
-7	+.003	+.067	-.0[illegible]	+.020	+.044	-.064	.030 +.142	+.070	+.023	+.142	.399
-8	+.043	-.029	+.038	+.039	+.108	+.022	+.070	.053 +.108	+.049	-.030	.418
-9	+.041	+.015	+.0[illegible]	+.039	+.051	+.089	+.023	+.049	.063 +.089	-.011	.445
+10	+.021	+.147	-.045	-.002	+.045	+.063	+.142	-.030	-.011	.075 +.147	.477
Σo	-.001	.000	-.001	.000	.000	.000	-.003	-.001	-.001	0.001	Σr=3.781
Σr_{ka}	.271	.361	.267	.273	.498	.372	.399	.418	.445	.477	$\sqrt{\Sigma r}$=1.9445
k_2	+.1394	-.1857	-.1373	+.1404	+.2561	+.1913	-.2052	-.2150	-.2289	+.2453	$1/\sqrt{\Sigma r}$=0.51427
κ_2	.0194	.0345	.0189	.0197	.0656	.0366	.0421	.0462	.0524	.0602	Check $\Sigma k2$=1.9446

Table XXV. Second Factor Residuals of the 10 Subtests of the Échelle d'Intelligence Ottawa-Wechsler in Age Group VI

	+ 1	- 2	- 3	+ 4	+ 5	+ 6	- 7	- 8	- 9	+ 10
+ 1	+ .047 .079	- .079	+ .047	- .003	+ .027	- .023	- .026	+ .013	+ .009	- .013
- 2	- .079	+ .113 .101	- .002	- .064	- .060	+ .058	+ .029	- .069	- .028	+ .101
- 3	+ .047	- .002	+ .047 .079	+ .042	- .005	- .011	- .076	+ .009	+ .029	- .079
+ 4	- .003	- .064	+ .042	+ .041 .064	+ .004	+ .009	- .009	+ .009	+ .007	- .036
+ 5	+ .027	- .060	- .005	+ .004	+ .042 .060	- .028	- .009	+ .053	- .003	- .018
+ 6	- .023	+ .058	- .011	+ .009	- .028	+ .056 .103	- .103	- .019	+ .045	+ .016
- 7	- .026	+ .029	- .076	- .009	- .009	- .103	+ .100 .103	+ .028	- .024	+ .092
- 8	+ .013	- .069	+ .009	+ .009	+ .053	- .019	+ .028	+ .062 .083	- .000	- .083
- 9	+ .009	- .028	+ .029	+ .007	- .008	+ .045	- .024	- .000	+ .037 .067	- .067
+ 10	- .013	+ .101	- .07?	- .036	- .01d	+ .016	+ .092	- .083	- .067	+ .067 .101
o	- .001	- .001	.001	.000	- .002	.000	.002	.003	.000	.000

Table XXVI. Intercorrelations of the 10 Subtests of the Echelle d'Intelligence Ottawa-Wechsler and Computation of the First Factor Loadings in Age Group VII

	1	2	3	4	5	6	7	8	9	10	Σ rak
1	.759	.639	.603	.723	.708	.610	.752	.642	.440	.565	6.441
2	.639	.612	.563	.644	.545	.472	.623	.561	.523	.275	5.457
3	.603	.563	.518	.591	.554	.504	.541	.584	.416	.421	5.295
4	.723	.644	.591	.707	.712	.595	.664	.555	.491	.515	6.197
5	.708	.545	.554	.712	.676	.556	.612	.499	.504	.523	5.889
6	.610	.472	.504	.595	.556	.527	.585	.576	.423	.473	5.321
7	.752	.623	.541	.664	.612	.585	.705	.649	.587	.499	6.217
8	.642	.561	.584	.555	.499	.576	.649	.616	.520	.445	5.647
9	.440	.523	.416	.491	.504	.423	.587	.520	.480	.333	4.717
10	.565	.275	.421	.515	.523	.473	.499	.445	.333	.482	4.531
Σrka	6.441	5.457	5.295	6.197	5.889	5.321	6.217	5.647	4.717	4.531	Σr = 55.712
k_1	.8629	.7311	.7094	.8302	.7889	.7129	.8329	.7565	.6319	.6070	$\sqrt{\Sigma r}$ = 7.4641
k_1^2	.7446	.5345	.5032	.6892	.6224	.5082	.6937	.5723	.3993	.3684	$1/\sqrt{\Sigma r}$ = 0.13397
											Check: Σk. = 7.4637

Table XXXVII. First Factor Residuals and the Computation of the Second Factor Loadings of the 10 Subtests of the Echelle d'Intelligence Ottawa-Wechsler in Age Group VII.

	+1	+2	-3	+4	+5	-6	+7	-8	+9	+10	$\sum$rak
+1	.014 +.105	+.008	+.009	+.007	+.027	+.005	+.033	+.011	-.105	+.041	.141
+2	+.008	.078 +.169	-.044	+.037	-.032	+.049	+.014	-.008	+.061	-.169	.085
-3	+.009	-.044	.015 +.047	-.002	+.006	-.002	+.050	+.047	+.032	+.010	.153
+4	+.007	+.037	-.002	.018 +.073	+.057	-.003	-.028	+.073	-.034	+.011	.191
+5	+.027	-.032	+.006	+.057	.054 +.098	+.006	-.045	+.098	+.006	+.044	.265
-6	+.005	+.049	-.002	-.003	+.006	.019 +.049	+.009	-.037	+.028	-.040	.138
+7	+.033	+.014	+.050	-.028	-.045	+.009	.011 +.061	-.019	+.061	-.007	.129
-8	+.011	-.008	+.047	+.073	+.098	+.037	-.019	.044 +.098	-.042	+.014	.309
+9	-.105	+.061	+.032	-.034	+.006	+.028	+.061	-.042	.081 +.105	-.051	.061
+10	+.041	-.169	+.010	+.011	+.044	-.040	-.007	+.014	-.051	.114 +.169	.02 2
$\sum$e	.000	.000	-.001	.000	-.001	.000	-.001	-.001	-.001	-.001	$\sum r$=1.494
$\sum$rkm	.141	.085	.153	.191	.265	.138	.129	.309	.061	.022	$\sqrt{\sum r}$=1.2223
k_2	+.1154	+.0695	-.1252	+.1563	+.2168	-.1129	+.1055	-.2528	+.0499	+.0180	$1/\sqrt{\sum r}$=0.81813
k_2	.0133	.0048	.0157	.0244	.0470	.0127	.0111	.0639	.0025	.0003	Check $\sum k_2$=1.2223

XXXVIII

Table . Second Factor Residuals of the 10 Subtests of the "Echelle d'Intelligence Ottawa-Hechsler in Age Group VII

		+ 1	+ 2	− 3	+ 4	+ 5	− 6	+ 7	− 8	+ 9	+ 10
+	1	+ .092 **.111**	+ .000	− .006	− .011	+ .002	− .008	+ .021	− .018	− .111	+ .039
+	2	+ .000	+ .164 **.170**	− .053	+ .026	− .047	+ .041	+ .007	− .026	+ .058	− .170
−	3	− .006	− .053	+ .031 **.053**	− .022	− .021	− .016	+ .037	+ .015	+ .026	+ .008
+	4	− .011	+ .026	− .042	+ .049 **.045**	+ .023	− .021	− .045	+ .034	− .042	+ .008
+	5	+ .002	− .047	− .021	+ .023	+ .051 **.068**	− .019	− .068	+ .043	− .005	+ .040
−	6	− .008	+ .041	− .016	− .021	− .019	+ .036 **.042**	− .003	+ .009	+ .022	− .042
+	7	+ .021	+ .007	+ .037	− .045	− .068	− .003	+ .050 **.068**	− .046	+ .056	− .009
−	8	− .018	− .026	+ .015	+ .034	+ .043	+ .009	− .046	+ .034 **.055**	− .055	+ .009
+	9	− .111	+ .058	+ .026	− .042	− .005	+ .022	+ .056	− .055	+ .103 **.111**	− .052
+	10	+ .039	− .170	+ .008	+ .008	+ .040	− .042	− .009	+ .009	− .052	+ .169 **.170**
Σ_o		.000	.000	−.001	−.001	−.001	−.001	.000	−.001	.000	.000

Table XXXIX. Intercorrelations of the 10 Subtests of the Echelle d'Intelligence Ottawa-Wechsler and Computation of the First Factor Loadings in Age Group VIII

	1	2	3	4	5	6	7	8	9	10	Σ rak
1	.856	.778	.745	.838	.778	.739	.809	.661	.612	.552	7.368
2	.778	.746	.662	.753	.724	.612	.749	.613	.310	.567	6.514
3	.745	.662	.647	.775	.624	.645	.638	.620	.391	.505	6.252
4	.838	.753	.775	.788	.674	.617	.724	.615	.474	.461	6.719
5	.778	.724	.624	.674	.764	.728	.890	.638	.396	.599	6.815
6	.739	.612	.645	.617	.728	.680	.647	.661	.502	.606	6.437
7	.809	.749	.638	.724	.890	.647	.817	.716	.544	.588	7.122
8	.661	.613	.620	.615	.638	.661	.716	.725	.500	.701	6.450
9	.612	.310	.391	.474	.396	.502	.544	.500	.388	.349	4.466
10	.552	.567	.505	.461	.599	.606	.588	.701	.349	.575	5.503
Σ rka	7.368	6.514	6.252	6.719	6.815	6.437	7.122	6.450	4.466	5.503	Σr =63.646
k_1	.9236	.8165	.7837	.8422	.8543	.8069	.8927	.8085	.5596	.6898	$\sqrt{\Sigma r}$ = 7.9779
k_1^2	.8530	.6667	.6142	.7093	.7298	.6511	.7969	.6537	.3134	.4758	$1/\sqrt{\Sigma r}$ = 0.12535
											Check Σk. = 7.9730

Table XL. First Factor Residuals and the Computation of the Second Factor Loadings of the 10 Subtests of the échelle d'Intelligence Ottawa-Seashler in Age Group VIII.

		+1	+2	+3	+4	-5	-6	+7	-8	+9	-10	$\sum$rak
+	+1	.003 +.095	+.024	+.081	+.060	+.011	+.006	-.016	+.086	+.095	+.085	.467
+	+2	+.024	.079 +.147	+.022	+.065	-.027	+.047	+.020	+.047	-.147	-.004	.194
+	+3	+.021	+.022	.033 +.115	+.115	+.046	-.013	-.062	+.014	-.048	+.036	.246
+	+4	+.060	+.065	+.115	.079 +.120	+.046	+.063	-.028	+.066	+.003	+.120	.030
+	-5	+.011	-.027	+.046	+.046	.034 +.127	+.039	-.127	-.053	+.082	+.010	.154
+	-6	+.006	+.047	-.013	+.063	+.039	.089 +.073	+.073	+.009	-.050	+.049	.296
+	+7	-.016	+.020	-.062	-.028	-.127	+.073	.080 +.127	+.006	+.044	+.028	.065
+	-8	+.086	+.047	+.014	+.066	-.053	+.009	+.006	..071 +.143	-.047	+.143	.414
+	+9	+.095	-.147	-.048	+.003	+.002	-.050	+.044	-.047	.075 +.147	+.037	.116
+	-10	+.085	-.004	+.036	+.120	+.010	+.049	+.028	+.143	+.037	.099 +.143	.647
$\sum_o$		-.001	.000	-.002	-.001	-.001	.000	-.002	-.002	.000	-.001	$\sum r$=3.229
$\sum$rka		.467	.194	.246	.630	.154	.296	.065	.414	.116	.647	$\sqrt{\sum r}$=1.7969
k_2		+.2599	+.1080	+.1369	+3506	-.0857	-.1647	+.0361	-.2304	+.0646	-.3601	$1/\sqrt{\sum r}$=0.55651
k_2^2		.0675	.0117	.0187	.1229	.0073	.0271	.0013	.0531	.0042	.1297	Check: $\sum k^2$=1.7970

Table XLI. Second Factor Residuals of the 10 Subtests of the Echelle d'Intelligence Ottawa-Wechsler in Age Group VIII

		+ 1	+ 2	+ 3	+ 4	- 5	- 6	+ 7	- 8	+ 9	- 10
+	1	+ .028 .078	- .004	- .015	- .031	- .011	- .037	- .025	+ .026	+ .078	- .009
+	2	- .004	+ .135 .154	+ .007	+ .027	- .036	+ .029	+ .016	+ .022	- .154	- .043
+	3	- .015	+ .007	+ .096 .067	+ .067	+ .034	- .036	- .067	- .018	- .057	- .013
+	4	- .031	+ .027	+ .067	+ .003 .067	+ .016	+ .005	- .041	- .015	- .020	- .006
-	5	- .011	- .036	+ .034	+ [illegible]	+ .120 .130	+ .025	- .130	- .073	+ .077	- .021
-	6	- .037	+ .029	- [illegible]	+ .005	+ .025	+ .046 .067	+ .067	- .029	- .061	- .010
+	7	- .025	+ .016	- .067	- .041	- .130	+ .067	+ .126 .130	- .002	+ .042	+ .015
-	8	+ .026	+ .022	- .018	- .015	- .073	- .029	- .002	+ .090 .073	- .062	+ .060
+	9	+ .078	- .154	- .057	- .020	+ .077	- .061	+ .042	- .062	+ .143 .154	+ .014
-	10	- .009	- .043	- .013	- .006	- .021	- .010	+ .015	+ .060	+ .014	+ .013 .060
Σ_o		.000	-.001	-.002	-.001	.001	-.001	.001	-.001	.000	.000

APPENDIX 2

ABSTRACT OF:
A FACTOR ANALYSIS OF THE ECHELLE D'INTELLIGENCE OTTAWA-WECHSLER

In this thesis an attempt was made to discover the functional unities underlying performance on the Echelle d'Intelligence Ottawa-Wechsler. The hypothesis guiding our purpose is as follows: the Ottawa-Wechsler measures constant factors in the various age groups from 15 to 59 inclusive.

The subjects used in this study were those of the standardization sample of the Ottawa-Wechsler. This group (N = 750) divided into eight age groups, is a stratified sample of the French-speaking population of Greater Ottawa. Thurstone's Centroid Method of Factor Analysis was followed.

Factor analysis indicated only two factors. The factors found by inspection of graphical representation of test vectors by age group were as follows:

Age Group I:

1) ability to acquire and use knowledge of a verbal nature.
2) ability to evaluate and organize visual material.

Age Group II:

1) ability to acquire and use knowledge.
2) ability to evaluate visual material.

Age Group III:

1) ability to acquire and use knowledge.

2) ability to evaluate visual material.

Age Group IV:

1) ability to acquire and use knowledge.

2) ability to evaluate visual material.

Age Group V:

1) ability to acquire and use knowledge.

2) ability to evaluate visual material.

Age Group VI:

1) ability to acquire and use knowledge.

2) unidentifiable.

Age Group VII:

1) ability to acquire and use knowledge.

2) unidentifiable.

Age Group VIII:

1) ability to acquire and use knowledge.

2) ability to evaluate visual material.

In the Appendix I to this thesis can be found 24 tables giving the original correlations, computation of first factors, first factor residuals, computation of second factors, and the second factor residuals.