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THE DIFFERENCE BETWEEN THE NUMBER OF CORRECT RESPONSES OF THREE INTELLECTUALLY DEFINED GROUPS ON THE DIGIT SYMBOL SUBTEST OF THE WAIS

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A Thesis Submitted to the Graduate Division in Partial Fulfillment of the Requirements for the Degree of Master of Science

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ABSTRACT

This study was a preliminary endeavor concerned with an investigation into whether young adults of defined age ranges and defined intellectual levels obtain significantly different scores on the Digit Symbol subtest of the WAIS.

With the confidence level set at .05, the null hypothesis that there was no significant difference between the Digit Symbol subtest scores of the retarded, normal, and superior groups was tested. The term young adults was used to describe subjects between the ages of seventeen and twenty-five. The intellectual level defined as retarded, included Intelligence Quotient scores between 50 and 70; the normal level had Intelligence Quotient scores between 90 and 110; the superior level had Intelligence Quotient scores at 120 and above.

Subjects for the retarded group were obtained from the Joplin Area Sheltered Workshop, and from Nevada State Hospital Number Three, Nevada, Missouri. Due to the requirements imposed upon the retarded group, only thirty subjects were found who met the requirements. All thirty agreeded to take part in the study. All were administered the Digit Symbol subtest of the WAIS in accordance with the manual instructions.

Subjects for the normal and superior groups were obtained at Missouri Southern College, Joplin, Missouri. Since recent Intelligence Quotients were not available for the students, one hundred and fifty Otis Quick-Scoring Mental Ability Tests, Gamma test: Form AM, were administered to classes the psychology

staff felt would have either a majority of students with an Intelligence Quotient range between 90 and 110, or 120 and above.

As the Otis tests were graded, the scores were listed as normal, superior, or not usable. The normal group had thirty-six qualifying scores; the superior group had thirty-four qualifying scores. The subjects of both groups were interviewed just prior to testing to determine if they met all the requirements imposed upon their respective groups. Only three subjects from the normal group were excluded. In both groups, only the first thirty qualifying subjects were administered the Digit Symbol subtest of the WAIS.

The Kruskal-Wallis one-way analysis of variance was used to test the null hypothesis. A significant difference between the three groups was found to be above the .001 level of confidence. Thus, the null hypothesis was rejected. It was concluded that people with higher Intelligence Quotients score significantly higher on the Digit Symbol subtest of the WAIS than people with lower Intelligence Quotients.

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CHAPTER I

THE PROBLEM AND DEFINITION OF TERMS

There are many factors that must be taken into consideration when standardizing performance sections of intelligence tests, including hand-eye co-ordination and performance. It has been stated by some who have studied hand-eye co-ordination in relation to performance, that dull individuals and people with physical handicaps perform slower than people of average intelligence or people of superior intelligence. (Briggs 1960, p.320)

Even though performance and hand-eye co-ordination are incorporated in the Digit Symbol subtest of the WAIS, few studies have tried to use this subtest to determine how much difference there is between the performance of dull and average people, average and superior people, and superior and dull people. Studies of the Digit Symbol subtest of the WAIS in regard to the number of correct responses of specific age ranges and specific intellectual levels are extremely limited.

I. THE PROBLEM

Statement of the problem. The purpose of this study was to determine whether there is a significant difference at the .05 level of confidence in the number of correct responses

obtained by retarded, normal, and superior young adults on the Digit Symbol subtest of the WAIS. The hypothesis to be tested was that there is no significant difference between the Digit Symbol subtest scores of the retarded, normal, and superior groups.

Importance of the study. It has been generally accepted that intellectually superior young adults learn faster and get more correct responses than retarded or even normal people on a performance type test. Little, however, has been done experimentally to prove or disprove this assumption.

It is of interest to the experimenter to find out if superior young adults of a defined age range do significantly better on the Digit Symbol subtest of the WAIS than do normal or retardates of the same age range.

Delimitations of the study. This study was concerned with whether there is a significant difference in the number of correct responses made by young adults, predefined as to age and intellectual level, on the Digit Symbol subtest of the WAIS. Subjects between the ages of seventeen and twenty-five were used. For the purpose of this study, the subjects were essentially free from physical limitations that would hinder motor responses applicable to the task.(Briggs 1960, p.318)

It was necessary to determine whether the subjects had any physical limitations that would interfere with performance on the Digit Symbol subtest of the WAIS. Available medical

information on the retarded subjects was reviewed. Because no medical information was available on the normal and superior subjects, each subject was interviewed (See Appendix I) to determine his eligibility.

Because of the apparent co-ordinative effects that medications have on the performance type of tests, subjects on medication were excluded from the study.(Townsend and Mursky 1960, p.216) Since it has been suggested that the performance of left-handed people who write with the crab technique is hampered by their style of writing on the Digit Symbol subtest, they were excluded from the study.(Bonier and Hanley 1961, p.287)

Limitations of the problem. There is no way of knowing whether the three groups were equally motivated to perform at their optimum. The study was hampered by the small sample of thirty subjects for each group. What might hold true for a small sampling in Southwest Missouri, may not be true for other geographic areas.

It was not known if any of the subjects used in the study had any emotional disturbances. Therefore, it is not known if the results were affected by emotional disturbances.

All the subjects in the retarded group had either had the WISC or the WAIS intelligence test. It is not known how much the scores of this group were affected by the practice of having had the same or a similar subtest.

Two types of intelligence tests were used to obtain the three groups. As stated, the results of the individual intelligence tests were employed to determine the retarded group; the Otis Quick-Scoring Mental Ability Test, Gamma test: Form AM, was used to determine the IQ's of 90 to 110 for the normal group, and the IQ's of 120 and above for the superior group. It was not ascertained how the use of different types of intelligence tests to obtain the three groups would affect the respective group's scores on the Digit Symbol subtest.

The subjects in the normal and superior groups were college students. A more representative sample may have shown different results.

The groups did not contain an equal number of males and females. It is not known what effect this had on the results.

A final limitation was that two subjects with childhood epilepsy were used. Both subjects' seizures had been petit mal in nature; their last seizures had occurred over five years previous to the time they were used in this study.

Basic Assumptions. The first assumption was that all subjects were motivated to perform at their optimum. A second assumption was that if any of the subjects had had a Digit Symbol test before, their score was not appreciably affected by the practice effect.

II. DEFINITIONS OF TERMS USED

Retarded subjects. The term retarded subjects in this study refers to those individuals who scored between 50 and 70 on the WISC or WAIS individual intelligence test.

Normal subjects. The term normal subjects refers to those individuals who scored between 90 and 110 on the Otis Quick-Scoring Mental Ability Test, Gamma test: Form AM.

Superior subjects. The term superior subjects refers to those individuals who scored a 120 or above on the Otis Quick-Scoring Mental Ability Test, Gamma test: Form AM.

Young adult. This term describes the seventeen to twenty-five year old subjects used.

CHAPTER II

REVIEW OF THE LITERATURE

The Digit Symbol test was in fairly wide use before Dr. David Wechsler used a form of it in his scales. However, after Dr. Wechsler developed his particular form of the Digit Symbol test and standardized it, along with the other subtests of his scale, questions began to arise as to the reliability of the norms obtained for the subtests.(Manny, Siegel, and Durtak 1968, p.465)

A study was conducted by Manny, Siegel, and Durtak(1968, pp. 465-468) on an even larger sampling of retardates than used in the standardization of the WAIS. The norms obtained by Manny, Siegel, and Durtak for the Digit Symbol test and th Object Assembly test were almost the same as those obtained b Wechsler. They obtained some variation from the Wechsler nor for the remaining performance subtests; however, none of the variations were significant.

Burik(1950, pp.33-42) stated that while Wechsler claimed his Digit Symbol test measured learning ability, Luchins and Luchins(1953, pp.125-142) claimed it measured psychomotor spe In an attempt to resolve this question, Burik correlated the Digit Symbol test of the Wechsler-Bellevue scale with several established motor tests; then he correlated the Digit Symbol test with Wechsler's memory scale.

With the correlations obtained in the study, it was concluded that the scores on the Digit Symbol test had no real relationship to associational learning. While considerabl learning did take place during performance, it was incidental in nature and not a decisive part of the test. A second conclusion of the study was that the test was significantly related to motor tests such as dotting, tapping, and canceling of digits. A third conclusion indicated that added motivation practice, and longer time intervals all failed to increase the learning involved in the Digit Symbol test; they tended instead to impair motor efficiency.

Another study tried to measure the relationship of learning and motor abilities with the Digit Symbol subtest score on the Wechsler-Bellevue scale. The results pointed to the possibility that the Digit Symbol test is essentially a motor test, probably involving speed of perception and writing. (Munstenin and Leipold 1961, pp.103-112)

There were others who felt the speed with which people completed the Digit Symbol test was due to the way they perceived the instructions. In order to test this hypothesis, Luchins and Luchins(1953, pp.125-142) felt that there would have to be four groups of subjects. The subjects consisted of sophomores and juniors who were taking general psychology courses at McGill University.

The study was administered during conference hours when large classes were divided into smaller study groups. The

groups ranged from fifteen to twenty-four students; they were administered mimeographed copies of the Digit Symbol subtest of the Wechsler-Bellevue. The first group of subjects was given the regular instructions of the Digit Symbol subtest of the Wechsler-Bellevue and told to try to memorize the symbols as they went. The second group of subjects was given the regular instructions and told to copy the symbols by referring back to the coded symbols. The third group received the Wechsler-Bellevue instructions, but told to take their time in completing the task. The fourth group of subjects was given only the Wechsler-Bellevue manual instruction.

The results of the four groups indicated that the nature of the task assigned influenced the score. The first three groups did significantly better at the .05 level of confidence than the fourth group. It was suggested that under the usual test instructions, a higher score need not indicate better learning, but perhaps a better perception as to how the test should be completed.

The current writer feels the assumption could also be made that people of superior intelligence can better organize tasks to be completed, and therefore the ability to better perceive may be a part of what constitutes a superior intelligence.

The controversy of the Digit Symbol test does not stop with what it measures and what type of instructions are given.

It goes on to include sex differences, age differences, handness, amount of anxiety involved, and whether people with special handicaps should be tested with this type of test.

As far as the controversy of one sex performing better than the other on decoding tests, Smith(1967, pp.1007-1083) studied sex differences on the Digit Symbol subtest of the WAIS. He concluded that there is a definite difference in favor of females. He stated that the Digit Symbol subtest of the WAIS is the only subtest that showed constant sex differences in all ages, with females superior to males from ages five to sixty-four.

According to Wechsler(1958, p.147), there are eight subtests of the WAIS that show clear-out sex differences. Five of the subtests favor the males, and three subtests favor the females. Wechsler indicated that other subtests besides the Digit Symbol subtest show a constant sex difference such as the Arithmetic subtest. However, the Digit Symbol subtest shows the highest constant sex differences at all ages.

It was also concluded by Smith that apart from the speed and accuracy of specific mental operations, the Digit Symbol performance involved visual-motor co-ordinations in perception. However, it was felt higher scores obtained by females were not just the result of the above; rather their scores might reflect greater speed and accuracy in writing. He based this conclusion on the fact that females are superior to males on written tests. To check the hypothesis, Smith administered

an oral digit symbol test. The results indicated the females scored superior to the males. His conclusion was that females may be superior in the particular aspect of mental functioning measured by the Digit Symbol test.

Studies on how age affects performance on the Digit Symbol test concluded that speed and accuracy of writing decline with age.(Wechsler 1958, p.81) A study done by Beck, Feshbach, and Legg(1962, pp.263-265) concluded that the Digit Symbol scores of the WAIS decrease in a directional descending fashion with increasing age. The results agreed with Wechsler's(1958, p.204) findings.

In a study done by Kaufman(1966, pp.180-183) on an oral Digit Symbol test developed for people who had hand impariments, it was concluded that the older people are, the slower they perform. The study found that the older people did better on the oral test than on the written Digit Symbol test. Younger subjects performed equally well on both tests.

Another interesting study on the Digit Symbol test set out to determine whether there was a difference in performance on the test in relation to the severity of functional articulatory defects. Three groups were used. They were rated: sever functional articulatory defect, mild functional articulatory defect, and normal. All three groups were matched in respect to age, sex, social background, and intelligence.

All three groups were administered the Digit Symbol test according to the WAIS manual instructions. The mild group scored the best. It was felt that the poor functioning of the normal group was due to a higher level of anxiety; it was stated that the results may have been affected by the different anxiety levels. It was also felt that the sample of above-average children may not have been a true sample of the total population.(Trapp and Evans 1960, pp.176-180)

A study was done by Goldfrab(1961, pp.7-12) on performance under stress. The study matched subjects according to intelligence, age, sex, and self-acceptance. It was concluded that the personality variables of intellectual control and self-acceptance do not appear to be major factors of behavior under stress; and that performance under stress cannot be predicted.

In a study done on similar lines as Goldfrab's, Goodsteine and Farber(1957, pp.152-154) questioned whether in any specific situation, there is relationship between anxiety and performance. The results they obtained were not conclusive. They did, however, discover that people with low levels of anxiety did worse than those of intermediate or high levels of anxiety. They also stated in the summary that people with moderate levels of anxiety, as measured on the Taylor Anxiety Scale, performed better than those of low or high anxiety levels.

Fogel and Blumklotz(1965, pp.109-111) stated that anxiety could affect performance on the Digit Symbol subtest of the WAIS, but that what a person did before taking the subtest could affect the results even more. They matched their subjects in relation to age, sex, and education. They then gave one group motor inhibiting tasks, while the second group received neutral tasks before being administered the subtest. The group of subjects that received motor inhibiting tasks before receiving the subtest got significantly fewer number of correct responses. However, there was not a significant difference in the number of errors made by each group.

It is felt by the current writer that there would be only a few instances where the results of the study by Fogel and Blumklotz would be of any consequence. In most instances, people will not engage in motor inhibiting tasks before taking the WAIS or a digit symbol test.

Matarazzo and Philips(1955, pp.131-134) conducted a study on performance as a function of increasing levels of anxiety. They concluded that the Digit Symbol subtest of the WAIS induces anxiety to those who take it. They also stated that there may be a functional relationship between the subtest and anxiety.

The Digit Symbol subtest of the WAIS was compared with vocabulary scores, and with scores on a depression inventory. Clinical judgments were made by experienced psychiatrists

as to the depth of depression, intensity of anxiety, and severity of illness. Beck, Feshback, and Legg concluded that scores obtained on the Digit Symbol subtest of the WAIS could not be associated with depression.

Beck, Feshback, and Legg did, however, find a significant difference between Digit Symbol scores and increasing severity of mental illness. The performance of psychotics was substantially worse than that of neurotics, thus suggesting a possible application of this test to discrimination between neurotic and psychotic individuals or groups.

Of all the studies on the Digit Symbol subtest of the WAIS to determine what it measures, or how, and to whom the test should be administered, one thing seems to remain constant. Individuals with superior intelligence score higher and have less errors than other people.

It is just one step further to assume that if people score in the superior range on the WAIS, they would, for the most part, be functioning at superior levels in their peer groups in society. It would also seem that the majority of the above cited studies on the Digit Symbol subtest confirmed what Wechsler had already said about the test.

CHAPTER III

DESIGN AND PROCEDURES

Organization of the study. This study was designed to find out if there is a significant difference at the .05 level of confidence in the number of correct responses obtained by retarded, normal, and superior young adults on the Digit Symbol subtest of the WAIS. The age range for the young adults was seventeen to twenty-five years. The IQ levels were set as follows: 50 to 70 for the retarded group, 90 to 110 for the normal group, and 120 and above for the superior group. After the qualifying subjects for each group were determined, the Digit Symbol subtest of the WAIS was administered in accordance with the instructions in the WAIS manual.

Of the thirty retarded subjects listed in Table I(p.16) the first fourteen entries were subjects from Nevada State Hospital Number Three, Nevada, Missouri. They had been tested upon entrance into the hospital with either the WISC or WAIS intelligence test, and were classified retarded with minimal emotional disturbance. Their IQ scores on the tests were between 50 and 70. All fourteen subjects met the requirements imposed upon the retarded group; none had been in the hospital over two years. These subjects were placed in the hospital because there was no one to care for them, or because

their families refused to care for them.

IQ scores were obtained from the Joplin Area Sheltered Workshop records for twenty-one subjects. All IQ's were WAIS full scale scores; all subjects had been tested in the last two years. The necessary information regarding the requirements of the retarded subjects was obtained from the workshop records. Because of age restriction and medical restrictions, only sixteen subjects were given the Digit Symbol subtest of the WAIS. Their results constitute the remaining sixteen entries in Table I(p. 16)

Only twenty-eight of the retarded subjects were found to meet all the restrictions imposed on their group. Two subjects that had had childhood epileptic seizures were incorporated. Records at the workshop indicated that neither of the subjects were on medication or had had a seizure for over five years; their last seizures were petit mal in nature. Since it was assumed the results of these two subjects would not affect the results of the retarded group, it was of interest to note that both subjects scored over thirty correct responses. This was higher than most subjects in their group.

It can be observed in Table I, that the mean IQ score from the hospital group(M_1) was 60.57, and the mean IQ score from the workshop group(M_2) was 59.06. Since there seemed to be little difference in the mean IQ scores of the hospital subjects and workshop subjects, it was assumed that confinement

TABLE I

IQ AND DIGIT SYMBOL SCORES
FOR THE RETARDED GROUP

Sex	I.Q.	D.S.	Sex	I.Q.	D.S.	Sex	I.Q.	D.S.
M	68	35	M	59	26	M	61	15
F	50	32	M	51	17	M	51	9
M	68	34	F	60	28	M	50	18
M	70	36	F	57	28	M	58	31
M	69	35	M	56	21	M	66	39
M	56	35	F	60	36	F	62	25
M	70	19	F	70	18	M	69	28
M	56	21	M	70	19	F	53	42
M	51	24	F	50	21	F	56	36
M	63	30	F	50	38	F	63	41

Number of subjects = 30 I.Q. 50-70 D.S. = Digit Symbol Score
M_1 = 60.57 M_2 = 59.06 M = Male F = Female

in the hospital did not affect performance on the Digit Symbol subtest.

At both the Joplin Area Sheltered Workshop and State Hospital Number Three in Nevada, all subjects were told in advance they were chosen to take part in a study. They were also told that their participation was voluntary. All subjects who qualified for the retarded group agreed to take

part in the study.

The fourteen retarded subjects from State Hospital Number Three in Nevada, were tested in a room used by the hospital's psychologist for testing. The sixteen subjects from the workshop were tested in a room used as an office. Both rooms used for testing were as free from major distractions as possible.

It was purposed to obtain the normal and superior groups from Missouri Southern College in Joplin, Missouri. However, it was discovered no recent IQ scores were available. In order to obtain subjects for these two groups, one hundred and fifty students were administered the Otis Quick-Scoring Mental Ability Test, Gamma test: Form AM(see Appendix II). The students were enrolled in psychology classes the Staff of the Department of Psychology felt contained either a majority of superior students, or a majority of average students. Of the one hundred and fifty Otis Tests given, thirty-six subjects were found for the normal group, and thirty-four subjects for the superior group. The rest of the IQ scores fell between the upper limits of the normal group, and the lower limits of the superior group.

As scores were found that qualified for the normal group, they were listed along with the name of the person who made the score. The subjects, as their name appeared on the list, were then given the opportunity to take part in the study. If they agreed, they were administered the Digit Symbol subtest

of the WAIS. Only one subject did not want to be a part of the study; two subjects could not be used because they were taking medication.

As can be observed in Table II, the normal group had IQ scores ranging from 90 to 110. It can also be observed that all but three IQ scores of the normal group fell between 100 and 110.

TABLE II

IQ AND DIGIT SYMBOL SCORES
FOR THE NORMAL GROUP

Sex	I.Q.	D.S.	Sex	I.Q.	D.S.	Sex	I.Q.	D.S.
F	105	50	M	110	53	M	109	52
M	105	63	M	106	67	M	98	66½
M	110	61	F	109	76	M	105	56
F	107	64	M	100	54	M	104	52
F	103	48	F	109	61	F	108	70
M	104	61	F	108	61	M	98	57
M	102	52	F	107	53	F	110	65
F	100	67	M	110	66	M	110	49
M	105	48	M	100	59	F	110	65
M	104	58	M	98	66	F	110	73

Number of subjects = 30 I.Q. 90-110 D.S. = Digit Symbol Score
M = Male F = Female

The procedure for testing the superior group was the same as that used for testing the normal group. As scores that qualified for the superior group were found, they were listed along with the name of the individual who made the score. The subjects were then given the opportunity to take part in the study as their name appeared on the list. The current experimenter chose to administer the Digit Symbol subtest of the WAIS to only the first thirty subjects on the list.

The IQ scores for the superior group fell mainly in the 120 to 130 range. This can be observed from Table III(p. 20).

The testing for the normal and superior groups was done in rooms used by the psychology staff for testing. The rooms were as free from major distractions as possible.

It can be noted from the three tables, that there were eleven females in the retarded group, twelve females in the normal group, and thirteen females in the superior group. Since each group had approximately the same ratio of males to females, it was assumed that any advantage females might have had over males on this type of test would not significantly affect the score of any one group.

Explanation of Sampling Technique. For all three groups, the first thirty people who met the requirements of each group and agreed to take part in the study were used. The sampling was handled in this manner because not enough

TABLE III

IQ AND DIGIT SYMBOL SCORES
FOR THE SUPERIOR GROUP

Sex	I.Q.	D.S.	Sex	I.Q.	D.S.	Sex	I.Q.	D.S.
F	120	83	M	128	59½	F	122	73
F	120	62	M	131	76	F	124	66
M	121	50	M	129	82	F	122	55
F	120	73	F	125	74	M	123	67
F	124	72	F	122	65	M	123	79
M	123	63	M	120	70	M	129	64
M	120	54	M	122	59	F	131	76
M	129	67	F	123	67	M	128	72
M	124	85	M	122	58	M	124	63
F	130	66	F	120	76	M	120	64

Number of subjects = 30 D.S. = Digit Symbol Score
I.Q. 120 and above M = Male F = Female

retarded subjects, who met the requirements of the study, could be found to employ random sampling techniques.

Explanation of Treatments. All subjects selected for the three groups, a total of ninety, were administered the Digit Symbol subtest of the WAIS in accordance with the administration directions in the WAIS manual.

Description of Measuring Instrument. The measuring instrument was the WAIS Digit Symbol subtest. Only the Digit Symbol subtest portion of the WAIS Record Form was used. A copy of the WAIS Record Form is located in Appendix III.

Method of Organizing and Analyzing the Data. The Kruskal-Wallis one-way analysis of variance was used to test the null hypothesis that there is no significant difference between the Digit Symbol scores of the three previously defined groups. The non-parametic one-way analysis of variance was used in order to avoid making any assumption concerning normality of the distribution of the population. The Kruskal-Wallis test is stated as being "the most efficient of the non-parametic tests of K independent samples;" K equals three or more samples drawn from the same population.(Siegel 1956, pp. 189-194)

The scores that the subjects made on the Digit Symbol subtest of the WAIS were ranked as retarded, normal, or superior in Table IV(p. 22).

The lowest Digit Symbol score received the rank of one and the highest Digit Symbol score received the rank of ninety. After the scores were ranked as required by the Kruskal-Wallis one-way analysis of variance, the sums of each group were determined and inserted into the formula: $H = 12/N(N+1) \sum_{j=1}^{k} R_j 2/N_j - 3(N+1)$.(see Appendix IV)

TABLE IV

RANKING OF DIGIT SYMBOL SCORES AND MEANS
OF THE RETARDED, NORMAL, AND SUPERIOR GROUPS

R	R	R	N	N	N	S	S	S
22	14	2	34.5	39.5	37	89	51	79
19	3	1	58	72	69	56	83.5	67
20	15.5	4.5	53.5	83.5	44.5	34.5	88	43
25	12.5	18	61	41.5	37	79	81	72
22	9	28	31.5	53.5	75	76.5	64	86.5
22	25	12.5	53.5	53.5	46	58	75	61
6.5	4.5	15.5	37	39.5	64	41.5	49.5	83.5
9	6.5	30	72	67	33	72	72	76.5
11	9	25	31.5	49.5	64	90	47.5	58
17	27	29	47.5	44.5	79	67	83.5	61
		M = 465.0			M = 1572.5			M = 2057.5

R = Retarded N = Normal S = Superior M = Mean

Reference to Table C, p. 249, (Siegel 1956) indicated that the H of 65.0845, obtained with two degrees of freedom, had a probability of occurrence under .001.

To correct for ties, the number of scores that were tied in each group was determined. This was done by counting the number of tied scores in Table IV. It was found that there were twenty-five groups of ties.

The formula $T = t^3 - t$, where t equal the number of tied scores was used. The first tie occurred between two scores in the retarded group, thus T = 8-2=6. Counting the rest of the tied scores, the values of $T = t^3 - t$ was computed as seen in Appendix IV.

It can be observed that for any particular value of t , the value of T is constant. After the total of T was obtained, the formula $1 - \mathcal{E}T/N^3-N$ for the total correction of ties was computed(see Appendix IV). The formula for the correction of ties becomes the denominator for the formula for H corrected for ties. $H = \dfrac{12/N(N+1) \sum_{j=1}^{k} R_j 2/N_j - 3(N+1)}{1 - \mathcal{E}T/N^3-N}$

Thus, H is found to be 65.1322. Reference to Table C, p. 249, (Siegel 1956) shows that the probability of H as large as 65.1322, with two degrees of freedom, is less than .001.

Since none of the scores of the retarded group overlapped with scores of the normal or superior group, it can be concluded that the subjects of the normal and superior groups scored significantly more correct responses on the Digit Symbol subtest of the WAIS.

However, scores of the normal and superior groups did overlap. No definite conclusion as to whether the superior group's Digit Symbol scores were significantly higher could be drawn without employing the Kruskal-Wallis one-way analysis of variance. The scores for the normal and superior groups

were ranked as shown in Table V. The lowest Digit Symbol score received the rank of one; the highest Digit Symbol score received the rank of sixty.

TABLE V

RANKING OF DIGIT SYMBOL SCORES AND MEANS OF THE NORMAL AND SUPERIOR GROUPS

N	N	N	S	S	S
4.5	9.5	7	59	21	49
28	42	39	26	53.5	37
23.5	53.5	14.5	4.5	58	13
31	11.5	7	49	51	42
1.5	23.5	4.5	46.5	34	56.5
23.5	23.5	16	28	45	31
7	9.5	34	11.5	19.5	53.5
42	37	3	42	42	46.5
1.5	19.5	34	60	17.5	28
17.5	14.5	49	37	53.5	31
		M = 672.5			M = 1157.5

N = Normal S = Superior M = Mean

After the scores were ranked, the sums of the two groups were determined and inserted into the formula: $H = 12/N(N+1) \sum_{j=1}^{k} R_j 2/N_j - 3(N+1)$ (see Appendix V).

Reference to Table C, p. 249, (Siegel 1956) indicated that the H of 13.05 with one degree of freedom has a probability of occurrence under .001.

To correct for ties, the number of scores that were tied in each group was again determined. This was done by counting the number of tied scores in Table V. It was found that there were eighteen groups of ties.

After the total of T was obtained, the formula $1 - \Sigma T/N^3-N$ for the total correction of ties was computed.(see Appendix V) The formula for the corrections of ties became the denominator for the formula for H corrected for ties. The H was found to be 13.08.

Reference to Table C, p. 249, (Siegel 1956) showed that the probability of H as large as 13.08 with one degree of freedom, is less than .001. Therefore, it can be concluded that the superior group obtained significantly more correct responses on the Digit Symbol subtest of the WAIS than did the normal group.

In view of the earlier mentioned findings, it can also be stated that the normal group had significantly more correct responses on the Digit Symbol subtest of the WAIS than did the retarded group; the retarded group had significantly fewer correct responses than did the superior group. In accordance with these results, the null hypothesis was rejected. It was concluded that people with higher IQs will have a significantly higher Digit Symbol subtest score.

CHAPTER IV

DISCUSSION, SUMMARY, AND CONCLUSION

The specific concern of this study was to investigate whether young adults of defined age ranges and defined intellectual levels obtained significantly different scores on the Digit Symbol subtest of the WAIS. The Krushal-Wallis one-way analysis of variance was used to test the null hypothesis that there is no significant difference between the Digit Symbol subtest scores of the retarded, normal, and superior groups. The test showed that there was a difference between the scores of the three groups. Thus, the null hypothesis was rejected.

As mentioned before, no work has been done on this aspect of the WAIS Digit Symbol subtest. It is hoped that this study will lead to other studies that will develop new applications of the Digit Symbol test. Perhaps a better oral digit symbol test could be developed, or even a digit symbol test in braille for the blind.

In spite of the limitations of the study, the results are in general agreement with Wechsler's assumption. The Digit Symbol subtest apparently does, to a degree, measure whatever aspect or aspects of the human intellect that make it superior, average, or inferior.

Summary and Conclusion. This study investigated whether young adults of defined age ranges and defined intellectual levels obtained significantly different scores at the .05 level of confidence on the Digit Symbol subtest of the WAIS. After the qualifying subjects were determined, they were administered the Digit Symbol subtest of the WAIS in accordance with the administration instructions in the WAIS manual.

Results indicated a significant difference in the three groups tested. H = 65.1322; d/f = 2; p .001; thus, the null hypothesis was rejected.

This study can be characterized as a preliminary investigation, and can be considered indicative only of the sample employed. However, the results are in general agreement with the basic assumption made in testing. There are differences between retarded, normal, and superior groups; these differences can be measured.

The general conclusion drawn from this study is that people with higher IQs, will usually have higher Digit Symbol scores.

Recommendations. It is felt by the current writer that if this study were repeated using larger randomly-selected samples, a more valid inference about the results could be made to the respective populations. It is also

recommended that a study be conducted using a larger sample to determine if there is a significant difference in performance on the Digit Symbol subtest of the WAIS between institutionalized mentally retarded and retarded individuals in sheltered workshop environments.

APPENDIX

APPENDIX I

The list of interview questions asked the subjects from Missouri Southern College to determine their eligibility was as follows:

1. Do you presently take any medications?
2. Have you ever had epileptic seizures?
3. Have you ever had a prolonged high fever?
4. Have you ever had any brain injury?
5. Have you ever had any spinal injury?
6. Have you ever had any spinal disease?

APPENDIX II

OTIS QUICK-SCORING MENTAL ABILITY TESTS

By ARTHUR S. OTIS, PH.D.

Formerly Development Specialist with Advisory Board, General Staff, United States War Department

Gamma
AM

GAMMA TEST: FORM AM

IQ..... For Senior High Schools and Colleges Score.....

Read this page. Do what it tells you to do.

Do not open this booklet, or turn it over, until you are told to do so.
Fill these blanks, giving your name, age, birthday, etc. Write plainly.

Name..... Age last birthday .....years
First name, initial, and last name

Birthday..... Teacher..... Date.....19.....
Month Day

Grade..... School..... City.....

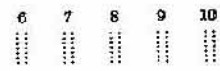
This is a test to see how well you can think. It contains questions of different kinds. Here are three sample questions. Five answers are given under each question. Read each question and decide which of the five answers below it is the right answer.

Sample a: Which one of the five things below is soft?
① glass ② stone ③ cotton ④ iron ⑤ ice.....

The right answer, of course, is *cotton;* so the word *cotton* is underlined. And the word *cotton* is No. 3; so a heavy mark has been put in the space under the 3 at the right. This is the way you are to answer the questions.

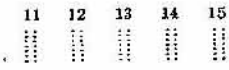
Try the next sample question yourself. Do not write the answer; just draw a line under it and then put a heavy mark in the space under the right number.

Sample b: A robin is a kind of —
⑥ plant ⑦ bird ⑧ worm ⑨ fish ⑩ flower....



The answer is *bird;* so you should have drawn a line under the word *bird*, and *bird* is No. 7; so you should have put a heavy mark in the space under the 7. Try this one:

Sample c: Which one of the five numbers below is larger than 55?
⑪ 53 ⑫ 48 ⑬ 29 ⑭ 57 ⑮ 16.....



The answer, of course, is 57; so you should have drawn a line under 57, and that is No. 14; so you should have put a heavy mark in the space under the 14.

The test contains 80 questions. You are not expected to be able to answer all of them, but do the best you can. You will be allowed half an hour after the examiner tells you to begin. Try to get as many right as possible. Be careful not to go so fast that you make mistakes. Do not spend too much time on any one question. No questions about the test will be answered by the examiner after the test begins. Lay your pencil down.

Do not turn this booklet until you are told to begin.

52 53 54 55 56

1. The opposite of hate is —
① enemy ② fear ③ love ④ friend ⑤ joy

2. If 2 pencils cost 5 cents, how many pencils can be bought for 50 cents?
⑥ 100 ⑦ 10 ⑧ 20 ⑨ 25 ⑩ 5

3. A dog does not always have —
⑪ eyes ⑫ bones ⑬ a nose ⑭ a collar ⑮ lungs

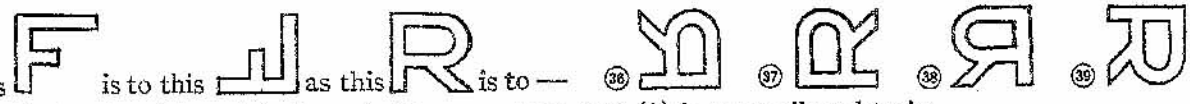
4. A recollection that is indefinite and uncertain may be said to be —
⑯ forgotten ⑰ secure ⑱ vague ⑲ imminent ⑳ fond

5. Which of these words would come first in the dictionary?
㉑ more ㉒ pile ㉓ mist ㉔ pick ㉕ mine

6. A fox most resembles a —
㉖ pig ㉗ goat ㉘ wolf ㉙ tiger ㉚ cat

7. Gold is more costly than silver because it is —
㉛ heavier ㉜ scarcer ㉝ yellower ㉞ harder ㉟ prettier

8. The first drawing below is related to the second in the same way that the third one is to one of the remaining four. Which one?



9. A radio is related to a telephone in the same way that (?) is to a railroad train.
㊶ a highway ㊷ an airplane ㊸ gasoline ㊹ speed ㊺ noise

10. The opposite of wasteful is —
㊻ wealthy ㊼ quiet ㊽ stingy ㊾ economical ㊿ extravagant

11. A debate always involves —
(51) an audience (52) judges (53) a prize (54) a controversy (55) an auditorium

12. A party consisted of a man and his wife, his two sons and their wives, and four children in each son's family. How many were there in the party?
(56) 7 (57) 8 (58) 12 (59) 13 (60) 14

13. One number is wrong in the following series.
1 5 2 6 3 7 4 9 5 9
What should that number be?
(61) 9 (62) 7 (63) 8 (64) 10 (65) 5

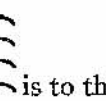
14. A school is most likely to have —
(66) maps (67) books (68) a janitor (69) a teacher (70) a blackboard

15. What letter in the word WASHINGTON is the same number in the word (counting from the beginning) as it is in the alphabet?
(71) A (72) N (73) G (74) T (75) O

16. Which word makes the truest sentence? Fathers are (?) wiser than their sons.
(76) always (77) usually (78) much (79) rarely (80) never

17. Four of these five things are alike in some way. Which one is not like the other four?
① nut ② turnip ③ rose ④ apple ⑤ potatoes

18. The opposite of frequently is —
⑥ occasionally ⑦ seldom ⑧ never ⑨ periodically ⑩ often

19. This  is to this  as this  is to — ⑪ ⑫ ⑬ ⑭

20. At a dinner there is always —
⑯ soup ⑰ wine ⑱ food ⑲ waiters ⑳ dishes

21. If 10 boxes full of apples weigh 400 pounds, and each box when empty weighs 4 pounds, how many pounds do all the apples weigh?
㉑ 40 ㉒ 360 ㉓ 396 ㉔ 400 ㉕ 404

(Go right on to the next page.)

ANSWER SHEET

Page 6

64 66 67 68 69 70

65 71 72 73 74 75

66 76 77 78 79 80

67 1 2 3 4 5

68 6 7 8 9 10

69 11 12 13 14 15

70 16 17 18 19 20

71 21 22 23 24 25

72 26 27 28 29 30

73 31 32 33 34

74 35 36 37 38

75 41 42 43 44

76 46 47 48 49 50

77 51 52 53 54 55

78 56 57 58 59 60

79 61 62 63 64 65

80 66 67 68 69 70

Page 5

46 66 67 68 69 70

47 71 72 73 74 75

48 76 77 78 79 80

49 81 82 83 84 85

50 86 87 88 89

51 1 2 3

52 6 7 8 9 10

53 11 12 13 14 15

54 16 17 18 19 20

55 21 22 23 24 25

56 26 27 28 29

57 31 32 33 34 35

58 36 37 38 39 40

59 41 42 43 44 45

60 46 47 48 49 50

61 51 52 53 54

62 56 57 58 59 60

63 61 62 63 64 65

Page 4

22 26 27 28 29 30

23 31 32 33 34 35

24 36 37 38 39 40

25 41 42 43

26 46 47 48 49 50

27 51 52 53 54 55

28 56 57 58 59 60

29 61 62 63 64 65

30 66 67 68 69 70

31 71 72 73 74 75

32 76 77 78 79 80

33 1 2 3 4

34 6 7 8 9 10

35 11 12 13 14

36 16 17 18 19 20

37 21 22 23

38 26 27 28 29 30

39 31 32 33 34 35

40 36 37 38 39 40

41 41 42 43 44 45

42 46 47 48 49 50

43 51 52 53

44 56 57 58 59 60

45 61 62 63 64

Page 3

1 1 2 3 4 5

2 6 7 8 9 10

3 11 12 13 14 15

4 16 17 18 19 20

5 21 22 23 24 25

6 26 27 28 29 30

7 31 32 33 34 35

8 36 37 38 39

9 41 42 43 44 45

10 46 47 48 49 50

11 51 52 53 54 55

12 56 57 58 59 60

13 61 62 63 64 65

14 66 67 68 69 70

15 71 72 73 74 75

16 76 77 78 79 80

17 1 2 3 4 5

18 6 7 8 9 10

19 11 12 13 14

20 16 17 18 19 20

21 21 22 23 24 25

NOTE. *This Answer Sheet is not intended for machine scoring.* [2]

APPENDIX III

22. If a boy can run at the rate of 5 feet in $\frac{1}{5}$ of a second, how many feet can he run in 10 seconds? (26) 1 (27) 50 (28) 250 (29) 2 (30) 25

23. A thermometer is related to temperature as a speedometer is to — (31) fast (32) automobile (33) velocity (34) time (35) heat

24. "State of changing place" is a good definition for — (36) advancement (37) retardation (38) rotation (39) motion (40) revision

25. If the first two statements following are true, the third is (?).
All residents in this block are Republicans.
Smith is not a Republican. Smith resides in this block.
(41) true (42) false (43) not certain

26. If the words below were arranged to make a good sentence, with what letter would the second word of the sentence begin?
same means big large the as
(46) a (47) b (48) m (49) s (50) t

27. Sunlight is to darkness as (?) is to stillness.
(51) quiet (52) sound (53) dark (54) loud (55) moonlight

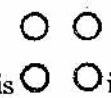
28. A grandmother is always (?) than her granddaughter.
(56) smarter (57) more quiet (58) older (59) smaller (60) slower

29. Such things as looks, dress, likes, and dislikes indicate one's —
(61) character (62) wisdom (63) personality (64) gossip (65) reputation

30. A tree always has —
(66) leaves (67) fruit (68) buds (69) roots (70) a shadow

31. In general it is safest to judge a man's character by his —
(71) voice (72) clothes (73) deeds (74) wealth (75) face

32. Which of these words is related to many as exceptional is to ordinary?
(76) none (77) each (78) more (79) much (80) few

33. This  is to this  as this  is to — (1)  (2)  (3)  (4) 

34. What is related to a cube in the same way that a circle is related to a square?
(6) circumference (7) corners (8) sphere (9) solid (10) thickness

35. Which one of these pairs of words is most unlike the other three?
(11) run — fast (12) large — big (13) loan — lend (14) buy — purchase

36. The opposite of awkward is —
(16) strong (17) pretty (18) graceful (19) short (20) swift

37. The two words superfluous and requisite mean —
(21) the same (22) the opposite (23) neither same nor opposite

38. Of the five words below, four are alike in a certain way. Which one is not like these four?
(26) push (27) hold (28) lift (29) drag (30) pull

39. The idea that the earth is flat is —
(31) absurd (32) misleading (33) improbable (34) unfair (35) wicked

40. The opposite of loyal is —
(36) treacherous (37) enemy (38) thief (39) coward (40) jealous

41. The moon is related to the earth as the earth is to —
(41) Mars (42) the sun (43) clouds (44) stars (45) the universe

42. The opposite of sorrow is —
(46) fun (47) success (48) joy (49) prosperity (50) hope

43. If the first two statements are true, the third is (?).
Frank is older than George. James is older than Frank.
George is younger than James.
(51) true (52) false (53) not certain

44. If $2\frac{1}{2}$ yards of cloth cost 30 cents, what will 10 yards cost?
(56) \$1.20 (57) 75¢ (58) 40¢ (59) \$3.00 (60) $37\frac{1}{2}$¢

45. Congest means to bring together, condole means to grieve together.
Therefore con means — (61) to bring (62) together (63) to grieve (64) to bring or grieve together

(Go right on to the next p

WAIS RECORD FORM

Wechsler Adult Intelligence Scale

Name _____

Birth Date _____ (MO DAY YR.) Age _____ Sex _____ Marital: S M D W (CIRCLE ONE)

Nat. _____ Color _____ Tested by _____

Place of Examination _____ Date _____

Occupation _____ Education _____

TABLE OF SCALED SCORE EQUIVALENTS*

Scaled Score	RAW SCORE											Scaled Score
	Information	Comprehension	Arithmetic	Similarities	Digit Span	Vocabulary	Digit Symbol	Picture Completion	Block Design	Picture Arrangement	Object Assembly	
19	29	27-28		26	17	78-80	87-90					19
18	28	26		25		76-77	83-86	21		36	44	18
17	27	25	18	24		74-75	79-82		48	35	43	17
16	26	24	17	23	16	71-73	76-78	20	47	34	42	16
15	25	23	16	22	15	67-70	72-75		46	33	41	15
14	23-24	22	15	21	14	63-66	69-71	19	44-45	32	40	14
13	21-22	21	14	19-20		59-62	66-68	18	42-43	30-31	38-39	13
12	19-20	20	13	17-18	13	54-58	62-65	17	39-41	28-29	36-37	12
11	17-18	19	12	15-16	12	47-53	58-61	15-16	35-38	26-27	34-35	11
10	15-16	17-18	11	13-14	11	40-46	52-57	14	31-34	23-25	31-33	10
9	13-14	15-16	10	11-12	10	32-39	47-51	12-13	28-30	20-22	28-30	9
8	11-12	14	9	9-10		26-31	41-46	10-11	25-27	18-19	25-27	8
7	9-10	12-13	7-8	7-8	9	22-25	35-40	8-9	21-24	15-17	22-24	7
6	7-8	10-11	6	5-6	8	18-21	29-34	6-7	17-20	12-14	19-21	6
5	5-6	8-9	5	4		14-17	23-28	5	13-16	9-11	15-18	5
4	4	6-7	4	3	7	11-13	18-22	4	10-12	8	11-14	4
3	3	5	3	2		10	15-17	3	6-9	7	8-10	3
2	2	4	2	1	6	9	13-14	2	3-5	6	5-7	2
1	1	3	1		4-5	8	12	1	2	5	3-4	1
0	0	0-2	0	0	0-3	0-7	0-11	0	0-1	0-4	0-2	0

*Clinicians who wish to draw a "psychograph" on the above table may do so by connecting the subject's raw scores. The interpretation of any such profile, however, should take into account the reliabilities of the subtests and the lower reliabilities of *differences between* subtest scores.

SUMMARY

TEST	Raw Score	Scaled Score	
Information			
Comprehension			
Arithmetic			
Similarities			
Digit Span			
Vocabulary			
Verbal Score			
Digit Symbol			
Picture Completion			
Block Design			
Picture Arrangement			
Object Assembly			
Performance Score			
Total Score			

VERBAL SCORE _____ IQ _____

PERFORMANCE SCORE _____ IQ _____

FULL SCALE SCORE _____ IQ _____

I. INFORMATION	SCORE 1 or 0		SCORE 1 or 0		SCORE 1 or 0
1. Flag		11. Height		21. Senators	
2. Ball		12. Italy		22. Genesis	
3. Months		13. Clothes		23. Temperature	
4. Thermometer		14. Washington		24. Iliad	
5. Rubber		15. Hamlet		25. Blood vessels	
6. Presidents		16. Vatican		26. Koran	
7. Longfellow		17. Paris		27. Faust	
8. Weeks		18. Egypt		28. Ethnology	
9. Panama		19. Yeast		29. Apocrypha	
10. Brazil		20. Population			

OBSERVATIONS:

65-211AS
Printed in U. S. A.

	SCORE 2, 1 or 0	6. VOCABULARY
1. Bed		
2. Ship		
3. Penny		
4. Winter		
5. Repair		
6. Breakfast		
7. Fabric		
8. Slice		
9. Assemble		
10. Conceal		
11. Enormous		
12. Hasten		
13. Sentence		
14. Regulate		
15. Commence		
16. Ponder		
17. Cavern		
18. Designate		
19. Domestic		
20. Consume		
21. Terminate		
22. Obstruct		
23. Remorse		
24. Sanctuary		
25. Matchless		
26. Reluctant		
27. Calamity		
28. Fortitude		
29. Tranquil		
30. Edifice		
31. Compassion		
32. Tangible		
33. Perimeter		
34. Audacious		
35. Ominous		
36. Tirade		
37. Encumber		
38. Plagiarize		
39. Impale		
40. Travesty		

2. COMPREHENSION	SCORE 2, 1 or 0
1. Clothes	
2. Engine	
3. Envelope	
4. Bad company	
5. Movies	
6. Taxes	
7. Iron	
8. Child labor	
9. Forest	
10. Deaf	
11. City land	
12. Marriage	
13. Brooks	
14. Swallow	

3. ARITHMETIC			
	R or W	Time	SCORE
1. 15"			0 1
2. 15"			0 1
3. 15"			0 1
4. 15"			0 1
5. 30"			0 1
6. 30"			0 1
7. 30"			0 1
8. 30"			0 1
9. 30"			0 1
10. 30"			0 1
11. 60"			0 1 1-10 2
12. 60"			0 1 1-10 2
13. 60"			0 1 1-15 2
14. 120"			0 1 1-20 2

4. SIMILARITIES	SCORE 2, 1 or 0
1. Orange—Banana	
2. Coat—Dress	
3. Axe—Saw	
4. Dog—Lion	
5. North—West	
6. Eye—Ear	
7. Air—Water	
8. Table—Chair	
9. Egg—Seed	
10. Poem—Statue	
11. Wood—Alcohol	
12. Praise—Punishment	
13. Fly—Tree	

5. DIGIT SPAN	SCORE
Digits Forward	Circle
5-8-2 6-9-4	3 3
6-4-3-9 7-2-8-6	4 4
4-2-7-3-1 7-5-8-3-6	5 5
6-1-9-4-7-3 3-9-2-4-8-7	6 6
5-9-1-7-4-2-8 4-1-7-9-3-8-6	7 7
5-8-1-9-2-6-4-7 3-8-2-9-5-1-7-4	8 8
2-7-5-8-6-2-5-8-4 7-1-3-9-4-2-5-6-8	9 9
Digits Backward	Circle
2-4 5-8	2 2
6-2-9 4-1-5	3 3
3-2-7-9 4-9-6-8	4 4
1-5-2-8-6 6-1-8-4-3	5 5
5-3-9-4-1-8 7-2-4-8-5-6	6 6
8-1-2-9-3-6-5 4-7-3-9-1-2-8	7 7
9-4-3-7-6-2-5-8 7-2-8-1-9-6-5-3	8 8

F____ + B____ = ____
Highest numbers circled

APPENDIX IV

$$H = \frac{12}{90(90+1)}\left[\frac{(465)^2}{30} + \frac{(1572.5)^2}{30} + \frac{(2057.5)^2}{30}\right] - 3(90+1)$$

$$H = \frac{12}{8190}\left[\frac{216225}{30} + \frac{2,472,756.25}{30} + \frac{4,233,306.25}{30}\right] - 273$$

$$H = .0014652\left[7,207.5 + 82,425.20834 + 141,110.2083\right] - 273$$

$$H = .0014652\left[230742.9166\right] - 273$$

$$H = 65.084521$$

$$\frac{t}{T}\ \frac{2}{6}\ \frac{2}{6}\ \frac{3}{24}\ \frac{2}{6}\ \frac{2}{6}\ \frac{3}{24}\ \frac{3}{24}\ \frac{2}{6}\ \frac{2}{6}\ \frac{3}{24}\ \frac{2}{6}\ \frac{2}{6}\ \frac{2}{6}\ \frac{2}{6}\ \frac{2}{6}\ \frac{4}{60}\ \frac{3}{24}\ \frac{3}{24}$$

$$\frac{t}{T}\ \frac{3}{24}\ \frac{3}{24}\ \frac{5}{120}\ \frac{2}{6}\ \frac{3}{24}\ \frac{4}{60}\ \frac{2}{6}$$

$$T = 534$$

$$1 - \frac{\Sigma T}{N^3 - N}$$

$$1 - \frac{534}{(90) - 90}$$

$$1 - \frac{534}{728,910}$$

$$1 - .000732 = .999268$$

$$H = \frac{65.0842}{999268}$$

H = 65.1322 with two degrees of freedom

7. DIGIT SYMBOL

1	2	3	4	5	6	7	8	9	SCORE
—	⊥	⊐	L	U	O	∧	X	=	

SAMPLES

2	1	3	7	2	4	8	1	5	4	2	1	3	2	1	4	2	3	5	2	3	1	4	6	3
1	5	4	2	7	6	3	5	7	2	8	5	4	6	3	7	2	8	1	9	5	8	4	7	3
6	2	5	1	9	2	8	3	7	4	6	5	9	4	8	3	7	2	6	1	5	4	6	3	7
9	2	8	1	7	9	4	6	8	5	9	7	1	8	5	2	9	4	8	6	3	7	9	8	6

8. PICTURE COMPLETION

	SCORE 1 or 0
1. Knob	
2. Tail	
3. Nose	
4. Handles	
5. Diamond	
6. Water	
7. Nose piece	
8. Peg	
9. Oar lock	
10. Base thread	
11. Stars	
12. Dog tracks	
13. Florida	
14. Stacks	
15. Leg	
16. Arm image	
17. Finger	
18. Shadow	
19. Stirrup	
20. Snow	
21. Eyebrow	

9. BLOCK DESIGN

	Time	SCORE
1. 60"	1 / 2	0 2 4
2. 60"	1 / 2	0 2 4
3. 60"		0 4
4. 60"		0 4
5. 60"		0 4
6. 60"		0 4
7. 120"		0 4 5 (31-40) 6 (1-30)
8. 120"		0 4 5 (45-70) 6 (1-45)
9. 120"		0 4 5 (61-80) 6 (1-60)
10. 120"		0 4 5 (61-80) 6 (1-60)

10. PICTURE ARRANGEMENT

	Order	Time	SCORE
1. Nest 60"	1 / 2		0 2 4 WXY
2. House 60"	1 / 2		0 2 4 PAT
3. Hold up 60"			0 4 ABCD
4. Louie 60"			0 4 ATOMIC
5. Enter 60"			0 4 OPENS
6. Flirt 60"			0 2 (JNAET AJNET) 4 (JANET)
7. Fish 120"			0 2 (EGFHIJ) 4 5 (25-40) 6 (1-25) EFGHIJ EJFGHI
8. Taxi 120"			0 2 (SALMUE) 4 5 (16-25) 6 (1-15) SAMUEL AMUELS

SCORE

11. OBJECT ASSEMBLY

		Time	SCORE
Manikin	120"		0 1 2 3 4 5 6 (16-20) 7 (11-15) 8 (1-10)
Profile	120"		0 1 2 3 4 5 6 7 8 9 11 (36-45) 12 (26-35) 13 (1-25)
Hand	180"		0 1 2 3 4 5 6 7 9 (41-50) 10 (31-40) 11 (1-30)
Elephant	180"		0 1 2 3 4 5 6 7 8 10 (31-50) 11 (21-30) 12 (1-20)

0080

APPENDIX V

$$H = \frac{12}{60(60+1)} \left[\frac{(672.5)^2}{30} + \frac{(1157.5)^2}{30} \right] - 3(60+1)$$

$$H = \frac{12}{3660} \left[\frac{452,256.25}{30} + \frac{1339,806.25}{30} \right] - 183$$

$$H = .00327868 \left[15075.208 + 44,660.2083 \right] - 183$$

$$H = .00327868 \left[59,735.4163 \right] - 183$$

$$H = 13.053$$

t	2	2	3	2	2	2	2	2	4	3	3	3	3	5	2	3	4	2
T	6	6	24	6	6	6	6	6	60	24	24	24	24	120	6	24	60	6

$$T = 438$$

$$1 - \frac{\Sigma T}{N^3 - N}$$

$$1 - \frac{438}{(60)^3 - 60}$$

$$1 - \frac{438}{216000 - 60}$$

$$1 - \frac{438}{215,940}$$

$$1 - .00202834 = .99797166$$

$$H = \frac{13.053}{.99797166}$$

$$H = 13.07954 = 13.08 \text{ with one degree of freedom}$$

BIBLIOGRAPHY

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BOOKS

Siegel, Sidney. Non Parametric Statistics. New York: McGraw-Hill, 1956.

Wechsler, David. The Measurement of Adult Intelligence. Baltimore: Williams and Williams, 1958.

MAGAZINES

Beck, Aaron, Seymore Feshback, and Donald Legg. The Clinical Utility of the Digit Symbol Test. Journal of Consulting Psychology. 1962, 26(3), 263-268.

Bonier, Richard, and Charles Hanley. Handness and Digit Symbol Performance. Journal of Clinical Psychology. 1961, 12(3), 286-289.

Briggs, Peter. The Validity of WAIS Performance Subtests Completed with one Hand. Journal of Clinical Psychology. 1960, 16, 318-320.

Burik, Theodore. Relative roles of the Learning and Motor Factors in the Digit Symbol Subtest. Journal of Psychology. 1950, 30, 33-42.

Fogel, M.L., and P. Blumklotz. The Effects of Different Training Tasks on Digit Symbol Performance. Journal of Clinical Psychology. 1965, 21(1), 109-112.

Goldfrab, Allen. Performance Under Stress in Relation to Intellectual Control and Self-Acceptance. Journal of Consulting Psychology. 1961, 25, 7-12.

Goodsteine, Leonard, and I.E. Farber. On Relation Between A Scale Scores and the Digit Symbol Performance. Journal of Consulting Psychology. 1957, 21, 152-154.

Howell, R.J. Changes in Wechsler Subtest with Age. Journal of Consulting Psychology. 1955, 19, 47-50.

Kaufman, A. An Oral Digit Symbol Test. Journal of Clinical Psychology. 1966, 22, 180-183.

Luchins, Abraham, and Edith Luchins. Effects of Varying the Administration of the Digit Symbol Subtest of the Wechsler-Bellevue Inventory Scale. Journal of General Psychology. 1953, 49, 125-142.

Matarazzo, J.D., and Jeanne Philips. Digit Symbol Performance as a Function of Increasing Levels of Anxiety. Journal of Consulting Psychology. 1955, 19, 131-134.

Manny, Sternhicht, Louis Siegel, and Martin Durtak. WAIS Subtest Characteristics of Institutionalized Retardates. Educational Psychology and Measurements. 1968, 28, 465-468.

Munstenin, Bernard, and Walleam Leipold. The Role of Learning and Motor Abilities in Wechsler's-Bellevien Digit Symbol. Educational Psychology and Measurements. 1961, 21, 103-112.

Smith, A. Consistent Sex Differences in Specific Decoding Test Performance. Educational Psychology and Measurements. 1967, 27, 1077-1083.

Trapp, E.P., and T. Evans. Functional Articulatory Defect and Performance on Non-Verbal Task, Journal of Speech and Hearing Disorders. May 1960, 176-180.