

AD-781 643

EVALUATION OF SINDBAD TESTS

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Navy Experimental Diving Unit
Washington, D. C.

1 June 1974

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UNCLASSIFIED

Security Classification

AD-781643

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Navy Experimental Diving Unit Building 214, Washington Navy Yard Washington, D. C. 20374	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED
	2b. GROUP

3. REPORT TITLE
EVALUATION OF SINDBAD TESTS

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
Final

5. AUTHOR(S) (First name, middle initial, last name)
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C. REPORT DATE 1 June 1974	7a. TOTAL NO. OF PAGES 75	7b. NO. OF REFS 0
--------------------------------------	-------------------------------------	-----------------------------

8a. CONTRACT OR GRANT NO. b. PROJECT NO. c. d.	9a. ORIGINATOR'S REPORT NUMBER(S) RESEARCH REPORT 4-74
	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10. DISTRIBUTION STATEMENT
Approved for public release; distribution unlimited

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
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13. ABSTRACT

This paper presents the baseline results and analysis of the SINDBAD (Systematic Investigation of Diver Behavior At Depth) data gathered at the U.S. Navy Experimental Diving Unit. Fourteen of the tests in the SINDBAD battery were administered in a dry hyperbaric chamber at one atmosphere absolute pressure to twenty-seven U.S. Navy first class divers. Eight additional tests from the same battery were taken by sixteen of the same divers under similar conditions. Factor analysis of the results revealed that each test was measuring a unique ability. The normative data was gathered on each test for use in comparative studies in both wet and dry hyperbaric environments.

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14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Diving Divers Human Performance Performance Testing						

ia

NAVY EXPERIMENTAL DIVING UNIT
BLDG. 214, WASHINGTON NAVY YARD
WASHINGTON, D.C. 20374

IN REPLY REFER TO

RESEARCH REPORT 4-74

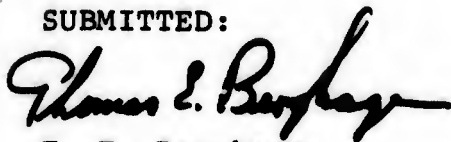
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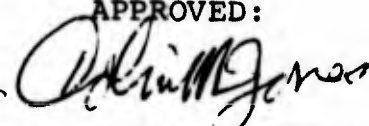
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INTRODUCTION

Purpose

The purpose of this study is twofold: (1) to evaluate the adequacy of the various tests in the SINDBAD performance test battery and (2) to establish normative dry baseline data on Navy First Class Divers. No evaluation of the tests in the SINDBAD test system has ever been conducted. Although most of the tests in the system are well established, the transfer of these tests from paper and pencil administration to the SINDBAD presentation style may have altered their validity and reliability. It is also possible that there is a great deal of redundancy among the 26 tests in the SINDBAD test battery. Therefore, one of the goals of this evaluation program is test consolidation. This test consolidation is to be done mathematically by the use of Factor Analysis.

The gathering of the normative dry baseline data was designed to obtain performance statistics on the Navy diver population. These statistics are to be used in evaluating the test instructions and the range of item difficulty. The baseline scores are also to be used as a reference point for comparative studies done during immersion and at various depths with various gas mixtures.

Background

There has never been a systematic attempt to study the effects of the undersea environment on a broad spectrum of human performance. There have been several studies of man's performance in hyperbaric environments which have focused on specific aspects of human behavior.

Recent attempts have been made to integrate these diverse studies into a consolidated picture of man's underwater performance capability. (Egstrom, G.H., Weltman, G., Cuccaro, W.J. and Willis, M.A., 1973; and Vaughan, 1974.) The results of this work, although instructive, have done little more than point up the large gaps that exist in our knowledge. We still do not have an adequate description of the relationship between the pressure environment and man's primary mental and perceptual motor abilities.

In 1966, the Experimental Diving Unit surveyed the various tests that were being utilized in various diving laboratories around the world. Based upon this survey, a decision was made to develop an integrated human performance testing system. A system that would include measures of all of the primary mental and perceptual motor abilities that had been thus far defined. In the system definition phase of the program, the contractors, BioTechnology, Inc. and the Experimental Diving Unit, settled on a set of potential primary abilities and related performance measures that seemed to be applicable to present and anticipated diver activities. Through a subcontract with Edwin Fleishman (American Institute for Research), a number of tests were identified for each ability factor. From the list of alternative tests identified for each selected ability factor, the particular measure to be included in the system was selected. Selection involved the application of three basic criteria. There were:

- (1) Methodological considerations (e.g., factorial purity, range of ability levels covered, sensitivity);
- (2) Engineering constraints; and
- (3) Practical considerations

In Table 1 are listed the selected factors and their associated tests. A full description and an example of each of these tests can be found in the paper by Reilly and Cameron (1968). For a detailed listing of alternative perceptual motor tests for the same factors, see Fleishman (1954). For the same detailed listing for cognitive factors, see Zavala (1967).

METHOD

Subjects

Twenty seven subjects were used in the evaluation of the SINDBAD test system. They ranged in age from 26 to 41 years with a median age of 31.6 years. All the subjects were U. S. Navy first class divers stationed at the Experimental Diving Unit. Their pay grades ranged from E-4 to E-8.

A comparison of the Navy General Classification Test Scores for this sample, with those of the average Navy first class diver, reveals no significant difference on the GCT (General Classification Test), MECH (Mechanical), and CLER (Clerical) subtests. However, the experimental group performed significantly lower ($P < .05$) on the Air (Arithmetic) subtest.

Tests

A description of each of the tests used in this study along with the underlying theoretical factor is given below:

#1 Factor: Flexibility of Closure

Test: Hidden Patterns

Description

Flexibility of Closure is the ability to keep one or more definite configurations in mind so as to make identification in spite of perceptual distractions. In the Hidden Patterns tests, stimuli are projected on the screen. The subjects attempt to recognize a figure that may or may not be hidden among other lines. The test contains many rows of patterns. In each pattern, the subject looks for a model figure which is shown at the top of the slide. If the model is embedded in the pattern, he touches the (+) key on the keyboard; if the model does not appear in the pattern, he touches the (-) key. Correct, incorrect, and total responses are accumulated on the experimenter's console. The test is scored as correct minus incorrect responses in a two-minute period.

#2 Factor: Length Estimation

Test: Shortest Road

Description

Length Estimation is the ability to judge distances. In the Shortest Road test, stimuli are projected on the screen. The subject examines two irregular lines that connect a pair of points to determine which of the two lines is shorter. The upper line of each stimulus is designated (+), the lower line is designated (-). The subject selects the shorter line and indicates his choice by touching the appropriate key on the keyboard.

Correct, incorrect, and total responses are accumulated on the experimenter's console. The test is scored as correct minus incorrect responses in a 30 second period.

#3 Factor: Perceptual Speed

Test: Number Comparison

Description

Perceptual Speed is the ability to compare one pattern with another under speeded conditions, and involves making rapid comparisons among items of visual information. In the Number Comparison tests, the subject inspects pairs of multi-digit numbers, projected on the screen, to determine whether the numbers in each pair are the same or different. He indicates "same" or "different" by touching, respectively, the (+) or (-) key on the keyboard. Correct, incorrect, and total responses are accumulated on the experimenter's console. The test is scored as correct minus incorrect responses in a 90-second period.

#4 Factor: Spatial Orientation

Test: Card Rotations

Description

Spatial Orientation is the ability to identify a particular kind of spatial pattern and not be distracted by patterns in a different spatial position. The Card Rotations test measures an individual's ability to detect differences in the spatial orientation of figures. The subject inspects drawings of irregularly shaped objects projected on the screen, and determines whether they are the same as or different from a reference object. He indicates

"same" or "different" by touching, respectively, the (+) or (-) key on the keyboard. Correct, incorrect, and total responses are accumulated on the experimenter's console. The test is scored as correct minus incorrect responses in a 2-minute period.

#5 Factor: Finger Dexterity

Test: Key Insertion

Description

Finger Dexterity is the ability to make rapid, skillful, controlled movements of small objects where the fingers are primarily involved. The Key Insertion test employs a small shape-coded object containing a permanent magnet. Half of the object is square, the other half round. The square and round keys correspond to openings in a template which covers the keyboard. The subject's task is to insert the test object into nine template openings working across rows. To execute the task, the subject uses one hand, and must insert, retrieve, and invert, then insert the test object in the next position, etc. Each insertion of the test object is monitored visually on the experimenter's console to ensure that the sequence is being performed properly. The test is scored automatically as the total insertions made in a 30-second period.

#6 Factor: Manual Dexterity

Test: Wrench and Cylinder

Description

Manual Dexterity is the ability to make skillful, controlled arm-hand manipulation of relatively large objects. The Wrench and Cylinder test employs specially constructed tools which are used

in conjunction with the keyboard. The outer portion of the cylinder is a sleeve which, by means of internal threads, can be moved to expose one or the other end of the inner component. The ends of the inner component are shape coded (square and round) and magnetic. The subject uses the wrench to stabilize the inner component and rotates the outer sleeve to expose first one end, then the other. As each end is exposed, it is inserted into a correspondingly shaped opening on the keyboard. Each complete operation is thus registered and accumulated for scoring at the experimenter's console. The test is scored automatically as the total operations (keyboard registrations) performed in a 60-second period.

#7 Factor: Reaction Time

Test: Visual Reaction Time

Description

Reaction Time is the speed with which an individual can respond to a stimulus. In Visual Reaction Time, the subject inserts a magnetic stylus into an aperture on the keyboard, and when a window beneath the position lights up, withdraws the stylus as rapidly as possible. Response time accumulates on the experimenter's console. Score is the mean of 10 trials.

#8 Factor: Time Interval Estimation

Test: Interval Reproduction

Description

Time Interval Estimation is the ability to judge intervals of elapsed time or to discriminate differences between two or more time intervals. In Interval Reproduction, the subject indicates his

estimate of elapsed time intervals ranging from 10 seconds to as long as is practicable in the testing situation, recognizing that both long- and short-term interval reproduction depend on operational requirements. Error score is the difference between the prescribed time interval and the subject-generated interval. Score is expressed as a percentage; the relationship between actual and estimated time.

#9 Factor: Wrist-Finger Speed

Test: Tapping

Description

Wrist Finger Speed is the ability to make pendular and/or rotary wrist movements which involve rapid, repetitive jabbing in which accuracy is not critical. In the Tapping test, the subject uses the magnetic stylus to tap as rapidly as possible, back and forth between the (+) and (-) keys on the keyboard. The number of responses accumulates on the experimenter's console. Score is the number of responses in one 30-second trial.

#10 Factor: Associative Memory

Test: Word-Number

Description

Associative Memory is the ability to remember bits of unrelated material. On the Word-Number test, columns of six words, each of which is paired with a two-digit number, are projected on the screen. The subject's task is to memorize the numbers associated with the words. Later, the words by themselves, are presented in a different order, and the subject responds by indicating the appropriate numbers on the keyboard. Each response registers on the experimenter's console. Score is the number of items remembered correctly. There is no time limit on the recall phase of the test.

#11 Factor: Induction

Test: Letter Sets

Description

Induction is the ability to find general concepts that fit sets of data, and to form and test hypotheses. In the Letter Sets test, problems are projected on the screen. Each problem has five groups of letters with four letters in each group. Four groups are alike in some way, the fifth is different. The subject determines the rule that makes four group alike, and indicates the group of letters that does not conform to the rule by touching the appropriate key on the keyboard. Responses are registered on the experimenter's console. Score is the number of correct responses in a 3-minute period.

#12 Factor: Number Facility

Test: Addition

Subtraction

Multiplication

Division

Description

Number Facility is the ease with which abstract symbols can be mentally manipulated. Addition, Subtraction, Multiplication, and Division tests measure how quickly and accurately an individual can mentally perform a basic computational operation. Arithmetic problems are projected on the screen. The subject solves each problem and indicates his answer by touching the appropriate digits on the

keyboard. Subject responses register on the experimenter's console. The tests are scored as the number of correct responses in a 2-minute period. The score is the sum of the scores for the four tests.

#13 Factor: Spatial Scanning

Test: Choosing a Path

Description

Spatial Scanning is the ability to visually explore a wide or complicated visual field. Items in the Choosing a Path test are projected on the screen. Each item consists of a network of lines as in an electrical-circuit diagram having many intermeshed wires with several sets of terminals. The subject visually traces the circuits and determines which one of five pairs of terminals completes a circuit through a circle at the top of the diagram. The subject responds by touching the appropriate key on the keyboard. Responses register on the experimenter's console. The test is scored as the number of items correct in a 3-minute period.

#14 Factor: Visualization

Test: Surface Development

Description

Visualization is the ability to understand relationships involved performing imaginary movements in three-dimensional space. In the Surface Development test, the subject tries to visualize how a two-dimensional pattern can be bent to form a three-dimensional object. The subject inspects drawings projected on the screen, one of which represents a flat piece of metal which can be bent

to form a three-dimensional object which is also shown. He indicates which edges on the pattern correspond to designated points on the object by touching the appropriate key on the keyboard. The score is the number of correct responses in a 3-minute period.

#15 Factor: Control Precision

Test: Position Control

Description

Control Precision is the ability to make sensitive, highly controlled positioning adjustments, primarily where larger muscle groups are involved. Adjustments are made in response to visual stimuli. In the test of Position Control, a target dot moves in a clockwise course around the face of the oscilloscope display. The subject controls a second dot which he attempts to keep superimposed on the target dot by moving the control stick with his dominant hand in a smooth clockwise circle. Performance is scored as the time integral of the absolute value of error voltage. The score is computed and shown on the experimenter's console. The score is the mean of three 60-second trials.

#16 Factor: Multi-limb Coordination

Test: Two-hand Tracking

Description

Multi-limb Coordination is the ability to coordinate the movements of two hands, two feet, or combinations of hands and feet simultaneously. Two-hand Tracking involves keeping a luminous dot centered on the face of the oscilloscope display by using left and right hand control sticks to control horizontal and

vertical axes of motion respectively. Performance is scored as the time integral of the absolute value of error voltage. The score is the mean of three 60-second trials.

#17 Factor: Response Orientation

Test: Choice Reaction Time

Description

Response Orientation is the ability to choose and perform an appropriate movement from several alternatives. In Choice Reaction Time, the subject holds a magnetic stylus at the center of four apertures in a keyboard template which provides for a directional response--forward, backward, left, or right. The subject is shown a random sequence of four colors, one at a time, projected on the screen. To each color, he makes the appropriate directional response which has been learned through practice prior to actual testing. Time for each response made by the subject is totaled automatically on the experimenter's console. The test is scored as the mean response time for a series of 24 test stimuli.

#18 Factor: System Equalization

Test: Rate Control

Description

System Equalization is the ability to control one or more axes of motion in systems having zero-order dynamics, first-order dynamics, or second-order dynamics. In Rate Control, the subject uses the tracking control(s) to keep a dot centered on the

oscilloscope (compensatory mode) or to keep a control dot superimposed on a target dot (pursuit mode). Performance is scored as the time integral of the absolute value of error voltage and is shown on the experimenter's console. The score is the mean of three 60-second trials.

#19 Factor: Vigilance

Test: Visual Signal Detection

Description

Vigilance is the ability to attend to one or more information sources or situations for relatively long periods to detect specified events which occur at random, or unpredicted intervals. In Visual Signal Detection, the subject observes the on-line digital display to detect numbers which appear at irregular intervals. Ten signals appear during a 6-minute period. The signals appear for .25 seconds at random intervals. The subject indicates his having seen the signal by touching the appropriate key on his keyboard. The score is the percentage of signals detected.

#20 Factor: Memory Span

Test: Visual Digit Span

Description

Memory Span is the ability to recall and reproduce a series of items after a single presentation of the series. The Visual Digit Span test involves recall and reproduction of a series of digits immediately after they have been presented and removed from view. The subject views series of digits of increasing length (from three to ten digits) shown one at a time, at 1-second intervals, on the optical (on-line) display. He then attempts

to recall the sequence and reproduce it by touching the appropriate digits on the keyboard. Subject responses register on the experimenter's console. Score is the length of the longest series correctly reproduced. Maximum score is 10.

#21 Factor: Time Sharing

Test: Track and Monitor

Description

Time Sharing is the ability to divide attention among two or more information sources through temporal/spatial sampling. Time sharing is customarily measured by presenting the subject with two or more displays separated in a manner which prohibits their being viewed simultaneously. In the Track and Monitor test, the subject uses the control stick to keep a control dot superimposed on a target dot on the oscilloscope. At the same time, he monitors a keyboard light which illuminates at various intervals. The subject indicates he has detected the onset of the light by using the keyboard. Score is expressed as tracking error during four 60-second trials (t) by the formula:

$$t = \frac{(t_2 + t_3) - (t_1 + t_4)}{(t_1 + t_4)}$$

where trials 2 and 3 consist of tracking with time sharing.

#22 Factor: Visual Monitoring

Test: Terminal Digits

Description

Visual Monitoring is the ability to attend to a continuously changing visual information source and report system status on

request. In Terminal Digits, the subject observes numbers which change at a rate of one per second on the on-line display. At various times, the display goes blank, and the subject reports the last two digits shown before the display was interrupted by using his keyboard. Score is the percentage of correct reports in ten trials. Trials consist of random length intervals longer than 10 seconds, but less than 60 seconds duration.

TEST ADMINISTRATION

The tests were administered in two sections; each section having a total test time of approximately one hour. The first section included Tests #1 through #14 which were given in chronological order. The tests in the second section were presented in the following order: 17, 15, 16, 18, 21, 19, 20, 22 to make administration simpler for the experimenter. For those tests that used slide stimulus material, the same slides were presented in the same order for all subjects. All of the 22 tests used in this initial evaluation were administered to each test subject twice. Although the first administration of the tests was considered an orientation, scores were recorded in an attempt to obtain equivalent form reliability coefficients. In the "Time Interval Reproduction" task, the same times and order of presentation were used for all individuals; they being: 10 seconds, 35 seconds, 15 seconds, 47 seconds, 60 seconds, 22 seconds, and 150 seconds (2 1/2 minutes). The "Key Insertion," "Wrench and Cylinder," and "Tapping" tests were timed with the clock starting with the subject's

first response. The subject was allowed two practice trials on the simple "Reaction Time" test. On the "Choice Reaction Time" task, the subject was allowed as much practice as he wished. All the tasks involving tracking, with the exception of "Track and Monitor" (time sharing) were administered until the subject reached an asymptotic performance level, and they were scored according to the following formula:

$$\text{Score} = \bar{X}^2 + \bar{Y}^2$$

\bar{X}^2 = Mean S axis score
squared

\bar{Y}^2 = Mean Y axis score
squared

The "Track and Monitor" test was scored according to the procedure described in the section above on "Time Sharing."

TESTING ENVIRONMENT

The subjects were tested in the two hyperbaric chambers at the Experimental Diving Unit. Testing was done in these locations because future studies involving immersion and/or high pressures will take place in this environment. The temperatures in the chamber complexes ranged between 75° and 90°. Noise distractions were uncontrolled and at times were quite disturbing for the subjects. This is the environment in which future studies are to be conducted and the same distractions will be present.

TESTING PROCEDURE

Communications was maintained between the subject and the experimenter at all times in order to clarify or elaborate on the tasks as needed. The subject was provided with written instructions for each test (Appendix A) and at the time of testing

was instructed to read the appropriate instructions.

For the actual testing, the subject was seated at a small work bench in front of the chamber view port. Visual test stimuli were presented on one of three display devices: (1) a back projection screen; (2) an oscilloscope; or (3) a digital display. The digital display and the oscilloscope were located outside the chamber and had to be viewed through the view port. The slide material was projected through the view port onto a back projection screen located in the chamber about 3 feet from the subject. All of the responses made by the subject were transmitted to the experimenter's console where they were automatically scored and manually recorded on an answer sheet by the experimenter.

RESULTS

The descriptive statistics obtained on the 22 tests that were administered are shown in Table 3. The individual scores for each subject on each test are shown in Appendix B. Frequency histograms depicting the distribution of scores on the first 14 tests are given in Appendix C. The statistics in Table 3 and Appendices B and C are those gathered on the second administration of the tests. The first administration of the tests was an orientation for the subjects and only used for a rough estimate of the reliability. An important aspect of Table 3 is the size of the standard deviation in relationship to the mean for several of the tests. Tests with a mean values that are not more than twice the size of the standard deviation indicate measures that have an unusually high variance or are badly skewed. The corrective

action needed for such tests is outlined in the discussion section of this paper.

The equivalent form reliability for the first 14 tests are given in Table 4. Because the first administration of the tests was designed to be an orientation to the SINDBAD test system, the reliability scores are somewhat in question. On the first administration of the tests, a number of questions arose and several of the tests had to be started over or repeated. The question whether or not the authors should have even attempted this statistic or bothered to include it in the report is one worth asking. The authors feel that even if these statistics are wrong, they are the best information that is presently available on the SINDBAD tests, and therefore, should be included. Future studies will confirm or refute these findings.

Table 5 presents the intercorrelations among the 22 tests that were given. The correlations among the last eight tests are based upon a sample of only 16 divers as are all the other statistics on these tests. The lack of any real high correlations in this matrix can be indicative of a couple different things. First of all, it could mean that each of the tests within the SINDBAD test battery is an independent measure of some underlying unique human ability. The tests included in the system were selected on a theoretical basis to do just that. The lack of high correlations among the tests is certainly an indication of test independence. Before we get too carried away with these results, however, the reader must keep in mind the low reliabil-

ities in Table 5 and the large variances of Table 3. If the tests within the SINDBAD system are imprecise or unreliable, one would also expect to find a lack of correlation. Which interpretation one chooses is still open to question. This study has provided some hints concerning the structure of the SINDBAD system, but no clear cut position on its adequacy.

As a further interpretive aid, the data was subjected to a factor analysis. Two separate principal component factor analyses were conducted to determine the minimum number of factors that could explain the correlation matrix in Table 5. An important decision in any factor analysis is; how much of the matrix variance do you wish to account for? This decision depends a great deal upon what the factor analysis is being used for. In this study, we choose to account for all the variance in intercorrelation matrix. The authors wished to see if a single test would correlate with each individual factor. For those readers interested in a different interpretive strategy, the authors have included Figure 1 which shows the proportion of variance accounted for by each additional factor.

Tables 6 and 7 present the results of the factor analysis. The importance of these two tables is that each theoretical factor has one and only one test that correlates highly with each. This is certainly additional support for the position that the tests selected for the SINDBAD system are independent measures of separate unique underlying abilities. Although the results are indicative, they are far from conclusive. The

real significance of these findings will have to wait for a second study.

DISCUSSION

Since the "Hidden Patterns," "Shortest Road," "Number Comparison," and "Card Rotations" tasks are all quite similar in format, they will be discussed together. All four tests have low reliability (.18-.34) and high standard deviations in comparison to their means. Even so, the factor analysis revealed high factor loadings for these four variables - all .90 or above. It is suspected that the low reliability is due to an inconsistent binary scoring mechanism in the SINDBAD machinery. This low reliability could probably be improved by changing the scoring format by by-passing the binary scorer. This would require manual recording of the responses. Because of the rapid rate of responses in these tests, a recorder would be necessary, as it would be impossible for the experimenter to handle the recording as well as the changing of the slides and monitoring of the clock.

The "Key Insertion" and the "Wrench and Cylinder" tasks have also been grouped together for discussion purposes because of their similarities. These tests are also plagued with relatively low reliabilities (.40 and .35, respectively). They both have high factor loadings (both in excess of .90), and more respectable standard deviations. The low reliability can be accounted for by the length of the tests. That is, the difference between a score of 12 and 13 is presently a substantial difference in

performance, when in fact it may not be. It is suggested that the time of testing for these two tasks be increased to between twice and three times as long. This would increase the range, make the difference between consecutive scores less significant, and hopefully, increase reliability.

Reaction time is shown as a distinct factor with a high factor loading (.94) and respectable reliability (.73). No changes are suggested for this task.

"Interval Reproduction" shows, again, a high factor purity (.95), but with a mediocre reliability (.50). This is probably inherent in what is being tested. A more consistent measure of the results might be the median percentage error rather than the mean percentage error. Most of the results seem to have a positive skew, and this should tend to compensate for the ceiling effect of this test.

The "Tapping" test has very respectable results. The reliability is high (.83), the factor loading is high (.90) and no significant skew in either direction. No alterations are proposed.

The "Word-Number" task shows only a moderately high factor loading (.75), but a fairly high reliability (.72). The low factor purity is quite likely due to the nature of the factor.

"Associative Memory" is required in most of the other tasks in small portions. No changes are recommended.

The "Letter Sets" tasks suffers from the same problems as the "Key Insertion" and "Wrench and Cylinder" tests. It has a small range and, consequently, a measurement difference of unity

is quite substantial. The factor loading on this test is high (.93), but the reliability is low (.49). Recommendations are to increase the testing time from 180 seconds to 300 seconds to broaden the range and increase consistency of testing.

The results from the arithmetic tests revealed high factor purity (.90) and quite high test-retest reliability (.93). No modifications are recommended.

The "Choose a Path" task revealed a high factor loading (.94) and a moderate reliability (.68). This test has a very substantial positive skew. An increase in the testing time would have little effect on this skew, but it would decrease the basement effect. It is recommended that the administration time be increased from 180 to 240 seconds in future testing.

The "Surface Development" task has a high reliability (.80) but a low factor purity (.41). This factor has loadings greater than .41 for two other tests. It is proposed to retain this test, despite the factorial impurities, as measurement of visualization with no changes in methodology.

The "Position Control," "Two-Hand Tracking," and "Rate Control" tracking tasks all had high factor purity (.96, .87, and .90 respectively). No reliability data is available on these test (as well as the rest of the tests discussed). The two-hand tracking, and especially rate control tasks, suffer from a basement effect. The scoring mechanism has an upper limit of 100. It is suggested that the times be shortened to 40 seconds from 60 seconds on these two tasks to avoid the testing basement.

The "Choice Reaction Time" task has the highest factor loading (.98). The only recommendation on this test is shorten the number of trials from 24 to 10. A cursory scanning of the data shows no substantial changes within the test over the 24 trials so this reduction should have very little effect.

The "Visual Signal Detection" task shows a factor loading of .87. The range is low and the test is affected by a ceiling. It is suggested the test time be increased from 6 to 15 minutes and to give a total of 25 to 50 signals in this time instead of 10.

The "Visual Digit Span" task has a factor loading of .86. The range is small (5-8). There is no obvious modification in the methodology that might increase the range short of biasing the results in favor of certain subjects.

The "Track and Monitor" task has a high factor loading (.91). It is suspected that the reliability is low on this task. The major problem area is that since there are no practice trials, the learning taking place during the task seems to be more of a major component than the time-sharing. Consequently, in several cases, the subjects performed poorer while not time-sharing. It is proposed to have several practice trials, (not time-sharing), to decrease the learning factor, before beginning to measure.

The "Terminal Digits" task has a high factor loading (.97). There is a severe ceiling problem in this test. Fifty percent of the subjects performed perfectly. To correct this, the

subjects should be required, in the future, to recall the last 3 or even the last 4 digits presented.

The following is a summary of suggested changes in the methodology:

- | | |
|-----------------------|-------------------------------------------------------------------|
| HIDDEN PATTERNS | 1. By pass binary scorer |
| SHORTEST ROAD | 2. Same as 1 |
| NUMBER COMPARISON | 3. Same as 1 |
| CARD ROTATIONS | 4. Same as 1 |
| KEY INSERTION | 5. Increase testing time from
30 seconds to 60-90 seconds |
| WRENCH & CYLINDER | 6. Increase testing time
from 60 seconds to
120-180 seconds |
| REACTION TIME | 7. No changes |
| INTERVAL REPRODUCTION | 8. Use median performance
instead of mean |
| TAPPING | 9. No changes |
| WORD-NUMBER | 10. No changes |
| LETTER SETS | 11. Increase testing time
from 180 seconds to
300 seconds |
| ARITHMETIC | 12. No changes |
| CHOOSE A PATH | 13. Increase testing time
from 180 seconds to
240 seconds |
| SURFACE DEVELOPMENT | 14. No changes |

POSITION CONTROL	15. No changes
TWO-HAND TRACKING	16. Decrease time of each trial from 60 seconds to 40 seconds
CHOICE REACTION TIME	17. Decrease number of trials from 24 to 10
RATE CONTROL	18. Same as 16
VISUAL SIGNAL DETECTION	19. Increase testing time from 6 to 15 minutes and number of signals from 10 to 25 - 50
VISUAL DIGIT SPAN	20. No changes
TRACK & MONITOR	21. Allow subject practice trials
TERMINAL DIGITS	22. Increase number of digits to be recalled from 2 to 3 or 4

CONCLUSIONS

The test data gathered and the structural analysis conducted tends to indicate that the twenty-two tests that were evaluated are separate, independent measures of underlying human abilities. Test administration and scoring procedures are still a crucial problem for the SINDBAD system. The instructions and testing times need to be re-evaluated using the changes suggested in this report. Alternative equipment for presenting and scoring the tests is needed. The optical scoring technique is far

to sensitive for use in this type of environment. The potentials originally projected for the SINDBAD system are still present, but will require additional equipment changes and test alterations to be realized.

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TABLE 1

List of Factors and Tests Included in the SINDBAD
Measurement System

FACTOR	TEST
1. Flexibility of Closure	Hidden Patterns
2. Length Estimation	Shortest Road
3. Perceptual Speed	Number Comparison
4. Spatial Orientation	Card Rotations
5. Finger Dexterity	Key Insertion
6. Manual Dexterity	Wrench and Cylinder
7. Reaction Time	Visual Reaction Time
8. Time Interval Estimation	Interval Reproduction
9. Wrist-Finger Speed	Tapping
10. Associative Memory	Word-Number
11. Induction	Letter Sets
12. Number Facility	Addition Subtraction Multiplication Division
13. Spatial Scanning	Choosing a Path
14. Visualization	Surface Development
15. Control Precision	Position Control
16. Multi-limb Coordination	Two-hand Tracking
17. Response Orientation	Choice Reaction Time
18. System Equalization	Rate Control
19. Vigilance	Visual Signal Detection
20. Memory Span	Visual Digit Span
21. Time Sharing	Track and Monitor
22. Visual Monitoring	Terminal Digits
23. Arm-Hand Steadiness	Arm Tremor
24. Flexibility of Set	Binary Set Persistence
25. Speed of Arm Movement	Horizontal Arc

TABLE 2

COMPARISON OF EXPERIMENTAL GROUP WITH THE GENERAL DIVER
FIRST CLASS POPULATION

		GCT	ARI	MECH	CLER
Experimental Sample	Mean	56.81	50.00	56.42	48.23
	S.D.	7.43	6.49	5.80	8.94
	N	27	26	26	26
Average Navy 1st Class Diver	*Mean	54.85	53.30	56.45	50.26
	S.D.	8.10	7.82	6.62	8.11
	N	351	351	351	351
	t	1.31	2.46	.02	1.12
	p	N.S.	.05	N.S.	N.S.

*BERGHAGE (1972)

TABLE 3

SUMMARY TABLE OF SINDBAD RESULTS

TEST NO.	TEST NAME	FACTOR NAME	MFAN (X)	STD. DEV.	RANGE	MEDIAN	MODE
1	HIDDEN PATTERNS	FLEXIBILITY OF CLOSURE	28.3	14.7	9-66	23.1	9
2	SHORTEST ROAD	LENGTH ESTIMATION	7.15	3.77	1-16	6.2	7
3	NUMBER COMPARISON	PERCEPTUAL SPEED	12.6	5.25	7-27	11.8	8
4	CARD ROTATIONS	SPATIAL ORIENTATION	15.1	10.3	1-36	13.5	11
5	KEY INSERTION	FINGER DEXTERITY	17.6	3.09	12-23	17.3	18
6	WRENCH AND CYLINDER	MANUAL DEXTERITY	10.3	2.11	8-14	9.5	8
7	VISUAL REACTION TIME	REACTION TIME	.285	.036	.242-.394	.275	.258,.272
8	INTERVAL REPRODUCTION	TIME INTERVAL ESTIMATION	16.3	10.2	3.6-32.7	13.2	None
9	TAPPING	WRIST-FINGER SPEED	106.0	20.3	78-174	104	95, 106
10	WORD-NUMBER	ASSOCIATIVE MEMORY	8.93	4.73	0-18	8.6	9
11	LETTER SETS	INDUCTION	6.18	1.96	2-10	5.9	6
12	ARITHMETIC	NUMBER FACILITY	35.1	12.5	10-57	36.5	34,40,42,47
13	CHOOSE A PATH	SPATIAL SCANNING	3.93	3.09	0-14	3.1	6
14	SURFACE DEVELOPMENT	VISUALIZATION	11.3	5.35	2-23	11.2	14
15*	POSITION CONTROL	CONTROL PRECISION	43.8	16.7	28.3-99.7	40.0	None
16*	TWO-HAND TRACKING	MULTI-LIMB COORDINATION	97.1	17.3	63.8-132.9	102	None
17*	CHOICE REACTION TIME	RESPONSE ORIENTATION	1.09	.242	.65-1.54	1.08	None
18*	RATE CONTROL	SYSTEMS EQUALIZATION	99.8	26.7	57.3-141.4	99.5	None
19*	VISUAL SIGNAL DETECTION	VIGILANCE	80.0	8.94	60-90	75.7	80
20*	VISUAL DIGIT SPAN	MEMORY SPAN	6.19	.981	5-8	6.25	7
21*	TRACK AND MONITOR	TIME SHARING	.178	.508	.355-2.00	.0835	None
22*	TERMINAL DIGITS	VISUAL MONITORING	89.4	13.4	60-100	95.0	100

* Based on N = 16, all others based on N = 27

TABLE 4
EQUIVALENT FORM RELIABILITY

Test No.	r	Test No.	r
1	.20	12	.93
2	.34	13	.68
3	.18	14	.80
4	.33	15	NA
5	.40	16	NA
6	.35	17	NA
7	.73	18	NA
8	.50	19	NA
9	.83	20	NA
10	.72	21	NA
11	.49	22	NA

TABLE 5

INTER-CORRELATION MATRIX

FACTOR NAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
# 1 Flexibility of Closure	1.0																						
# 2 Length Estimation	.17	1.0																					
# 3 Perceptual Speed	.11	.33	1.0																				
# 4 Spatial Orientation	.58	.14	.03	1.0																			
# 5 Finger Dexterity	.17	.05	.11	.31	1.0																		
# 6 Manual Dexterity	.08	.08	.00	.09	.33	1.0																	
# 7 Reaction Time	.33	.04	.11	.28	.16	.14	1.0																
# 8 Time Interval Estimation	.11	.11	.21	.16	.40	.23	.22	1.0															
# 9 Wrist-Finger Speed	.05	.04	.34	.06	.33	.40	.16	.21	1.0														
# 10 Associative Memory	.28	.28	.14	.21	.10	.29	.35	.03	.21	1.0													
# 11 Induction	.18	.03	.00	.02	.13	.08	.17	.07	.04	.48	1.0												
# 12 Number Facility	.02	.09	.29	.09	.12	.18	.15	.10	.10	.53	.53	1.0											
# 13 Spatial Scanning	.30	.18	.03	.15	.26	.09	.21	.28	.28	.16	.26	.22	1.0										
# 14 Visualization	.13	.48	.28	.17	.60	.19	.16	.16	.20	.17	.26	.22	.13	1.0									
# 15 Control Precision	.28	.11	.27	.07	.33	.22	.06	.09	.04	.32	.19	.04	.09	.14	1.0								
# 16 Multi-Limb Coordination	.06	.45	.29	.56	.01	.13	.13	.01	.20	.10	.38	.17	.22	.14	.19	1.0							
# 17 Response Orientation	.52	.06	.14	.48	.13	.06	.42	.26	.06	.34	.17	.08	.26	.11	.13	.18	1.0						
# 18 Systems Equalization	.22	.01	.25	.41	.18	.34	.03	.22	.11	.17	.15	.47	.08	.49	.37	.32	.10	1.0					
# 19 Vigilance	.51	.24	.21	.61	.03	.10	.35	.08	.23	.17	.18	.22	.19	.35	.07	.35	.31	.56	1.0				
# 20 Memory Span	.33	.26	.23	.17	.02	.05	.02	.39	.29	.02	.00	.03	.08	.04	.38	.24	.12	.20	.46	1.0			
# 21 Time Sharing	.02	.55	.20	.34	.22	.45	.18	.42	.15	.13	.44	.09	.19	.01	.13	.52	.02	.40	.08	.31	1.0		
# 22 Visual Monitoring	.19	.49	.58	.48	.10	.03	.20	.10	.05	.49	.43	.46	.42	.18	.07	.34	.16	.03	.06	.24	.27	1.0	

Correlations between Variables 1 - 14 based on N = 27
 All other based on N = 16

TABLE 6

SINDBAD FACTOR ANALYSIS RESULTS

FACTOR NAMES

VARIABLES	SPATIAL ORIENTATION	REACTION TIME	INDUCTION	LENGTH ESTIMATION	WRIST-FINGER SPEED	TIME INTERVAL ESTIMATION	SPATIAL SCANNING	PERCEPTUAL SPEED	FINGER DEXTERITY	NUMBER FACILITY	FLEXIBILITY OF CLOSURE	ASSOCIATIVE MEMORY	MANUAL DEXTERITY	VISUALIZATION
1. HIDDEN PATTERNS	.30	-.16	-.10	-.11	.03	-.07	-.15	.06	.09	.01	.90	-.07	.06	-.01
2. SHORTEST ROAD	.09	-.02	.02	.96	.01	-.04	.09	.16	-.07	.04	.09	.11	-.04	.01
3. NUMBER COMPARISON	.01	-.03	-.01	.18	.17	-.12	-.04	.94	-.11	.15	-.06	-.04	.01	.02
4. CARD ROTATIONS	.91	-.14	.03	.10	-.07	-.08	-.07	.00	.17	.03	-.29	-.06	-.06	-.01
5. KEY INSERTION	.14	.07	.02	.00	.14	-.24	.11	-.07	.92	.05	-.07	-.05	-.15	.06
6. WRENCH AND CYLINDER	.05	.06	-.04	.04	.20	-.10	.01	-.01	.15	-.08	.05	.10	.95	-.01
7. VISUAL REACTION TIME	-.13	.94	.09	-.04	-.10	-.11	.08	-.03	.10	-.07	.14	.12	-.06	-.01
8. INTERVAL REPRODUCTION	-.07	-.11	-.03	-.05	-.07	.95	-.14	-.11	-.13	.07	.06	.00	.10	-.02
9. TAPPING	-.07	-.12	.01	.00	.90	-.08	.15	.20	.18	.02	-.03	-.10	-.23	-.01
10. WORD-NUMBER	.11	-.23	.34	-.22	.16	-.01	-.15	.07	.05	.31	-.12	.75	.20	.01
11. LETTER SETS	.02	.10	.93	.01	.01	-.03	.12	-.02	.07	.25	.10	-.16	.03	-.02
12. ARITHMETIC	.03	-.08	.28	.04	.01	.08	.13	.17	.09	.90	-.01	-.17	.09	-.02
13. CHOOSE A PATH	-.07	.08	.11	.09	.14	-.14	.94	-.04	.12	.11	.13	.08	-.01	-.01
14. SURFACE DEVELOPMENT	.12	.12	.19	-.45	.13	.26	.08	-.14	.64	.15	-.07	.05	-.11	.41

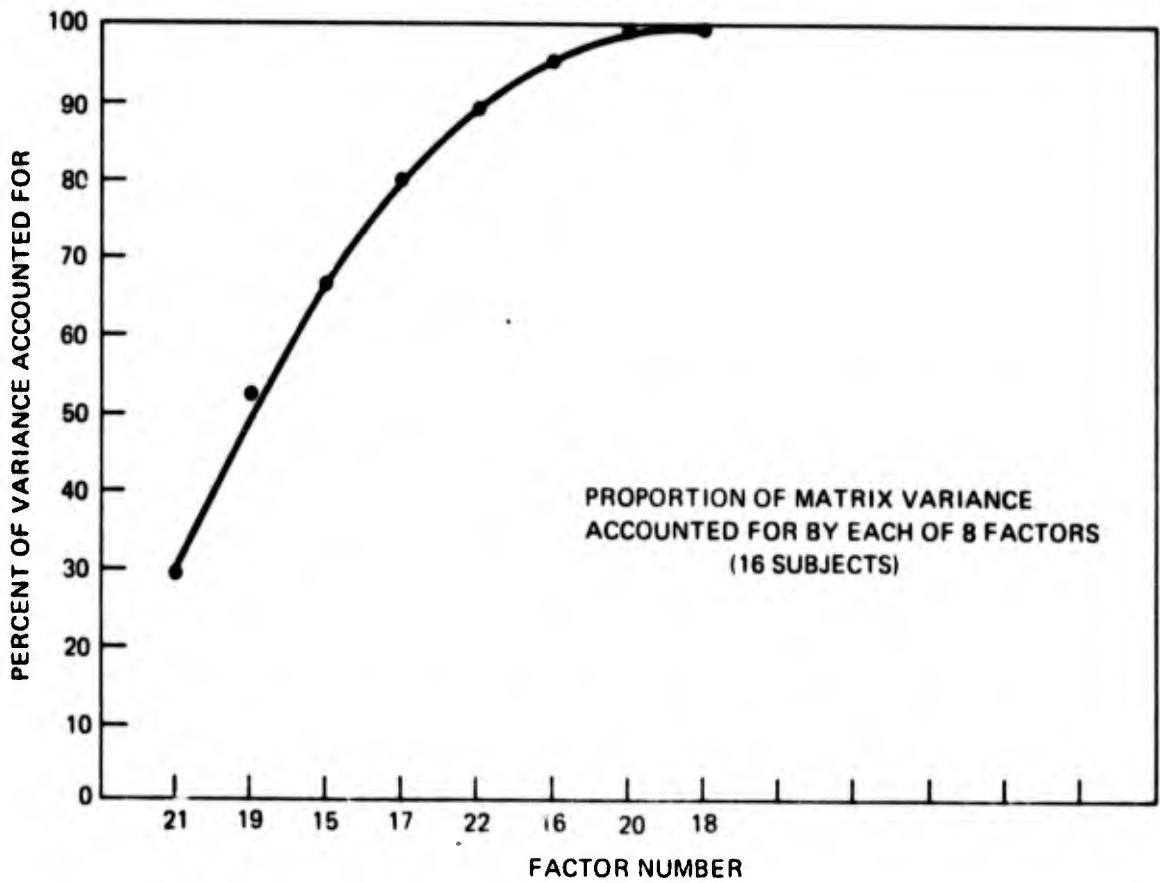
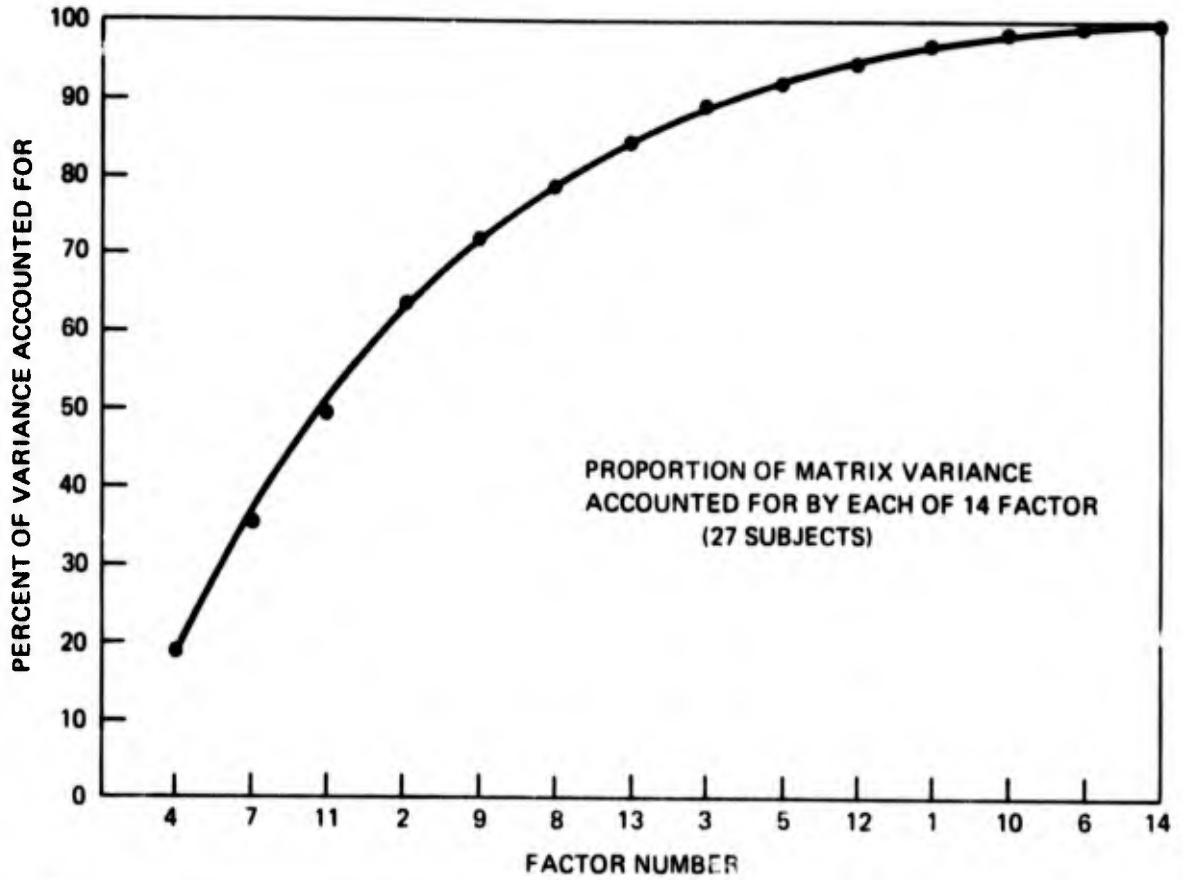
TABLE 7

SINDBAD FACTOR ANALYSIS RESULTS

FACTOR NAMES

VARIABLES	TIME SHARING	VIGILANCE	CONTROL PRECISION	RESPONSE ORIENTATION	VISUAL MONITORING	MULTI-LIMB COORDINATION	MEMORY SPAN	SYSTEMS EQUALIZATION
15. POSITION CONTROL	.06	-.04	.96	-.07	-.02	.06	.17	-.18
16. TWO-HAND TRACKING	.30	.21	.08	.11	-.18	.87	.19	-.11
17. CHOICE REACTION TIME	.01	.12	-.06	.98	.08	.08	-.03	-.03
18. RATE CONTROL	.20	.28	.22	.04	.00	.10	-.08	.90
19. VISUAL SIGNAL DETECTION	.05	.87	.05	-.17	-.02	-.21	.26	.32
20. VISUAL DIGIT SPAN	-.24	-.27	.24	-.04	-.15	.20	.86	.09
21. TRACK AND MONITOR	.91	.04	-.06	.00	.15	-.27	.21	.19
22. TERMINAL DIGITS	-.12	.02	-.02	.09	.97	-.14	-.10	.00

TABLE 8



#1 Diver Task/Instructions

Determine whether the figure shown at the top center of the slide is present or absent within each of the remaining 10 figures. If the figure is present, touch the (+) key. If it is not present, touch the (-) key. The pattern must be in the orientation shown. It will not be turned or rotated in any way. Work from left to right, doing first the top row, then the bottom row.

Work as rapidly as possible but make only one response to each pattern. If you feel that an error has been made, ignore it and continue doing the problems in order. This test is scored electronically and scoring requires that there be 10 and only 10 responses per slide all in order.

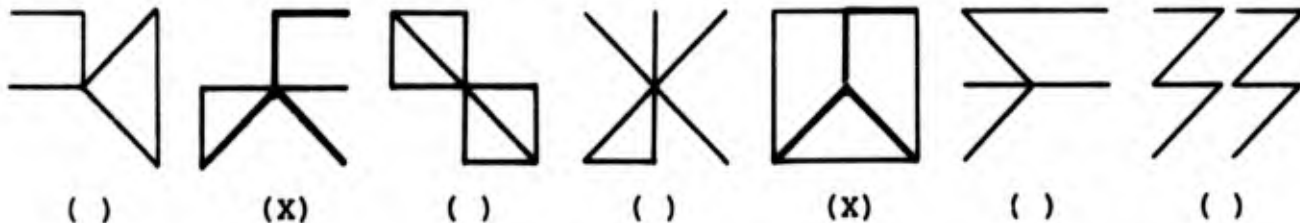
After responding to the final pattern on a slide, signal (*) for the next slide.

SAMPLE:



In the next row, when the model appears, it is shown by

heavy lines:



#2 Diver Task/Instructions

In each figure shown in the slide, determine which line is the shortest between the two points. Register your answers by touching (+) or (-), whichever one identifies the line selected as the shortest.

Do the problems in order: only one answer per problem - no corrections permitted. Signal (*) when slide is completed.

In this test, you are to examine two lines and determine the shorter and make a response with the magnetic stylus. In the problems, the high road is (+) and the low road is (-). The shorter road is darkened (wider).



#3 Diver Task/Instructions

Look at each pair of numbers. Compare them quickly but carefully. If they are exactly the same, touch (+). If they are different, touch (-). Give only one answer per problem; no corrections permitted. Work down the slide from top to bottom. When you are finished with a slide, signal (*).

SAMPLE:

659	_____	659	(+)	7343801	_____	7343801	(+)
73845	_____	73855	(-)	18824	_____	18824	(+)
1624	_____	1624	(+)	705216831	_____	795216831	(-)
438	_____	436	(-)	971	_____	971	(+)
4821459	_____	4814259	(-)	446014721	_____	446014721	(+)

#4 Diver Task/Instructions

On each side, compare the reference figure on the left, isolated by a vertical line, with each of the figures to the right of the line. If the figure on the right of the line has been formed by simply rotating the reference figure clockwise (or counterclockwise), touch (+). If the figure on the right has been formed by flipping the reference figure over on its back (and then possibly rotating it), touch (-).

Do the problems from left to right in order. Do not skip any items; make no corrections. Signal (*) when slide is completed.

SAMPLE:



The pluses and minuses indicate correct responses.

#5 Diver Task/Instructions

Set the finger dexterity template (template #1) in place on the keyboard and tighten the holding screws (finger-tight only).

Hold the test object in your dominant hand (hand used in writing, etc.). Use your other hand and the magnetic stylus to signal (*) that you are ready, then put the stylus aside. Use only one hand in doing the test. On signal, turn the square surface of the object downward and insert it into #1 on the keyboard. Without releasing the object, retrieve it,

rotate it in your fingertips, and insert the circular side into #2. Continue working in this manner, row by row, until you have completed the board (...#7, #8, #9). Move from #9 back to #1 and continue the test until signaled to stop. Work as rapidly as possible.

#6 Diver Task/Instructions

Fasten the template in place on keyboard. Grasp the test object in one hand and the wrench in the other.

Use the wrench on the square end of the object to rotate the cylinder exposing the square end. Remove the wrench and insert the square into position #1 on keyboard. Retrieve, and use the wrench again, this time to expose the round end. Insert the round end in #2. Repeat this procedure, square in #3, round in #4, etc. until signaled to stop. (Figure 12 illustrates the test procedure). Work as rapidly as possible.

#7 Diver Task/Instructions

Insert your stylus into the position marked RT and observe the window directly beneath RT position. When the window lights up, withdraw the stylus as rapidly as possible. Return your stylus to the RT position and stand ready for the next trial. Repeat this procedure until the experimenter signals that the test is over.

#8 Diver Task/Instructions

Your task is to indicate when a certain period of time has gone by. Do this by inserting your stylus at #9 and holding it there until you think the prescribed time interval has elapsed. Then, remove the stylus. A timer runs while the stylus is inserted and thus a direct measure of your ability to judge elapsed time is obtained.

#9 Diver Task/Instructions

Grasp the magnetic stylus firmly between the thumb and first two fingers of your dominant hand (hand used for writing, etc.) as though throwing a dart. On signal, tap as rapidly as possible, back and forth between (+) and (-) keys. Continue tapping until you are signaled to stop.

#10 Diver Task/Instructions

Study the slides containing the work-number pairs. Learn to associate each word and number. Later, you will be shown only the words and asked to give the number. The amount of time for learning is prescribed by the experimenter. You will be advised of the total time available.

Upon presentation of the test slides which contain only the work of the word-number pair learned previously, tap out the corresponding numbers, working down the test in order from top to bottom. After registering each two-digit number, touch the (*) key. An answer sequence would thus be: 25(*); 14(*); 38(*); and so on.

SAMPLE LEARNING SLIDE:

<u>Object</u>	<u>Number</u>
Window	75
Desk	41
Carpet	19
Door	84
Glass	90

#11 Diver Task/Instructions

Each row of letter sets on a slide represents a separate problem. In each row, all but one set have a certain characteristic in common. For example, four sets may have their letters in alphabetical order, while the remaining one does not.

The task is to identify that set which does not agree with the others. There is only one such set in each problem. If it looks as though there is more than one possible answer, you have not discovered the correct rule. The rules are not based on the sound of groups of letters, the shape of letters, or whether the letter combinations form parts of words.

Working the problems in the order A, B, C, D, identify the answer by its number. For example, in row A, the answer may be #3; in row B, the answer may be #5, and so on.

Give only one answer per problem. Signal (*) when all problems on the slide have been completed.

#12 Diver Task/Instructions

Solve each arithmetic problem mentally. When you have the answer, enter it on the keyboard. For example, $18 \times 9 = 162$. The answer should be entered as 1, 6, 2, not 2, 6, 1.

Important: After each complete answer, signal (*) and then, continue with the next problem.

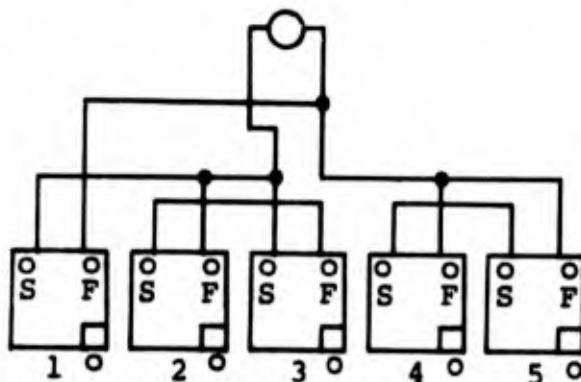
Signal (***) when you have completed a slide.

#13 Diver Task/Instructions

Examine the "wiring diagram" on the slide. Note that connections are made only at the dots, otherwise the lines cross without connecting.

Each box contains an "S" for "Start" and an "F" for "Finish." From one of the boxes, the line eleaves from S, goes through the circle at the top of the diagram, and returns to F in the same box it started from. This is true of only one box. The task is to identify that box, enter its number (1, 2, 3, 4, or 5) on the keyboard and signal (*) for next slide.

SAMPLE:



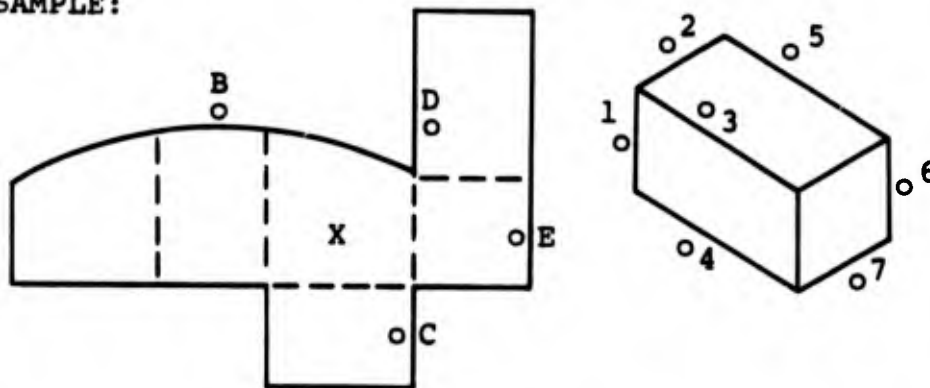
The first box is the one which has the line from S, through the circle, and back to F.

#14 Diver Task/Instructions

At the left of each slide is a flat figure containing dotted lines. Imagine that the pattern was made from thin

metal and folded or bent along the dotted lines to form the object on the right. Your task is to tell where an edge in the left figure, marked by a letter, appears in the right figure, identified by a number. One surface has been marked "x" in both figures. It is the same surface in both figures. This helps to show how the pattern was folded. Sometimes two edges are folded together so that they both have the same letter in the right-hand figure. Start with edge "A" and identify its new location by entering the proper number on the keyboard. Enter only numerical answers. Do not enter any letters. Do the problems in order, A, B, C, etc. If you do not know an answer, guess at it, but do not skip any problems. Signal (*) when you have completed the slide.

SAMPLE:



A = 6, B = 2, C = 7, D = 4, E = 6

#15 Diver Task/Instructions

On the oscilloscope display, a target dot will move in a clockwise circle during the test. Keep the control dot superimposed on the target dot by moving the control stick in a smooth clockwise circle.

#16 Diver Task/Instructions

Use your left and right hand control sticks to control the horizontal and vertical axes respectively in keeping the dot centered on face of oscilloscope.

#17 Diver Task/Instructions

Attach the Response Orientation template to the keyboard. Hold the stylus at the center of the four openings on the template. When a colored slide appears, move the stylus rapidly to the position corresponding to that color. Slide the stylus forward, backward, and so on. Do not raise the stylus. Continue responding to a slide until the slide is removed, indicating that the correct response has been made.

This is primarily a test of response speed, but incorrect responses are also scored, so do not make unnecessary moves. The experimenter will give you practice trials to learn the response for each color.

#18 Diver Task/Instructions

In COMPENSATORY mode, keep the dot centered on oscilloscope using the manual tracking controls(s) selected by the experimenter.

In PURSUIT mode, keep the control dot superimposed on the target dot using the manual tracking control(s) selected by the experimenter.

#19 Diver Task/Instructions

Observe the digital display to detect numbers as they occur. Use your stylus on the keyboard to report each number detected. When a digit appears, respond as rapidly as possible.

The test may last for a relatively long time. The numbers that you are to detect will occur at irregular intervals, meanwhile, you must continue to watch the display.

#20 Diver Task/Instructions

View the series of digits on the optical (on-line) display. The display goes dark after the final digit in the sequence. Wait for the entire sequence to be presented before responding.

Reproduce the sequence (all the digits in the order that they were presented) by touching appropriate digits on the keyboard. Touch the (*) key at the end of your answer sequence.

#21 Diver Task/Instructions

With your dominant hand (hand you write with) on the control stick, keep the control dot superimposed on the target dot. As you track, visually scan back and forth between the oscilloscope and the "correct" (green) lamp on the keyboard. This lamp will be illuminated from time to time while you are tracking. Each time you detect the light, signal (*) the experimenter using the stylus in your other hand.

Continue tracking and reporting the light signals until advised that the test is over.

#22 Diver Task/Instructions

Observe the numbers that appear on the digital (on-line) display. The numbers will continue to change at a rate of one per second. At various times, the display will be interrupted and go blank. When it does, you are to report the last two digits shown before the display was interrupted. Use the magnetic stylus and keyboard to register your answers. Give the digits in the order they occurred.

As an example, the display may have shown: 7, 9, 3, 6, 8, 2, 4, "OFF". You would recall the last two digits as "2" and "4", and respond on the keyboard: 2, 4,. When you have responded, the display will begin the cycle again. Continue working until you are signaled to stop.

#23 Diver Task/Instructions

With your arm fully extended, but without locking your elbow, hold the photocell stylus directly in front of the spot of light on the screen. The tip of the stylus should be no more than one inch away from the screen, but it should not touch the screen at any time. (The trial starts and ends upon signal from the experimenter.)

#24 Diver Task/Instructions

You will be shown a series of words whose letters have been rearranged. Your task is to mentally unscramble the letters to discover the word they represent. For example, N-T-K-I-H would be solved as the word "THINK".

To indicate your answers, spell out the word by using the number corresponding to each letter. For example: if you saw
D O L F
1 2 3 4 , you would answer with "FOLD" by touching 4, 2, 3, 1
with the stylus. Signal (*) when all problems on the slide have
been completed.

#25 Diver Task/Instructions

The speed at which you can move your extended arm through
the water (or through space, if dry) is measured in the following
way:

Hold the photocell stylus as you would hold a
pencil. Let the cable fall outside your wrist
(away from your body). Extend your arm fully
but without locking your elbow and stand (or sit)
so that the top of the stylus is about 6 to 8
inches outside the left edge of the screen, then
swing your arm in an arc from left to right so
that the stylus "looks at" the screen as it goes
by.

A timer will start when the stylus crosses the edge of
the screen and stops when the stylus moves off the screen on
the opposite side. During the test, make the movement as
rapidly as possible. Be careful not to strike the screen.
The test is two moves left to right, and two moves right to
left.

IMPORTANT:

Keep the stylus pointed away from the screen except during arm movement in testing.

INDIVIDUAL TEST SCORES
Raw Data Sheet-Baseline

TEST No.	SUBJECT 01 Alger	SUBJECT 02 Ault	SUBJECT 03 Brewer	SUBJECT 04 Brown	SUBJECT 05 Goehring
1	34	31	21	19	66
2	04	14	12	02	07
3	16	14	08	07	12
4	13	32	15	11	23
5	19	18	19	16	20
6	08	12	14	09	08
7	.287	.272	.287	.339	.242
8	10.0	11.6	14.7	18.7	21.4
9	112	119	140	088	106
10	18	02	10	09	16
11	08	03	08	08	06
12	42	14	34	30	47
13	03	06	06	03	04
14	10	05	06	13	12
15			46.6		56.4
16			105.2		101.8
17			0.91		0.85
18			138.6		97.6
19			60		80
20			05		06
21			.209		.134
22			100		100

TEST No.	SUBJECT 06 Goodspeed	SUBJECT 07 Hink	SUBJECT 08 Lash	SUBJECT 09 Nordan	SUBJECT 10 O'Bryan
1	09	22	20	34	26
2	11	10	06	02	03
3	17	28	20	18	19
4	17	20	08	11	11
5	18	13	20	18	19
6	11	08	13	14	12
7	.294	.247	.329	.271	.342
8	32.2	14.1	12.3	25.8	11.4
9	089	117	174	114	092
10	08	16	11	10	09
11	07	07	08	02	08
12	47	40	49	19	28
13	06	02	09	00	04
14	12	05	21	15	19
15	37.1	42.0	45.6	34.1	47.7
16	89.1	67.5	110.3	108.2	86.6
17	1.30	0.90	1.17	0.76	1.54
18	72.2	141.4	74.0	92.9	105.6
19	80	80	80	90	80
20	05	05	06	07	06
21	.012	-.055	.120	-.043	.083
22	100	100	090	070	100

TEST No.	SUBJECT 11 Phillips	SUBJECT 12 Price	SUBJECT 13 Radecki	SUBJECT 14 Schlegel	SUBJECT 15 Templin
1	44	27	45	20	22
2	04	01	10	07	13
3	10	13	21	07	15
4	18	18	05	14	25
5	14	15	17	14	21
6	11	10	12	09	14
7	.254	.272	.252	.245	.314
8	14.1	19.6	05.8	38.0	03.2
9	095	103	132	095	096
10	06	09	04	11	08
11	04	07	04	11	08
12	14	10	24	42	40
13	00	04	01	01	02
14	07	11	06	14	14
15					28.7
16					63.8
17					1.15
18					63.8
19					80
20					07
21					2.000
22					100

TEST No.	SUBJECT 16 Thomas	SUBJECT 17 Travers	SUBJECT 18 Virgil	SUBJECT 19 Watkins	SUBJECT 20 Wetzel
1	09	09	22	19	32
2	16	07	05	06	09
3	12	08	12	07	16
4	01	02	01	03	28
5	13	16	12	18	21
6	08	10	08	10	08
7	.324	.250	.262	.394	.258
8	27.0	03.0	42.9	06.3	09.5
9	078	107	092	081	106
10	00	06	06	00	10
11	06	07	06	04	05
12	27	46	36	17	34
13	05	14	00	07	04
14	03	08	11	10	14
15		33.7		45.0	28.3
16		110.7		106.7	80.8
17		1.29		1.03	1.06
18		97.4		115.2	91.4
19		80		70	90
20		07		06	05
21		.000		.084	.073
22		070		060	090

TEST No.	SUBJECT 21 Langdon	SUBJECT 22 Jones	SUBJECT 23 Kennedy	SUBJECT 24 Gibson	SUBJECT 25 Fine
1	61	24	18	24	15
2	07	04	07	08	05
3	18	08	14	27	08
4	36	07	06	05	19
5	18	23	16	16	23
6	10	09	07	11	13
7	.305	.286	.296	.274	.276
8	11.1	26.1	06.7	13.3	10.5
9	098	126	093	110	103
10	05	09	14	12	04
11	04	07	06	06	04
12	43	38	35	55	34
13	03	06	00	05	02
14	13	23	02	06	14
15	34.6	36.5	45.7		
16	98.6	105.3	132.9		
17	1.10	1.29	1.40		
18	80.0	109.1	140.0		
19	90	70	70		
20	07	05	07		
21	.273	-.355	-.048		
22	100	080	100		

TEST No.	SUBJECT 26 Bunting	SUBJECT 27 Hesler
1	43	48
2	07	06
3	08	09
4	25	34
5	23	16
6	09	10
7	.268	.257
8	09.1	21.8
9	105	086
10	13	15
11	08	09
12	36	57
13	06	03
14	18	14
15	99.7	39.6
16	99.2	87.6
17	0.97	0.65
18	120.2	57.3
19	90	90
20	08	07
21	.214	.145
22	080	090

#1 FACTOR: FLEXIBILITY OF CLOSURE

TEST: HIDDEN PATTERNS

DESCRIPTIVE STATISTICS
FOR VARIABLE 1

NUMBER OF OBSERVATIONS = 27.0

CENTRAL TENDENCY

MEAN = 28.296
MEDIAN = 23.063

DISPERSION

STANDARD DEVIATION = 14.770
COEFFICIENT OF VARIATION = 52.821
RANGE = 9.00 TO 66.00

SKEWNESS

BASED ON THE THIRD MOMENT = 0.971

KURTOSIS

BASED ON THE FOURTH MOMENT = 0.151

SCORE INTERVAL MIN POINT FREQUENCY PERCENT CUMULATIVE PERCENT HISTOGRAM X = 0.160

9.000 -	14.000	11.500	2.	11.111	11.111	XXXXXXXXXXXXXXXXXXXX
14.000 -	18.000	16.500	4.	14.815	25.925	XXXXXXXXXXXXXXXXXXXX
18.000 -	24.000	21.500	8.	29.630	55.555	XXXXXXXXXXXXXXXXXXXX
24.000 -	29.000	26.500	7.	7.407	62.963	XXXXXXXXXXXXXXXXXXXX
29.000 -	34.000	31.500	4.	14.815	77.778	XXXXXXXXXXXXXXXXXXXX
34.000 -	39.000	36.500	0.	0.0	77.778	XXXXXXXXXXXXXXXXXXXX
39.000 -	44.000	41.500	7.	7.407	85.185	XXXXXXXXXXXXXXXXXXXX
44.000 -	49.000	46.500	2.	7.407	92.593	XXXXXXXXXXXXXXXXXXXX
49.000 -	54.000	51.500	0.	0.0	92.593	XXXXXXXXXXXXXXXXXXXX
54.000 -	59.000	56.500	0.	0.0	92.593	XXXXXXXXXXXXXXXXXXXX
59.000 -	64.000	61.500	1.	3.704	96.296	XXXXXX
64.000 -	69.000	66.500	1.	3.704	100.000	XXXXXX



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#2 FACTOR: LENGTH ESTIMATION

TEST: SHORTEST ROAD

DESCRIPTIVE STATISTICS
FOR VARIABLE 2

NUMBER OF OBSERVATIONS = 27.0

CENTRAL TENDENCY

MEAN = 7.148
MEDIAN = 6.750

DISPERSION

STANDARD DEVIATION = 3.769
COEFFICIENT OF VARIATION = 52.732
RANGE = 1.00 TO 16.00

SKEWNESS

BASED ON THE THIRD MOMENT = 0.516

KURTOSIS

BASED ON THE FOURTH MOMENT = -0.448

SCORE INTERVAL MID POINT FREQUENCY PERCENT CUMULATIVE PERCENT HISTOGRAM X = 0.120

SCORE	INTERVAL	MID POINT	FREQUENCY	PERCENT	CUMULATIVE PERCENT	HISTOGRAM	X
0.500	-	1.500	1.	3.704	3.704	XXXXXXX	0.120
1.500	-	2.500	2.	7.407	11.111	XXXXXXXXXXXXXXXXXXXX	0.120
2.500	-	3.500	1.	3.704	14.815	XXXXXXX	0.120
3.500	-	4.500	3.	11.111	25.926	XXXXXXXXXXXXXXXXXXXX	0.120
4.500	-	5.500	2.	7.407	33.333	XXXXXXXXXXXXXXXXXXXX	0.120
5.500	-	6.500	3.	11.111	44.444	XXXXXXXXXXXXXXXXXXXX	0.120
6.500	-	7.500	6.	22.222	66.667	XXXXXXXXXXXXXXXXXXXX	0.120
7.500	-	8.500	1.	3.704	70.370	XXXXXXX	0.120
8.500	-	9.500	1.	3.704	74.074	XXXXXXX	0.120
9.500	-	10.500	2.	7.407	81.481	XXXXXXXXXXXXXXXXXXXX	0.120
10.500	-	11.500	1.	3.704	85.185	XXXXXXX	0.120
11.500	-	12.500	1.	3.704	88.889	XXXXXXX	0.120
12.500	-	13.500	1.	3.704	92.592	XXXXXXX	0.120
13.500	-	14.500	1.	3.704	96.296	XXXXXXX	0.120
14.500	-	15.500	0.	0.0	96.296		0.120
15.500	-	16.500	1.	3.704	100.000	XXXXXXX	0.120

#3 FACTOR: PERCEPTUAL SPEED

TEST: NUMBER COMPARISON

DESCRIPTIVE STATISTICS
FOR VARIABLE 3

NUMBER OF OBSERVATIONS = 27.0
 CENTRAL TENDENCY
 MEAN = 12.593
 MEDIAN = 11.500
 DISPERSION
 STANDARD DEVIATION = 5.250
 COEFFICIENT OF VARIATION = 41.688
 RANGE = 7.00 TO 27.00
 SKEWNESS
 BASED ON THE THIRD MOMENT = 0.896
 KURTOSIS
 BASED ON THE FOURTH MOMENT = -0.360

SCORE INTERVAL MID POINT FREQUENCY PERCENT CUMULATIVE PERCENT HISTOGRAM K= 0.200

SCORE INTERVAL	MID POINT	FREQUENCY	PERCENT	CUMULATIVE PERCENT	HISTOGRAM
6.500 - 8.500	7.500	10.	37.037	37.037	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
8.500 - 10.500	9.500	2.	7.407	44.444	XXXXXXXXXX
10.500 - 12.500	11.500	3.	11.111	55.556	XXXXXXXXXXXXXXXXXXXX
12.500 - 14.500	13.500	3.	11.111	66.667	XXXXXXXXXXXXXXXXXXXX
14.500 - 16.500	15.500	3.	11.111	77.778	XXXXXXXXXXXXXXXXXXXX
16.500 - 18.500	17.500	3.	11.111	88.889	XXXXXXXXXXXXXXXXXXXX
18.500 - 20.500	19.500	1.	3.704	92.592	XXXXX
20.500 - 22.500	21.500	1.	3.704	96.296	XXXXX
22.500 - 24.500	23.500	0.	0.0	96.296	
24.500 - 26.500	25.500	0.	0.0	96.296	
26.500 - 28.500	27.500	1.	3.704	100.000	XXXXX

#5 FACTOR: FINGER DEXTERITY

TEST: KEY INSERTIONS

DESCRIPTIVE STATISTICS
FOR VARIABLE 5

NUMBER OF OBSERVATIONS = 27.0
 CENTRAL TENDENCY
 MEAN = 17.630
 MEDIAN = 17.800
 DISPERSION
 STANDARD DEVIATION = 3.090
 COEFFICIENT OF VARIATION = 17.529
 RANGE = 12.00 TO 23.00
 SKEWNESS
 BASED ON THE THIRD MOMENT = 0.779
 KURTOSIS
 BASED ON THE FOURTH MOMENT = -0.896

SCOPE INTERVAL MID POINT FREQUENCY PERCENT CUMULATIVE PERCENT HISTOGRAM X = 0.100

SCOPE INTERVAL	MID POINT	FREQUENCY	PERCENT	CUMULATIVE PERCENT	HISTOGRAM	X = 0.100
11.500 - 12.500	12.000	1.	3.704	3.704	XXXXXXXXXX	
12.500 - 13.500	13.000	2.	7.407	11.111	XXXXXXXXXXXXXXXXXXXXXXXXXX	
13.500 - 14.500	14.000	2.	7.407	18.519	XXXXXXXXXXXXXXXXXXXXXXXXXX	
14.500 - 15.500	15.000	1.	3.704	22.222	XXXXXXXXXXXX	
15.500 - 16.500	16.000	5.	18.519	40.741	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	
16.500 - 17.500	17.000	1.	3.704	44.444	XXXXXXXXXXXX	
17.500 - 18.500	18.000	5.	18.519	62.963	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	
18.500 - 19.500	19.000	3.	11.111	74.074	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	
19.500 - 20.500	20.000	2.	7.407	81.481	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	
20.500 - 21.500	21.000	2.	7.407	88.889	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	
21.500 - 22.500	22.000	0.	0.0	88.889		
22.500 - 23.500	23.000	3.	11.111	100.000	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	

#8 FACTOR: MANUAL DEXTERITY

TEST: WRENCH AND CYLINDER

DESCRIPTIVE STATISTICS
FOR VARIABLE 6

NUMBER OF OBSERVATIONS = 27.0
 CENTRAL TENDENCY
 MEAN = 10.296
 MEDIAN = 10.000
 DISPERSION
 STANDARD DEVIATION = 2.109
 COEFFICIENT OF VARIATION = 20.482
 RANGE = 7.00 TO 14.00
 SKEWNESS
 BASED ON THE THIRD MOMENT = 0.357
 KURTOSIS
 BASED ON THE FOURTH MOMENT = -1.139

SCORE INTERVAL MID POINT FREQUENCY PERCENT CUMULATIVE PERCENT HISTOGRAM $\bar{x} = 0.140$

SCORE INTERVAL	MID POINT	FREQUENCY	PERCENT	CUMULATIVE PERCENT	HISTOGRAM
7.500 - 8.500	8.000	7.	25.926	25.926	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
8.500 - 9.500	9.000	4.	14.815	40.741	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
9.500 - 10.500	10.000	5.	18.519	59.259	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
10.500 - 11.500	11.000	3.	11.111	70.370	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
11.500 - 12.500	12.000	3.	11.111	81.481	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
12.500 - 13.500	13.000	2.	7.407	88.889	XXXXXXXXXXXXXXXXXXXX
13.500 - 14.500	14.000	3.	11.111	100.000	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

#7 FACTOR: REACTION TIME
 TEST: VISUAL REACTION TIME

DESCRIPTIVE STATISTICS
 FOR VARIABLE 7

NUMBER OF OBSERVATIONS = 27.0
 CENTRAL TENDENCY
 MEAN = 0.285
 MEDIAN = 0.275
 DISPERSION
 STANDARD DEVIATION = 0.016
 COEFFICIENT OF VARIATION = 12.729
 RANGE = 0.24 TO 0.39
 SKWNESS
 BASED ON THE THIRD MOMENT = 1.079

KURTOSIS
 BASED ON THE FOURTH MOMENT = 0.787

SCORE INTERVAL MID POINT FREQUENCY PERCENT CUMULATIVE PERCENT HISTOGRAM X = 0.100

SCORE	INTERVAL	MID POINT	FREQUENCY	PERCENT	CUMULATIVE PERCENT	HISTOGRAM
0.242	-	0.251	4.	14.815	14.815	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.251	-	0.260	4.	14.815	29.630	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.260	-	0.269	2.	7.407	37.037	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.269	-	0.278	5.	18.519	55.555	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.278	-	0.287	2.	7.407	62.963	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.287	-	0.296	2.	7.407	70.370	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.296	-	0.305	2.	7.407	77.778	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.305	-	0.314	1.	3.704	81.481	XXXXXXXXXXXX
0.314	-	0.323	0.	0.0	81.481	
0.323	-	0.332	2.	7.407	88.889	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.332	-	0.341	1.	3.704	92.592	XXXXXXXXXXXX
0.341	-	0.350	1.	3.704	96.296	XXXXXXXXXXXX
0.350	-	0.359	0.	0.0	96.296	
0.359	-	0.368	0.	0.0	96.296	
0.368	-	0.377	0.	0.0	96.296	
0.377	-	0.386	0.	0.0	96.296	
0.386	-	0.395	1.	3.704	100.000	XXXXXXXXXXXX

#8 FACTOR: TIME INTERVAL ESTIMATION
 TEST: INTERVAL REPRODUCTION

DESCRIPTIVE STATISTICS
 FOR VARIABLE 8

NUMBER OF OBSERVATIONS = 27.7
 CENTRAL TENDENCY
 MEAN = 163.037
 MEDIAN = 132.500
 DISPERSION
 STANDARD DEVIATION = 102.613
 COEFFICIENT OF VARIATION = 62.938
 RANGE = 30.00 TO 429.00
 SKWNESS
 BASED ON THE THIRD MOMENT = 0.931
 KURTOSIS
 BASED ON THE FOURTH MOMENT = 0.071

SCORE INTERVAL MID POINT FREQUENCY PERCENT CUMULATIVE PERCENT HISTOGRAM X = 0.160

SCORE INTERVAL	MID POINT	FREQUENCY	PERCENT	CUMULATIVE PERCENT	HISTOGRAM
30.000 - 70.000	50.000	5.	18.519	18.519	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
70.000 - 110.000	90.000	4.	14.815	33.333	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
110.000 - 150.000	130.000	8.	29.630	62.963	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
150.000 - 190.000	170.000	1.	3.704	66.667	XXXXXX
190.000 - 230.000	210.000	3.	11.111	77.778	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
230.000 - 270.000	250.000	3.	11.111	88.889	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
270.000 - 310.000	290.000	0.	0.0	88.889	
310.000 - 350.000	330.000	1.	3.704	92.593	XXXXXX
350.000 - 390.000	370.000	1.	3.704	96.296	XXXXXX
390.000 - 430.000	410.000	1.	3.704	100.000	XXXXXX

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#9 FACTOR: WRIST-FINGER SPEED

TEST: TAPPING

DESCRIPTIVE STATISTICS
FOR VARIABLE 9

NUMBER OF OBSERVATIONS = 27.0
 CENTRAL TENDENCY
 MEAN = 105.815
 MEDIAN = 103.500
 DISPERSION
 STANDARD DEVIATION = 20.258
 COEFFICIENT OF VARIATION = 19.145
 RANGE = 78.00 TO 174.00
 SKEWNESS
 BASED ON THE THIRD MOMENT = 1.431
 KURTOSIS
 BASED ON THE FOURTH MOMENT = 2.525

SCORE INTERVAL MID POINT FREQUENCY PERCENT CUMULATIVE PERCENT HISTOGRAM $\bar{x} = 0.120$

SCORE INTERVAL	MID POINT	FREQUENCY	PERCENT	CUMULATIVE PERCENT	HISTOGRAM
77.500 - 85.500	81.500	2.	7.407	7.407	XXXXXXXXXXXXXXX
85.500 - 93.500	89.500	6.	22.222	29.630	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
93.500 - 101.500	97.500	4.	14.815	44.444	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
101.500 - 109.500	105.500	4.	22.222	66.667	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
109.500 - 117.500	113.500	9.	14.815	81.481	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
117.500 - 125.500	121.500	1.	3.704	85.185	XXXXXXXXXX
125.500 - 133.500	129.500	2.	7.407	92.593	XXXXXXXXXXXXXXXXXXXX
133.500 - 141.500	137.500	1.	3.704	96.296	XXXXXXXXXX
141.500 - 149.500	145.500	0.	0.0	96.296	
149.500 - 157.500	153.500	0.	0.0	96.296	
157.500 - 165.500	161.500	0.	0.0	96.296	
165.500 - 173.500	169.500	0.	0.0	96.296	
173.500 - 181.500	177.500	1.	3.704	100.000	XXXXXXXXXX

#10 FACTOR: ASSOCIATIVE MEMORY

TEST: WORD-NUMBER

DESCRIPTIVE STATISTICS
FOR VARIABLE 10

NUMBER OF OBSERVATIONS = 27.1

CENTRAL TENDENCY
MEAN = 8.926
MEDIAN = 8.625

DISPERSION
STANDARD DEVIATION = 4.731
COEFFICIENT OF VARIATION = 52.999
RANGE = 0.0 TO 18.00

SKENNESS
BASED ON THE THIRD MOMENT = -0.071

KURTOSIS
BASED ON THE FOURTH MOMENT = -0.718

SCORE INTERVAL MID POINT FREQUENCY PERCENT CUMULATIVE PERCENT HISTOGRAM X = 0.080

SCORE INTERVAL	MID POINT	FREQUENCY	PERCENT	CUMULATIVE PERCENT	HISTOGRAM
0.0 - 1.000	0.500	2.	7.407	7.407	XXXXXXXXXXXXXXXXXXXXXXX
1.000 - 2.000	1.500	1.	3.704	11.111	XXXXXXXXXXXXXXX
2.000 - 3.000	2.500	0.	0.0	11.111	
3.000 - 4.000	3.500	2.	7.407	18.519	XXXXXXXXXXXXXXXXXXXXXXX
4.000 - 5.000	4.500	1.	3.704	22.222	XXXXXXXXXXXXXXX
5.000 - 6.000	5.500	3.	11.111	33.333	XXXXXXXXXXXXXXXXXXXXXXX
6.000 - 7.000	6.500	0.	0.0	33.333	
7.000 - 8.000	7.500	2.	7.407	40.741	XXXXXXXXXXXXXXXXXXXXXXX
8.000 - 9.000	8.500	4.	14.815	55.555	XXXXXXXXXXXXXXXXXXXXXXX
9.000 - 10.000	9.500	3.	11.111	66.667	XXXXXXXXXXXXXXXXXXXXXXX
10.000 - 11.000	10.500	2.	7.407	74.074	XXXXXXXXXXXXXXXXXXXXXXX
11.000 - 12.000	11.500	1.	3.704	77.778	XXXXXXXXXXXXXXX
12.000 - 13.000	12.500	1.	3.704	81.481	XXXXXXXXXXXXXXX
13.000 - 14.000	13.500	1.	3.704	85.185	XXXXXXXXXXXXXXX
14.000 - 15.000	14.500	1.	3.704	88.889	XXXXXXXXXXXXXXX
15.000 - 16.000	15.500	2.	7.407	96.296	XXXXXXXXXXXXXXXXXXXXXXX
16.000 - 17.000	16.500	0.	0.0	96.296	
17.000 - 18.000	17.500	1.	3.704	100.000	XXXXXXXXXXXXXXX
18.000 - 19.000	18.500	0.	0.0	100.000	

#11 FACTOR: INDUCTION

TEST: LETTER SETS

DESCRIPTIVE STATISTICS
FOR VARIABLE 11

NUMBER OF OBSERVATIONS = 27.0
 CENTRAL TENDENCY
 MEAN = 6.185
 MEDIAN = 6.400
 DISPERSION
 STANDARD DEVIATION = 1.962
 COEFFICIENT OF VARIATION = 31.719
 RANGE = 2.00 TO 17.00

SKEWNESS
 BASED ON THE THIRD MOMENT = -0.220
 KURTOSIS
 BASED ON THE FOURTH MOMENT = -0.826

SCORE INTERVAL MID POINT FREQUENCY PERCENT CUMULATIVE PERCENT HISTOGRAM $\bar{x} = 0.120$

SCORE INTERVAL	MID POINT	FREQUENCY	PERCENT	CUMULATIVE PERCENT	HISTOGRAM
1.500 - 2.500	2.000	1.	3.704	3.704	XXXXXX
2.500 - 3.500	3.000	1.	3.704	7.407	XXXXXX
3.500 - 4.500	4.000	5.	18.519	25.926	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.500 - 5.500	5.000	2.	7.407	33.333	XXXXXXXXXXXXXXXXXXXX
5.500 - 6.500	6.000	5.	18.519	51.852	XXXXXXXXXXXXXXXXXXXXXXXXXX
6.500 - 7.500	7.000	5.	18.519	70.370	XXXXXXXXXXXXXXXXXXXXXXXXXX
7.500 - 8.500	8.000	6.	22.222	92.593	XXXXXXXXXXXXXXXXXXXXXXXXXX
8.500 - 9.500	9.000	1.	3.704	96.296	XXXXXX
9.500 - 10.500	10.000	1.	3.704	100.000	XXXXXX

#12 FACTOR: NUMBER FACILITY

TEST: ARITHMETIC

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DESCRIPTIVE STATISTICS
FOR VARIABLE 12

NUMBER OF OBSERVATIONS = 27.0
 CENTRAL TENDENCY
 MEAN = 35.074
 MEDIAN = 36.500
 DISPERSION
 STANDARD DEVIATION = 12.484
 COEFFICIENT OF VARIATION = 35.592
 RANGE = 10.00 TO 57.00
 SKEWNESS
 BASED ON THE THIRD MOMENT = -0.370

KURTOSIS
 BASED ON THE FOURTH MOMENT = -0.749

SCORE INTERVAL MID POINT FREQUENCY PERCENT CUMULATIVE PERCENT HISTOGRAM X = 0.080

SCORE INTERVAL	MID POINT	FREQUENCY	PERCENT	CUMULATIVE PERCENT	HISTOGRAM	X = 0.080
10.000 - 13.000	11.500	1.	3.704	3.704	XXXXXXXXXX	
13.000 - 16.000	14.500	2.	7.407	11.111	XXXXXXXXXX	
16.000 - 19.000	17.500	2.	7.407	18.519	XXXXXXXXXX	
19.000 - 22.000	20.500	0.	0.0	18.519		
22.000 - 25.000	23.500	1.	3.704	22.222	XXXXXXXXXX	
25.000 - 28.000	26.500	2.	7.407	29.630	XXXXXXXXXX	
28.000 - 31.000	29.500	0.	0.0	29.630		
31.000 - 34.000	32.500	3.	11.111	40.741	XXXXXXXXXX	
34.000 - 37.000	35.500	3.	11.111	51.852	XXXXXXXXXX	
37.000 - 40.000	38.500	4.	14.815	66.667	XXXXXXXXXX	
40.000 - 43.000	41.500	3.	11.111	77.778	XXXXXXXXXX	
43.000 - 46.000	44.500	1.	3.704	81.481	XXXXXXXXXX	
46.000 - 49.000	47.500	3.	11.111	92.592	XXXXXXXXXX	
49.000 - 52.000	50.500	0.	0.0	92.592		
52.000 - 55.000	53.500	1.	3.704	96.295	XXXXXXXXXX	
55.000 - 58.000	56.500	1.	3.704	100.000	XXXXXXXXXX	

#14 FACTOR: VISUALIZATION

TEST: SURFACE DEVELOPMENT

DESCRIPTIVE STATISTICS
FOR VARIABLE 14

NUMBER OF OBSERVATIONS = 27.0
 CENTRAL TENDENCY
 MEAN = 11.333
 MEDIAN = 11.750
 DISPERSION
 STANDARD DEVIATION = 5.369
 COEFFICIENT OF VARIATION = 47.200
 RANGE = 2.00 TO 23.00
 SKEWNESS
 BASED ON THE THIRD MOMENT = 0.221

KURTOSIS
 BASED ON THE FOURTH MOMENT = -0.663

SCORE INTERVAL MID POINT FREQUENCY PERCENT CUMULATIVE PERCENT HISTOGRAM X = 0.120

SCORE INTERVAL	MID POINT	FREQUENCY	PERCENT	CUMULATIVE PERCENT	HISTOGRAM	X = 0.120
1.500 - 3.500	2.500	2.	7.407	7.407	XXXXXXXXXXXXXXXXXXXX	
3.500 - 5.500	4.500	2.	7.407	14.815	XXXXXXXXXXXXXXXXXXXX	
5.500 - 7.500	6.500	4.	14.815	29.630	XXXXXXXXXXXXXXXXXXXX	
7.500 - 9.500	8.500	1.	3.704	33.333	XXXXXXXXXX	
9.500 - 11.500	10.500	4.	14.815	48.149	XXXXXXXXXXXXXXXXXXXX	
11.500 - 13.500	12.500	4.	14.815	62.963	XXXXXXXXXXXXXXXXXXXX	
13.500 - 15.500	14.500	6.	22.222	85.185	XXXXXXXXXXXXXXXXXXXX	
15.500 - 17.500	16.500	0.	0.0	85.185	XXXXXXXXXXXXXXXXXXXX	
17.500 - 19.500	18.500	2.	7.407	92.593	XXXXXXXXXXXXXXXXXXXX	
19.500 - 21.500	20.500	1.	3.704	96.296	XXXXXXXXXX	
21.500 - 23.500	22.500	1.	3.704	100.000	XXXXXXXXXX	