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**A FACTORIAL STUDY
OF TESTS IN THE
PERCEPTUAL AREA**

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INTRODUCTION*

This analysis of human abilities is a continuation of the extensive series of factor studies which were conducted in the Air Force Aviation Psychology Program during the war (2, 4, 5). The present study deals particularly with a substantial number of tests of visual perception; it includes printed tests, apparatus tests, and a unique set of nine tests in motion-picture form which were developed in the Air Force during the war (3).

The sample studied consisted of pre-aviation cadets tested during the summer of 1945. This group was quite homogeneous in age; about 99 per cent were either 18 or 19 years old. In schooling, about 60 per cent were high-school graduates with no college training, about 23 per cent had attended college for one year, and about two per cent had received more than one year of college training. All had previously passed the Air Force Qualifying Examination, a preliminary screening test (2).

The test battery consisted of 23 tests which were routinely administered to all aircrew candidates at that time to determine their subsequent classification, which will be referred to as the classification tests, and 47 experimental or non-classification tests. The total sample, all of whom took the classification tests, was 8,574; this is the number of cases for the intercorrelations of the classification tests among themselves. Time did not permit the administration of every experimental test to every candidate, so they were grouped into six sub-batteries of from seven to 11 tests and given according to a plan whereby each possible pair of this set of six batteries was administered together to groups of 372 or more examinees. The sample size for each experimental test against experimental tests in other sub-

*This has been a large-scale project, and various individuals and organizations have contributed to it at one stage or another. It was designed in 1945 by J. P. Guilford and his staff at the Psychological Research Unit, San Antonio. The tests were administered in the summer of 1945 by the Psychological Section at Keesler Field, Mississippi, which was directed by W. F. Grether. Tabulating machine runs for the correlations were made by the Department of Biometrics, United States Air Force School of Aviation Medicine, which was directed by Lt. Col. W. L. Deemer. Final correlation computations and the factor analysis were accomplished by the Department of Psychology, United States Air Force School of Aviation Medicine, while it was under the direction of the present author (1946-47). The rotations have been completed by the author since that time. The basic data of this paper are contained in a project report of the Department of Psychology, United States Air Force School of Aviation Medicine (Roff, Merrill, Report of Project Number 21-02-009, Personnel selection and classification procedures: perceptual tests, a factorial analysis.)

batteries ranged from 372 to 523; the median size of these samples was 480. The sample size for each experimental test against experimental tests in its own sub-battery and against each of the classification tests ranged from 2281 to 2425. Thus, three sizes of sample were used for the test intercorrelations: the total sample of 8,574 for the classification tests, approximately 2350 for the experimental tests with other tests in their own sub-battery and with the classification tests, and a median sample of 480 for experimental tests with experimental tests outside their sub-batteries.

In previous studies in this series, only orthogonal solutions were used. In the present study, interpretations are based upon an oblique solution. If there is little correlation among the factors, the results obtained by the two methods do not differ greatly. When there is substantial correlation between some pairs of factors, however, the picture given by oblique axes and their correlations is distinctly different from that obtained by regarding all the factors as statistically independent; also, the solution is more nearly unique. To permit comparison both with previous studies and between the two types of rotational solution, a set of orthogonal loadings is presented below, in addition to the oblique solution upon which primary reliance is placed.

DESCRIPTION OF TESTS

The 70 tests of this battery are briefly described below. More nearly complete descriptions of the tests can be found in various volumes of the Aviation Psychology Program Research Reports (printed tests, 1, 4, apparatus tests, 5, and motion-picture tests, 3). These fuller descriptions also contain illustrations of the tests, which will be found helpful in obtaining concrete impressions of the contents of the tests. The code number of each test is included here in the test descriptions to indicate the specific test used, as described in these sources. Test lengths and time limits have been included as an indication of the time allowed per item, which varies over a considerable range.

1, NORMALITY OF PERCEPTION, CP806CX4: This test requires the comparison of lengths under illusion-producing conditions. It has seven 10-item parts, each containing a different set of illusions. The horizontal-vertical and the Titchener's circles illusions are among the types included. The content of this test is essentially parallel to that of test 9, Objectivity of Perception, of this battery, which contains other illusions of length. However, the instructions for these two tests differ markedly; for test 9 the instructions emphasize the desirability of resisting the illusory effects, while for this test no attempt is made to produce an illusion-resisting set in the examinee. 70 items, 8 minutes and 15 seconds.

2, POSITION ORIENTATION, CP526B: This is a version of Thurstone's Hands test, modified somewhat to make use of a special IBM answer sheet. Problems consist of pictures of hands in which the examinee is required to determine quickly whether the right or left hand is shown. 280 items, 10 minutes.

3, FOLLOWING ORAL DIRECTIONS, CI651C: This test requires the visualization of changes in flight path of a plane, in response to verbal instructions, according to a given set of rules of operation. The examinee is supposed to be flying a plane toward a base, while subject to attacks from various directions; in each problem he is told his initial direction of flight, and five successive directions from which he is attacked. He is to change his direction of flight in response to each attack; the right answer is the direction in which he would be flying after the attack. The problems are presented by phonograph records.

4, SUCCESSIVE PERCEPTION-1 CP509C1: This is one of nine tests in motion-picture form which is included in the present battery. The test is designed to measure the ability to integrate successive partial impressions into a single visual scheme or pattern.

It is composed of 45 motion-picture items in which a slot in an opaque screen moves over a black pattern on a gray background, exposing it successively from top to bottom. The pattern is different and varies in complexity from item to item.

5, MINIMAL MOVEMENTS, CP213C: This motion-picture test was designed to measure the ability to detect barely visible movement of an object and to determine the direction of this movement. A black spot appears on the screen against a gray background in one of the four quadrants of the field of a bombsight, schematically represented. It appears in different quadrants for different items. The items vary in respect to the speed of motion of the spot and the length of time during which the movement appears on the screen (2-3 seconds).

6, CAMOUFLAGED OUTLINES, CP821A: This is a form of the Gottschaldt figures test, arranged for IBM machine scoring. It requires the identification of geometrical figures which are embedded in more complex diagrams. Two sets of four standard figures each are provided. The examinee is required to indicate which of the standard figures is included in each complex design. 32 items, 11 minutes.

7, MEMORY FOR TACTICAL PLANS, CI509C: This is a delayed memory test using meaningful paragraph material. The content, which was phonographically recorded and presented, was modeled on a flight briefing; it included instructions about the objective of the flight, distances, bombs to be carried, and other pertinent items. The briefing was phonographically presented at the beginning of a half-day testing period; recall was tested after from two to three hours spent in taking other tests. 40 recall items, total testing time 25 minutes.

8, PLANNING AIR MANEUVERS, CI408AX3: This test requires the planning of an efficient flight course, in accordance with a given set of rules. The maneuvers in the test must be made over the shortest, simplest, and most direct path. The examinee must select the correct path and indicate the direction in which he is traveling at each indicated point.

9, OBJECTIVITY OF PERCEPTION, CP806CX1: This, like test 1, consists of sets of visual illusions. Five types of illusions are represented by 10 items each, and two other illusions by 15 items each. Each illusion is presented as a separate section, including all the items for that illusion. Among the illusions represented are the Sanders parallelogram, Poggendorf and the familiar Müller-Lyer illusions. 80 items, 9 minutes and 15 seconds.

10, SUCCESSIVE PERCEPTION, CP509C2: This is another motion-picture test intended to measure the ability to form an inte-

grated total impression of a visual experience which has been perceived in successive stages or parts. The test is composed of 50 items in which a black spot on a uniform light gray background moves over a complex path, thereby tracing an imaginary pattern, during an interval of 10 seconds.

11, CAMOUFLAGED FIGURES, CP810A: This is a modification of Thurstone's Hidden Digits test, using capital letters instead of digits. It was designed to measure the ability to distinguish a pattern from a confused background. Each design is composed of a large number of dots. The dots are so arranged that some of them form a capital letter. The problem is to identify this capital letter. 58 items, 24 minutes.

12, DIRECTIONAL PLOTTING, CE455A: This plotting test was based on some of the operations in navigator training. It was designed to measure the ability to plot a chart accurately and quickly. In each problem the examinee locates two separate points and determines the direction from one point to the other point. 46 items, 15 minutes.

13, LANDING JUDGMENT, CP505E: This motion-picture test was designed to measure the ability to learn certain spatial discriminations believed to be required for successfully landing an airplane. A view of a runway and part of a surrounding airfield is shown on the screen, as it appears during an approach glide. The examinee is required to judge at which of the five spots on the runway his glide is aimed, and to record his choice on a standard answer sheet. 60 items.

14, AREA VISUALIZATION, CP815A: This is a variation of the familiar paper form board type of test. The items are relatively easy, since no more than two pieces are to be put together in an item. The examinee is required to indicate which one of three figures will be formed when two segments are rotated about so that they fit together. 60 items, 14 minutes.

15, PLOTTING, CE452A: This is another plotting test, similar in many ways to test 12, Directional Plotting. In this test the examinee is required to plot movements on a chart quickly and accurately. The test booklet contains the directions and a list of problems which are merely descriptions of moves on the chart. 47 items, 15 minutes.

16, ESTIMATION OF LENGTH, CP631B: This test requires the comparison of lengths of lines. The examinee matches the length of each of a number of bars with one of the five standard lengths. Each item consists of a single bar which is exactly the same length as one of the five standards printed near the middle of the page. 120 items, 6 minutes.

17, OBJECTIVITY OF PERCEPTION, CP806BX1: This is another test consisting of visual illusions. The other illusions tests involve chiefly the perception of length. This one, however, consists chiefly of Gestalt illusions, including the comparison of ordered with unordered aggregations of objects. The types of comparisons required in other parts include the areas of crosses and triangles, the areas of two triangles, one of which is directly beneath the other, and of two squares, one square with the page and the other tilted on one corner. The instructions attempt to produce an illusion-resistant set, as in the other Objectivity of Perception tests. 125 items, in 10 different parts; 10 minutes and 30 seconds.

18, ANGLE ESTIMATION, CP218A: This test requires the estimation of the angle from which an aerial photograph of a military vehicle was taken, in terms of a given scale of angles. The angles are at intervals of 10 degrees, from 0 to 90 degrees. 46 items, 10 minutes.

19, INTEGRATION OF ATTENTION, CP415A: This motion-picture test was intended to measure ability to react to patterns and combinations of visual events and relations between events. It is a variation of the Flexibility of Attention Test, which is variable 35 in this battery. This test employs the same content as Flexibility of Attention, but requires the subject to look for and record *simultaneous combinations* of wrong dials. In addition to watching all the dials, he must perceive them as a whole in order to note the combinations which are formed. Isolated wrong dials do not count.

20, VISUAL MEMORY, CP514A: This is a recognition memory test with aerial photographs as content. The test consists of five large photographs to be studied. Each of these is immediately followed by 24 test-photographs. Two minutes are allowed for answering each set of test-photographs after one minute of studying each large map.

21, PENETRATION OF CAMOUFLAGE, CP812A: This test, adapted from Thurstone's Hidden Pictures test, requires the perception of human faces hidden in parts of a larger picture, as in children's puzzle pictures. Six large pictures, containing 71 concealed faces; 15 minutes.

22, PLANE FORMATION, CP805C: This motion-picture test was designed to measure the ability to apprehend a visual pattern within a brief exposure period and reproduce it accurately. The task of the examinee was to observe the screen and, immediately after the exposure, to fill in spaces on the answer sheet corresponding to the sections of the grid which included planes, *i.e.*, to reproduce the pattern made by the five planes.

23, VOCABULARY, CI604BX1: This is a standard general vo-

cabulary test, which was constructed to be appropriate in difficulty for the aviation cadet population. 90 five-choice items, 12 minutes.

24, DISCRIMINATION REACTION TIME I-II, CP634A: This and the following test represent attempts to duplicate with printed tests the psychomotor test, Discrimination Reaction Time, which is test 70 of this battery. Black and white circles take the place of the colored lights of the other test, and the answers are recorded by making a pencil mark rather than by striking a switch. 95 items, 2 minutes and 15 seconds.

25, DISCRIMINATION REACTION TIME III-IV, CP634A: This test is similar to the previous one, and constitutes the second half of the test booklet. (These two tests are each divided into two parallel parts; hence this test is Parts III and IV.) It differs from the preceding test in having a somewhat more complex pattern of stimuli. 95 items, 2 minutes and 45 seconds.

26, FLIGHT ORIENTATION, CP528A: This is one of the group of tests that require visualization of the movement of a plane in three-dimensional space. Each item consists of two photographs of terrain as seen from the cockpit of a plane; the problem is to determine the maneuver which would produce the change in view from the first to the second picture. 97 items, 22 minutes.

27, LANDING JUDGMENT, CP505B: This test is more or less a paper-and-pencil form of test 13, Landing Judgment, CP505E, a motion-picture test. It requires the learning, from a study of photographs of the ground as it appears from a plane during a landing, of the correct height for leveling off during a landing glide, and the subsequent judgment, for single test photographs, that they are correct in height, too low, or too high, in terms of the learned standard. 52 test photographs, 5 minutes and 45 seconds.

28, FOLLOWING DIRECTIONS, CP402A: This test requires the rapid comprehension of a set of instructions, which are contained in the test itself, and the adjustment to changes in instructions which occur from time to time within the test. 420 items, 10 minutes.

29, POSITION VISUALIZATION I, CP534A: This test requires the visualization of changes in position of an imagined American flag. An initial position of the flag is given for each item, with two successive changes of position; the problem is to determine the direction (vertical or horizontal) of the stripes, and the position of the stars after the changes in position have been imagined. The flags are not pictured in the test items; their original positions, in terms of direction of stripes and position of stars, are given instead. 50 items, 22 minutes.

30, PATTERN COMPREHENSION, CP803B: This is a form of the familiar surface-development or unfolded solids test, which requires the matching of a solid figure with a two-dimensional pattern of the figure as it would look if unfolded onto a flat surface. 10 solid figures, with 30 matchings to be made; 22 minutes.

31, MECHANICAL MOVEMENTS, CI904AX2: This test derives from the Thurstone Mechanical Movements test. It involves the comprehension of the operation of mechanical systems, and the tracing of the direction of movement through the moving parts of these systems. 30 diagrams, with 48 questions; 40 minutes.

32, COMPASS ORIENTATION, CI660A: This is a modification and development of the orientation-direction items of the Stanford-Binet test. It is a speed test which requires the determination of the direction of flight, given an initial compass direction and the instruction to turn right or left. 150 items, 5 minutes.

33, PLANE-NAME MEMORY, CI503AX2: This is a paired-associates immediate memory test, which requires the association of names with plane silhouettes. It consists of two parts. In Part I the examinee is given 4 minutes to study a page of 20 planes shown in front-view silhouettes. The name of each plane appears below the silhouette of that plane. At the end of 4 minutes the examinee identifies the silhouettes studied. Part II is exactly the same except that the silhouettes are side views of planes.

34, VERBAL RECOGNITION, CI322A: This is a form of the well-known disarranged-words test. Words with their letters out of normal order are presented in sets of ten, under categories such as colors, animals, and sports; the problem is to determine what each word would be if arranged in proper order. The first letter of each scrambled word is capitalized, regardless of where it appears in the scrambled word. 10 sets of 10 words each, 12 minutes and 30 seconds.

35, FLEXIBILITY OF ATTENTION, CP411E: This motion-picture test was designed to measure the ability to distribute attention over a wide range of stimuli. It consists of five schematic instrument dials projected on the screen having simple indicators or pointers moving continuously in an irregular manner. 36 phases with 137 items, running time of film 15 minutes.

36, OBJECT COMPLETION, CP811A: This is a variation of the Street Gestalt Completion test; it requires the identification of pictures of objects, parts of which have been deleted. It is the examinee's task to select from a list of alternative answers the name of the object which is partially portrayed in the item. 60 incomplete pictures, 30 minutes.

37, DRIFT DIRECTION, CP221B: This motion-picture test was designed to measure the ability to detect the drift of a moving spot to one side or the other of the main direction in which it moves. A black spot appears against a gray background in one of the four quadrants of a circle with perpendicular crosslines, like the field of a bombsight. The spot is stationary for the initial 2 seconds of each item. The spot then moves, slowly but noticeably, either up, down, to the right, or to the left, depending upon which of the four quadrants it is located in. 60 items, decreasing progressively in movement time from 6 seconds to 2 seconds; running time of film 19 minutes.

38, DIRECTIONAL MARKING, CP533A: This test requires rapid responses to printed instructions concerning the locations of marks to be placed in a rectangular area. Each item in this test consists of 4 problems; each problem requires the examinee to place the 4 marks at the distances and directions from the dot which are indicated in the instructions. 29 answer boxes, each with 4 responses required; 6 minutes and 15 seconds.

39, FIGURE CLASSIFICATION, CI213AX1: This is a familiar non-verbal reasoning test, designed to measure the ability to draw comparisons and make generalizations. The examinee is required to find the characteristic which is common to the three figures at the left and is found in *only one* of the five figures at the right. The typical test problem requires the detection of exact, but obscure, similarities. 32 items, 11 minutes.

40, SPATIAL VISUALIZATION III, CP535A: This test requires the examinee to imagine the folding of a square piece of paper according to orally presented instructions, and to identify the end result in a set of five possible answers. In every problem the examinee imagines folding a square sheet of paper into various shapes. 40 items, presented from recordings; over-all time approximately 27 minutes.

41, STICK AND RUDDER ORIENTATION, CP531A: This is one of the group of tests requiring visualization of the movement of a plane in three-dimensional space; it is somewhat similar to test 26, Flight Orientation, of this battery. Each item contains three successive photographs of terrain as it would appear from the cockpit of a plane which is changing its position. Besides the determination of the maneuver which would produce the changes shown in the appearance of the terrain, the examinee is required to indicate the stick and rudder movements which would produce the maneuver. 45 items, 14 minutes.

42, AMBIGUOUS FIGURES, CI316A: This is a non-verbal

reasoning test. It is designed to measure the ability to find relationships between geometric figures. The examinee is required to find as many relationships as possible from a pair of geometric figures. 16 sets of figures, 24 minutes.

43, SIGNAL INTERPRETATION, CI656C: In this test the examinee is required to learn a complex set of signals, and to make rapid responses to a visual situation on the basis of the material learned. In each problem there is a diagrammatic representation of 10 airplane carriers in a row. The examinee must determine from which of these carriers planes will take off. 15 rows of ships, 7 minutes.

44, CAMOUFLAGED WORDS, CI323A: This is a variation of Thurstone's Mutilated Words test; it requires perception on the basis of incomplete visual cues. The purpose of this test is to determine how well the examinee can identify words, parts of which have been removed or camouflaged. Each mutilated word has two items based upon it. 30 camouflaged words, with two right responses to each; 20 minutes.

45, ESTIMATION OF RELATIVE VELOCITIES, CP205B3: This motion-picture test was designed to require a complex judgment of the *relation between two velocities*, measured by estimating the imagined point at which the faster of two moving spots (planes) would overtake the slower. The paths of the two motions are parallel. 50 trials, 10 at each of the five points in a random order.

46, CRAWFORD-BENNETT POINT MOTION, FORM B: This is the commercially available form of this test, which is a form of mechanical movements test. It requires visualization of the path of movement of moving parts of mechanisms. Each item presents an assembly drawing of certain parts of a machine. 30 problems, 15 minutes.

47, PLANE FORMATION MEMORY, CI513A: This test requires memory of the positions of diagrammatic plane silhouettes in formation. The task of the examinee is to select those planes that have been moved out of position. There are 40 formations to be memorized; the study time for each set is 8 seconds with 15 seconds allowed to locate, select, and blacken answers on the answer sheet. The total testing time is approximately 17 minutes.

48, DIAL AND TABLE READING, CP622A-621A: The scores for this test are composed of the scores from two separate tests, Dial Reading and Table Reading, which are contained in one test booklet. Dial Reading measures how quickly and accurately the examinee can read the dials on an instrument panel. 57 items, 9 minutes. Table

Reading has two parts. The first part consists of a large bivariate table in which the examinee is given a pair of marginal values and finds the entry in the body of the table corresponding to these. In the second part the examinee must determine which of four tables to enter to find the one pair of numbers called for in the specific item. In Table Reading part I has 43 problems, 8 minutes; part II has 43 problems, 7 minutes.

49 and 50, BIOGRAPHICAL DATA BLANK (PILOT) and BIOGRAPHICAL DATA BLANK (NAVIGATOR), CE602D: This set of biographical data items had two keys, pilot and navigator, which had been empirically validated against success in pilot and navigator training. The examinee is asked for certain information about his background, family, home, education, hobbies, and civilian employment. This blank contains 65 items. The time limit of 25 minutes is so set that almost all examinees could finish.

51, SPATIAL ORIENTATION I, CP501B: This is a perceptual speed test in which the examinee is required to locate small sections of an aerial photograph within a larger picture. 9 large photographs, with 49 small photographs to be matched; 5 minutes.

52, SPATIAL ORIENTATION II, CP503B: This test, informally known as the map-photo test, differs from the preceding test in that the small aerial photographs are to be matched with a colored aviation map, rather than with another aerial photograph. 12 aerial maps, with 48 problem photographs; 18 minutes.

53, READING COMPREHENSION, CI614H: This test was designed to measure understanding of paragraph material and ability to draw inferences based on material read. An attempt was made to minimize mechanical and numerical content in the material presented. Material was included on navigation, physics, map reading, and astronomy. 8 paragraphs, with 36 questions to be answered; 30 minutes.

54, INSTRUMENT COMPREHENSION, CI616C: The original form of this test was the first of the tests which require the determination of the location of a plane from views of instruments or terrain as seen from the cockpit. Because of its validity, this area was explored intensively, and other factorially similar tests were constructed. In this test each item consists of pictures of two instruments, an artificial horizon and a compass, followed by pictures of five planes. The problem is to determine which of the five planes has a position and direction consistent with the instrument readings. 60 items, 15 minutes.

55, MECHANICAL PRINCIPLES, CI903B: This test was de-

rived from existing tests such as Thurstone's Mechanical Movements test and the Bennett and Fry Mechanical Aptitudes test. Each item consists of a pictured mechanical situation, with questions about it designed to test the ability to understand mechanical forces and movements. 40 items, 20 minutes.

56, SPEED OF IDENTIFICATION, CP610A: This is a perceptual speed test similar to Thurstone's Identical Forms test; it requires the matching of airplane silhouettes. The examinee must choose one of five silhouettes at the right which corresponds to the silhouette on the left. 12 sets of planes, with a total of 48 items; 4 minutes.

57 and 58, NUMERICAL OPERATIONS I (FRONT), and NUMERICAL OPERATIONS II (BACK), CI702B: This is a simple numerical computation test, scored in two parts for this analysis. The 100 problems on the front of the sheet (test 54) involve addition and multiplication. The 80 problems on the back (test 55) involve subtraction and division. The time limit for each test is 5 minutes.

59, MECHANICAL INFORMATION, CI905B: This is a verbal mechanical knowledge test, relating particularly to the operation of parts of automobiles. Most of the items are quite brief, calling for only a limited amount of reading and requiring quite specific mechanical knowledge. 30 items, 12 minutes.

60, COORDINATE READING, CP224B: This test consists of a circular graph simulating an oscilloscope screen. The circle is graduated in degrees from 0 degrees to 360 degrees. A scale graduated in miles runs from the center to the edge and concentric circles appear at 10-mile intervals from the center. Located within the circle are dashes representing target returns on the oscilloscope screen. The task for each item is to determine the bearing and ranges of a dash line from the center of the circle. 85 items, 20 minutes.

61, GENERAL INFORMATION, CE505F: This is a knowledge and information test concentrating particularly on the areas of flying and sports and hobbies. The first 50 items relate to flying, and the last 60 to various sports and hobbies. Six items from a mechanical information test appear in the sports and hobbies section. The test was constructed to indicate participation in these subjects. 40 minutes.

62, PRACTICAL JUDGMENT, CI301C: This test requires the solving of verbally presented problem situations. A number of pieces of factual information are presented; the examinee is required to determine the most practical course of action among five proposed alternatives. 30 items, 30 minutes.

63, ARITHMETIC REASONING, CI206C: This arithmetic reasoning test emphasizes particularly speed-and-distance problems.

The items are arranged roughly in order of increasing difficulty and expressed simply and concisely in aviation terms. 30 items, 25 minutes.

64, COMPLEX COORDINATION, CM701E: This is an apparatus test of speed and accuracy of hand and foot adjustment to a complex perceptual stimulus. The examinee operates controls similar to those used in an airplane in flight. The subject is faced by a stimulus panel on which there are three rows of red lights and three corresponding rows of green lights. A particular pattern of red lights, one in each row, is presented to the subject. His task is to move his controls so as to turn on the green light corresponding to each of the red lights. As soon as each of the three red lights is matched by the corresponding green light, a new set of red lights is automatically presented. 8 minutes.

65, PEDESTAL SIGHT MANIPULATION, CM824A: In this apparatus test, the examinee must manipulate an actual B-29 pedestal sighting station so as to track and frame an airplane-like target moving across a screen in a series of simulated attacks approximating pursuit curves. The examinee must track the target in azimuth and in elevation by keeping the center dot of the reticle on the nose of the attacking aircraft and at the same time vary the diameter of the circle of dots so as to keep it matched to the wingspan of the attacking aircraft. The approximate running time for a complete test film is 9 minutes and 30 seconds.

66, RUDDER CONTROL, CM120B: This apparatus test requires the adjustment of pedal pressures to maintain equilibrium. The subject is seated on a chair mounted on a beam so as to be in unstable equilibrium. The beam swings on a pivot behind the subject, and is mounted on a heavy base. The beam can swing to the right or left. By varying the spring tension on the two sides of the beam, the subject can keep the beam balanced in a central position. The subject's task is to keep the beam centered so that a sighting bar mounted on the fuselage in front of the subject is pointed at a target. The test is given in six 1-minute trials.

67, FINGER DEXTERITY, CM116A: This is an apparatus test of finger dexterity, involving precision and speed of movement in turning pegs. The board is set up so that all 48 pegs have the same color facing the examinee. His task is to remove each peg in turn, rotate it through 180 degrees, and reinsert it in the hole. Five 35-second test trials, with the right hand.

68, ROTARY PURSUIT, CP410B: This is an apparatus test of rhythmic eye-hand coordination, involving pursuit of a target around

a circular path with a pointer; it is an adaptation of Koerth's Rotary Pursuit test. In the second part of the test, simultaneous attention to extraneous stimuli is required. The examinee endeavors to keep a stylus on a small brass rotating target with one hand and at the same time depresses one of two keys with the other hand, corresponding to light signals which alternate in an irregular order. 5 trials without divided attention, 10 trials with divided attention; 20 seconds per trial.

69, TWO-HAND PURSUIT, CM810A: In this apparatus test, the examinee's task is to manipulate two control handles so as to keep a small round target centered in a tube-like eyepiece set into the top of a test unit. The task of pursuing a moving target by the bi-manual manipulation of controls is complicated by the presence of mirrors between the target and the eye. These change the apparent direction of movement required from that which would be appropriate without the mirrors, thus producing a learning situation which is more complex than a similar situation with direct vision. Eight 1-minute trials.

70, DISCRIMINATION REACTION TIME, CP611D: This is an apparatus test of speed of selective response to the relationships among four visual stimuli. The subject must react to the relative positions of a red and a green light on the stimulus panel. Which one of 4 toggle switches must be pushed depends upon whether the red light appears above, below, to the right, or to the left of the green light. A white light is used as a warning signal, and then a pair of lights is turned on, one red and one green. A time clock sums up the time until the correct toggle switch is pushed, turning out the stimulus lights and stopping the time clock, which constitutes the examinee's score. 80 settings in 4 groups of 20 each.

ANALYSIS

The matrix of product-moment correlation coefficients of the 70 variables is shown in Table 1. A multiple-factor analysis was made of these correlations by the Thurstone multiple-group method (8). The grouping of the tests for the extraction of each of the factors was as follows.

I. 48, Dial and Table Reading; 50, Biographical Data—Navigator; 57, Numerical Operations I; 58, Numerical Operations II.

II. 23, Vocabulary; 34, Verbal Recognition; 44, Camouflaged Words; 53, Reading Comprehension; 62, Practical Judgment.

III. 51, Spatial Orientation I; 52, Spatial Orientation II; 56, Speed of Identification.

IV. 49, Biographical Data—Pilot; 55, Mechanical Principles; 59, Mechanical Information; 61, General Information.

V. 64, Complex Coordination; 65, Pedestal Sight Manipulation; 66, Rudder Control; 67, Finger Dexterity; 68, Rotary Pursuit; 69, Two-Hand Pursuit.

VI. 7, Memory for Tactical Plans; 20, Visual Memory; 33, Plane-Name Memory.

VII. 13, Landing Judgment; 18, Angle Estimation; 26, Flight Orientation; 27, Landing Judgment; 30, Pattern Comprehension; 31, Mechanical Movements; 41, Stick and Rudder Orientation; 46, Point Motion, Form B; 54, Instrument Comprehension.

VIII. 2, Position Orientation; 12, Directional Plotting; 15, Plotting; 17, Objectivity of Perception; 19, Integration of Attention; 35, Flexibility of Attention; 38, Directional Marking; 45, Estimation of Relative Velocities; 47, Plane Formation Memory; 60, Coordinate Reading.

IX. 39, Figure Classification; 42, Ambiguous Figures; 63, Arithmetic Reasoning.

X. 3, Following Oral Directions; 8, Planning Air Maneuvers; 28, Following Directions; 29, Position Visualization I; 32, Compass Orientation; 40, Spatial Visualization III; 43, Signal Interpretation; 70, Discrimination Reaction Time.

XI. 1, Normality of Perception; 9, Objectivity of Perception; 16, Estimation of Length.

XII. 6, Camouflaged Outlines; 11, Camouflaged Figures; 14, Area Visualization; 21, Penetration of Camouflage; 36, Object Completion.

XIII. 4, Successive Perception I; 10, Successive Perception II; 22, Plane Formation.

XIV. 5, Minimal Movements; 37, Drift Direction.

XV. 24, Discrimination Reaction Time I-II; 25, Discrimination Reaction Time III-IV.

XVI. 30, Pattern Comprehension; 31, Mechanical Movements; 46, Point Motion, Form B.

XVII. 23, Vocabulary; 29, Position Visualization I; 53, Reading Comprehension.

XVIII. 49, Biographical Data—Pilot; 50, Biographical Data—Navigator.

For the first 15 of these groups, no variable appears in more than one group. These 15 factors were extracted, with the highest column coefficient of each variable as the estimated communality. Additional factors were then extracted by making additional groups, based on the pattern of residuals, and treating these as if they had been included in the original extraction, by adding them onto the matrices already obtained in the extraction of the first 15 factors. It required some trial and error to obtain significant factors by this procedure, since some groupings tried would not yield an inverse, and others yielded factor loadings low enough to seem negligible. In the end, three additional factors were accepted, for an over-all total of 18.

After the extraction of these 18 factors, separate distributions were made of the residuals for three different sets of correlations: classification tests with each other ($N=8574$), experimental tests with classification tests ($N=2281$ to 2425), and experimental tests with each other. For the classification test intercorrelations, more than two-thirds of the residuals fell between $+0.015$ and -0.015 , and no residual exceeded ± 0.050 . For the correlations between the experimental tests and the classification tests, more than two-thirds of the residuals fell between $+0.020$ and -0.020 , and only one residual ($.090$) exceeded ± 0.075 . For the experimental test intercorrelations, more than two-thirds of the residuals fell between $+0.035$ and -0.035 , and six residuals fell beyond ± 0.125 . No patterning which would lead to

further significant reduction in the residuals was found, so no further factors were extracted.

The multiple-group method of analysis yields factor loadings which do not differ greatly from those obtained after orthogonal rotation. Thus, the table of orthogonal factor loadings which was obtained after a few minor rotations is presented here, as being of greater interest than the original loadings; this particular orthogonal solution is shown in Table 2.

Rotations to an oblique structure were made by the single-plane method (8). The oblique loadings so obtained are shown in Table 3. The transformation matrix from the orthogonal loadings shown in Table 2 is given in Table 4. The intercorrelations between primary factors are shown in Table 5.

INTERPRETATION OF RESULTS

An interpretation and discussion of the 18 factors obtained is given below. Since there is sometimes substantial correlation of a factor with other factors, some attention is directed to these factor intercorrelations as part of the process of interpretation.

1. Defining variables for the first factor are as follows:

<i>Variable</i>	<i>Loading</i>
57. Numerical Operations I .....	.63
58. Numerical Operations II .....	.59
63. Arithmetic Reasoning .....	.33

This is the *Number* factor which has been found in previous analyses whenever tests of simple numerical computation have been included in the battery being analyzed. It has correlations above .30 with five other factors; the highest are those with the eighth (plotting, .61) and fifteenth (complex reaction time, .40) factors.

2. Defining variables for the second factor are as follows:

<i>Variable</i>	<i>Loading</i>
23. Vocabulary .....	.53
28. Following Directions .....	.35
53. Reading Comprehension .....	.30
34. Verbal Recognition .....	.21
62. Judgment .....	.20

These tests are in the verbal area, and this factor is similar to verbal factors which have been found in many previous studies. It correlates above .30 with only one other factor (the sixth, memory) and is thus relatively independent in this battery. In line with previous usage, it will be called *Verbal*.

3. Defining variables for the third factor are as follows:

<i>Variable</i>	<i>Loading</i>
56. Speed of Identification .....	.37
51. Spatial Orientation I .....	.29
52. Spatial Orientation II .....	.19

This is the simple *Perceptual Speed* factor which has appeared consistently in previous analyses by Thurstone, in the Air Force, and by other investigators. Since it is the most centrally located factor of the present study, its characteristics deserve consideration in some detail.

The first test listed above is a translation of the Thurstone Identi-

cal Forms Test into airplane silhouette content. Each item requires the identification, among five silhouettes, of the one which is identical in form with the given one. It is highly speeded; there are 48 items with a time limit of only four minutes. When scored R - W, mean scores for groups similar to this one tend to fall around 32. It is a relatively simple and straightforward measure of sheer speed in making visual identifications. The second test is very similar in function measured; the task set is the location, in a larger aerial photograph, of certain specific segments which are separately shown.

In the orthogonal solution presented here, 17 tests have loadings above .30 on this factor. The reduction of the number of tests with loadings of this or nearly this size to two in the oblique solution is accompanied by a correspondingly large number of high inter-factor correlations. This factor has correlations above .50 with eight other factors, and correlations between .31 and .50 with two more. It is thus nearer the centroid of the entire group of perceptual factors than is any other in this battery. In line with previous usage, it will be called *Perceptual Speed*.

4. Defining variables for the fourth factor are as follows:

<i>Variable</i>	<i>Loading</i>
59. Mechanical Information .....	.52
61. General Information .....	.35
55. Mechanical Principles .....	.29
49. Biographical Data—Pilot .....	.29
14. Area Visualization .....	.26

This factor is similar to the *Mechanical* factor which has appeared in previous analyses. The first test is a measure of mechanical knowledge, the second contains, in addition to mechanical information items, sections on knowledge of flying, aviation, automobile-driving, and sports. The third and fourth tests have also appeared consistently on such a factor. It has correlations above .30 with three other factors, the fifth (psychomotor), seventh (orientation), and sixteenth (visualization). It is negatively correlated (-.30) with the first (numerical) factor.

5. Defining variables for the fifth factor are as follows:

<i>Variable</i>	<i>Loading</i>
68. Rotary Pursuit .....	.46
69. Two-Hand Pursuit .....	.40
67. Finger Dexterity .....	.35
65. Pedestal Sight Manipulation .....	.30
64. Complex Coordination .....	.29

66. Rudder Control .....	.25
70. Discrimination Reaction Time .....	.19

This is the *Psychomotor* factor which has consistently appeared in analyses of the Air Force classification tests. It is the only psychomotor factor to appear in this study; this is in line with previous experience in that no second factor from this group of tests has appeared consistently, when only the prescribed psychomotor tests were used. It has correlations above .30 with seven other factors; of these the highest are those with the seventh (orientation), sixteenth (visualization), tenth (directional thinking) and fourth (mechanical) factors.

6. Defining variables for the sixth factor are as follows:

<i>Variable</i>	<i>Loading</i>
33. Plane-Name Memory .....	.40
20. Visual Memory .....	.31
7. Memory for Tactical Plans .....	.30
27. Landing Judgment B .....	.25

This is a memory factor. The first three tests are all so labelled, and the fourth requires immediate learning and memory. These tests are somewhat diverse in content, and it seems very likely that the inclusion of additional memory tests would result in the emergence of additional memory factors. The one "memory" test in this battery without a substantial loading on this factor (Test 47) has its main loading on the eighth factor. This present factor has correlations above .30 with five other factors. It will be called simply *Memory*.

7. Defining variables for the seventh factor are as follows:

<i>Variable</i>	<i>Loading</i>
41. Stick and Rudder Orientation .....	.44
54. Instrument Comprehension .....	.30
26. Flight Orientation .....	.27
13. Landing Judgment E.....	.26
27. Landing Judgment B .....	.24
18. Angle Estimation .....	.23

The first three of these tests all require determination of the position of an airplane from views of either the horizon or the instrument panel, as seen from the pilot's seat in the plane. Consideration of the three remaining tests and of a similar set of tests in a companion study to this one (6) indicates a more general interpretation. The common task running through these tests seems to be the question,

in somewhat varying situations, "In what position would you be if what you saw looked like this?" This requires a form of space thinking, and this is one of a family of correlated space factors. It has correlations above .30 with seven other factors. The highest (.75) is that with factor sixteen (visualization). To indicate what seems to be its basic feature, it will be called *Orientation*.

8. Defining variables for the eighth factor are as follows:

<i>Variable</i>	<i>Loading</i>
12. Directional Plotting .....	.38
15. Plotting .....	.29
47. Airplane Formation Memory .....	.29
38. Directional Marking .....	.28
48. Dial and Table Reading .....	.25

The first two of these tests require the rapid location of initial points on a chart and the rapid moving to a second point according to prescribed directions. The fourth, Directional Marking, is similar to these in that rapid movements up or down and/or right or left on the answer sheet in response to printed instructions are required. The Airplane Formation Memory Test, which appears here rather than with the other memory tests, requires memorization of the position of airplane silhouettes on a page and the identification of those which have been moved on the response sheet. The precise nature of the factor, which is a new one, is not clear. It is highly oblique to a number of other factors; it has correlations around .60 with the first, tenth, and fifteenth factors, and one almost as high (.52) with the third. Altogether, it has correlations above .30 with nine other factors. It would thus be expected that any one of these tests would appear factorially complex if described in orthogonal terms with axes rotated through previously established factors. Earlier experience with these tests (4) bears out this expectation. Since it is difficult to select a general term which will clearly differentiate this factor from its nearest neighbors, it will simply be called, after the tests which have highest loadings on it, *Plotting*.

9. Defining variables for the ninth factor are as follows:

<i>Variable</i>	<i>Loading</i>
42. Ambiguous Figures .....	.40
14. Area Visualization .....	.28
39. Figure Classification .....	.27
7. Memory for Tactical Plans .....	.26

This factor is similar to reasoning factors described in various

earlier studies. The first three of these tests are non-verbal measures of a type commonly used in intelligence tests. The fourth, a verbal meaningful-memory test, has been found to be more closely related to measures of comprehension and reasoning than are tests involving rote memory. Correlations above .30 occur with four other factors, but none of these correlations exceeds .40. It will be called *Reasoning*.

10. Defining variables for the tenth factor are as follows:

<i>Variable</i>	<i>Loading</i>
3. Following Oral Directions .....	.37
32. Compass Orientation .....	.33
43. Signal Interpretation .....	.29
28. Following Directions .....	.26
14. Area Visualization .....	.25

An indication of the content of these tests can best be obtained from the second one, since it can be explained and illustrated more easily than the others. Each item consists of a given compass direction and a given direction of turn (right or left); the answer required is the new direction after the turn has been made. Thus (4):

Item	You Are Flying	and Turn	New Direction
80.	North	left	.....
81.	West	right	.....
82.	East	left	.....

It is highly speeded; there are 150 items with a time limit of only five minutes.

The first test, Following Oral Directions, also has a prominent directional component. Its items also require the determination of direction, following movement, although in a somewhat more complex setting. The third and fourth tests also fit this interpretation. This factor has correlations of .50 or more with six other factors; the highest are those with the eighth (plotting) and seventh (orientation) factors. To characterize it specifically, it will be called *Directional Thinking*.

11. Defining variables for the eleventh factor are as follows:

<i>Variable</i>	<i>Loading</i>
1. Normality of Perception .....	.57
16. Estimation of Length .....	.33
9. Objectivity of Perception .....	.30

This factor is similar to the length perception factor which has been found in previous studies. The first and third tests contain vari-

ous common illusions of length and are similar in content; however, their instructions differ markedly. The instructions for Normality of Perception emphasize the taking of a naive, phenomenological attitude: "Your task is to report how the figure looks to you, not how you think it should look." On the other hand, instructions for Objectivity of Perception emphasize the aims of resisting illusory effects and of working rapidly: "This is a test of your ability to detect rapidly, merely by inspection, the true sizes of camouflaged figures." The effect of this difference in instructions is that the test taken with an illusion-resisting set correlates much more highly with tests not on this factor than does the Normality of Perception test; on the other hand, the Normality test has a slightly higher correlation with the other defining test for this factor, Estimation of Length.

This factor has correlations above .30 with seven other factors; the two highest are those with the third (perceptual speed) and thirteenth (perceptual closure) factors. It will be called *Length Perception*.

12. Defining variables for the twelfth factor are as follows:

<i>Variable</i>	<i>Loading</i>
44. Camouflaged Words .....	.40
34. Verbal Recognition .....	.37
36. Object Completion .....	.28
40. Spatial Visualization III .....	.23

The first and third tests contain, respectively, words and pictures of objects, parts of which have been deleted; the problem is to identify the words or objects on the basis of these incomplete visual cues. The second test requires the identification of words whose letters have been disarranged in order. In all these cases, a meaningful interpretation must be made of inadequate or distorted visual information. This factor has correlations above .30 with five other factors. Of these, the highest are those with the seventeenth (perception through camouflage, .67) and third (perceptual speed, .54) factors. This factor, which is somewhat similar to factors previously reported (7), will be called *Perceptual Closure*.

13. Defining variables for the thirteenth factor are as follows:

<i>Variable</i>	<i>Loading</i>
10. Successive Perception 2 .....	.49
22. Plane Formation .....	.26
4. Successive Perception 1 .....	.24

These three tests are all in motion-picture form (3). In the first,

a dot traces a complex path on the screen; the examinee is required to identify the figure traced among five given figures. In the third, successive thin sections of a figure are shown on the screen; the problem is to identify the total figure among five given figures. In the second, five planes are shown on the screen in a pattern; the examinee is required to reproduce the pattern thus briefly shown. This factor has correlations above .30 with 10 other factors. The highest are those with the third (perceptual speed, .70) and sixteenth (visualization, .69) factors. There is apparently a similarity between the requirements made by at least the first of these tests and the kind of tracing movements through a system of pulleys that is required by some items in a mechanical movements test. This particular factor has not been described in previous research. As a tentative name, the term used when two of these tests were constructed will be applied: *Sequential Perception*.

14. Defining variables for the fourteenth factor are as follows:

<i>Variable</i>	<i>Loading</i>
37. Drift Direction .....	.43
5. Minimal Movements .....	.41
13. Landing Judgment E .....	.29
19. Integration of Attention .....	.26
9. Objectivity of Perception .....	.22
4. Successive Perception 1 .....	.21

All these except Objectivity of Perception are motion-picture tests. The first two were developed to measure ability to detect movement and to determine its direction. In Drift Direction, "a black spot appears against a gray background in one of the four quadrants of a circle with perpendicular crosslines The spot is stationary for the initial two seconds of each item. The spot then moves, slowly but noticeably, either up, down, to the right, or to the left In some items the spot moves in a perfectly straight line parallel to one of the crosslines of the circle; in other items, it drifts toward or away from the crossline" (3). The task is to detect the direction of movement. The second test is similar except that the spot may "either remain stationary or move very slightly in one of four directions The task is to indicate whether the spot remains stationary or, if it moves, to record the direction of motion" (3). The third and fourth tests make similar requirements. This factor has no correlation with other factors above .20; it is thus relatively independent in this battery. It will be called *Movement Detection*.

15. Defining variables for the fifteenth factor are as follows:

<i>Variable</i>	<i>Loading</i>
24. Discrimination Reaction Time I-II .....	.50
25. Discrimination Reaction Time III-IV .....	.39

These two tests were constructed in an attempt to measure with printed tests the abilities required by the psychometer test, Discrimination Reaction Time (test 70). An indication of the nature of the factor defined can be obtained from the other factors with which it correlates most highly: the eighth (plotting, .61), the tenth (directional thinking, .53), and the third (perceptual speed, .52). Altogether, it has correlations above .30 with nine factors. It will be called *Complex Reaction Time*.

16. Defining variables for the sixteenth factor are as follows:

<i>Variable</i>	<i>Loading</i>
30. Pattern Comprehension .....	.46
46. Point Motion, Form B .....	.38
31. Mechanical Movements .....	.34
55. Mechanical Principles .....	.31
29. Position Visualization .....	.31
63. Arithmetic Reasoning .....	.31
26. Flight Orientation .....	.27
28. Following Directions .....	.23
2. Position Orientation .....	.21

The first, third, and fourth of these tests have previously contributed to the definition of a factor called "visualization" (4). The second seems the same kind of test. The essential behavior required seems to be the tracing of movement, as through a mechanical system. The most closely related factor, the seventh (orientation, .75) is also one of a family of space factors. The present factor has correlations above .30 with 12 other factors. In line with terminology used before, it will be called *Visualization*.

17. Defining variables for the seventeenth factor are as follows:

<i>Variable</i>	<i>Loading</i>
21. Penetration of Camouflage .....	.32
11. Camouflaged Figures .....	.26
29. Position Visualization I .....	.24
6. Camouflaged Outlines .....	.21

In the first, second, and fourth of these tests, in each item a meaningful object must be perceived against a background which was

designed to conceal the object. The third test does not fit this description, but an inspection of the first-order correlations indicates that its appearance here is not an inconsistency. The two nearest factors to this one are the third (perceptual speed, .68) and the twelfth (perceptual closure, .67). It has correlations above .30 with a total of seven other factors. To refer to the common content of the defining variables, it will be called *Perception Through Camouflage*.

18. Defining variables for the eighteenth factor are as follows:

<i>Variable</i>	<i>Loading</i>
49. Biographical Data—Pilot .....	.48
50. Biographical Data—Navigator .....	.43

This factor, defined by the two scores on the Biographical Data Blank, results from the correlation, partly in the keys and partly otherwise, of these two scores. Statistically, it is a highly stable factor. Since it first appeared in an analysis of the first classification battery to utilize both these scores (5), it has reappeared consistently in subsequent analyses based on samples of several thousands. Its correlations with other factors are negligible. Its psychological meaning is not apparent; it will simply be called *Biographical Data*.

DISCUSSION

The primary aim of this study has been the exploration of the area covered by a complex set of perceptual tests and factors, in order to determine the pattern of interrelations both within this set and with other tests and factors. Eight of the factors of this set may, because of their interrelations, be considered as forming a family of related perceptual factors. The third (perceptual speed) factor occupies a central position in this group. The seven other factors which are grouped with this one include plotting, directional thinking, length perception, perceptual closure, sequential perception, complex reaction time, and perception through camouflage. Although these are distinct from each other, they are far from independent.

One perceptual factor, movement detection, does not go with the factors of the main perceptual group; it has no correlation with any other factor above .20. It is a new factor about which little is known. The two space factors, orientation and visualization, have substantial correlations with some of the perceptual factors; reference to other studies indicates that they can more appropriately be regarded as belonging to a different, although related, family.

The remaining factors represent previously determined factors or factor areas, as may be indicated by listing them.

1. Number
2. Verbal
4. Mechanical
5. Psychomotor
6. Memory
9. Reasoning
18. Biographical Data

All these except the psychomotor factor tend to be relatively independent of the perceptual factors described above. It seems likely that each of these would break down, under intensive analysis, into a family of related factors more or less similar in structure to the set of perceptual factors found in this study. Thus continuing research is increasing the number of factors which have been described; however, many or even most of these new factors will join with already established factors in correlated families. This integration of new with old factors is one major gain obtained by oblique solutions over the unorganized increase in the number of supposedly independent factors shown when orthogonal axes are used.

The presentation of both orthogonal and oblique solutions permits a general comparison of results obtainable with these two methods. For the purpose of locating the main defining tests for each factor, the two types of solution give similar results. In almost all cases the two or three variables with highest loadings on the orthogonal rotation occupy a similar position on the oblique one, but the size of loadings is reduced. Defining variables with lower loadings tend to shift more; this is particularly noticeable for tests with substantial loadings on one or two other factors—the first loading may drop to zero in the oblique solution. When the correlations between factors are small, there is relatively little difference between the two procedures. With a rise in the correlation between factors, discrepancies in the description of individual tests in the two situations increase both in number and in size.

TABLE 1
Intercorrelations of the Seventy Tests*

Test
No.

1.																				
2.	216																			
3.	053	350																		
4.	111	199	257																	
5.	114	111	109	200																
6.	186	267	274	316	098															
7.	028	136	284	190	124	226														
8.	083	204	293	222	050	311	248													
9.	400	230	128	206	164	336	082	249												
10.	198	231	283	415	224	331	199	299	236											
11.	167	127	126	270	092	459	069	251	271	303										
12.	186	379	379	252	144	344	288	347	303	340	262									
13.	125	116	118	110	230	142	063	170	128	213	165	131								
14.	159	136	094	173	-002	299	030	154	169	185	225	152	069							
15.	210	367	388	235	164	364	200	276	329	299	196	520	131	112						
16.	358	257	208	194	151	303	161	132	305	227	227	233	017	139	282					
17.	148	154	109	086	084	156	074	143	188	170	117	172	073	105	179	161				
18.	191	178	199	161	195	292	110	306	247	252	306	301	213	082	206	157	122			
19.	030	162	215	188	306	117	134	164	200	078	308	066	020	255	142	073	090			
20.	061	075	189	235	159	316	218	237	121	270	224	217	113	087	253	143	143	210		
21.	109	161	124	190	050	336	083	072	166	147	320	144	048	120	189	152	086	191		
22.	189	230	337	314	125	313	176	292	344	481	327	417	144	122	345	222	129	215		
23.	-008	128	282	220	022	268	241	223	245	176	180	291	-019	004	185	116	072	156		
24.	048	332	224	281	154	301	323	237	282	271	233	286	153	081	354	201	147	110		
25.	083	348	364	240	040	330	309	201	318	208	228	375	129	129	386	244	131	110		
26.	052	347	492	260	093	443	352	323	305	312	313	298	230	109	274	220	124	317		
27.	-046	125	170	224	062	184	198	152	122	181	147	147	171	030	163	123	026	154		
28.	041	206	388	221	069	331	308	205	267	146	194	340	008	081	199	127	094	086		
29.	049	293	511	298	138	446	445	333	298	323	394	449	160	117	370	194	193	279		
30.	015	261	397	292	020	470	255	247	269	312	376	263	125	110	147	197	095	294		
31.	013	293	425	274	042	435	288	406	336	341	323	390	205	112	210	193	064	299		
32.	-002	348	563	277	098	258	313	237	249	257	256	363	139	149	397	193	104	196		
33.	061	210	295	249	081	328	369	184	125	216	311	238	175	049	274	152	133	195		
34.	056	165	283	230	000	228	212	180	138	158	251	228	-026	091	251	132	155	078		
35.	166	277	212	265	254	248	151	233	278	281	179	334	109	127	373	115	091	185		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		

*Decimal points have been omitted.

TABLE 1* (Continued)

Test No.	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1.																
2.																
3.																
4.																
5.																
6.																
7.																
8.																
9.																
10.																
11.																
12.																
13.																
14.																
15.																
16.																
17.																
18.																
19.																
20.	109															
21.	056	215														
22.	205	222	182													
23.	120	162	162	162												
24.	132	188	169	212	179											
25.	149	224	099	257	163	540										
26.	148	252	152	199	275	271	311									
27.	134	275	149	132	094	226	234	235								
28.	161	037	045	154	396	203	309	309	151							
29.	176	231	142	246	402	287	359	488	216	423						
30.	071	215	128	281	166	211	231	449	102	368	481					
31.	086	201	135	257	247	245	286	573	133	368	553	617				
32.	195	160	112	232	251	284	398	413	190	378	521	288	339			
33.	108	348	187	192	235	153	175	331	190	190	334	211	275	323		
34.	118	169	122	281	387	124	207	119	066	267	189	128	149	209	179	
35.	368	214	165	270	178	305	234	216	190	133	163	157	217	237	121	235

*Decimal points have been omitted.

TABLE 1* (Continued)

36.	131	262	338	260	214	179	147	290	127	119	234	291	324	124	263	236	097	
37.	152	169	130	257	004	136	138	225	078	048	122	127	172	094	190	065	207	094
38.	197	199	156	330	289	314	369	214	154	230	291	146	224	328	106	294	297	107
39.	183	232	172	250	411	148	107	275	121	172	283	321	338	191	206	235	171	202
40.	207	239	188	287	249	233	220	325	121	275	371	405	442	291	227	248	269	309
41.	183	226	240	308	220	155	181	558	300	098	380	349	419	247	170	161	196	286
42.	107	-006	039	057	019	153	108	034	-069	117	034	036	110	042	001	054	044	103
43.	238	137	118	310	289	174	360	406	088	283	475	313	319	315	154	258	255	286
44.	096	250	311	224	386	165	144	212	082	182	209	257	210	231	167	438	216	326
45.	098	099	076	126	014	040	223	128	055	035	135	027	086	128	-016	115	152	-026
46.	091	103	102	191	129	094	078	370	101	055	329	441	455	089	141	085	153	216
47.	134	144	095	374	138	244	349	340	128	134	299	310	263	272	174	185	206	261
48.	293	235	194	445	325	413	472	398	210	360	483	304	382	474	281	323	379	190
49.	025	026	044	002	-058	016	-004	160	100	-013	057	090	189	010	047	-065	011	081
50.	034	092	081	079	098	111	122	097	074	095	133	038	059	104	140	132	103	028
51.	170	263	305	355	144	323	318	331	209	195	263	251	283	261	248	279	297	283
52.	158	278	256	317	175	251	236	420	217	212	357	423	448	261	266	122	187	314
53.	148	217	131	191	591	203	243	367	128	378	469	352	436	341	308	274	143	225
54.	170	229	200	297	244	266	311	521	245	229	438	345	448	372	275	126	192	259
55.	081	152	100	173	203	127	103	445	121	194	386	463	609	169	208	037	080	243
56.	178	256	288	311	162	286	268	317	224	149	242	222	274	232	312	202	206	282
57.	211	118	062	273	271	269	305	133	048	210	270	034	103	349	117	340	257	029
58.	204	131	049	312	318	303	332	185	077	289	323	117	172	376	144	329	253	044
59.	015	025	051	-027	120	005	-052	183	048	081	164	217	387	048	014	-057	-051	113
60.	249	225	218	436	264	349	403	363	231	318	392	316	387	334	261	282	284	230
61.	111	105	113	032	251	079	065	273	188	107	195	104	292	142	226	030	041	189
62.	102	156	035	149	384	170	181	298	135	265	310	246	348	209	184	142	089	168
63.	150	153	086	293	396	223	248	344	071	361	447	380	403	317	206	253	151	167
64.	173	142	123	184	071	268	269	382	164	162	336	274	421	256	125	078	252	132
65.	057	076	107	056	022	090	109	160	112	029	120	108	144	112	034	012	123	101
66.	040	029	045	-031	-050	079	058	249	097	003	149	146	279	107	057	-102	088	069
67.	135	125	101	137	077	225	206	161	081	101	155	154	190	164	110	122	185	068
68.	127	111	105	041	017	159	140	224	132	045	174	113	235	170	127	033	199	077
69.	159	084	071	101	042	184	173	240	087	126	232	175	288	193	091	006	158	103
70.	248	208	171	344	216	365	350	392	167	245	413	320	390	396	259	218	316	195
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36

*Decimals points have been omitted.

TABLE 1* (Continued)

36.	012	153	258	272	048	348	162	198	104	217	332	157	076	145	179	177	037	311
37.	016	153	125	228	324	173	105	237	244	156	131	239	207	098	270	131	095	211
38.	095	287	390	080	077	246	372	224	312	234	149	471	083	128	480	236	201	194
39.	-045	031	298	223	042	292	241	262	238	284	262	333	102	175	228	169	112	295
40.	091	234	416	301	174	429	312	349	290	330	343	397	119	248	328	171	098	325
41.	004	208	298	278	126	307	199	247	194	273	296	273	239	137	338	168	157	372
42.	-045	107	146	103	030	098	129	109	053	046	087	152	096	058	088	051	129	000
43.	066	256	452	141	077	218	322	388	278	311	248	505	113	116	322	150	186	277
44.	156	225	313	214	107	302	250	148	117	204	272	301	127	137	294	150	127	252
45.	051	135	119	128	091	158	038	063	060	068	-008	153	098	038	156	184	109	135
46.	085	215	278	178	079	233	151	235	138	211	241	219	168	087	099	068	127	379
47.	015	202	216	147	-032	140	145	202	193	262	190	355	114	108	370	182	149	151
48.	165	382	463	312	107	354	341	351	342	358	253	564	105	141	558	317	211	253
49.	-019	009	058	013	021	054	-042	079	075	068	093	011	092	100	-014	025	034	186
50.	014	029	076	032	-007	044	074	021	087	067	089	143	-006	-009	096	056	073	045
51.	202	296	299	347	109	405	211	211	278	346	339	317	152	237	375	289	150	219
52.	098	219	327	297	108	414	270	322	241	343	378	326	217	204	271	184	142	346
53.	021	135	355	200	070	306	388	284	228	206	224	416	074	033	243	149	104	240
54.	087	335	432	252	110	319	206	289	277	311	277	412	215	140	330	237	160	356
55.	016	187	298	172	087	327	148	323	261	237	235	251	208	145	122	113	131	406
56.	139	254	205	337	119	368	183	163	233	298	338	240	124	236	295	248	146	234
57.	174	287	313	194	084	183	232	128	226	187	093	385	-012	033	393	244	158	056
58.	151	262	332	200	044	222	271	192	257	212	115	409	-002	058	386	269	163	082
59.	-037	020	111	056	054	133	033	163	076	071	073	059	066	104	-010	023	026	159
60.	172	320	386	274	078	400	266	377	383	383	308	491	121	269	397	310	193	249
61.	-011	070	192	106	057	150	167	157	141	143	125	131	142	116	079	060	047	239
62.	-004	073	243	126	062	249	243	243	196	150	143	240	068	051	146	107	146	209
63.	077	212	381	186	051	320	342	312	297	267	204	423	072	079	251	206	154	226
64.	072	282	330	206	171	241	080	240	218	275	199	269	207	089	256	161	117	299
65.	031	091	102	087	075	112	033	105	092	128	119	126	107	044	120	079	059	139
66.	021	122	150	046	133	063	-044	141	084	102	036	072	214	035	096	049	091	226
67.	066	179	162	144	070	181	063	130	123	111	122	165	028	112	246	169	099	134
68.	079	179	159	096	168	158	015	117	121	138	099	148	151	033	203	118	109	248
69.	078	170	190	128	147	138	067	167	145	176	098	180	117	075	208	153	128	184
70.	096	292	377	274	122	312	245	291	271	294	258	389	128	130	333	205	178	258
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

*Decimals points have been omitted.

TABLE 1* (Continued)

36.																					
37.																					
38.	129																				
39.	098	262																			
40.	213	280	312																		
41.	141	266	154	345																	
42.	073	109	210	169	070																
43.	121	395	323	450	296	147															
44.	130	321	290	322	188	105	305														
45.	033	191	005	071	107	031	132	073													
46.	153	154	199	349	321	071	236	179	047												
47.	080	324	198	338	198	062	238	192	076	167											
48.	166	526	299	353	238	137	450	357	168	181	387										
49.	070	-024	-045	077	224	-020	019	-038	005	173	-011	000									
50.	033	121	083	059	038	073	128	134	043	-016	027	173	173								
51.	151	276	192	308	286	093	247	288	138	145	266	427	072	088							
52.	168	198	258	374	381	097	288	222	097	340	237	340	112	030	406						
53.	087	354	409	339	237	131	392	325	060	223	176	411	-024	145	191	300					
54.	174	260	206	347	475	071	324	228	081	261	190	390	171	075	308	353	327				
55.	175	119	227	364	419	044	284	159	044	502	139	206	282	-008	150	367	315	379			
56.	138	212	174	261	296	053	201	243	095	130	163	321	115	069	476	336	173	290	141		
57.	067	423	166	183	038	077	279	284	102	-016	188	527	-141	137	237	082	296	181	-022		
58.	096	419	228	225	063	074	329	341	123	027	235	552	-136	142	243	145	345	215	056		
59.	031	-034	054	128	221	-002	072	002	-028	314	-039	028	381	-090	000	164	160	190	499		
60.	179	339	307	385	296	125	387	319	149	169	272	581	065	130	433	367	325	376	259		
61.	037	043	074	140	395	-033	104	081	047	173	-007	123	389	018	143	224	235	343	354		
62.	082	196	250	267	255	072	282	219	066	208	120	264	139	086	143	260	400	242	342		
63.	099	349	356	353	175	143	433	314	083	274	264	485	-024	133	180	277	520	287	344		
64.	159	203	136	271	363	054	256	133	138	289	182	298	197	003	254	283	153	357	380		
65.	074	050	041	100	187	028	090	059	072	109	109	125	115	019	147	133	031	163	128		
66.	103	-001	-016	092	311	011	088	-019	077	222	041	053	308	-031	054	145	006	235	357		
67.	049	152	110	116	100	053	153	105	078	055	123	228	059	057	209	135	090	156	080		
68.	097	107	022	126	253	-020	100	033	083	185	074	127	154	025	151	134	041	219	247		
69.	108	146	099	146	222	064	173	073	067	205	119	203	180	-025	147	147	105	229	262		
70.	157	371	268	341	312	088	410	261	172	197	228	442	070	124	322	295	308	364	257		
	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55		

*Decimals points have been omitted.

TABLE 1* (Continued)

36.															
37.															
38.															
39.															
40.															
41.															
42.															
43.															
44.															
45.															
46.															
47.															
48.															
49.															
50.															
51.															
52.															
53.															
54.															
55.															
56.															
57.	169														
58.	168	686													
59.	055	109	-064												
60.	347	359	395	075											
61.	231	003	005	444	183										
62.	122	128	185	237	250	267									
63.	133	403	497	132	394	101	341								
64.	218	099	109	245	273	241	164	154							
65.	132	038	030	077	127	140	053	035	269						
66.	062	072	-083	298	071	318	111	-008	429	219					
67.	204	163	122	030	180	079	071	075	261	176	126				
68.	139	024	005	113	102	169	065	-012	378	256	384	301			
69.	149	075	076	230	175	159	099	092	438	208	325	237	311		
70.	262	264	300	028	394	133	214	309	372	173	146	262	225	267	
	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70

*Decimals points have been omitted.

TABLE 2
Rotated Factor Loadings: Orthogonal*

Test No.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	h ²
1	18	-13	23	-07	01	04	08	13	-12	-01	59	13	12	-16	-16	-02	-04	-06	58
2	26	04	22	-05	14	03	13	29	-07	16	06	07	-12	02	11	28	-04	-10	39
3	24	16	08	07	14	26	10	21	18	45	-09	14	-03	03	-02	20	-23	00	59
4	09	16	38	-05	09	12	06	00	10	22	03	01	25	24	12	18	-02	-07	44
5	-05	06	12	00	21	15	07	20	-01	-01	14	-12	10	41	-01	-07	-06	-04	35
6	02	16	43	03	08	19	10	13	12	19	18	12	-03	-04	05	28	25	-09	53
7	08	20	17	06	-02	53	-02	07	13	21	00	02	-12	02	20	06	-27	-07	56
8	01	08	11	14	11	25	14	29	21	21	04	15	13	-04	00	05	00	-02	35
9	18	18	24	07	05	-05	11	32	19	14	37	-11	-07	16	18	13	01	00	53
10	06	07	34	01	10	16	16	23	20	18	05	-05	48	-02	-02	09	00	03	56
11	04	13	36	-06	02	04	19	-04	15	29	16	15	03	07	06	23	28	06	49
12	28	20	21	04	11	24	04	52	22	13	-03	-06	03	00	-07	10	09	02	60
13	-11	-02	15	03	12	10	30	10	17	03	01	-01	-02	25	11	01	-10	01	27
14	-11	-02	29	10	02	15	-13	18	22	30	09	08	-06	01	-04	-02	05	-04	35
15	30	03	33	-05	24	21	02	45	05	12	03	-02	-06	05	-04	-02	09	-07	55
16	17	03	33	00	12	07	01	17	14	00	36	02	-05	00	-03	08	02	-07	35
17	08	02	16	02	13	10	00	17	17	-01	12	07	-04	-03	-03	-04	-03	02	14
18	-01	09	21	14	17	08	33	15	15	08	12	16	-08	16	-14	15	06	06	39
19	07	11	15	02	14	08	-07	37	17	11	-06	-16	01	26	-11	-05	-08	-02	36
20	-01	00	36	-03	10	38	14	06	-02	-05	-03	17	12	00	-02	02	15	03	38
21	-03	08	42	-05	10	02	05	03	05	04	02	12	-06	03	-09	02	37	01	37
22	21	-01	35	-09	-03	09	08	32	11	18	05	14	30	03	-10	16	-02	00	49
23	22	72	10	13	02	18	02	07	07	13	06	17	07	-07	09	-15	03	-03	73
24	22	-01	32	-03	21	19	02	15	16	09	-04	-04	-02	03	52	08	06	-03	57
25	29	-05	24	-09	18	24	04	29	-01	23	02	05	-08	-14	39	09	03	00	57
26	10	13	25	11	16	29	39	09	07	30	03	04	-20	02	-02	31	-06	04	61
27	03	-04	27	03	10	25	27	06	-06	14	-09	00	09	-13	10	-14	00	08	32
28	23	39	04	04	05	16	-05	11	04	31	09	01	-11	05	13	21	-01	-01	43
29	26	17	10	12	14	43	19	16	00	30	03	04	-01	-05	-04	38	24	01	69
30	-01	15	13	06	04	18	24	08	13	24	08	16	08	-10	04	62	03	01	65
31	03	24	17	32	19	17	22	11	24	30	05	03	-01	-06	05	44	-06	-02	67
32	36	09	09	02	17	32	10	17	00	46	-04	-01	-03	-02	-01	07	08	-02	54
33	00	09	35	07	10	48	01	-02	-04	14	02	-01	00	-02	-18	08	14	04	46
34	29	25	25	-10	05	12	-16	11	-09	06	-07	38	16	-05	-09	07	04	05	48
35	23	00	24	-13	23	11	06	33	-08	-05	-04	12	09	16	-01	19	08	05	41

APPENDIX

35

*Decimal points have been omitted.

TABLE 2* (Continued)

Test No.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	h ²
36	-12	12	34	02	04	14	13	02	04	16	-02	36	11	-06	01	13	14	01	39
37	-03	-09	17	00	08	19	12	23	02	-05	05	08	07	42	01	13	03	02	36
38	35	11	21	-04	11	24	01	42	08	01	-02	16	-11	-11	01	03	-01	00	47
39	02	37	16	-04	02	24	09	11	38	00	01	16	11	-08	-09	09	07	02	45
40	01	12	23	06	07	21	05	29	17	23	02	29	08	10	-07	31	07	00	49
41	01	16	29	18	16	05	57	23	-01	16	-15	07	12	-07	-10	04	13	09	66
42	-04	02	05	-06	03	01	-12	14	43	04	-10	10	-12	09	11	00	-07	05	29
43	21	25	07	01	10	17	06	36	27	36	-04	11	-09	-02	-05	06	-05	05	52
44	26	20	30	-06	04	16	04	08	02	-07	-05	49	-07	12	-16	18	21	01	60
45	11	03	10	-06	10	-03	10	24	-04	04	-02	-01	01	-04	00	-03	-04	03	11
46	-09	15	09	22	07	06	34	19	11	-04	-03	10	05	-02	-04	46	01	01	49
47	15	05	17	-13	06	12	15	33	09	07	-11	06	16	-27	10	17	04	00	39
48	43	17	34	00	14	24	02	42	18	17	-04	00	02	-10	04	10	-04	01	67
49	-05	-15	14	43	14	-14	12	-02	-01	10	04	05	-03	05	-02	02	-01	51	57
50	18	03	10	00	-01	14	-04	00	08	00	-01	06	-04	-01	03	-05	-01	41	25
51	15	02	59	-09	13	03	07	13	06	21	02	11	01	-02	-01	11	00	-01	49
52	-04	10	41	08	05	16	23	12	15	22	-03	07	00	-01	-02	28	04	-03	44
53	21	56	12	16	00	38	07	07	24	08	03	05	-11	-01	03	12	-01	-01	65
54	16	12	25	18	15	15	42	18	10	30	01	01	-01	-02	03	05	02	03	49
55	-08	15	07	46	15	10	36	13	15	09	06	16	02	01	00	40	01	01	64
56	04	09	64	00	13	04	03	02	04	20	-02	-04	-02	02	01	10	01	-01	49
57	75	03	17	00	05	18	-05	12	18	04	01	02	01	07	-07	-17	07	-16	75
58	73	07	15	04	-01	21	-08	13	18	03	04	09	01	05	00	05	-01	-16	71
59	-17	15	02	67	12	-10	05	05	04	05	01	01	03	02	04	21	05	00	59
60	31	07	39	08	07	13	05	27	24	26	06	12	-09	-06	04	09	-01	-02	52
61	-07	19	26	53	17	06	21	01	-05	14	-03	-01	-02	-08	-02	-18	-02	12	54
62	08	36	10	28	04	18	11	10	12	10	03	15	-05	00	13	02	-13	07	37
63	42	26	05	18	-09	30	06	15	24	08	08	13	01	00	-02	27	04	-05	57
64	08	04	12	15	51	-03	26	16	10	20	-03	00	02	04	08	18	-07	-01	50
65	03	-03	11	02	39	-01	13	-02	08	04	-03	00	00	-01	07	04	06	02	20
66	-07	-09	-02	33	45	-08	30	07	04	06	-01	00	-03	05	00	06	-03	07	44
67	12	01	17	05	43	01	-05	03	07	05	00	02	-02	-07	03	12	-01	02	26
68	03	-03	07	05	57	02	22	06	-08	01	02	01	-01	-01	-05	10	06	05	41
69	01	03	05	16	54	00	06	11	14	09	05	-07	03	00	01	12	-03	-02	39
70	22	09	19	-03	31	20	11	23	14	24	-02	09	06	-04	06	15	00	07	42
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	h ²

*Decimals points have been omitted.

TABLE 3
Rotated Factor Loadings: Oblique*

Test No.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII
1	-02	-10	-08	-04	00	23	04	00	-08	-04	57	14	10	-21	-12	-10	-09	-04
2	00	03	11	-07	-01	-13	07	07	-16	08	07	08	-14	07	11	21	-05	-07
3	10	00	08	02	-04	-01	05	-08	18	37	-02	11	-01	03	00	11	-21	03
4	07	19	10	-04	01	-08	-04	-17	-02	07	-07	03	24	21	12	07	01	-06
5	-12	10	-04	-04	07	02	04	02	-05	01	07	02	09	41	01	-08	01	-05
6	-07	04	03	09	-01	07	-02	03	01	02	13	01	-04	-02	05	16	21	-10
7	00	05	13	04	-16	30	01	-16	26	16	06	03	-03	09	18	06	-24	-05
8	-07	-08	-14	16	-03	12	06	11	20	11	09	10	14	-04	04	-06	-03	-03
9	-01	18	02	04	-11	-18	02	02	04	06	30	-12	-06	22	15	16	07	02
10	-03	02	-07	01	07	09	01	14	02	-07	-03	-07	49	-08	-04	-07	03	02
11	-01	08	00	-01	-04	-09	06	-14	01	12	08	01	02	04	09	11	26	05
12	02	03	-04	04	01	01	-02	38	02	01	-04	-10	05	02	-10	10	11	06
13	-03	-09	07	-01	-05	01	26	-10	15	-03	05	00	-02	29	16	-03	-07	-04
14	-13	-14	07	26	-14	10	-17	02	28	25	14	04	-04	00	-03	-11	05	-04
15	04	-05	04	01	08	06	-01	29	-03	03	05	00	-03	05	-04	-06	10	-03
16	05	-01	07	04	05	10	-03	01	06	-04	33	-01	-06	01	-04	05	01	-04
17	01	-06	04	05	06	11	02	05	18	-01	18	05	-03	-01	-01	-06	-10	03
18	03	-07	03	05	02	00	23	-01	08	01	14	10	-13	17	-06	09	04	02
19	00	05	10	03	00	-09	-07	21	07	10	-07	-06	02	26	-14	-03	00	00
20	-02	-11	-03	00	07	31	10	08	02	-18	-03	14	13	-02	04	-08	09	01
21	-03	00	07	04	07	00	01	10	-01	-08	-01	03	-07	00	-05	-05	32	00
22	02	-06	02	-02	-07	-03	00	15	-02	04	03	12	26	-02	-07	03	-04	02
23	03	53	-09	00	01	-03	08	01	06	02	05	13	16	-04	08	-10	00	00
24	07	04	02	05	04	00	-03	-05	06	-06	-05	-08	05	09	50	03	08	00
25	-03	-03	-04	-01	00	07	-01	08	-02	09	06	03	01	-09	39	03	02	04
26	04	-06	14	-04	-02	13	27	-09	-02	14	05	-03	-18	06	-01	27	-04	02
27	-05	-12	04	-01	01	25	24	05	02	-07	-03	00	17	-15	13	-22	01	06
28	02	35	00	-04	-03	-11	-10	-06	-05	26	02	-01	-06	10	07	23	02	03
29	10	04	-16	03	08	15	01	10	-16	15	-07	-06	00	-06	-07	31	24	03
30	-06	04	-03	-02	00	01	05	-05	-04	09	01	03	02	-04	03	46	00	-02
31	03	07	07	18	04	01	03	-07	09	14	02	-07	-04	00	01	34	-04	-04
32	15	01	-07	00	04	07	00	03	-04	33	-06	-03	04	-08	-02	00	12	02
33	00	-04	07	05	09	40	-06	05	01	02	-04	-03	04	-05	-20	02	15	04
34	07	21	-01	-07	09	-04	-14	08	-07	03	-07	37	14	-08	-03	-01	-06	10
35	04	03	-03	-13	16	-07	01	22	-21	-09	-08	17	04	17	03	11	06	08

*Decimal points have been omitted.

TABLE 3* (Continued)

Test No.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII
36	-13	-01	00	08	-03	07	07	-05	09	02	01	28	09	-07	10	-04	04	-02
37	00	-07	-06	02	-06	-01	05	02	-04	-02	01	15	00	43	09	09	04	00
38	07	-04	02	-01	01	08	04	28	05	-04	07	12	-08	-07	04	03	-06	05
39	-01	11	-05	-05	06	12	08	08	27	-10	02	01	13	-06	-09	05	02	01
40	-07	-02	-06	12	-06	-02	-06	08	11	17	02	23	02	12	-01	17	01	00
41	-04	-06	03	02	03	-01	44	22	-11	-14	-11	01	12	-09	-04	-07	12	03
42	-02	-07	06	07	-06	-09	-06	-03	40	10	-01	02	-11	14	13	00	-08	05
43	00	05	00	01	-05	-06	04	13	21	29	03	04	-04	00	-05	02	-04	07
44	20	05	02	-02	04	-05	05	02	-01	-05	-03	40	-15	11	-04	11	07	04
45	-05	01	03	-09	04	-05	10	18	-07	-03	01	01	03	-02	00	-04	-03	04
46	-05	-01	00	07	01	-04	19	12	-07	-15	-02	02	-05	05	-04	38	-02	-04
47	-09	-05	-05	-11	05	05	09	29	-03	-12	-08	-02	19	-24	08	06	00	01
48	14	04	09	00	03	04	-01	25	03	01	-02	-05	07	-08	00	07	-03	07
49	-02	-08	04	29	02	-07	00	-06	-04	06	02	03	-04	03	03	02	04	48
50	05	05	00	-04	02	08	-03	-01	05	-01	-02	00	03	-02	05	01	01	43
51	02	-04	29	-03	02	00	03	00	02	02	04	08	01	-03	02	-02	-01	01
52	-04	-07	19	07	-07	05	12	00	07	02	-03	-02	-02	02	-02	16	03	-06
53	13	30	03	02	-03	12	07	-02	15	00	01	-05	-05	06	-01	20	-02	-02
54	08	-06	05	07	-03	03	30	02	02	07	04	-05	03	-03	05	-02	04	01
55	02	-04	-06	29	-01	05	16	-02	02	-02	06	06	-07	07	03	31	-03	-04
56	00	04	37	02	03	02	-02	-03	-01	-01	-05	-04	00	02	-01	01	04	-01
57	63	-05	01	05	04	00	-03	01	05	02	02	-03	03	-03	-05	-09	06	-04
58	59	01	01	07	-02	-02	-09	-04	03	03	03	02	00	00	01	12	-04	-04
59	00	08	-04	52	-02	-13	-12	02	-05	01	-04	00	-05	06	01	20	05	-03
60	14	-08	15	14	-09	00	01	04	17	13	12	03	-07	-06	06	04	-03	02
61	00	04	12	35	00	10	14	02	02	-03	01	01	02	-08	-01	-18	00	09
62	02	20	02	15	-09	02	10	-06	13	04	08	12	-02	07	15	05	-15	07
63	33	08	-09	11	-09	03	-01	00	06	04	04	00	-02	01	-03	31	00	01
64	05	00	03	04	29	-09	11	-01	00	07	-02	-03	00	06	09	04	-05	-02
65	05	-03	00	-01	30	01	06	-04	03	-04	-03	-02	00	-01	09	-06	06	01
66	04	-12	-04	19	25	-03	15	-02	00	00	03	02	-07	06	03	-03	-01	03
67	07	02	06	03	35	00	-10	00	01	00	-01	01	-03	-06	01	02	-01	04
68	00	-02	-05	-07	46	07	10	06	-13	-06	01	04	-03	-01	-03	-03	06	03
69	02	02	-04	09	40	01	-06	03	05	04	03	-05	01	01	-02	01	00	-02
70	03	02	-04	-05	19	04	02	05	04	11	-01	05	09	-03	06	03	00	09

*Decimals points have been omitted.

TABLE 4
Transformation Matrix*

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII
1	75	07	00	-08	08	-17	00	-08	-23	00	-05	-06	00	-10	00	14	00	15
2	-15	82	04	-25	09	-20	08	08	-10	-09	-09	00	07	10	-09	11	00	00
3	00	-06	60	08	-08	10	00	00	00	-26	00	00	00	00	00	-08	00	00
4	25	-10	-04	84	-17	00	-16	00	00	00	00	00	-08	00	00	09	00	00
5	00	08	-10	-08	85	09	-10	00	00	00	00	09	00	00	00	-19	00	00
6	00	-16	-21	00	00	78	00	00	19	00	00	00	10	00	00	00	00	00
7	08	-21	00	-25	-09	04	77	-08	-08	-26	09	-09	00	00	09	-04	00	-10
8	-37	-08	-18	08	-21	-17	00	75	-08	00	09	09	00	10	00	00	00	00
9	22	-25	00	17	00	00	00	-15	75	00	09	-28	00	00	00	00	00	00
10	-15	00	00	09	-21	-17	-12	-23	18	86	00	00	10	-10	00	-17	09	00
11	-15	12	-26	00	00	20	-08	-23	00	09	89	00	00	00	00	00	00	00
12	00	-12	-21	17	-10	-09	08	-23	30	17	22	91	-11	00	28	-18	-28	00
13	00	16	-40	00	17	00	-16	08	-18	-17	-18	06	95	-14	00	-19	00	00
14	21	16	00	00	-17	-38	00	-30	-08	21	-13	18	-10	95	09	09	09	00
15	-15	22	-18	08	-17	-17	00	-23	00	-09	00	00	10	14	94	00	00	00
16	00	08	08	-10	08	-16	-53	00	-30	00	-18	-09	-17	10	-09	90	00	00
17	00	00	-48	17	10	-10	-16	30	-24	-09	-18	-18	00	-10	00	00	94	00
18	-22	16	-09	-17	09	00	00	08	-11	00	-09	-06	10	00	00	09	09	98

*Decimals points have been omitted.

TABLE 5
Correlations Between Primaries*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	100																		
2	27	100																	
3	24	08	100																
4	-30	19	19	100															
5	-08	-08	44	49	100														
6	32	38	30	07	04	100													
7	-07	18	39	61	59	19	100												
8	61	22	52	-02	29	36	27	100											
9	19	27	22	-11	10	-01	13	31	100										
10	31	16	53	25	50	43	58	61	04	100									
11	33	-02	54	02	29	01	18	46	13	30	100								
12	19	10	53	02	17	25	29	27	31	21	24	100							
13	14	-08	70	25	43	14	51	39	28	48	51	46	100						
14	05	-17	08	02	15	19	-03	20	-03	08	15	-13	15	100					
15	40	06	52	-03	35	35	19	61	10	53	33	15	32	04	100				
16	03	08	53	40	54	22	75	36	37	54	35	50	69	-07	32	100			
17	16	09	68	03	23	24	33	26	38	29	42	67	55	-04	27	50	100		
18	03	-10	-04	01	-10	-07	-09	-07	-03	-13	01	-04	-10	03	-07	-14	-08	100	

*Decimals points have been omitted.

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