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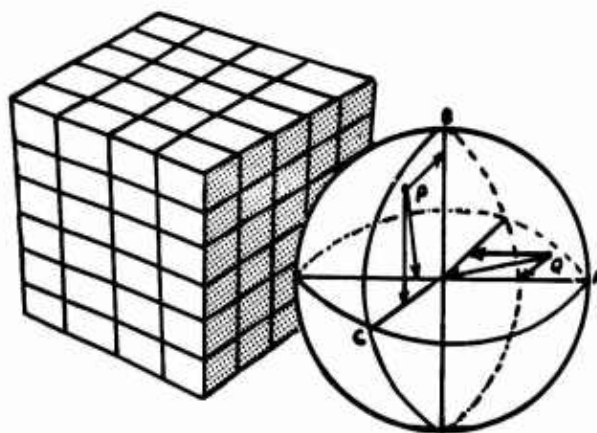| AUTHORITY |
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STRUCTURE-OF-INTELLECT FACTORS AND THEIR TESTS, 1966

Studies of Aptitudes of High-level Personnel

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REPORTS FROM THE PSYCHOLOGICAL LABORATORY
UNIVERSITY OF SOUTHERN CALIFORNIA
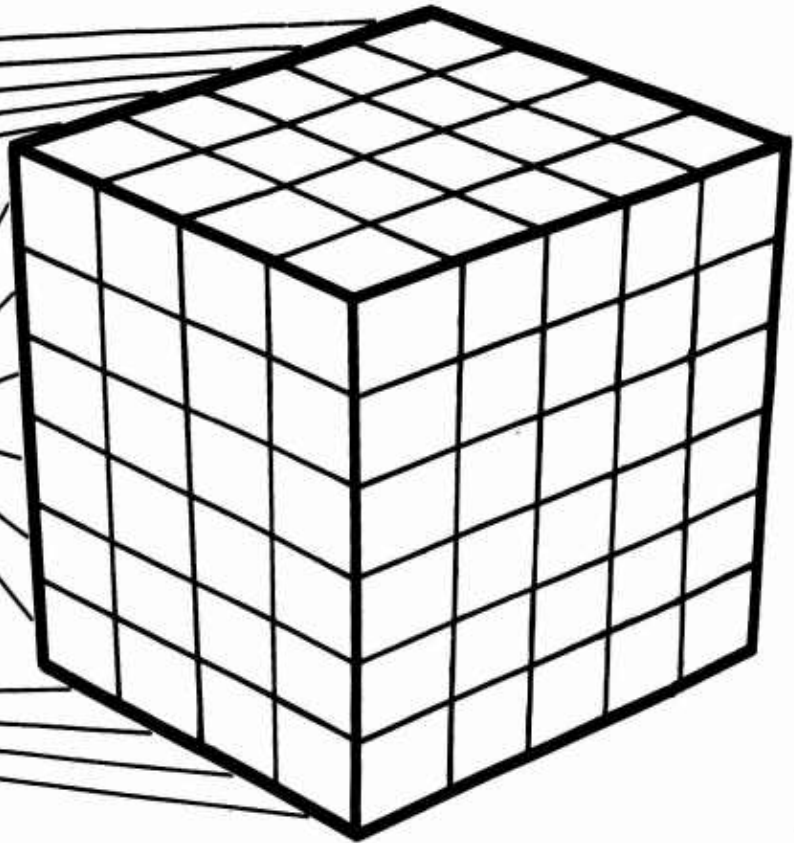
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The ideas basic to the structure-of-intellect theory were formulated in the late 1950's, and were successively refined until the present model was formulated. The model is a three-way classification of intellectual abilities designed to encompass and organize intellectual-aptitude factors. It has also served to predict the existence of undiscovered factors.

The three dimensions of the model specify (a) the operation, (b) the content, and (c) the product of a given kind of intellectual act. These dimensions and their subcategories are considered in detail below. Each factor hypothesized or accounted for by the model is uniquely located and defined by specifying a category on each of the three dimensions. The three categories that specify each factor are coded in terms of a trigram symbol specifying the operation, content, and product, respectively, for the factor. The letters employed as codes are given below with definitions of the dimensions and their categories.

Definitions of Categories in the
Structure of Intellect

OPERATIONS

Major kinds of intellectual activities or processes; things that the organism does with the raw materials of information, information being defined as "that which the organism discriminates."

C — Cognition. Immediate discovery, awareness, rediscovery, or recognition of information in various forms; comprehension or understanding.

M — Memory. Retention or storage, with some degree of availibility, of information in the same form it was committed to storage and in response to the same cues in connection with which it was learned.

D — Divergent Production. Generation of information from given information, where the emphasis is upon variety and quantity of output from the same source. Likely to involve what has been called transfer. This operation is most clearly involved in aptitudes of creative potential.

N — Convergent Production. Generation of information from given information, where the emphasis is upon achieving unique or conventionally accepted best outcomes. It is likely the given (cue) information fully determines the response.

E — Evaluation. Reaching decisions or making judgments concerning criterion satisfaction (correctness, suitability, adequacy, desirability, etc.) of information.

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Broad classes or types of information discriminable by the organism.

F — Figural. Information in concrete form, as perceived or as recalled possibly in the form of images. The term "figural" minimally implies figure-ground perceptual organization. Visual spatial information is figural. Different sense modalities may be involved, e.g., visual kinesthetic.

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S— Symbolic. Information in the form of denotative signs, having no significance in and of themselves, such as letters, numbers, musical notations, codes, and words, when meanings and form are not considered.

M— Semantic. Information in the form of meanings to which words commonly become attached, hence most notable in verbal thinking and in verbal communication but not identical with words. Meaningful pictures also often convey semantic information.

B— Behavioral. Information, essentially non-verbal,involved in human interactions where the attitudes, needs, desires, moods, intentions, perceptions, thoughts, etc., of other people and of ourselves are involved.

PRODUCTS

Forms that information takes in the organism's processing of it.

U— Units. Relatively segregated or circumscribed items of information having "thing" character. May be close to Gestalt psychology's "figure on a ground."

C— Classes. Conceptions underlying sets of items of information grouped by virtue of their common properties.

R— Relations. Connections between items of information based upon variables or points of contact that apply to them. Relational connections are more meaningful and definable than implications.

S— Systems. Organized or structured aggregates of items of information; complexes of inter-related or interacting parts.

T— Transformations. Changes of various kinds (redefinition, shifts. or modification) of existing information or in its function.

I— Implications. Extrapolations of information, in the form of expectancies, predictions, known or suspected antecedents, concomitants, or consequences. The connection between the given information and that extrapolated is more general and less definable than a relational connection.

The Known Factors and Some of Their
Recommended Tests

This summary has been prepared for the benefit of those who would like concrete referents for the factor concepts and those who may want to utilize factor tests in their research.

The factors are listed in systematic order, following categories in the structure-of-intellect model. The major sequence is in terms of the operation categories — cognition, memory, divergent production, convergent production, and evaluation. Within each operation category, the products are taken in turn — units, classes, relations, systems, transformations,

and implications. Within each product category, the content categories are taken in turn— figural, symbolic, semantic, and behavioral.

The sources of the various tests are given in terms of the following abbreviations:

A— Adkins, D. C., & Lyerly, S. B. Factor analysis of reasoning tests. Chapel Hill, N. C.: Univer. North Carolina, 1951.

Cr— Christal, R. E. Factor analytic study of visual memory. Psychological Monographs, 1958, 72 ('Whole No. 466).

ETS— Educational Testing Service, Princeton, N. J. Kit of reference tests for cognitive factors, by French, J. W., Ekstrom, Ruth B., & Price, L. A., 1963.

F— Fleishman, E. A., Roberts, M. M. & Friedman, M. P. A factor analysis of aptitude and proficiency measures in radiotelegraphy. Journal of Applied Psychology, 1958, 42, 129-137.

Kn— Karlin, J. E. A factorial study of auditory function. Psychometrika, 1942, 7, 251-279.

Ky— Kelley, H. P. Memory abilities: a factor analysis. Psychometric Monographs, No. 11, 1964.

LLT— Thurstone, L. L. A factorial study of perception. Psychometric Monographs, No. 4, 1944.

SPS— Sheridan Psychological Services, Box 837, Beverly Hills, California.

USAF— United States Air Force, Personnel Research Laboratory, Lackland Air Force Base, Texas. Forms modified in research at the University of Southern California are designated as USAF-M.

All other tests, without such symbols, were designed as experimental tests by the Aptitudes Research Project, U. S. C. The number of the most recent Report from the Psychological Laboratory in which each test is more completely described with a sample item is enclosed in parentheses at the end of each test description. The Reports are listed on the last page, with instructions for obtaining them.

Permission to reproduce certain Project tests for research purposes is usually granted to qualified investigators upon their completion of a prepared test-request form. Exceptions are tests subsequently published, tests that have not yet been factor analyzed, and tests with photographic or auditory content that cannot be reproduced without sacrificing much of the information in the items.

Preceding the factors and tests for each operation category there appears a matrix for the factors in that category. The appearance of a trigram for a cell indicates that the ability has been demonstrated as a factor. The letter "I" indicates that the hypothesized factor is currently under investigation.

COGNITION FACTORS

	Figural	Symbolic	Semantic	Behavioral
Units	CFU-V CFU-A	CSU-V CSU-A	CMU	CBU
Classes	CFC	CSC	CMC	CBC
Relations	CFR	CSR	CMR	CBR
Systems	CFS	CSS	CMS	CBS
Transformations	CFT	(I)	CMT	CBT
Implications	CFI	CSI	CMI	CBI

CFU-V - the ability to "close" figural information to perceive a complete visual form.

Gestalt Completion Test - Write the names of objects presented in silhouette figures with enough parts blotted out to make the task of cognition sufficiently difficult for testing purposes. (ETS) (34)

Concealed Words Test - Recognize words in which part of each letter has been erased. (ETS) (34)

Peripheral Span - Recognize letters flashed 1/25th second in peripheral vision. Individually administered. (LLT)

Dark Adaptation - Recognize letters in dim illumination: test individually administered. (LLT)

CFU-A - the ability to perceive auditory figural units by organizing groups of successive inputs.

Copying Behind - Mark the digits 1 to 5 on an answer sheet following the hearing of the scrambled digits read in rapid succession. (F)

Army Radio Code - Discriminate the code signals for the letters I, N, and T after 25 minutes of instruction and practice. (F)

Dot Perception - Report how many dots, from 1 to 5, are given at the beginning or end of a series of code signals. (F)

CSU-V - the ability to recognize graphic symbolic units, such as words.

Word Combinations - Make a new word using the last letters of one word and the initial letters of the next. (33)

Omelet Test - Recognize a word whose letters have been scrambled. (23)

Disemvoweled Words - Recognize a word whose vowels have been removed. (38)

Correct Spelling - Recognize whether or not given words are spelled correctly. (SPS) (38)

CSU-A - the ability to decode auditory information in the form of language symbols.

Haphazard Speech - Recognize short phrases spoken with unusual inflection and pitch changes. (Kn)

Illogical Grouping - Recognize short phrases spoken with grouping contrary to sense of the passage. (Kn)

Singing - Recognize words in a short selection sung with piano accompaniment. (Kn)

CMU - the ability to comprehend the meanings of words or ideas.

Guilford-Zimmerman Verbal Comprehension - A multiple-choice vocabulary test. (SPS) (39)

Reading Comprehension - Answer multiple-choice questions concerning meanings in a paragraph. (USAF)

Information Test - Part of the Wechsler Adult Intelligence Scale.

Word Completion - Write a synonym or short definition for each given word. (39)

CBU - the ability to understand units of expression, such as facial expression.

Faces - Indicate which man's face expresses the same feeling or intention as a given woman's face. (34)

Expressions - indicate the gesture, posture, or expression that expresses the same thought, feeling, or intentions as the given gesture, posture, or expression. (34)

CFC - the ability to recognize classes of figural items of information.

Figure Classification - Recognize classes of three sets of figures each, then assign given figures to the classes. (39)

Picture Classification - Assign pictures to classes each defined by a group of three pictures. (35)

Figural Class Inclusion - Assign, from five alternatives, one figure that contains the same property or properties as two given figures. (39)

CSC - the ability to recognize common properties in sets of symbolic information.

Number-Group Naming - State what it is that three given numbers have in common. (39)

Number Classification - Select one of five alternative numbers to fit into each of four classes of three given numbers each. (39)

Best Number Pairs - Choose one of three number pairs that makes the most exclusive (best) class. (33)

CMC - the ability to recognize common properties of words, ideas, and objects.

Word Classification - Select the one word in a set of four that does not belong to the class by virtue of its meaning. (39)

Verbal Classification - Assign each word to one of two classes, or to neither, each class being represented by a set of four words. (34)

Sentence Classification - Decide whether each given sentence conveys fact, possibility, or a name. (39)

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CBC - the ability to see similarity of behavioral information in different expressional modes.

Expression Grouping - Choose the alternative expression that belongs with a given group of expressions. (SPS) (34)

Picture Exclusion - Indicate the one photographed expression that does not belong with three other given photographed expressions on the basis of the thoughts, feelings, or intentions portrayed. (34)

CFR - the ability to recognize figural relations between forms.

Figure Analogies - From multiple choices, select a figure that completes an analogy. (11)

Figure Matrix - From multiple choices, select a figure to fill a matrix cell, in a 3 x 3 matrix with a different relation in columns and rows. (34)

CSR - the ability to see relations between items of symbolic information.

Seeing Trends II - Find a repeated relationship between successive pairs of words in a series, the relations being in the form of spelling or alphabetical properties. (33)

Word Relations - A kind of analogies test in which the items of information related are words, the relations being in the form of spelling or alphabetical properties. (33)

CMR - the ability to see relations between ideas or meanings of words.

Verbal Analogies I - From multiple choices select a word to complete a meaningful relationship. (34)

Word Matrix Test - Discover relations in rows and columns, then supply the missing word. (34)

CBR - the ability to understand social relationships.

Social Relations - Select one of three given statements that expresses the feeling of a given face, taking into account the relationship demonstrated in another, interacting, face. (34)

Silhouette Relations - Select one of three photographed faces that expresses the individual's feeling or intention in a silhouette relationship between two people. (34)

CFS - the ability to comprehend arrangements and positions of visual objects in space.

Card Rotations Test - From a group of six drawings of a card shown rotated and/or turned over, indicate which ones show the card not turned over. (ETS)

Cube Comparisons Test - Indicate which items present two drawings that can be of the same cube and which cannot, judging from the markings on the faces of the cubes. (ETS)

Guilford-Zimmerman Spatial Orientation - Indicate the position of a boat with respect to the landscape after a pictured change in the boat's position. (SPS)

CSS - the ability to understand the systematic interrelatedness of symbols within an organized set.

Circle Reasoning - Discover the rule for marking one circle in sequence with other circles and with dashes. (33)

Letter Triangle - Find the system by which letters of the alphabet are arranged in a triangular pattern, with some vacant positions, then select one of five alternative answers (letters) to fill a designated position. (33)

Number Series - Find the rule for series of numbers and write a description of each series. (11)

Letter Series - Find the rule for series of letters and write the next two letters in each series. (11)

CMS - the ability to comprehend relatively complex ideas.

Guilford-Zimmerman General Reasoning - A multiple-choice arithmetic-reasoning test in which numerical computation is minimized. (SPS)

Ship Destination - Find the distance of a ship to a port, taking into account the influences of an increasing number of variables. (SPS) (39)

Necessary Arithmetical Operations - Given the facts of a problem, select from multiple choices the pair of number operations needed to solve the problem. (14)

Necessary Facts - Given all necessary facts but one, state the one that is missing to make the arithmetical problem structure complete. (31)

Problem Solving - Solve five-choice verbally stated problems, using arithmetic. (39)

CBS - the ability to comprehend a social situation or sequence of social events.

Missing Pictures - Select one of three photographed social interactions that completes a given story, making sense of the thoughts and feelings of the actors in the photographed story. (SPS) (38)

Missing Cartoons - Select one of four alternative cartoons that completes a cartoon strip, making sense of the thoughts and feelings of the characters. (SPS) (38)

CFT - the ability to visualize how a given figure or object will appear after given changes, such as unfolding or rotation.

Form Board Test - Indicate which scrambled black pieces would fit together to form a given complete figure. (ETS)

Paper Folding Test - Select one of five drawings of fully-opened paper that shows how a given folded and punched paper would look unfolded. (ETS)

Surface Development Tests - Indicate which lettered edges in a drawing of a solid figure correspond to numbered edges, or dotted fold lines, in a plane diagram of the unfolded sides of the solid. (ETS)

Guilford-Zimmerman Spatial Visualization - Indicate among alternatives the position of an alarm clock after illustrated maneuvers. (SPS)

CMT - the ability to see potential changes of interpretations of objects and situations.

Similarities - Give as many as six ways in which two given objects are alike. (32)

Social Institutions - Suggest two improvements each for institutions, such as taxes, divorce, etc. The score is the number of farsighted needed improvements given. (11)

Cartoons - Write as many as two "punch lines" for given cartoons. (11)

CBT - the ability to reinterpret either a gesture, a facial expression, a statement, or a whole social situation so that its behavioral significance is changed.

Picture Exchange - Select one of three alternative photographs that, when substituted for a given picture in a story sequence, will change the meaning of the story by altering the thoughts, feelings, or intentions of the actors. (SPS) (34)

Social Translations - Select one of three diadic pairs between which a given verbal statement would have a different meaning or intention, from that given. (SPS) (34)

CFI - the ability to forsee the consequences involved in figural problems.

Competitive Planning - Starting with four incomplete, adjacent squares, add one line at a time, playing for two opponents, in such a way as to maximize the numbers of squares completed by both. (USAF-M) (10)

Route Planning - A maze-tracing test, in which the examinee indicates through which lettered points he must pass in order to reach the goal. (USAF-M) (10)

Planning a Circuit - Trace visually an electrical circuit diagram with overlapping wires and indicate which pair of terminals should be attached to a battery to make the circuit work. (USAF-M) (10)

CSI - the ability to forsee or to be sensitive to consequences in a symbolic problem.

Word Patterns - Arrange a given set of words efficiently in a kind of crossword-puzzle pattern. (33)

Symbol Grouping - Rearrange scrambled symbols of three kinds to achieve a specified systematic order in as few moves as possible. (33)

S-Test - Discover problems in items composed of numbers, letters, and words and solve the problems. (33)

CMI - the ability to anticipate or be sensitive to the needs of or the consequences of a given situation in meaningful terms.

Pertinent Questions - Write as many as four questions, the answers to which should help to reach a decision in a conflict situation. (SPS) (32)

Alternate Methods - List as many as six different ways of accomplishing a certain task. (10)

Seeing Problems - Write as many as five problems arising from the presence of a given object. (35)

Apparatus Test - Suggest two improvements in each of some common appliances. (32)

CBI - the ability to draw implications or make predictions about what will happen following a given social situation.

Cartoon Predictions - Select one of three cartoon situations that can be predicted from the given cartoon, based upon the feelings and intentions of the cartoon characters. (34)

MEMORY FACTORS

	Figural	Symbolic	Semantic	Behavioral
Units	MFU (I)	MSU	MMU	
Classes	(I)	MSC	MMC	
Relations	(I)	MSR	MMR	
Systems	MFS-V MFS-A (I)	MSS	MMS	
Transformations	(I)	MST	MMT	
Implications	(I)	MSI	MMI	

MFU - the ability to remember given figural objects.

Reproduction of Designs - Reproduce geometric-type designs having had a brief exposure to them. (Ky)

Map Memory - Select from multiple choices the segment of a map previously studied. (USAF)

MSU - the ability to remember isolated items of symbolic information, such as syllables and words.

Memory for Listed Nonsense Words - Recognize whether given nonsense syllables were on a previously studied page. (38)

Memory for Nonsense Words-Free Recall - Recall three-letter nonsense words presented on a previously studied page. (38)

Memory for Digital Units - Recognize whether given two-digit numbers were previously read aloud. (38)

MMU - the ability to remember isolated ideas or word meanings.

Picture Memory - Recall names of common objects pictured on a previously studied page. (37)

Recalled Words - Recall words presented on a previously studied page. (37)

Word Recognition - Recognize whether given words were on a previously studied page. (37)

MSC - the ability to remember symbolic class properties.

Memory for Number Classes-Recall - Recall the class properties of groups of three numbers each that were studied on a previous page. (38)

Memory for Nonsense Word Classes - Indicate which of four nonsense words given in each item on a test page represents a class given on a previously studied page. (39)

Memory for Word Classes - Indicate whether each of a number of words on a test page represents a class studied on a previous page. (39)

MMC - the ability to remember verbal or ideational class properties.

Classified Information - Recognize classes similar to those given on a previously studied page. (39)

Picture Class Memory - Indicate whether or not a given two-element class represents the same concept as one given on a previously studied page. (39)

MSR - the ability to remember definitive connections between units of symbolic information.

Memory for Word-Number Relations - Remember the connections, based on symbolic properties, between words and numbers given in two pairs and then indicate which number from four alternatives is associated with a new word on the basis of the remembered connection. (38)

Memory for Name Relations - Remember what kind of last name goes with first names, based on symbolic properties, and on the basis of memory choose one last name from four alternatives that goes with a given new first name. (38)

Memory for Letter Series - Recognize the series rule associated with a given letter on a previously studied page. (38)

Memory for Numerical Relations - Recall the symbolic relationship between numbers presented in pairs on a previously studied page. (38)

MMR - the ability to remember meaningful connections between items of verbal information.

Remembered Relations - Complete sentences from alternatives in a manner consistent with previously studied relationships. (37)

Recalled Analogies - Recall missing elements for previously studied incomplete verbal analogies. (37)

MFS-V - the ability to remember the spatial order or placement of given visual information.

Space Memory - Identify the form that was previously exposed in each of five sections within five squares. (Cr)

Position Memory - Recall the position of a number-word pair approximately four hours after the initial administration of the Number-Word test. (Ky)

MFS-A - the ability to remember auditory complexes of rhythm or melody.

Musical Memory - Recognize musical compositions heard earlier. (Kn)

Rhythm - Recognize patterns of taps. (Kn)

MSS - the ability to remember the order of symbolic information.

Memory for Transpositions - Recognize changes in two auditory presentations of the order of two sets of four numbers. (38)

Consonant, Digit, and Nonsense Word Span - Recall series of consonants, digits, and nonsense words in order after auditory or visual presentation. (38)

Memory for Order of Listed Numbers - Recognize which of four alternative numbers was presented first in a list of twelve numbers on a previously studied page.

MMS - the ability to remember meaningfully ordered verbal information.

Learned Information - Reproduce a short essay, with ideas in proper sequence, given several key terms in scrambled order. (37)

Memory for Test Order - Indicate whether or not a given test preceded another in a test booklet just completed. (37)

MST - the ability to remember changes in symbolic information.

Memory for Word Transformations - Recognize which of two divisions of a large word into two smaller words is the same as that presented on a previously studied page. (38)

Memory for Hidden Transformations - Recognize whether words hidden in sentences are formed in the same way they were formed on a previously studied page. (38)

MMT - the ability to remember changes in meaning or redifinitions.

Double Meanings - Recognize pairs of definitions that were or were not presented as words with double meanings in sentences previously studied. (37)

Homonyms - Recognize a definition that matches the definition of the "other element" in a pair of previously studied homonyms. (37)

MSI - the ability to remember arbitrary connections between symbols.

Guilford-Zimmerman Numerical Operations - Add, subtract, multiply, and divide numbers; a multiple-choice test. (SPS) (33)

Number-Letter Association - Recall letters arbitrarily associated with numbers upon presentation of the number. (38)

Addition Test - Add sets of one- and two-digit numbers. (ETS)

Division Test - Divide two- and three-digit numbers by single digits. (ETS)

Subtraction and Multiplication Test - Subtract two-digit numbers; multiply two-digit numbers by single digits. (ETS)

MMI - the ability to remember arbitrary connections between pairs of meaningful elements of information.

    Related Alternatives - Recognize objects that are related to persons' jobs, based upon studying a page of name-job pairs. (37)
    Books and Authors - Recall probable occupations for given fictitious persons after studying a page of name-book pairs. (37)
    Paired Associates Recall - Recall word-word paired associates (38)

DIVERGENT-PRODUCTION FACTORS

	Figural	Symbolic	Semantic	Behavioral
Units	DFU	DSU	DMU	(I)
Classes	DFC	DSC	DMC	(I)
Relations		DSR	DMR	(I)
Systems	DFS	DSS	DMS	(I)
Transformations	DFT	(I)	DMT	(I)
Implications	DFI	DSI	DMI	(I)

DFU - the ability to produce many figures that conform to simple specifications.

    Make a Figure - Given three lines, e.g., two short, straight lines and a curved line, make different combinations in limited time. (35)
    Make a Mark - Make simple figures of a specified kind, e.g., open figures composed of curved lines. (35)
    Sketches - Add figural details to several replications of the same basic design to produce a variety of recognizable objects. (SPS) (35)
    Dot Systems - Draw two copies of a given letter in different, relative positions within a matrix of equally spaced dots. (35)

DSU - the ability to produce many symbolic units, like words, that conform to simple specifications not involving meanings.

    Word Fluency - Write words containing a specified letter. (SPS) (39)
    Suffixes - Write words ending with a specified suffix. (39)
    Word Beginnings Test - Write words beginning with a specified prefix. (ETS)
    Word Beginnings and Endings Test - Write words with specified first and last letters. (ETS)

DMU - the ability to produce many elementary ideas appropriate to given requirements.

    Ideational Fluency - Write names of things fitting relatively broad classes, e.g., things that are white and adible. (SPS) (37)
    Topics Test - Write ideas about a given topic. (ETS)
    Theme Test - Write as many words as possible about a given topic. (ETS)
    Thing Categories Test - List things that are round or that could be called round. (ETS)

    Plot Titles (non-clever) - List appropriate titles for a given short story. (37)
    Consequences (obvious) - List consequences of a proposed unusual event, e.g., no babies born for one year. (SPS) (37)
    Utility Test (fluency) - List uses for a common brick and for a common wooden pencil. (SPS) (37)

DFC - the ability to group figural information in different ways.

    Varied Figural Classes - Given a collection of three figural objects that can be conceived as representing different classes, which ones of five single figures can be classified with the three? (35)

    Alternate Letter Groups - Find letters that belong to a class because of a commonality of shapes or figural elements. (39)
    Figural Similarities - Use figural aspects of six complex figures to form classes of three figures each, based on some common feature. (35)
    Multiple Grouping of Figures - Group and regroup a number of given figures into as many different classes as possible. (39) .

DSC - the ability to group items of symbolic information in different ways.

    Multiple Letter Similarities (Varied Symbols) - Indicate the different common properties that sets of letter combinations may have in common. (39)

    Name Grouping - Classify a group of common names into several groups based upon the different spelling principles they have in common. (39)

    Multiple Grouping of Nonsense Words - Form as many different classes as possible from a given list of nonsense words.

DMC - the ability to produce many categories of ideas appropriate in meaning to a given idea.

    Utility Test (flexibility) - List uses for a common brick and for a common wooden lead pencil. Score is the number of shifts of classes in consecutive responses. (SPS) (39)

    Alternate Uses - List as many as six uses for an object, such as a newspaper, other than the common use, which is stated. (SPS) (39)
    Multiple Grouping - Arrange given words into different meaningful groups. (39)

DSR - the ability to relate letters or numbers in many different ways.

Letter Group Relations - Given a set of four letters that are related in several possible ways, select other sets of four that have the same relations. (35)

Number Rules - Given a starting number, relate one or more numbers to it in various ways to achieve a given result. (35)

Alternate Additions - Show how numbers in a set may be related in obtaining the same total using any or all given numbers, when only addition is permitted and only the given numbers may be used to obtain the same total in different ways. (35)

DMR - the ability to produce many relationships appropriate in meaning to a given idea.

Associational Fluency - Write synonyms for each of several given words, e.g., for the word "hard." (SPS) (37)

Simile Insertions - Supply a variety of appropriate words to fill each blank in a given simile. (37)

Controlled Associations - Write a number of synonyms for each given word. (11)

DFS - the ability to produce composites of figural information in many ways.

Making Objects - Given a few figures and lines, construct from them, with nothing added, specified, meaningful objects. (SPS) (35)

Monograms - Given three letters, e.g., A, V, and O, invent a variety of monogram designs. (35)

Designs - Given five figural elements, e.g., a line, a curve, a dot, an angle, and a circle, combine them in various ways to produce designs such as appear on wall paper, linoleum, or fabrics. (35)

DSS - the ability to organize sets of symbolic information into different systematic arrangements.

Make a Code - Invent a variety of code systems, using numbers and letters. (35)

DMS - the ability to organize words in various meaningful complex ideas.

Expressional Fluency - Construct a variety of four word sentences, given four initial letters, no word be used more than once. (SPS) (37)

Simile Interpretations - Complete in a number of ways a statement involving a simile, giving explanatory remarks. (37)

Word Arrangement - Write a number of sentences, each containing four specified words. (17)

DFT - the ability to process figural information in revised ways.

Match Problems II - Given a set of adjacent squares or triangles of the same size, each line being composed of a match, take away a specified number of matches to leave a specified number of squares (triangles) with no matches left over, solving each item in as many as four ways. (SPS) (35)

Match Problems III - Similar to Match Problems II, with some more difficult items requiring more insight. (35)

Match Problems IV - Similar to Match Problems II, except number of matches to be removed is not specified. (35)

Match Problems V - Similar to Match Problems II, except number of remaining squares is not specified. (35)

Planning Air Maneuvers - Select the most direct path in "skywriting" letter combinations (two capital letters) with an airplane. (USAF-M) (35)

DMT - the ability to produce unusual, remote, or clever responses involving reinterpretation or new emphasis on some aspect of an object or situation.

Plot Titles (clever) - Write titles for a short story; only clever titles being counted. (37)

Consequences (remote) - Give remote (distant in time or in space or in sequence of events) consequences for a specific event. (SPS) (37)

Symbol Production - Produce varied simple symbols to represent given activities and objects. (35)

Riddles (clever) - Give clever solutions to riddles. (18)

DFI - the ability to elaborate upon given figural information.

Decorations - Given articles of furniture and other objects in outline form, add decorative lines and markings. (SPS) (35)

Production of Figural Effects - Given a very simple line or two, build upon the given information to produce a (non-meaningful) figure of some degree of complexity. Scoring is in terms of amount added. (35)

Figure Production - Same as the previous test, except that a meaningful object is to be produced. (35)

DSI - the ability to produce varied implications from given symbolic information.

Limited Words - Given two common words, make a number of new word pairs from the letters included, using all the letters given. (35)

Symbol Elaboration - Given two simple equations involving letters, deduce a variety of other equations that follow from them. (35)

DMI - the ability to produce many antecedents, concurrents, or consequents, of given information.

Planning Elaboration - Add detailed operations needed to make a briefly outlined plan succeed. Scored in terms of number of details added. (37)

Possible Jobs - For a given figural symbol (emblem) suggest a number of different occupations or groups of people for which it might stand. (SPS) (37)

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CONVERGENT-PRODUCTION FACTORS

	Figural	Symbolic	Semantic	Behavioral
Units			NMU	
Classes	NFC	NSC	NMC	
Relations		NSR	NMR	
Systems		NSS	NMS	
Transformations	NFT	NST	NMT	
Implications		NSI	NMI	

NMU - the ability to converge upon an appropriate name or summarizing word for any given information.

Picture-Group Naming - Provide the class name for a group of five pictured objects. (39)
Word-Group Naming - Provide the class name for a group of five words. (39)
Naming Meaningful Trends (Seeing Trends I) - Name the meaningful trend in a group of words, where the order is not completely correct, but there is a trend. (39)

NFC - the ability to classify uniquely or conventionally items of figural information.

Figure-Concept Grouping - Classify a group of given figures so that the attribute of each class formed is also an attribute of a given target figure. (39)

NSC - the ability to classify uniquely items of symbolic information.

Letter Grouping - Group a given list of nonsense words into four classes, using each word only once. (39)
Restricted Symbolic Classifications - Classify a given list of nonsense words so that each word is a member of two classes. (39)

NMC - the ability to produce verbally meaningful classes under tight restrictions for class production.

Word Grouping - Given 12 common words, put them into four, and only four, classes, leaving no extra words. (39)
Figure Concepts (uncommon) - Given a collection of pictured objects, combine them in classes, the score being the number of uncommon classes. (4)
Largest Class - Form the largest possible class of words from a given list so that the remaining words also form a class. (39)

NSR - the ability to complete a specified symbolic relationship.

Correlate Completion II - Discover the rule by which two pairs of words are related, then apply it to a third pair, completing it. (31)

NMR - the ability to produce a word or idea that conforms to specific relational requirements.

Inventive Opposites - Write two antonyms for a given word, first letters of the responses being given. (LLT) (17)
Associations III - Produce a word that is similar in meaning to two other given words. (17)

NSS - the ability to produce a fully determined order or sequence of symbols.

Operations Sequence - State the order in which a sequence of numerical operations should be performed in going from one number to another. (33)
Word Changes - State the order in which to place words in order to go from a given starting word to a given goal word, changing only one letter at each step. (33)

NMS - the ability to order information into a verbally meaningful sequence.

Picture Arrangement - Given the four pictures of a comic strip, scrambled, indicate the temporal order needed to make sense. (A) (34)
Sentence Order - Indicate the temporal order in which three stated events should be placed to make sense. (34)
Temporal Ordering - List steps in appropriate order to complete a project, e. g. , planting a new lawn. (10)

NFT - the ability to break down given figural units to form new ones.

Penetration of Camouflage - Locate faces hidden in complex pictorial scenes. (USAF) (34)
Hidden Figures - Indicate which of five simple figures is concealed in each of the more complex Gottschaldt figures. (34)
Hidden Pictures - Find human or animal pictures hidden in a complex scene. (LLT)

NST - the ability to produce new symbolic items of information by revising given items.

Camouflaged Words - Find the name of a sport or game concealed in a sentence. (33)
Word Transformations - Indicate new divisions between letters in the words of a phrase. (33)

NMT - the ability to produce new uses for objects by tearing them out of their given context and redefining them.

Gestalt Transformation - Select one of five alternative objects, or parts of objects, to be used to serve a stated purpose. (22)
Object Synthesis - Name an object that could be readily made by combining two given objects. (11)
Picture Gestalt - Indicate which objects in a photograph will serve stated purposes. (32)

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NSI - the ability to produce a completely determined symbolic deduction from given symbolic information, where such an implication has not been practiced, as such.

Form Reasoning - Solve simple equations that are given in terms of combinations of similar geometric figures. (33)
Sign Changes - Given the condition that certain numerical-operation symbols are interchanged, solve simple equations. (33)

NMI - the ability to deduce meaningful information that is implicit in the given information.

Sequential Association - Indicate the best order for four words to produce a chain of associations. (22)
Attribute Listing II - State the essential attributes of an object that is to serve a certain purpose. (22)

EVALUATION FACTORS

	Figural	Symbolic	Semantic	Behavioral
Units	EFU (I)	ESU	EMU	
Classes	(I)	ESC	EMC	
Relations	(I)	ESR	EMR	
Systems	(I)	ESS	EMS	
Transformations	(I)	EST	EMT	
Implications	(I)	ESI	EMI	

EFU - the ability to judge quickly and accurately units of figural information as being similar or different, based upon minor aspects of the information.

Guilford-Zimmerman Perceptual Speed - Identify among five similar ones the drawing of a common object that is identical with the given object. (SPS) (33)
Identical Forms - Mark all forms in a row that are identical with the one at the left of the row. (LLT) (33)

ESU - the ability to make rapid decisions regarding the symbolic identity or accuracy of words, letter sets, and number sets.

Symbol Identities - Judge whether both members of pairs of words and of numbers are the same or different. (SPS) (33)
Letter "U" - Check all words in long lists that contain the letter "U." (33)
First Digit Cancellation - In a row of 30 digits, indicate each digit that is like the first one in the row. (ETS)

EMU - the ability to judge the suitability or adequacy of ideas and objects in terms of meeting certain criteria.

Sentensense - Judge whether a given sentence expresses internally consistent thoughts. (32)

Double Descriptions - From four alternatives, select the one thing that fits two descriptive categories best. (32)

ESC - the ability to judge applicability of class properties of symbolic information.

Best Number Class - Judge into which class a given number fits so as to receive the most possible points. The classes and their points are: EVEN MULTIPLES - 1 point; ODD MULTIPLES - 2 points; SQUARES - 3 points; PRIMES - 4 points. (33)

Sign Changes II - Choose the sign changes that make the expressions into correct equations. (formerly recommended for ESR) (33)

EMC - the ability to judge applicability of class properties of semantic information.

Best Word Class - Of four given class names, select the one to which the given object best belongs. (32)
Class Name Selection - Select a class name that best fits a group of four given words. (32)

ESR - the ability to make choices among symbolic relationships on the basis of similarity and consistency.

Symbol Manipulation - Judge whether symbolic conclusions based upon given premises are true or false. (33)

Related Words I - Choose the alternative word pair with a relation most like that of the given pair. (33)

EMR - the ability to make choices among semantic relationships on the basis of similarity and consistency of meanings.

Verbal Analogies III - In an analogies format, the relations between the first two words are fairly obvious and the choice of alternative completions very difficult. (32)

Best Trend Name - Select the word that best describes the order of four given words that describe a meaningful trend. (32)

ESS - the ability to estimate appropriateness of aspects of a symbolic system.

Way-Out Numbers - Choose the one alternative number from a list of four ordered numbers that is farthest away from the other three. (33)

Series Relations - Choose one of the three arithmetic operations that best relates each number in a given series to the previous number. (33)

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EMS - the ability to judge internal consistency of complexes of meaningful information.

Word Systems - Evaluate three matrices of words and indicate the one that shows the best trends and the one with the worst trends of words in both rows and columns. (32)

Unlikely Things - Select the two more unlikely or incongruous features from four given alternatives in sketches of common situations. (32)

EST - the ability to judge adequacies of symbolic substitutions and reorderings.

Jumbled Words - Judge whether or not words could be made by mixing the letters of a given word. (33)

EMT - the ability to judge which objects or ideas could best be transformed or redefined in order to meet some new requirement.

Useful Changes - Select the object that can perform the specified task most adequately, all alternative objects needing redefinition in order to perform the task at all. (32)

ESI - the ability to judge the consistency or probability of inferences from symbolic information.

Abbreviations - Choose one of three alternative words that a given abbreviation best implies. (33)

EMI - the ability to judge adequacy of a meaningful deduction.

Complete Thoughts - Judge whether a group of words expresses a complete thought or is a complete sentence. (32)

Sentence Selection - Judge which conclusion is fully supported by a given sentence. (32)

Logical Reasoning - Judge whether a conclusion follows logically from given premises. (32)

A Summary List of the Intellectual Factors

Table 1 presents a summarizing list of the factors just discussed. The grouping is somewhat different. With the operation category as the major basis for grouping, within each operation category the next grouping is by content category (bycolumns of the operation matrices). Other information in Table 1 provides common names of factors, where they have been applied, mostly before the model was fully designed; symbols of the same factor assigned in connection with the Educational Testing Service's list of factor tests; symbols for what are probably the same factors listed in Cattell's Universal Index; and finally, the numbers of Reports from the Psychological Laboratory, USC, in which it is believed that each factor was demonstrated. In the latter case, the identification of some factors with particular analyses depends upon some new rotation of axes, in which one of the aims was to achieve a greater degree of invariance of factors in different analyses.

Table 1

Known Structure-of-Intellect Factors, Various Names, and Reports in Which They Have Been Found

SI Trigram	Common Name	ETS Cognitive Factor	Cattell U.I.	Report Number
CFU-V	Visual cognition	Cs	U. I. T3	34
CFU-A	Auditory cognition			
CFC	Figural classification			6, 16, 29, 35, 39
CFR	Figural analogies			16, 34
CFS	Spatial orientation	S	U. I. T11	
CFT	Spatial visualization	Vz	U. I. T14	
CFI	Perceptual foresight	Ss		12, 21
CSU-A	Symbol cognition			23, 33, 38
CSU-V				
CSC				23, 33, 39, 38
CSR	Symbolic relations			23, 29, 31, 33, 35, 38
CSS	Symbolic patterns			16, 23, 33, 38
CSI				23, 33, 38
CMU	Verbal comprehension	V	U. I. T13	9, 12, 14, 22, 26, 31, 32, 33, 34, 39
CMC	Conceptual classification			9, 16, 22, 32, 34, 39
CMR	Semantic relations			22, 23, 34
CMS	General reasoning	R	U. I. T34	6, 8, 9, 14, 32, 34, 39
CMT	Penetration			21
CMI	Conceptual foresight	Sep		12, 13, 16, 21, 22, 26, 32, 34
CBU				34
CBC				34, 38
CBR				34, 38
CBS				34, 38
CBT				34, 38
CBI				34, 38
MFU	Visual memory			
MFS-V				
MFS-A				
MSU				38
MSC				38, 39
MSR				38
MSS				38
MST				38
MSI				38
MMU	Memory for ideas			37
MMC				37, 39
MMR	Meaningful memory			37
MMS	Memory for order			37
MMT				37
MMI				37
DFU	Figural fluency			29, 35
DFC	Figural spontaneous flexibility			29, 35, 39
DFS				29, 35
DFT	Figural adaptive flexibility	Xa		12, 21, 26, 29, 35
DFI	Figural elaboration			26, 35
DSU	Word fluency	Fw	U. I. T15	17, 26, 35, 39
DSC	Symbolic spontaneous flexibility			29, 33, 35, 39
DSR				29, 31, 35
DSS				26, 35
DSI	Symbolic elaboration			29, 35
DMU	Ideational fluency	Fi	U. I. T6	8, 12, 13, 16, 17, 18, 21, 22, 26, 27, 34, 35
DMC	Semantic spontaneous flexibility	Xs		8, 18, 21, 26, 35, 39
DMR	Associational fluency	Fa		13, 16, 17, 26, 35
DMS	Expressional fluency	Fe		17, 22, 26, 27, 35, 37
DMT	Originality	O		8, 13, 16, 17, 18, 21
DMI	Semantic elaboration			12, 26, 27, 35
NFC				39
NFT	Figural redefinition	Cf	U. I. T2	18, 34
NSC				39
NSR	Symbolic correlates			13, 31
NSS				23, 31, 33
NST	Symbolic redefinition			23, 31, 33
NSI	Symbol substitution			16, 33
NMU	Concept naming			16, 23, 34, 39
NMC				22, 39
NMR	Semantic correlates			17, 22
NMS	Semantic ordering			12, 23, 31
NMT	Semantic redefinition	Re		8
NMI	Deduction			22
EFU	Perceptual speed	P		6, 33
ESU	Symbolic identification		U. I. T12	33
ESC				33
ESR	Symbol manipulation			33
ESS				33
EST				33
ESI				33
EMU				32
EMC				32
EMR				31, 32
EMS				32
EMT				
EMI				·33

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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)*	2a. REPORT SECURITY CLASSIFICATION
Aptitudes Research Project	Unclassified
Department of Psychology	2b. GROUP
University of Southern California	---

3. REPORT TITLE

STRUCTURE-OF-INTELLECT FACTORS AND THEIR TESTS, 1966

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*
Technical Report

5. AUTHOR(S) *(Last name, first name, initial)*

Guilford, J. Paul
Hoepfner, Ralph

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
June, 1966	16	46

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
Nonr-228(20)	Reports from the Psychological Laboratory
b. PROJECT NO.	University of Southern California
NR 150-044	Number 36
c.	9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)*
d.	- - - -

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11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
- - -	Personnel and Training Branch
	Office of Naval Research
	Department of the Navy

13. ABSTRACT

The theory and definitions basic to the structure-of-intellect model are outlined and all the known factors and their tests are described briefly. (U)

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Factor Analysis						
Intelligence						
Tests						

DD FORM 1473 1 JAN 64   0101-807-6800