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ABSTRACT

This study investigated social intelligence in relation to individuals coping with other persons. In terms of structure of intellect theory, the first of these two areas includes six behavioral cognition abilities, one for each kind of product or mental construct of information. The second includes six behavioral divergent production abilities, concerned with the generation of behavioral ideas in quantity and variety. There were 22 tests designed to measure univocally those six DBX abilities. In order to determine the distinctness of these hypothesized abilities from behavioral cognition abilities on the one hand and from semantic divergent production abilities on the other, three of the former and four of the latter were represented by tests, plus the ability CMA, to represent the verbal IQ. Analysis revealed that DBX abilities could be demonstrated as distinct from one another, from behavioral cognition abilities, from semantic production abilities, and from IQ. (Author/EK)

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FINAL REPORT

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MEASURING CREATIVE SOCIAL INTELLIGENCE

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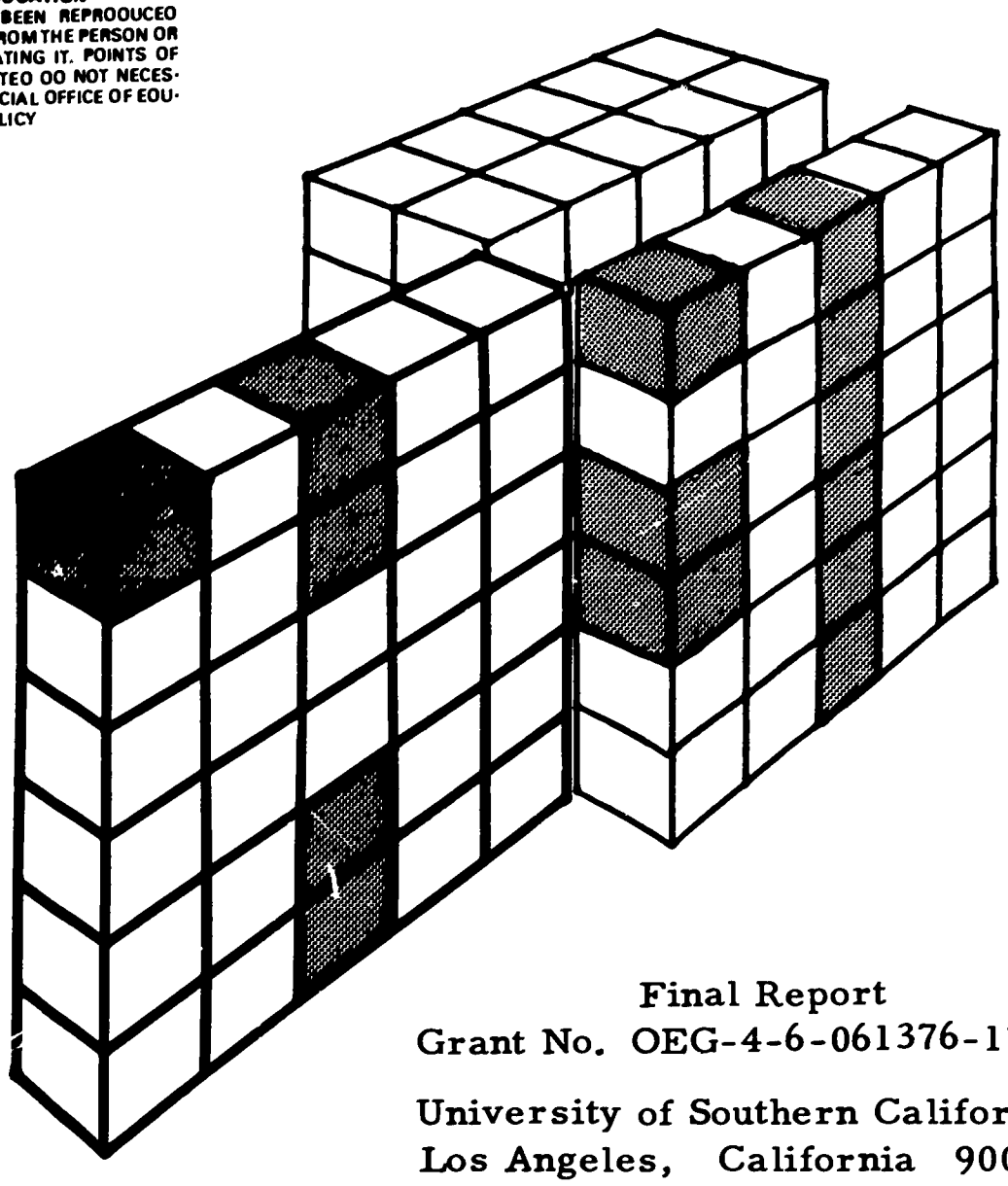

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SUMMARY

Of two important aspects of social intelligence, that pertaining to understanding the behavior of other persons and that pertaining to coping with other persons, the latter was the center of attention in this investigation. In terms of structure-of-intellect theory, the first of these two areas includes six behavioral-cognition abilities, one for each kind of product or mental construct of information. The second includes primarily the six behavioral-divergent-production abilities, which have to do with the generation of behavioral ideas in quantity and variety.

Twenty-two new tests were designed to measure univocally those six DBX abilities. In order to determine the distinctness of these hypothesized abilities from behavioral-cognition abilities on the one hand and from semantic-divergent-production abilities on the other, three of the former and four of the latter were also represented by tests in the analysis, plus the ability CMU (verbal comprehension), to represent the verbal IQ.

Analysis showed that the DBX abilities could be demonstrated as distinct from one another, from behavioral-cognition abilities, from semantic-production abilities, and presumably from IQ.

A minor experiment using vocal and facial expressive responses in two tests each showed the orthogonality of such measures of divergent production from that measured by tests calling for verbal communication of behavioral ideas, and from each other. This reminds us that the tests of DBX abilities are confined to measurement of behavioral ideas and that other abilities are involved in executions of expressive actions and undoubtedly other actions.

MEASURING CREATIVE SOCIAL INTELLIGENCE [1]

INTRODUCTION

With the burgeoning growth of our national population, and with its increasing concentration in urban centers, have come increased tensions that erupt in open confrontations and violence. Problems of interpersonal relations have accordingly increased enormously, in a population that is ill-equipped to cope with them. Ordinary intelligence, which has been commonly equated with aptitude for school learning, is not best adapted for dealing with interpersonal problems; a quite different kind of intelligence is most needed for that purpose, namely, a kind increasingly recognized as social intelligence.

A half-century ago, E. L. Thorndike (1920) pointed out the need for such a conception. Over the intervening years, nothing much had been done about Thorndike's conception until Guilford (1959) proposed a theory of intelligence in general, in which there is a prominent place for social intelligence. In his structure-of-intellect model, social intelligence found a logical place, along side of three other kinds of intelligence. The other three kinds deal with a concrete or "figural" intelligence, for dealing with things we can see or hear; a symbolic intelligence, for dealing with pure mathematics and languages; and an abstract intelligence, for dealing with thoughts. Social intelligence deals with the behavior of human individuals with whom we come in contact.

In the growing acquaintance with social intelligence, there has been observed an initial distinction between (1) knowing or understanding people's behavior and (2) coping with that behavior. In the first case, do we apprehend the other person's state of mind? Do we sense his attitude toward us? Do we see what he really wants? What is he likely to do next? These questions come under some more or less current, alternative psychological categories of "social sensitivity," "person perception," and "empathy." Programs of "sensitivity training" have been designed to improve the abilities involved, without realizing just what it means to be socially sensitive. There is now much basic information that could be utilized in this connection. We know that there are six defined social-cognition abilities involved (O'Sullivan, Guilford, and de Mille, 1965).

The investigation to be recounted here is concerned with the second major aspect of social intelligence, that of coping with the behavior of others. Once we have achieved an impression of the other person's state of mind, how prepared are we to attempt to determine his behavior? Can we defend ourselves against his aggression? Can we win him over to our point of view? Can we persuade or force him to do certain things? Success in these respects often tax our problem-solving skills, particularly the solution-finding components of problem solving.

As social intelligence differs from academic intelligence, so social-problem-solving skills differ from academic-problem-solving skills. The study reported here dealt primarily with basic solution-finding skills in interpersonal relations. It started with the hypothesis that corresponding to the six abilities for understanding immediate behavior there are six distinct abilities for creative thinking, which is the heart of creative social intelligence. Execution of steps by which solutions are applied undoubtedly involves more than these abilities, but they are a necessary link in the chain of behavioral events.

Some Basic Conceptions

In order to justify fully the manner in which the problem of creative social intelligence was investigated, it is necessary to explain some basic conceptions in more technical terms. Let us begin with the term "intelligence" itself, in order to see why dealing directly with other persons should be a matter of intelligence. The conception followed in this research is very different from that associated with intelligence tests and the IQ. As stated earlier, the orthodox conception makes intelligence equivalent to academic aptitude. The much broader view observed here, goes with the conception that an individual is an information-processing creature. By analogy to an electronic computer, he acquires information, he puts some of it into storage, and he retrieves information from storage for use, as in solving problems. It is interesting to note that the earliest meaning of "intelligence" equated it to information. In military circles, information is still intelligence.

In the conception followed in this report, intelligence includes the information-processing activities of an individual. This general view is considerably elaborated by Guilford (1967, especially chapters 9 and 10). Information itself, is defined as "that which the organism discriminates," to give it the broadest possible, logical meaning. In order to understand intelligence, therefore, we must know something about information and about the operations performed with information. A computer has a catalog of programs that determine what it does with information. What kinds of programs are characteristic of the human computer?

The Structure of Intellect

The structure-of-intellect theory takes care of the questions of fundamental kinds of information and of fundamental operations with information--the fundamental programs. Let us consider the kinds of information first.

Kinds of Information Content. --Without specifically saying so, the four basic kinds of information were mentioned in the opening paragraphs. There are four broad areas--figural (concrete), symbolic (code elements), semantic (imageless thoughts), and behavioral (psychological). It is as if we have four basic languages, and we are more or less proficient

[1] This study is one of a series conducted by the Aptitudes Research Project at the University of Southern California. Among the authors, Guilford and Hoepfner were Responsible Investigators and Hendricks was Study Leader.

in each of them but we are certainly not equally proficient in all of them. We can make translations from one to the other, for we build up associative connections across their boundaries. The important consideration for us here is that the way of getting social intelligence into the general picture of intelligence is to recognize behavioral information and to make the same theory apply to that area of information that applies in the others. Thus, social intelligence is not only given a firm foundation in the larger scheme of things, but there is also a model for analyzing it in order to come to know its nature, as we shall see.

Kinds of Informational Products. --The four distinct kinds of information do not include all that we can know about that subject, for within each of these broad areas we find six forms in which items of information come--six kinds of products, or constructs. Illustrations for the six kinds of products will be given from within the behavioral area, for that is the kind of content with which this study is most concerned.

A unit of behavioral information is a single condition or state of an individual's disposition of the moment. He is alarmed, he is amused, or he has the intention to hit someone. We can become aware of such states by use of certain cues that he gives--raised eyebrows, a smile, or the clenching of a fist.

A class of behavioral information, like a class of any other kind, is a generalized affair. We recognize certain states as being in a category of excitement, for example. The particulars (units) are different in some respects, but they share something in common. There are states of pleasure, of disgust, and of relaxation, for example.

A relation is some kind of recognized connection between two states or actions. There are recognized oppositions that go with contrasting overt behaviors, such as pleasant-unpleasant, tense-relaxed, or excited-calm, to name opposite poles of Wundt's classic dimensions of feeling. Osgood and others (1957) verified these dimensions empirically when they thought they were studying dimensions of meaning. There are also relations between pairs of persons in face-to-face moments, such as one dominating the other, or a relation of mutual confidence and trust.

A behavioral system can be found in the interactions of three or more persons. The system might be the triangle of the boss, his secretary, and his wife who has come unexpectedly on the scene. It might be a policeman attempting to arrest a traffic violator, with hostile threats from bystanders.

A transformation is a change or shift. In the behavioral area, it might be a modification of one's conception of the behavior in question. We might first think a man is drunk until we are told he has just suffered a heart attack. We think a man nearby may strike us as he raises his arm, until we see his finger pointing at something. A smile that we thought was friendly turned out to be covering a snarl of sinister intentions.

An implication is an item of information that is suggested by other information. A prediction of what a person will do next is a good example. A clerk hands you a bag of groceries and expects you to hand him some currency. A father starts to take off his belt, and his young son says "I'll be good." The father's act has a behavioral implication for the son. You put on a smile, and you expect a smile in return. Such expectations are continually made in social events and permit meaningful give and take in ongoing social affairs.

The distinctions of products just made will seem familiar and reasonable. But the importance of grouping behavioral information in these six ways should not be underestimated. For the fact is that the same person may be very able in dealing with one kind of behavioral product and incapable in dealing with another. The usual situation is that each person is uneven in six distinct and unique abilities. Some persons could, of course, be exceptionally high in all six ways and others could be low in all six ways, but they should be rare exceptions. But there are other aspects to consider; the kinds of operations that can be applied to information: the human computer's basic "programs."

Kinds of Operations. --Research on intellectual abilities has shown in decisive results that there are five fundamental kinds of operation; five things that are done with information. While a computer has information given to it, and to a limited degree this is also true of the individual, for he has many teachers, to a large extent he must acquire his information. Even when he is taught, he must achieve understanding, and understanding means the achieving of products of information, in any kind of content. The acquiring of information and the mastery that this implies come under the heading of cognition. Acquired information may become a part of the long-term memory store. This fixation of information in storage is the operation of memory. The process of fixation must be distinguished from the memory store itself, which is not an operation but a state of conservation. The understanding of behavior involves the operation of cognition where the information is behavioral. The six behavioral-cognition abilities have been demonstrated by the methods of factor analysis, as mentioned earlier (O'Sullivan, et al., 1965).

These six abilities were earlier proposed as the way of accounting for the aspect of social intelligence that is concerned with understanding others. We are now ready to consider a parallel way of accounting for the other aspect, that of coping with others in solving interpersonal problems. The secret lies mostly in the operation of divergent production when the information produced is behavioral. And remembering that behavioral information comes in the form of six products, which have already been described, we expect to find six behavioral-divergent-production abilities. Divergent production itself, in any area of informational content, is a matter of retrieving information from memory storage for purposes of the moment. The qualifying term "divergent" means that alternative items of information are produced to meet the same need; a kind of search phenomenon. The operation is defined as the "generation of logical alternatives." There is another recognized production

known as convergent production, which is a matter of "generation of logical imperatives." This operation is best illustrated by examples from mathematics and logic, but the structure-of-intellect theory proposes that the operation also applies in the behavioral area, a question with which we are not concerned here.

To make the story complete, the fifth kind of operation is evaluation. In evaluating information, we compare it with other prescribed information or with a prescribed standard, with respect to prescribed properties and the satisfaction of some logical criterion, such as identity or consistency. Behavioral information can also undoubtedly be evaluated in accordance with this definition, but we are not concerned with this aspect of social intelligence here either. Our concern is concentrated on the six hypothesized behavioral-divergent-production abilities.

To put this segment of social intelligence within the larger logical setting, we make a brief reference to the structure-of-intellect (SI) model, which is shown on the cover page of this report. With four kinds of content, five kinds of operation, and six kinds of product combined in all possible ways, 120 distinct kinds of ability are generated, each with its unique combination of content, operation, and product. It is assumed that the correlations among these abilities in any mature, homogeneous population are low or zero, and empirical findings tend to bear out this hypothesis. At the time this report was written, nearly a hundred of the SI abilities had been demonstrated by factor analysis, including the six with which this report is directly concerned.

Historical Note

The Midcentury Interest in Creativity

A number of trends of thought and activity during the past 20 years more or less converged upon this investigation of "creative social intelligence." We have just seen a description of the type of thinking that led to the views of the authors on theoretical bases of the study. There was a larger context that gives the study a more meaningful setting and a position in time. More specifically, we need to place the study in its relations to a growing concern with creativity.

It may be said that an impetus in formal interest in creativity emerged in the middle of this century. The signal seems to have been given by the second author (Guilford, 1950), when he devoted his presidential address to the American Psychological Association to the subject. Pointing out psychologists' sorry neglect of this important subject, he announced the launching of an attack on the subject on a large scale in a new approach through individual differences. That factor-analytic investigation was followed by a number of others, aimed at understanding the basic functions by which human individuals achieve unusual, novel, and clever responses such as are often needed for the solution of problems in new ways. Those functions have become known through studying the ways in which individuals differ in their thinking activities.

Other Approaches to Investigating Creativity

Before 1950, scattered investigations had attempted to fathom the thinking processes of the creative thinker by the biographical route. Anecdotes in some numbers were collected regarding how creative geniuses in different fields had reached their goal achievements. Some of these accounts were of observations made by the geniuses themselves. The most useful outcome was in the form of theory, such as that of Wallas (1945), regarding the major steps in creative problem solving--preparation, incubation, illumination, and verification. The Wallas theory was subjected to experimental study by Patrick (1935) and by Eindhoven and Vinacke (1952).

While the Aptitudes Research Project at the University of Southern California was pursuing the problem along the route indicated above, other investigators were taking different routes. One of these approaches was through observations of the behavior of men (and women) of recognized creative performance in their professions. Roe (1952) studied outstanding scientists; MacKinnon and others (1960) studied writers and architects; and Ravenna Helson (1965) studied mathematicians. The objectives were to determine in what respects highly creative persons differ from less creative people and how the more creative in the select groups differ from the relatively less creative. Practically no difference was found in general or academic intelligence, but there were some temperamental and motivational differences in ways that appeared to characterize the highly creative person. A number of other investigators agree that the correlation between creative performance and IQ is very low, in children and adolescents as well as in adults, and they confirm the fact that certain traits such as independence, proneness to humor, dominance, self-confidence, aesthetic interest, and some other qualities are common features of persons judged more creative (Getzels and Jackson, 1961; Torrance, 1962).

Creativity in the Structure-of-Intellect View

From none of these other approaches has a concept of social creativity arisen or has it been recognized. As a matter of fact, the implicit assumption seems to have been that creativity is much the same wherever we find it. Torrance (1962) is an exception, for he follows the Southern California distinction between figural and semantic creativity. He makes no distinctions however in the direction of either symbolic or behavioral creativity.

The SI view of creativity, which points to the divergent-production abilities and also the abilities pertaining to transformations as the salient intellectual contributors to creative performance, offers several advantages. From this point of view, creativity is no longer outside the realm of intelligence. The reason that previous investigators have found low and zero correlations between "intelligence" (as measured by IQ) and creative performance is that they have been measuring the wrong intellectual abilities. IQ tests are dominated by tests of cognition

abilities, not divergent production, and transformation abilities have almost no voice in them. Another advantage is that the SI model shows us where to look for creative social intelligence, and also the six components to expect. It also indicates five abilities for dealing with behavioral transformations, of which two have already been demonstrated--CBT in the O'Sullivan analysis, and DBT in the analysis reported here.

Table 1

Matrix of Divergent-Production Abilities from the SI Model

Contents				
F	S	M	B	
		DMU	DBU	Units
		DMC	DBC	Classes
			DBR	Relations
			DBS	Systems
		DMT	DBT	Transformations
		DMI	DBI	Implications

Code to columns:

F - figural (visual)
S - symbolic
M - semantic
B - behavioral

The major disadvantage of this approach is that non-intellectual qualities that contribute to creative performance are not included in the view. This does not mean that those qualities have no importance; they also need investigation. But not only are the creative intellectual abilities important because they are contributors, they also point directly to processes of creative thinking and to the kinds of skills that should be developed. It is well recognized in education that we know much better how to develop skills than we do how to change temperament or motivation. There is probably also a consensus that there is much more to be gained in effective living of the average person by building skills than by changing temperament or motivation. All of these considerations point to the importance of knowing about the behavioral-divergent-production abilities.

HYPOTHESES AND TESTS

Major Hypotheses

The first major hypothesis has already been mentioned, with some elaboration--that the six unique abilities of divergent production with behavioral information can be demonstrated by the methods of factor analysis. To orient the reader somewhat better to the place of those abilities within the SI model, Table 1 presents the matrix of all divergent-production abilities extracted from the model. The six abilities in question are in the last column, each with its trigram label. Of the 24 abilities represented in the matrix, all outside the behavioral column had previously been demonstrated except DFR (divergent production of figural relations), which has not been investigated.

The same six abilities are represented in a column of the matrix of behavioral abilities shown in Table 2. It has been said before in this report that the six behavioral-cognition abilities have been demonstrated. Those for memory, convergent production, and evaluation have not been investigated. They constitute by far the greatest number of unknowns in the SI model, all the cognition abilities having been demonstrated,

Table 2

Matrix of the Behavioral-Content Abilities from the SI Model

Matrix of the Behavioral-Content Abilities from the SI Model

Operations					
C	M	D	N	E	
CBU		DBU			Units
		DBC			Classes
CBR		DBR			Relations
CBS		DBS			Systems
		DBT			Transformations
		DBI			Implications

Code to columns:

C - cognition
M - memory
D - divergent production
N - convergent production
E - evaluation

and except for behavioral content, all memory and evaluation abilities, and most of the convergent-production abilities.

The second major hypothesis is that the six investigated abilities will be found to be distinct from other behavioral abilities and other divergent-production abilities. In order to test this hypothesis, included in the analysis was a sample of four semantic- divergent-production abilities and a sample of three behavioral-cognition abilities. There was only a sampling of these other abilities, in order to keep the test battery within reasonable bounds. In Table 1 the four semantic abilities are labeled, and in Table 2 the three behavioral-cognition abilities. If clear separations from these seven abilities can be demonstrated, this outcome should be a strong basis for assuming the separation from the other five abilities,

The third major hypothesis is that the six behavioral DP abilities will be found separate and distinct from one another. Experience in factor analysis of SI abilities has shown that this kind of discrimination is the most difficult one to achieve. Complete discrimination of any two abilities means that in the factor analysis, no tests of the one ability shows any significant loading or relationship to the other. When tests are written for SI abilities, an effort is made to control the conditions so that any one test shows significant relationship to only one factor. Sometimes such controls fail. If they failed completely, factors could not be separated and unique abilities could not be demonstrated.

A fourth major hypothesis was of a very different kind. It was to the effect that the abilities could be demonstrated by means of printed tests in group administration of those tests. This had been the universal experience with all other abilities of the SI model. But a new question arose in connection with DBX tests (where the X stands for each product in turn). Would verbal responses that examinees (E) put on paper be adequate to show that they have produced responses that have behavioral substance or would the content perhaps be semantic?

This general question of possible behavioral-semantic confusion had been encountered in the analysis of behavioral-cognition abilities. It was handled in that connection largely by utilizing pictorial material, in line drawings and photographs. In a great majority of the tests the information given to E was in pictorial form and his answers were also obtained by asking him to make choices among pictorial representations. A few of the tests, however, ventured to use verbally presented information. One or two tests even had verbal communication involved in both given and response information. The analysis was very reassuring on this question; there was little or no semantic involvement in the abilities measured.

But in the DBX tests, asking E to produce answers in pictorial form presents important limitations. If E were to draw his own graphic representations, we should find that skills in this form of communication are very limited, indeed. Es also differ considerably in drawing skills, and many would refuse outright to attempt answers of this sort. It was still possible to present information pictorially, and many of the tests did this. It was also possible in the case of some DBX abilities to avoid verbal communication by asking E to select pictures, in forming pairs or sequences, for example. But it was found more natural and convenient in many tests to ask E to give verbal statements. Decisions to do this were much easier, in view of the assurance from the cognition analysis that words can be made to convey behavioral information, when properly used.

Two steps were taken to help ensure that verbal responses conveyed behavioral information. Instructions emphasized the fact that the responses should reflect behavioral information, and the test scorers employed methods of discriminating when verbal answers did and did not convey that kind of information.

In a minor study, a quite novel way was tried for obtaining E's responses. The responses in two tests were in the form of vocalizations and in two others, in the form of facial expressions. E was instructed to produce the vocal expressions, which were tape recorded, and facial expressions, which were recorded by a camera. E uttered a given short statement, sometimes in response to a situation and sometimes not. He made faces in response to a given phrase alone or in a described situation, snapping his own picture when he thought each expression was ready. An account of this experiment will be found in Appendix B.

Tests for the Six Special Hypotheses

In what follows, the tests designed for each of the hypothesized DBX abilities will be briefly described, with reasons given for believing that they would represent their respective abilities. Additional information about the tests will be found in Appendix A, where all tests used in this analysis are accounted for, in alphabetical order. The DBX tests were all entirely new, for none such had existed before, because the subject of creative social intelligence had not been investigated before, at least explicitly.[2] Even if it had been, the approach would probably not have been through the avenue of individual differences.

Some General Problems of DBX Test Construction.--Strategies for designing a test for a certain DBX ability were similar to those employed in other segments of the SI model. Two general strategies have been followed since the search for test ideas for SI abilities began. One is to keep clearly in mind the three-category definition of the ability. For example, if a test is wanted for DBC, it must require divergent production, the information produced must be behavioral, and it must be in the form of certain class ideas. This specification implies that alternate classes should be produced by E, in each of which there can be particular items of behavioral information. In order for the class ideas to be genuinely alternate, it must be true that the particular items

[2] Special thanks are due Dr. Maureen O'Sullivan and Mrs. Anna Cox for major contributions to test development and construction.

of information can be classified in different ways, hence each item must have two or more properties; the items must be somewhat ambiguous.

The kind of test suggested might be a presentation of a number of expressive stimuli, in the form of outline drawings, perhaps. The expressions might come from the face, hands, or from body postures, but E is not to group the items along these lines; he is to group them in terms of common behavioral properties, e.g., a set of expressions indicating anxiety, another indicating hostility, and still another, tension. Different sources--faces, hands, postures--could appear in the same group. In the grouping process, and in presenting his groups, E need not name the class properties.

The major strategy in test construction is to observe the kinds of tests that have been successful measures of their own abilities in parallel positions in the SI model. Reference to Figures 1 and 2 will show that tests for DBU might be similar to tests for either CBU or DMU. They would differ in only one respect--a change in operation (from C to D) in the first case, and in content (from M to B) in the second. A good kind of test for DMU presents E with the specification for a class, to which he is to respond by naming members of the class. The members are units. For example, if told to name objects that are white and soft, he could say: cotton, foam, snow, flour, mush, whipped cream, face powder, and so on. An analogous test for DBU might specify that a person is both vexed and amused. To this information, E is to provide statements that the person might make showing his combined emotion. He might write the statements: "Well, you pulled a good one, didn't you?" "That's funny, but don't do it again." "Ouch! ha, ha."

DBU - Divergent Production of Behavioral Units. -- The test just described should be found by analysis to represent DBU. Although each response has more than one word, each statement represents a single behavioral idea. In DBU tests in general, to given information, E generates a number of beahvioral acts or states, all pertinent to the starting point. The given information in the four tests designed for DBU is either pictorial or verbal.

Expressing Mixed Emotions is like the illustration just given. A sample item asks for a list of statements a person might make if he were both jealous and disappointed. Such statements might be: "He won? But I was sure I would win." "How does he do it?"

Multiple Emotional Expressions is very similar to Expressing Mixed Emotions. The only difference is that only one emotion is specified. For example, E is asked to give several statements that a person might utter if he were angry. In a study of semantic fluency, Christensen and Guilford (1963) found that with two specified properties for a class the loading for the test on the factor for DMU was substantially greater than with one specified property. We shall have one opportunity to see whether the same kind of differences holds true for tests of DBU.

In Alternate Social Meanings, the class specification is given not by naming some mental state but by describing some overt behavior. A sample item reads: "If one person winks at another, what could he (she) be thinking or feeling?" Possible answers are: "Watch it, here he comes now." "You and I know better." "You're cute."

Alternate Picture Meanings specifies the class of responses by presenting in a line drawing a certain expression. E is to list statements that the person might be making or thoughts and feelings he might be experiencing. A picture of a face with a hand astride the nose, with thumb and forefinger holding eyes closed appears in a sample item. To this picture E might respond: "Let me see; where was I?" "I can't study any more tonight." "Good grief; what have I done?"

DBC - Divergent Production of Behavioral Classes. --In all content areas, an ability such as DBC pertains to a ready shifting from one class of information to another, a kind of flexibility. This is shown by rapid production of a number of different classes, given certain items of information. An illustration of a kind of test for this ability was given above. Among the tests to be described, the items to be classified in different ways are in the form of verbal comments indicating emotional states, photographs of faces in different expressions, and line drawings. In selecting such items for use in these tests, care was taken to ensure that each item was behaviorally ambiguous. Prior to testing, each item was exposed to a number of observers, each of whom was to name the mental state represented. An item was adopted for use if two or more different behavioral meanings were attributed to it. It could thus be classified in different ways. Items that had four or more meanings attributed to them were discarded as being too general. Another requirement for the group of selected items was that they could not be readily classified on some basis other than behavioral--figural or semantic, in the case of pictures and statements, respectively.

In Alternate Expressional Groups, sets of eight line drawings are given, involving the face, hands, feet, or whole body. From each set, E is to form as many class groups as he can, each having at least three items in it, each group representing a different behavioral class. He does not need to explain the basis for his groupings.

Alternate Face Groupings is the same in format as the test just described except the items to be grouped are photographs of faces, also eight to a set. Some sets are all male, some all female, and some of mixed sex.

Multiple Behavioral Grouping presents sets of eight statements, each very brief and emotionally loaded. By grouping and regrouping, E is to form as many classes as he can. In the following sample problem, six statements are given:

1. You get out of here
2. Are you sure

3. What a bore

4. How could you do such a thing

5. Didn't you listen to me

6. I wonder what time it is

E could form a group of numbers 2, 4, and 5, because of their common questioning state of mind of the speakers. Note that all punctuation marks are omitted so that E must obtain the behavioral meaning from the contents of the statements only. Another group might be 1, 3, and 4, indicating an attitude of rejection.

DBR - Divergent Production of Behavioral Relations. --In the analysis of behavioral-cognition abilities (O'Sullivan, et al., 1965), it was found that the most effective relations tests dealt with pairs of individuals between whom certain connections were portrayed. What one person is doing has a bearing on what the other is doing, and one's expression is properly meaningful only if both persons are taken into consideration. Such connections are behavioral relations.

In each problem of Alternate Facial Relations, eight photographed faces are given, each with a unique expression. In one problem it is the same male throughout, in another it is the same female, and in still another there are four of each sex. With each set of photographs a comment is given, e.g., "Wait, that's not what I really meant." E is to choose different pairs of faces such that the first of the pair is making the given statement to the second. If he chooses faces B and C, the B is to be making the comment to C. In each response the comment has a somewhat different behavioral meaning, depending upon the expressions.

In Forming Alternate Faces, a new technique was designed. In this test, E can form a face by placing a sketched upper half adjacent to a sketched lower half. On each page of the test booklet, 12 lower halves are presented, each including the lower part of the nose, the mouth and chin of a man's face. A slip of paper that can be detached from the booklet contains three upper halves, each including eyes and brow. E could thus try out the 36 possible combinations, forming that many different faces. But this is an inefficient procedure and he probably would not have time to do it. He may select some of the combinations as being relevant to a statement that he is also given as a basis for choosing the combinations he proposes to give as his responses. For example, if the described situation is stated as "Ted has just received some bad news," keeping this in mind, E seeks combinations to show what Ted could appropriately look like.

Forming Alternate Faces was originally intended for ability DBU, since it was thought that E is forming units in doing the task. But a preliminary testing experiment showed that this test was not inclined to go with other DBU-designed tests in the intercorrelations of scores, but to go instead with DBR-designed tests, hence the change in hypothesizing this test for DBR rather than DBU. One possible explanation is that the statement that is to determine the selection of faces implies a second person, with different possible relations between him and Ted. In one problem, the statement is "Ted has just been scolded by his teacher for being late," and in another, "Ted has just received a ticket for speeding." In other statements, however, the implication of a second person is not so clear: "Ted has just seen an accident," and "Ted has just found out his wallet was stolen."

Varied Emotional Relations presents in each problem nine sketches in line drawings, each with its own expression. Most are sketches of faces, but one in each set is of hand and one of hand and arm. The relation specified is the same for all problems--a cause-and-effect affair. E is to select pictures two at a time, such that there could be cause-and-effect events involving the two. The behavior of the first of the pair is a probable cause of the behavior of the second. In a sample item, one picture is of a face of a man, with an indication that he is whistling. The face of a girl that might be paired with it shows a coy expression, indicating a positive effect. A face of another potential pair member is a girl who is turning up her nose, indicating a negative effect. Or, E might pair the two girls, the coy girl evidently enjoying telling some unpleasant gossip that the second girl does not want to hear.

Creating Social Relations is of a somewhat different type, calling for verbal responses rather than forming pairs of persons or expressions. Two people are shown in line drawings in expressions that could mean a number of different things, depending upon relations that can be injected into the pair. For example, a woman shown above the waist, with raised hand and pointed finger, faces the head of a man who is not facing her. He is looking full-face forward, with eyes turned toward the ceiling. E is to write a number of comments that the man might be saying or thinking in the presence of the other person, such as: "I'm sorry, I didn't mean to do it." "Why do you think I did it?" "Oh, brother, here we go again." Each statement denotes a somewhat different relation between the same two people.

DBS - Divergent Production of Behavioral Systems. --A psychological novel is an example of a behavioral system on a grand scale. It consists of a sequence of events of interacting people in repeated confrontations. The story plot is a behavioral system and each episode might also be such a system. Tests for DBS were designed in accordance with this pattern, but on a much smaller scale than a novel, of course. Short-story plots and episodes are the most common kinds of behavioral systems that E is to use in tests for DBS. Emotional and attitudinal dispositions of the characters are specified so as to encourage behavioral directions rather than semantic. Besides suggesting that there be behavioral content in the stories, the investigators asked the test scorers to give credit only when complex interactions were indicated or implied by E's story.

In Creating Social Situations, the emotional states of three people are described; for example, a fearful woman, an angry man, and a sad child. E is to describe briefly different kinds of situations in which

this combination of emotions and people could reasonably occur. The characters are to be reacting to one another and not to some outside source. E might say that the child has brought home an unsatisfactory report card, crestfallen. The father goes into a rage, whereupon the mother becomes alarmed at his violence.

Writing Behavioral Stories is like the test just described except that the presentation to E is not verbal but in the form of a picture. In each photograph, there are three people, for example, a young man and two young ladies, in different positions, postures, and expressions. E is asked "How do the people feel or what are they thinking, and why? E is then told to write as many episodes as he can. The resemblance of this task to the Thematic Apperception Test (TAT) is obvious. But stories given to the TAT have not been scored for ability DBS, as such.

Multiple Cartoon Fill-Ins presents the first and last frames of a cartoon strip, with two or three persons involved in each scene. E's task is to tell verbally what might have happened between the two scenes, in a way that would tie them together in a series of events. The cartoons are entirely in pantomime, which provides more freedom of choice on the part of E. In completing the entire story in different ways, E is told to take into account the feelings and thoughts of the characters shown, and to make his completion so as to tie them together. In one problem, the first picture shows the man, Ferd'nand, sitting in a waiting room of a doctor or dentist. The nurse is motioning to the other man to come into the inner office. The terminal picture shows Ferd'nand under an office desk and the nurse searching for him. Suggestions for the missing events might be: "Ferd'nand has lost his purse and is looking for it." "Ferd'nand wanted to play games with the nurse and is hiding from her." "Ferd'nand has heard the other man cry out with pain and doesn't want to go in."

DBT - Divergent Production of Behavioral Transformations. --The changes in any area of information can be a modification of a unit or a system, and perhaps of any other kind of product. A change in interpretation of a particular expression would be a transformation of a unit. A change in a story plot would be a transformation of a system. The latter kind of change seemed easiest to put into test form.

Alternate Cartoon Completions presents in each problem two consecutive events in a cartoon strip, without a concluding frame. E is to suggest alternate conclusions so as to change the nature of the story each time. In the sample item, Ferd'nand is dressed as a scoutmaster and two boy scouts are helping an old lady across the street. The boys than take steps to assist a pretty young girl across the street, but Ferd'nand holds up a prohibiting hand. What will the concluding episode be like? E is to give alternative completions, changing the nature of the story with respect to the feelings, thoughts, and attitudes of the participants. E might say: "He'll ask her whether the boys are bothering her." "He'll make a date with her." "The girl will say, 'Dad, where did you get those shorts?"

Multiple Expression Changes is also concerned with a succession of events. Three steps are stated, such as:

1. A man trips a lady who is walking by.
2. She falls, and the man apologizes to her.
3. The lady then becomes angry.

From a page of 15 men's faces, each with a different expression, E is to select sets of three to go with the three stated events. In tripping the lady, the man might be surprised. amused, or sorry. When he apologizes to her, he might be either genuinely sorry, or placating, or perfunctory. As she shows anger, he might show surprise, amusement, or vexation. It was expected that the changes in sets of reactions that E has to produce would provide measurement of the hypothesized ability DBT. We shall see that something went awry.

Alternate Line Meanings is a quite different kind of test. Its design took into account the fact that some transformations are redefinitions and in this test E is asked to produce some redefinitions. The given stimuli are simple lines with different forms, slants, and degrees of heaviness. From earlier history (Guilford and Guilford, 1931) it was known that simple lines can be used to express human feelings and emotions in ways that are interpretable by observers. This connection was utilized in the test Alternate Line Meanings. Given a light, horizontal, gentle wave, most observers are likely to say that it represents laziness, tranquility, or relaxation. Given a heavy, zig-zag line sloping upward to the right, many observers agree that it indicates power and anger. In the test adapting such connections to an attempted assessment of DBT, E is to give as many different behavioral interpretations of each line as he can. By giving new meanings to replace others, E should be producing transformations. Since he is restricted to psychological dispositions, he should be redefining behavioral units.

In Multiple Story Plots, E is thought to be changing systems. In each problem, E is given the beginning of a story plot, e.g., "Two sisters, A and B, are both romantically interested in the same young man, C. One day he comes to their house unexpectedly." E is to take the story from there, and to make each completion a change to another story. E might give such completions as: "A tells C that B does not want to see him. Instead of discouraging him, this makes C all the more interested in B." "A and B praise each other to C, who becomes more confused than ever about which one he likes better."

DBI - Divergent Production of Behavioral Implications. --The difference between seeing implications as in ability CBI and producing implications, as in DBI, is a small but important one. It is true that there have been occasional confusions between CMI and DMI tests, for example, with a test for one showing some relation to the other. This is not strange, since E lists implications for given information in both kinds of tests. The difference is that he is to give only two to four responses in cognition

tests, with no limit except time in divergent-production tests. Evidently, the responses that he gives "off the top of his head" indicate cognition, whereas those that require a little inventive activity indicate divergent production. The first implications to come are probably in his memory store, or something very similar is there; the ones coming later have to be forced a little, hence "produced."

Suggested Feelings and Actions is perhaps the clearest example of what DBI means. That is, it satisfies clearly the definition for that ability. This test presents to E a description of a situation and asks him to suggest a number of different feelings that the situation should be expected to arouse, along with some action that might be expected. The giving of implied actions runs a little risk of getting over toward the semantic ability, DMI, however.

In other content areas, the divergent-implication abilities are often referred to as elaborative. Elaborations are extra or added items of information; added to what is already there, and those additions are largely suggested as implications from that source. One test for DBI was called Behavioral Elaborations. Each part of this test asks E to say what a person would be likely to do if another person in his presence does something directed to him. For example, it asks the question, "If person A winks at person B, what will B do?" E is to offer a number of suggested actions, such as: "Smile back timidly." "Become embarrassed, and blush." "Pretend he did not see the wink."

The idea for another DBI test can be traced back to early ARP history. An ability for being sensitive to problems was one of the first hypothesized in connection with factor-analytic investigations of creative thinking (Wilson, Guilford, Christensen, and Lewis, 1954). Such an ability was repeatedly found by factor analysis. When the SI theory and model became available, it was first logically related to ability EMI (evaluation of semantic implications). Later, it was demonstrated that sensitivity to problems should be identified with CMI, the parallel cognition ability. Seeing is cognizing, and seeing problems is cognizing implications. In any case, the implication aspect was correct, also the semantic aspect. Producing multiple problems should represent the class of divergent-implication abilities, and, if the content is behavioral, DBI.

The test Multiple Social Problems is that kind of test. To provide situations well-known to all examinees, each problem asks a question like: "What personal problems can a BROTHER and SISTER have with each other? Other questions pair other members of a family, and also, in one problem, a boy and his girl friend. Each problem is thus to be implied by the known interactions of two people of familiar status.

In Alternate Social Solutions, E is given a social problem of limited or personal scope, involving interacting persons, and he is to suggest a number of different solutions. He does not have to choose any one as being right or best; that would be evaluation. Ideas for solutions are generated as implications from the understood problem, which sets up a "search model," as Duncker called it (Duncker, 1945). The generation of a list of alternative solutions should indicate degrees of DBI. In a sample problem of this kind, E is to imagine that he is on a weekend trip with others. The others want to go hunting, but E wants to go fishing. What different solutions can E think of?

Reference Factors and their Tests

The abilities selected for representation by reference factors, those outside the six divergent-behavioral abilities that were of special interest, are listed in Tables 1 and 2, with one exception. There were three behavioral-cognition abilities and four semantic divergent-production abilities, plus CMU, which had no place in the two matrices. CMU was represented in the analysis as a stand-in measurement for IQ, which, when from a verbal test, is dominated by CMU. The relation of IQ to the expected new behavioral divergent-production abilities was of interest for certain reasons. Certain special types of scatter plots have been reported between IQ and many divergent-production tests in content categories other than behavioral (Guilford and Hoepfner, 1966), and between IQ and behavioral-cognition tests (Hoepfner and O'Sullivan, 1968).

Tests were added to the battery to mark factors for the eight abilities. These abilities and their marker tests, with one-line descriptions, are listed in Table 3. Further information regarding these tests can also be found in Appendix A.

PROCEDURES

Pretesting

Owing to some special problems encountered in the development of tests for divergent production of behavioral information, the pretesting period extended to two years. Nine separate experimental pretestings were conducted during that time. The general strategy was standard for a factor-analytic investigation of the type conducted by the Aptitudes Research Project. Each pretest battery concentrated on two or three of the abilities under special study. Two or more new tests were invented and written for each of the abilities in question. Perhaps two or three already known factors were represented by marker tests to be administered also in the pretest battery. Standard procedures of item analysis were applied and means, standard deviations, and reliabilities, and intercorrelations were examined in order to determine whether the new tests were functioning in ways desired.

Special problems arose in connection with the scoring of DBX tests. Since the responses to the items were to be verbal statements offered by the examinee, it was essential that the scorers be very familiar with contemporary usage of words, in their connotations among young people like those who served as subjects. Two undergraduate students were trained for this purpose. The scorers also had to become familiar with the nature of behavioral information and to learn how to discriminate between responses that merely convey semantic information and those that convey behavioral information. They

also had to learn when one response actually duplicates another, in terms of the behavioral product in the given response.[3]

Early in pretesting it was found that some tests intended for DBX abilities proved to be merely semantic in content. It was learned that E must be guided toward behavioral responses and away from semantic ones. One step in this direction was to provide illustrations of purely semantic responses, which E was told would be rejected. Positive examples of behavioral responses were also given, of course, in introducing each test.

Another discovery was that photographs of expressions from series that were produced some years ago (such as the Frois-Witman and Lightfoot pictures) (Hulin and Katz, 1935; Engen, Levy, and Schlosberg, 1957), do not necessarily mean what they did previously. In fact, one facial expression was given an interpretation opposite to that intended, by contemporary observers. Others were ambiguous. New photographs taken of contemporary subjects showing expressions were interpreted with much better aggrement. They were used with few exceptions, where photographed faces were wanted.

[3] For assistance in pretest scoring we are indebted to Mr. Michael Heffernan and Miss Mary Hendricks.

Test Administration

The 38 tests, 22 for DBX abilities and 16 for the others, were printed in booklets, each of which required a normal class period for administration. The order of the tests was fixed and it was applied to all examinees. The usual rules prevented tests for any one ability to be given in immediate succession; in fact, the tests for each ability were more widely dispersed throughout the booklets. The examinees were tested simultaneously in three groups, each with an administrator and two proctors.

The Subjects

The sample for this study included students in grades 10-12 of the Burbank High School, in Burbank, California. Burbank is primarily a middle-class,

Table 3

Previously Demonstrated SI Abilities and Marker Tests

Used to Determine their Factors

SI ability	Test	Nature of the test[a]
CMU	Verbal Comprehension	Multiple-choice vocabulary test
	Word Completion	Word-defining test
CBU	Expressions	Multiple-choice "behavioral-vocabulary" test
	Faces	Same as Expressions, confined to faces
	Stick Figure Expressions	Same, confined to stick figures
CBR	Social Relations	Select comment to go with one of two facing faces
	Silhouette Relations	Select face to go with one of two facing silhouette figures of persons
CBS	Missing Cartoons	Select cartoon frame to fill missing part of cartoon strip
	Missing Pictures	Same, with photographs rather then cartoons
DMU	Ideational Fluency	List objects with two common properties
	Plot Titles (nonclever)	Invent nonclever titles for a story
	Consequences (obvious)	List obvious effects of a given change
DMC	Utility Test (fluency)	List different uses for the same object
	Multiple Grouping	Classify and reclassify word meanings
DMT	Plot Titles (clever)	List clever titles to story plot
	Consequences (remote)	List indirect effects from a change
DMI	Possible Jobs	List jobs for which a given emblem stands
	Planning Elaboration	List detailed steps for an outlined plan

[a] For additional descriptions of tests, see Appendix A.

Caucasian community. Owing to absences and to the need for excluding some booklets showing irregularities, the number who completed all tests was 192, out of a total numbering 252. In the usable sample, 82 were girls and 110 were boys.[4]

Scoring

The cognition tests (see Table 3) were scored using preestablished keys. Those involving behavioral information were first item analyzed, as a check on the applicability of keys established earlier on other groups of subjects, and some minor modifications were made in the keys to be used in this study.

Scoring of the semantic-divergent-production tests was done independently by two experienced scorers. Where the two scorers differed on any response, the matter was decided by a third scorer. Consequences and Plot Titles were scored differently than was usual. The goal was to see that no two scores (for DMU and DMT, respectively) were derived from the same responses to parts of these tests. Each test was divided into two major parts, and a DMU score was obtained from one part and a DMT score from the other part. The DMU score, in each test, was a single count of the total number of acceptable responses, including clever and nonclever in Plot Titles and obvious and remote in Consequences. The DMT score was the number of clever responses in the DMT part of the Plot Titles test and the number of remote responses in the DMT part of the Consequences test. In the latter case, a higher standard for remoteness was applied.

The scorers for the DBX tests were selected in part on the basis of making high scores on some of the behavioral-cognition tests, to determine that they had high degrees of "social sensitivity." This procedure was to help ensure that they would be sensitive to the nuances they would encounter in responses in the DBX tests.[5] Each of the two scorers scored the DBX tests independently. Correlations between their scorings in the different tests ranged from .89 to .96. Where they differed on particular responses, the final decision was made by a third scorer, who was the first author of this report.

For tests in which E selects pairs or other combinations of expressions, as in most DMC and DMR tests, five observers judged independently all possible pairs or groups for acceptability as answers. Where three or more judges agreed that such a response would be acceptable, the pair or combination was accepted. Where two judges agreed and more than 10 per cent of the examinees gave a particular response, it was keyed as acceptable.

The problem of deciding when two of an E's responses to the same item were duplicates was solved in the following manner. Where two scorers agreed that a duplication occurred, no extra point was given. Where they disagreed, the third scorer broke the tie.

Statistical Analysis[6]

Total-score distributions were obtained and were checked for skewness and truncations. Only one distribution (for Consequences - remote) deviated sufficiently from symmetry to suggest a need for scaling or dichotomization. The distribution was narrow, precluding effective scaling, and because new questions had been raised regarding the use of dichotomies in correlating test variables, it was decided to leave this distribution as it was.

The usual descriptive statistics, including means, standard deviations, and reliability coefficients may be seen in Table 4. Reliability estimates were from intercorrelations of parts, with Spearman-Brown adjustments, from the Kuder-Richardson formula 20, or from application of Cronbach's general alpha coefficient. For three tests, communalities were used as lower-bound estimates. It will be seen that the reliability levels compare very favorably with those for other tests used in factor analysis. Each test measures a quality or qualities with much stability.

The Factor Analysis

The product-moment coefficients of correlation are given in Table 5. Factors were extracted by application of the principal-factors method, starting with squared multiple R's in the diagonals and iterating the extractions until communalities became stabilized, with 15 factors. The 15 factors accounted for 93.0 per cent of the total variance.

The 15 principal axes (14 for SI abilities and 1 for sex membership) were rotated by Cliff's (1966) orthogonal-rotation program designed to maximize the similarity of the empirical factor matrix to a target matrix. The initial target matrix was patterned in line with the experimental hypotheses, using the square root of each test's communality as its target loading on its own expected factor and zeros elsewhere. After the first rotation, and after each successive rotation, the target matrix was modified in the light of findings in the preceding rotation and also so as to improve positive manifold. The principal-component and final rotated matrices are given in Tables 6 and 7, respectively.

INTERPRETATIONS OF THE FACTORS

The interpretation of each factor is based upon the apparent common-factor content of tests loading .30 or higher on the factor. The factor loading for each factor are listed along with any additional significant loadings on other factors, where tests proved

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[4] For this testing we are very much indebted to Dr. R. Leland, Principal, and Miss Carolyn Barnes, Head Counselor, Burbank High School, Burbank, California.

[5] We are especially indebted to Mr. Peter Simer and Mr. Gene Prasse for their diligence and interest in scoring the DB tests.

[6] For the statistical analysis, computer assistance was obtained from Health Sciences Computer Facility, U.C.L.A., sponsored by NIH Grant FR-3, Western Data Processing Center, U.C.L.A., and Computer Sciences Laboratory, U.S.C.

Table 4

Means, Standard Deviations, Reliabilities, and Distributions of Scores

Name of Test and Code	Mean	Standard Deviation	Reliability[a]	Form of Distribution[b]
1. Alternate Cartoon Completion DBT01A	9.27	3.01	.64	0
2. Alternate Expressional Groups DBC03A	9.30	2.09	.48	0
3. Alternate Face Groupings DBC01A	14.65	4.01	.73	0
4. Alternate Facial Relations DBR01A	38.08	11.88	.96	0
5. Alternate Line Meanings DBT03A	11.12	3.62	.70	0
6. Alternate Picture Meanings DBU02A	32.98	8.38	.87	0
7. Alternate Social Meanings DBU01A	15.75	4.50	.68	0
8. Alternate Social Solutions DBI01A	19.99	4.29	.68	0
9. Behavioral Elaboration DBI04A	18.95	4.85	.82	0
10. Consequences DMT03C (obvious)	6.95	2.62	.59[c]	0
11. Consequences DMT03C (remote)	2.77	2.02	.47	+
12. Creating Social Relations DBR02A	19.23	5.44	.79	0
13. Creating Social Situations DBS01A	3.54	2.10	.45	+
14. Expressing Mixed Emotions DBU04A	13.73	4.51	.78	0
15. Expressions CBU01A	19.54	5.14	.64[d]	-
16. Faces - CBU02A	17.69	3.65	.55[d]	-
17. Forming Alternate Faces DBR04A	32.59	6.38	.88	-
18. Ideational Fluency DMU01B	34.49	8.33	.70	0
19. Missing Cartoons CBS01A	17.78	6.25	.81[d]	-
20. Missing Pictures CBS04A	9.96	3.45	.39[d]	0
21. Multiple Behavioral Grouping DBC02A	11.54	2.70	.64	0
22. Multiple Cartoon Fill-Ins DBS02A	7.49	2.51	.58	0
23. Multiple Emotional Expressions DBU03A	19.66	4.85	.75	0
24. Multiple Expression Changes DBT02A	23.26	5.41	.88	0
25. Multiple Grouping DMC02C	8.40	2.47	.71	+
26. Multiple Social Problems DBI03A	12.23	4.37	.78	0
27. Multiple Story Plots DBT04A	12.97	3.63	.82	0
28. Planning Elaboration II DMI01B	20.54	6.39	.70	0
29. Plot Titles DMT01G (clever)	1.00	1.18	.62[c]	++
30. Plot Titles DMT01G (non-clever)	6.30	2.78	.61[c]	+
31. Possible Jobs DMI03B	18.55	6.04	.75[e]	-
32. Silhouette Relations CBR05A	10.88	4.38	.43[d]	0
33. Social Relations II CBR02A	14.18	4.63	.51[d]	-
34. Stick Figure Expressions CBU05A	15.94	4.88	.46[d]	-
35. Suggested Feelings and Actions DBI02A	14.27	4.06	.80	0
36. Utility Test DMC01B (fluency)	20.85	6.76	.73	+
37. Utility Test DMC01B (flexibility)	9.92	7.11	.78	+
38. Varied Emotional Relations DBR03A	18.06	3.58	.64	-
39. Verbal Comprehension CMU02D	10.19	4.24	.75[d]	0
40. Word Completion CMU01B	11.42	3.89	.84[d]	0
41. Writing Behavioral Stories DBS03A	4.29	2.14	.63	0
42. Sex	.57	.50		

[a] Reliability estimates are Spearman-Brown corrections of interpart correlations, unless noted.

[b] Distribution forms are coded: -, slight negative skew; 0, symmetrical; +, slight positive skew; and ++ strong positive skew.

[c] Communality entered as reliability estimate.

[d] Reliability estimates are Kuder-Richardson coefficients.

[e] Reliability estimate is item-alpha coefficient.

to be factorially complex. The hypothesized factor content for each test is represented by the SI trigram after the test name. The number of the test in the battery precedes the test name. Significant loadings are indicated on the right. The factors will be discussed in the order listed in Table 7.

Reference Factors

CMU - Cognition of Semantic Units

40. Word Completion (CMU)	.81
39. Verbal Comprehension (CMU)	.71

No comment is necessary except to say that the absence of any other test significantly on CMU indicates no vocabulary problem in those tests. In other words, the CMU factor was well controlled in them.

CBU - Cognition of Behavioral Units

16. Faces (CBU)	.51
34. Stick Figure Expressions (CBU)	.50
15. Expressions (CBU)	.47

The three CBU-designed tests, and no others, demonstrated this ability. In the earlier analysis (O'Sullivan, et al., 1965), Faces and Expressions were among those used, but no test had a high loading on CBU. Furthermore, all the CBU tests loaded on the factor used faces as stimuli, in whole or in part, so that the question was raised as to whether the factor represented more than an ability to interpret facial expressions. The inclusion of a completely non-face test in this study was in part an attempt to obtain an answer to that question and also to achieve a possibly stronger test for CBU. The answer seems decisive, for the factor here pertains to a non-face test as well, and all three have higher loadings than were found before. All kinds of expressions are involved in the three tests--of face, hands, feet, and other body parts, as well as postures, either realistic, as in line drawings, or schematized, as in stick figures.

CBR - Cognition of Behavioral Relations

32. Silhouette Relations (CBR)	.48
33. Social Relations (CBR)	.41

This represents a second replication of a CBR factor, the first replication having been achieved using the same tests (Tenopyr, Guilford, and Hoepfner, 1966). The absence of loadings on any DBX factor, especially DBR, indicates that this is a distinct ability and that its variance was controlled in DBX tests, as well as in others.

CBS - Cognition of Behavioral Systems

19. Missing Cartoons (CBS)	.64
20. Missing Pictures (CBS)	.57

This is also a second replication for the CBS factor. In the first analysis (O'Sullivan, et al., 1965), Missing Cartoons had secondary loadings on both CBU and CBI. No secondary CBU loading was found in this analysis, but CBI was not included in this analysis, so this test's relation to that factor could not be re-examined.

DMU - Divergent Production of Semantic Units

10. Consequences (obvious) (DMU)	.57	(DBT .31)
18. Ideational Fluency (DMU)	.54	
36. Utility Test (fluency) (DMU)	.51	(DMI .32)
37. Utility Test (shifts) DMC)	.43	(DMC .59)
38. Varied Emotional Relations (DBR)	.35	(DBR .58)
30. Plot Titles (non-clever) (DMU)	.33	(DMC .35; DBI .33)
28. Planning Elaboration (DMI)	.32	(DMI .47)

Tests loading significantly on this factor included the four that were designed for it, plus three that were not. Three of the four designed for it had secondary loadings to be explained. Only the marker test Ideational Fluency was univocal for DMU in this analysis.

Utility Test (shifts) loads strongly on DMU because the two scores, for fluency and for shifts, intercorrelated so strongly (.57). Ordinarily this correlation is lower, as low as .27 in one study (Guilford and Hoepfner, 1966). There is an empirical reason for a positive correlation between the two scores, in that the number of shifts is limited by the total number of responses, an experimental dependence. The fact that the DMU score has no significant loading on DMC reflects the one-way dependence.

The secondary loading for Varied Emotional Relations on DMU suggests that in finding related pairs of facial expressions in that test, E is aided by generating semantic ideas in the form of units.

The secondary DMU loading for Planning Elaboration, a DMI test, is a replication of an earlier finding (Guilford and Hoepfner, 1966), where it was attributed to the fact that younger examinees are sometimes prone to name objects needed to implement a plan rather than actions. Naming objects is like the task in Ideational Fluency.

The secondary loading on DBT for Consequences (obvious) may reflect behavioral ideas in items of that test. This could be true in items like those asking for consequences of not needing food any more or all individuals losing sense of balance. Some effects would be felt in terms of human emotions and attitudes, and modifications in those features, hence the transformation aspect. Without having both DMX and DBX tests together in an analysis, this kind of behavioral involvement in DMX tests would not be found. One would hardly expect such an involvement in Consequences, a priori. The fact that both the obvious and remote scores had secondary loadings on DBT may be attributed to the fact that an obvious-remote distinction does not hold with respect to the behavioral content as it does for the semantic content; otherwise, one might expect the obvious score to have DBU variance, not DBT. Or it may be that behavioral responses tend to be remote.

The secondary loading on DMI for the Utility Test may come from the fact that in giving uses for a brick or a pencil, one use leads to or suggests another within the same class.

The secondary loading for Plot Titles (non-clever) on DBI is another example of behavioral content showing up in a DMU test. In this instance, however, both the DMU and DMT scores derived from Plot Titles, unlike those from Consequences, both go on

the implications factor DBI rather than DBT. In fact, the DMU score for Plot Titles is loaded as heavily on DBI as on DMU in this analysis. Considering these results, it seems reasonable to say that the titles are implied by the stories, and, as implications, it does not matter whether the titles are clever or non-clever; they are behavioral implications nevertheless.

DMC - Divergent Production of Semantic Classes

37. Utility Test (shifts) (DMC)	.59	(DMU .43)
25. Multiple Grouping (DMC)	.36	
30. Plot Titles (non-clever) (DMU)	.35	(DMU .33; DBI .33)

Both of the marker tests should probably have been univocal if it were not for the experimental dependency of the two scores for the Utility Test, as mentioned earlier. Since there were no significant loadings from tests of DBC, we may assume that semantic and behavioral abilities pertaining to divergent production of classes are well differentiated and that DMC variance was well controlled in DBC tests, and other DBX tests.

DMT - Divergent Production of Semantic Transformations

29. Plot Titles (clever) (DMT)	.57	(DBI .39)
11. Consequences (remote) (DMT)	.42	(DBT .36)

The two marker tests for DMT performed their usual function of demonstrating DMT, but both are involved with behavioral information, one for DBI and the other for DBT. The involvement of the DMU scores for these two tests with the same behavioral abilities was discussed earlier.

DMI - Divergent Production of Semantic Implications

28. Planning Elaboration (DMI)	.47	(DMU .32)
5. Alternate Line Meanings (DBT)	.35	(DBU .32; DBR .31)
36. Utility Test (fluency) (DMU)	.32	(DMU .51)
31. Possible Jobs (DMI)	.30	

The two marker tests just barely identify this factor for DMI, one of them univocally, but with minimum significance. The appearance of the Utility Test (fluency) here was discussed earlier.

Table 5

Correlation Matrix of 42 Variables (N = 192)

Test Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Alternate Cartoon Completion		19	26	27	27	46	41	45	40	37	19	35	26	41	11	-01	15
2. Alternate Expressional Groups	19		28	28	16	14	15	24	17	22	15	19	22	14	09	08	09
3. Alternate Face Groupings	26	28		38	24	35	23	29	30	28	19	34	30	23	08	18	29
4. Alternate Facial Relations	27	28	38		37	35	26	36	38	24	20	36	26	30	11	04	36
5. Alternate Line Meanings	27	16	24	37		34	33	29	36	15	19	36	21	34	18	11	12
6. Alternate Picture Meanings	46	14	35	35	34		46	42	43	30	23	53	40	55	13	09	24
7. Alternate Social Meanings	41	15	23	26	33	46		47	44	39	16	34	33	53	17	05	17
8. Alternate Social Solutions	45	24	29	36	29	42	47		47	44	25	44	37	50	23	15	11
9. Behavioral Elaboration	40	17	30	38	36	43	44	47		31	27	52	41	44	20	15	20
10. Consequences (obvious)	37	22	28	24	15	30	39	44	31		24	14	23	40	15	07	12
11. Consequences (remote)	19	15	19	20	19	23	16	25	27	24		33	14	32	21	03	09
12. Creating Social Relations	35	19	34	36	36	53	34	44	52	14	33		40	42	20	18	27
13. Creating Social Situations	26	22	30	26	21	40	33	37	41	23	14	40		39	10	12	23
14. Expressing Mixed Emotions	41	14	23	30	34	55	53	50	44	40	32	42	39		28	10	14
15. Expressions	11	09	08	11	18	13	17	23	20	15	21	20	10	28		24	-04
16. Faces	-01	08	18	04	11	09	05	15	15	07	03	18	12	10	24		-01
17. Forming Alternate Faces	15	09	29	36	12	24	17	11	20	12	09	27	23	14	-04	-01	
18. Ideational Fluency	36	29	21	29	18	34	37	46	34	51	26	25	29	41	23	08	-03
19. Missing Cartoons	18	13	00	16	18	15	25	36	19	26	27	24	13	37	48	07	-01
20. Missing Pictures	14	18	03	10	09	17	09	18	12	19	18	16	12	29	23	12	-06
21. Multiple Behavioral Grouping	20	42	34	38	31	29	32	31	34	31	24	34	27	31	14	07	18
22. Multiple Cartoon Fill-Ins	51	26	30	31	25	33	34	52	36	39	29	30	25	38	17	06	15
23. Multiple Emotional Expressions	48	23	29	37	34	61	47	48	51	40	24	47	38	61	27	10	12
24. Multiple Expression Changes	38	34	46	54	37	36	31	32	46	32	24	43	26	33	02	02	32
25. Multiple Grouping	29	16	32	31	28	21	32	34	32	29	24	33	26	33	21	-01	17
26. Multiple Social Problems	48	16	21	34	22	47	41	48	45	38	20	39	40	47	22	04	19
27. Multiple Story Plots	42	24	28	29	31	39	43	50	51	30	33	45	39	42	28	04	16
28. Planning Elaboration II	47	22	33	43	37	46	35	45	43	38	25	38	27	41	11	08	17
29. Plot Titles (clever)	44	24	34	39	22	38	36	37	42	27	10	38	28	26	02	-10	25
30. Plot Titles (non-clever)	13	07	11	19	08	14	34	32	23	13	15	14	12	31	20	03	-03
31. Possible Jobs	38	15	26	30	23	33	35	44	41	34	18	33	25	42	24	05	08
32. Silhouette Relations	00	09	10	03	00	-03	-03	10	06	07	03	10	11	07	23	28	05
33. Social Relations II	09	12	17	16	23	20	28	30	22	24	14	13	15	36	33	21	02
34. Stick Figure Expressions	17	12	15	08	05	02	14	14	12	15	-02	04	-06	13	28	20	-02
35. Suggested Feelings and Actions	43	20	19	20	31	46	41	48	52	40	28	41	40	47	29	19	14
36. Utility Test (fluency)	43	25	28	40	26	38	38	45	37	43	22	33	18	33	08	-01	10
37. Utility Test (flexibility)	41	19	04	21	07	26	23	31	14	28	31	22	10	26	13	-04	00
38. Varied Emotional Relations	25	31	41	51	31	36	33	27	34	37	20	38	30	36	04	06	26
39. Verbal Comprehension	21	00	-03	19	10	13	19	31	30	20	22	21	20	38	32	03	-11
40. Word Completion	25	-05	-03	20	17	19	35	35	34	25	22	19	19	44	38	04	-05
41. Writing Behavioral Stories	25	07	19	26	24	35	37	34	40	23	31	35	30	40	14	20	03
42. Sex	-19	-12	-18	-03	-21	-26	-25	-14	-24	-14	-10	-25	-30	-27	-11	-12	-11

Note. — Decimal points omitted.

Alternate Line Meanings was included in the study without much conviction as to where it would go factorially, but the a priori choice of hypothesis was DBT; B, because the responses are to pertain to emotion or feeling states; T because each line is to be interpreted alternatively or redefined in different ways. The appearance of that test on DMI seems to mean that each line suggests or implies psychological states, but the implications are conceived in semantic form. The test is similar to the DMI test Possible Jobs, in which outlined, meaningful objects imply different jobs or occupations. Possibly the detachment of the named emotions given by E in Alternate Line Meanings from any person makes the implications semantic rather than behavioral. There are further complexities in this test, which will be discussed later. In the rotations, it was clear that the test would not go on DBT but had to be targeted differently, as indicated in the results seen above.

The Experimental (DBX) Factors

DBU - Divergent Production of Behavioral Units

6.	Alternate Picture Meanings (DBU)	.67	
14.	Expressing Mixed Emotions (DBU)	.55	
23.	Multiple Emotional Expressions (DBU)	.52	(DBI .43)
7.	Alternate Social Meanings (DBU)	.50	
12.	Creating Social Relations (DBR)	.36	(DBR .37)
35.	Suggested Feelings and Actions (DBI)	.36	(DBI .36)
5.	Alternate Line Meanings (DBT)	.32	(DMI .35; DBR .31)

This factor emerged clearly, with four DBU-designed tests appearing on it, three with univocal loadings. Alternate Picture Meanings presents E with line drawings, each a face in a certain expression, to which E is to write a list of things the person might be saying or thinking. Expressing Mixed Emotions presents verbally the specification of two emotional states, with E to list things the person with such a combination might be saying or thinking. Multiple Emotional Expressions specifies verbally a single emotion, with E to offer alternative verbal responses to go under that heading. Alternate Social Meanings presents a description of an expressive act, such as lowering one's head, to which E is to

Table 5

(Continued)

18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
36	18	14	20	51	48	38	29	48	42	47	44	13	38	00	09	17	43	43	41	25	21	25	25	-19
29	13	18	42	26	23	34	16	16	24	22	24	07	15	09	12	12	20	25	19	31	00	-05	07	-12
21	00	03	34	30	29	46	32	21	28	33	34	11	26	10	17	15	19	28	04	41	-03	-03	19	-18
29	16	10	38	31	37	54	31	34	29	43	39	19	30	03	16	08	20	40	21	51	19	20	26	-03
18	18	09	31	25	34	37	28	22	31	37	22	08	23	00	23	05	31	26	07	31	10	17	24	-21
34	15	17	29	33	61	36	21	47	39	46	38	14	33	-03	20	02	46	38	26	36	13	19	35	-26
37	25	09	32	34	47	31	32	41	43	35	36	34	35	-03	28	14	41	38	23	33	19	25	37	-25
46	36	18	31	52	48	32	34	48	50	45	37	32	44	10	30	14	48	45	31	27	31	35	34	-14
34	19	12	34	36	51	46	32	45	51	43	42	23	41	06	22	12	52	37	14	34	30	34	40	-24
51	26	19	31	39	40	32	29	38	30	38	27	13	34	07	24	15	40	43	28	37	20	25	23	-14
26	27	18	24	29	24	24	24	20	33	25	10	15	18	03	14	-02	28	22	31	20	22	22	31	-10
25	24	16	34	30	47	43	33	39	45	38	38	14	33	10	13	04	41	33	22	38	21	19	35	-25
29	13	12	27	25	38	26	26	40	39	27	28	12	25	11	15	-06	40	18	10	30	20	19	30	-30
41	37	29	31	38	61	33	33	47	42	41	26	31	42	07	36	13	47	33	26	36	38	44	40	-27
23	48	23	14	17	27	02	21	22	28	11	02	20	24	23	33	28	29	08	13	04	32	38	14	-11
08	07	12	07	06	10	02	-01	04	04	08	-10	03	05	28	21	20	09	-01	-04	06	03	04	20	-12
-03	-01	-06	18	15	12	32	17	19	16	17	25	-03	08	05	02	-02	14	10	00	26	-11	-05	03	-11
	34	30	28	37	48	27	33	37	33	42	31	33	48	03	30	18	33	48	39	33	29	34	30	-24
34		46	12	28	28	07	23	26	32	32	02	21	37	16	34	31	31	25	32	08	43	41	40	-08
30	46		23	14	27	12	08	20	23	27	02	08	28	13	28	17	19	19	11	07	23	21	22	-08
28	12	23		29	35	33	33	26	33	31	36	21	36	12	16	00	29	32	14	44	14	20	13	-17
37	28	14	29		35	32	43	35	44	45	33	14	33	13	22	16	34	43	37	23	15	18	25	-17
48	28	27	35	35		43	29	52	47	47	38	30	44	00	26	09	52	32	22	30	33	35	37	-31
27	07	12	33	32	43		31	37	30	41	44	18	35	00	14	12	33	36	15	53	09	06	19	-17
33	23	08	33	32	29	31		25	28	30	44	23	33	05	10	10	25	34	30	32	26	19	23	-18
37	26	20	26	35	52	37	25		47	37	28	34	41	11	27	15	45	32	25	31	30	37	30	-29
33	32	23	33	44	47	30	28	47		43	25	19	37	07	31	15	43	41	24	20	26	26	31	-26
42	32	27	31	45	47	41	30	37	43		44	13	46	-04	28	19	41	52	32	35	30	27	34	-21
31	02	02	36	33	38	44	44	28	25	44		25	33	-06	05	02	32	46	38	33	13	12	19	-12
33	21	08	21	14	30	18	23	34	19	13	25		29	03	20	08	24	17	17	11	26	33	30	-13
48	37	28	36	33	44	35	33	41	37	46	33	29		05	30	19	46	43	25	23	34	46	29	-13
03	16	13	12	13	00	00	05	11	07	-04	-06	03	05		29	20	09	09	06	-06	14	17	13	08
30	34	28	16	22	26	14	10	27	31	28	05	20	30	29		22	30	20	08	08	30	35	29	-14
18	31	17	00	16	09	12	10	15	15	19	02	08	19	20	22		16	18	19	11	27	19	17	-03
33	31	19	29	34	52	33	25	45	43	41	32	24	46	09	30	16		28	23	23	29	38	37	-25
48	25	19	32	43	32	36	34	32	41	52	46	17	43	09	20	18	28		57	36	22	23	24	-04
39	32	11	14	37	22	15	30	25	24	32	38	17	25	06	08	19	23	57		19	29	28	26	05
33	08	07	44	23	30	53	32	31	20	35	33	11	23	-06	08	11	23	36	19		-04	04	16	-16
29	43	23	14	15	33	09	26	30	26	30	13	26	34	14	30	27	29	22	29	-04		75	38	-10
34	41	21	20	18	35	06	19	37	26	27	12	33	46	17	35	19	38	23	28	04	75		39	-08
30	40	22	13	25	37	19	23	30	31	34	19	30	29	13	29	17	37	24	26	16	38	39		-20
-24	-08	-08	-17	-17	-31	-17	-18	-29	-26	-21	-12	-13	-13	08	-14	-03	-25	-04	05	-16	-10	-08	-20	

provide alternative verbal responses for the person involved in the act. Although the responses in all tests are things that people might say or think, the context within which this performance is executed differs. One is of line drawings of facial expressions, the others of verbal specifications or descriptions. Thus, some degree of generality is indicated for the factor.

The presence of three "foreign" tests calls for comments. The DBR-designed test Creating Social Relations presents two persons in line drawings, emphasizing face and upper torso. E is to list things that one designated person might be saying to the other. Describing the test in this way indicates one important similarity to some DBU tests--making statements to go with expressions. If E can contribute acceptable responses without being restricted to those that depend upon relations between the two people, he would be thus exhibiting DBU rather than DBR.

In Suggested Feelings and Actions, in response to a described, normally emotion-provoking situation, E is to list several different emotions that might reasonably be aroused and to each emotion he is to add an appropriate action to his response. In such a two-step item, it may be that giving the list of emotions is a matter of DBU and giving actions that go with them is a matter of DBI. The equality of the two loadings, on DBU and DBI, would suggest this kind of interpretation. At least, it can be seen how the first step, listing emotions, is similar to the strongest tests for DBU. It had been intended that giving both responses to an item be implications.

Alternate Line Meanings came up for discussion before in connection with its loading on DMI. Listing

Table 6

Unrotated Factor Matrix

Test Name	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	h^2
1. Alternate Cartoon Completion	62	-11	19	18	24	-10	16	10	08	10	-02	-01	-09	-03	-11	61
2. Alternate Expressional Groups	35	-20	07	-33	04	13	-10	-10	13	-01	12	-04	-03	-10	-06	36
3. Alternate Face Groupings	45	-36	-12	-26	-05	02	12	-02	-05	-01	00	08	-02	-06	-01	44
4. Alternate Facial Relations	55	-28	06	-16	-34	-08	-02	17	-04	-04	-10	-11	10	-01	01	60
5. Alternate Line Meanings	46	-14	-17	-05	-07	-09	-10	12	-07	13	04	14	09	19	05	39
6. Alternate Picture Meanings	65	-20	-17	23	20	-10	-06	09	-11	-15	05	-19	-02	18	-02	71
7. Alternate Social Meanings	62	-05	-05	18	08	16	07	-07	-18	10	-09	01	07	11	18	56
8. Alternate Social Solutions	70	05	04	04	11	02	11	-10	03	03	-03	01	14	02	02	55
9. Behavioral Elaboration	67	-09	-18	11	-08	-09	11	02	04	04	05	13	05	-04	-06	56
10. Consequences (obvious)	56	-01	18	-08	18	27	03	00	04	-18	-25	16	-08	02	02	59
11. Consequences (remote)	42	07	04	-05	-03	-25	-36	-25	-04	-05	-21	16	03	-05	-24	58
12. Creating Social Relations	62	-17	-24	03	-05	-33	-07	-08	-02	01	14	-09	-05	03	-04	63
13. Creating Social Situations	51	-14	-29	11	03	-02	05	-17	18	-19	04	-05	-11	-16	22	57
14. Expressing Mixed Emotions	70	12	-15	15	05	06	-10	01	-08	-05	-13	-06	-03	12	05	61
15. Expressions	35	43	-17	-22	-02	-02	-01	-09	02	27	-04	-07	-18	21	-07	55
16. Faces	15	13	-35	-33	12	-04	20	-06	-20	-15	16	10	-04	08	-10	45
17. Forming Alternate Faces	24	-37	-14	-06	-10	-15	08	04	06	03	-22	-12	-02	-05	12	34
18. Ideational Fluency	62	12	21	-04	10	29	-09	-06	-05	-12	08	04	-07	-05	-03	58
19. Missing Cartoons	47	53	07	-19	05	-10	-26	04	-07	18	-05	-13	-03	-09	20	73
20. Missing Pictures	33	30	-03	-22	13	07	-31	15	10	-06	15	-15	04	-10	01	46
21. Multiple Behavioral Grouping	52	-20	-04	-21	-21	18	-16	-15	23	-04	12	02	06	15	01	58
22. Multiple Cartoon Fill-Ins	59	-06	17	-09	22	-09	09	-09	09	10	-10	11	10	-04	-02	51
23. Multiple Emotional Expressions	72	-01	-16	20	09	11	-08	09	01	-01	08	-09	-06	04	-14	66
24. Multiple Expression Changes	58	-41	-01	-13	-18	01	01	20	-03	07	-06	-01	-01	-15	-19	66
25. Multiple Grouping	51	-09	14	-04	-20	-02	00	-20	-01	16	03	12	-17	02	17	47
26. Multiple Social Problems	65	04	-10	16	06	09	12	03	10	00	-16	-21	-03	-13	-08	59
27. Multiple Story Plots	64	03	-10	02	17	-10	-03	-07	18	18	-04	03	15	-07	02	56
28. Planning Elaboration II	67	-07	14	-02	08	-07	-06	28	-01	00	12	14	09	-04	05	61
29. Plot Titles (clever)	54	-35	26	13	-15	-01	15	-07	03	08	22	-03	-04	01	05	61
30. Plot Titles (non-clever)	38	19	01	17	-27	32	07	-26	-24	15	04	-15	17	-11	-14	62
31. Possible Jobs	62	14	09	02	-07	13	01	12	09	04	09	01	06	02	-01	47
32. Silhouette Relations	12	25	-14	-40	-02	-12	30	-16	12	-16	-03	-14	07	03	00	45
33. Social Relations II	41	33	-17	-21	04	11	06	07	-03	-03	-06	02	19	06	06	42
34. Stick Figure Expressions	24	28	09	-32	06	01	25	21	-16	15	01	00	-17	-09	-01	44
35. Suggested Feelings and Actions	64	09	-17	10	12	-01	07	-01	06	01	01	06	-05	04	-09	50
36. Utility Test (fluency)	62	-09	44	-10	06	-05	06	02	-02	-09	08	-01	14	10	07	66
37. Utility Test (flexibility)	45	12	60	02	08	-24	02	-19	-11	-11	04	-13	-11	05	-03	74
38. Varied Emotional Relations	51	-42	02	-19	-16	13	-12	06	-16	-12	-13	-03	-18	06	04	63
39. Verbal Comprehension	45	57	07	15	-31	-10	05	11	12	-08	05	10	-12	-09	02	73
40. Word Completion	50	60	02	21	-35	-01	09	11	15	-15	-07	08	-03	11	-04	87
41. Writing Behavioral Stories	53	24	-13	08	-05	-16	-02	-05	-32	-16	05	09	10	-21	09	59
42. Sex	-32	06	29	-11	-13	-13	07	05	02	-08	-07	-13	16	12	-05	31

Note. — Decimal points omitted.

Table7

Rotated Factor Matrix

Test Name	CMU	CBU	CBR	CBS	DMU	DMC	DMT	DMI	DBU	DBC	DBR	DBS	DBT	DBI	SEX	h^2
1. Alternate Cartoon Completion	04	05	-08	01	29	16	-07	17	26	-02	18	05	42	40	06	60
2. Alternate Expressional Groups	14	07	02	18	25	00	03	05	-02	43	17	03	09	11	02	36
3. Alternate Face Groupings	15	15	10	-11	19	-04	01	12	06	30	42	14	09	16	-07	45
4. Alternate Facial Relations	09	-07	12	05	20	05	08	20	10	16	65	00	00	12	06	59
5. Alternate Line Meanings	04	09	09	-02	-03	00	04	35	32	17	31	03	12	02	-10	40
6. Alternate Picture Meanings	06	-01	02	03	11	07	-08	13	67	06	28	19	10	29	12	72
7. Alternate Social Meanings	00	01	20	-02	26	10	15	17	50	-01	16	10	15	25	-19	58
8. Alternate Social Solutions	09	05	25	06	27	12	14	21	29	12	12	13	29	32	-03	54
9. Behavioral Elaboration	17	06	07	-09	07	02	09	29	26	17	29	22	20	38	-06	56
10. Consequences (obvious)	14	09	11	05	57	-10	03	-04	25	12	12	08	31	08	-08	59
11. Consequences (remote)	18	05	-05	14	00	10	42	-02	19	20	20	23	36	-10	16	58
12. Creating Social Relations	02	08	02	04	-13	22	03	19	36	26	37	29	13	28	07	63
13. Creating Social Situations	07	-11	13	03	06	03	-13	-06	25	27	17	43	09	35	-17	57
14. Expressing Mixed Emotions	21	08	16	16	17	03	13	08	55	04	20	16	15	24	-10	61
15. Expressions	25	47	20	25	-13	15	12	00	19	14	-01	-13	13	14	-12	56
16. Faces	07	51	22	-09	-05	-11	-02	06	09	14	-02	25	-10	04	10	45
17. Forming Alternate Faces	09	-11	12	-07	-05	02	-11	-07	05	07	48	06	13	12	-08	34
18. Ideational Fluency	12	12	01	23	54	05	16	12	26	19	02	12	09	19	-04	58
19. Missing Cartoons	24	24	20	64	05	20	14	15	14	-05	04	10	17	02	-11	72
20. Missing Pictures	10	12	07	57	09	-11	00	15	14	16	-03	08	02	07	11	47
21. Multiple Behavioral Grouping	09	-06	14	06	19	02	09	15	19	60	24	-03	01	10	-06	57
22. Multiple Cartoon Fill-Ins	02	07	16	05	28	13	08	18	12	13	15	10	49	20	02	51
23. Multiple Emotional Expressions	13	07	-06	14	18	-04	08	17	52	15	18	11	13	43	-10	66
24. Multiple Expression Changes	04	04	-08	-01	22	-09	10	20	09	21	63	02	13	28	02	66
25. Multiple Grouping	14	06	02	00	21	36	11	14	08	25	25	09	14	10	-28	48
26. Multiple Social Problems	15	01	12	15	20	-02	07	-04	29	02	23	10	21	53	-02	58
27. Multiple Story Plots	05	00	18	18	03	05	10	23	23	18	13	15	43	33	-07	56
28. Planning Elaboration II	09	04	-01	16	32	02	-05	47	23	08	28	15	24	16	02	61
29. Plot Titles (clever)	09	02	12	05	19	11	57	07	12	-01	01	-02	-19	39	-14	61
30. Plot Titles (non-clever)	02	-14	-08	-14	33	35	-01	27	12	22	29	02	06	33	-06	61
31. Possible Jobs	26	05	10	18	29	03	08	30	21	14	12	-01	10	29	-03	47
32. Silhouette Relations	09	28	48	05	-04	06	-06	-11	-15	15	00	10	00	12	19	45
33. Social Relations II	17	24	41	20	11	-14	10	18	16	04	02	07	06	11	-04	42
34. Stick Figure Expressions	07	50	11	19	20	06	-06	13	-13	-14	10	-03	06	14	-04	44
35. Suggested Feelings and Actions	18	17	08	03	11	00	05	15	36	14	10	17	25	36	-04	49
36. Utility Test (fluency)	02	-03	17	09	51	29	01	32	17	12	20	03	21	09	16	65
37. Utility Test (flexibility)	11	04	-02	15	43	59	09	04	12	-04	05	09	22	04	28	73
38. Varied Emotional Relations	06	06	-02	00	35	01	03	-01	26	26	58	05	-02	-03	-10	62
39. Verbal Comprehension	71	13	05	21	10	15	08	19	03	-06	00	17	00	26	-01	74
40. Word Completion	81	09	19	10	12	07	12	14	20	-06	-01	05	00	24	04	87
41. Writing Behavioral Stories	17	14	14	13	10	09	25	23	22	-12	15	52	00	14	-01	59
42. Sex	02	-11	11	-03	-01	11	-02	-05	-24	-14	-03	-23	-09	-21	30	31

Note. — Decimal points omitted.

names of alternate emotions in responses to single lines of certain characteristics may be seen as somewhat like the task in Alternate Picture Meanings, which shows lines indicating expressions in combinations rather than singly. The fact that the combinations are in more or less familiar facial or bodily settings, however, make the two tests different. Another possible similarity is seen in the lines of the Stick Figure Expressions, where lines, as such, must carry the burden of communication of behavioral information. The difference in operation, CBU in the latter and DBU in the lines test, is not very relevant in this theorizing.

The additional loading in the DBU test Multiple Emotional Expressions is a strong one on DBI. In this test, E lists different remarks made by a person with only one dominant emotion specified. In presenting this test much earlier, the question arose as to whether specifying one feature would result in a lower loading on DBU than specifying two, as in Expressing Mixed Emotions. So far as DBU is concerned, the loading is about the same, unlike the results found by Christensen and Guilford (1963) for tests of DMU. The extra substantial loading on DBI is something else again. Such a shift involving the parallel abilities DMU and DMI could not have been detected, if it does, indeed, apply, in the study just referred to because no DMI factor was represented by tests. Why responding to a class having only one property specified should slant a test in the direction of implications where specifying two properties does not, is not easy to explain.

DBC - Divergent Production of Behavioral Classes

21. Multiple Behavioral Grouping (DBC)	.60	
2. Alternate Expressional Groups (DBC)	.43	
3. Alternate Face Groupings (DBC)	.30	(DBR .42)

All three tests hypothesized for DBC showed significant loadings, although one of them was very weak for it. All three tests were built on the same principle--forming alternate classes from a given set of expressional items (statements, line drawings, and photographed faces, respectively)-- with E to form classes, reclassifying items in different ways, thus showing flexibility with respect to class membership. The very different kinds of source information give some indication of generality of this ability.

Nothing is known that would account for the stronger loading of Alternate Face Groups on DBR than on DBC. A number of the DBR tests also ask E to choose combinations of expressional items that in pairs indicate how one person is responding to the other of the pair. These groupings are to be by pairs of persons rather than be small sets of three or more, as in DBC tests. It may be that E injects some relation-production into selecting his sets of three that receive credit for being classes.

DBR - Divergent Production of Behavioral Relations

4. Alternate Facial Relations (DBR)	.65	
24. Multiple Expression Changes (DBT)	.63	
38. Varied Emotional Relations (DBR)	.58	(DMU .35)
17. Forming Alternate Faces (DBR)	.48	
3. Alternate Face Groupings (DBC)	.42	(DBC .30)
12. Creating Social Relations (DBR)	.37	(DBU .36)
5. Alternate Line Meanings (DBT)	.31	(DBU .32; DMI .35)

All four of the tests written for DBR came out on this factor, with three additional tests not so intended. Two tests have univocal status on the factor. In Alternate Facial Relations E selects from among eight photographed facial expressions pairs such that there is a different relation for each pair. E is to keep in mind in each part of the test that a certain statement is being made by one member of the pair to the other, appropriate to the two expressions.

Varied Emotional Relations calls for similar pairings where the expressions appear in line drawings and there is no added statement to channel his choices. The additional freedom in this test may have had something to do with the secondary loading on DMU. At any rate, something about E's activity involved semantic information and the production of units. Another comment on this test was made earlier.

Forming Alternate Faces involves putting alternative upper halves and lower halves of line-drawn faces together to form alternate expressions to show how a man would look in different reactions to what has just happened to him, as stated to E. It was stated earlier how this test was first designed for DBU but in pretesting insisted on going with DBR tests. In the final analysis it performed consistently with that early experience, and univocally so.

Multiple Expression Changes was designed for DBT but came out solely in support of DBR. Targeted for DBT in the first rotation of axes, this test showed a definite preference for DBR, for which it was targeted in later rotations with much success. The test states three successive events happening to two people, a man and a woman. Mentioning two people interacting immediately suggests relations. The task for E is to select alternate sets of three faces each to go with the three events. It had been thought that the change from one set to another would involve transformations. But evidently E gives attention to the face at each step without much direct concern for the unity of the story. Selecting a face at each step produces a new relation between the two characters and, in most cases, incidentally alters the completion of the story. The production of a transformation thus appears to be an incidental byproduct of the varied production of behavioral relations.

The secondary relation of Creating Social Relations to DBU was discussed earlier. The appearance of the DBC test Alternate Face Groupings here on DBR was discussed under factor DBC. Alternate Line Meanings, of complexity three, found its third significant relationship with DBR. This one is not easily explained. Its relations to DBU and DMU made some sense.

DBS - Divergent Production of Behavioral Systems

41. Writing Behavioral Stories (DBS)	.52	
13. Creating Social Situations (DBS)	.43	(DBI .35)

Three tests had been designed for DBS, of which only two came out to demonstrate that ability, and one of those tests was of complexity two. The fact that both tests ask E to write short-story plots or design episodes makes the tests quite similar. A question of generality of the trait thus indicated can therefore be raised. The only clear difference between the two tests is that Writing Behavioral Stories presents photographed scenes with three interacting people, each of which is to suggest a series of different stories, whereas Creating Social Situations presents three described characters, each with a dominant emotion at the moment. The second test's involvement with DBI might be occasioned by E's thinking "Now what would an angry man do?" "What would a sad child do?" "What would a fearful woman do?" The instructions do emphasize that the characters must react to one another, no one being left out. Some DBI might also come in after E has joined two characters, which suggests what the third does-- an implication.

DBT - Divergent Production of Behavioral Transformations

22. Multiple Cartoon Fill-Ins (DBS)	.49	
27. Multiple Story Plots (DBT)	.43	(DBI .33)
1. Alternate Cartoon Completions (DBT)	.42	(DBI .40)
11. Consequences (remote) (DMT)	.36	(DMT .42)
10. Consequences (obvious) (DMU)	.31	(DMU .57)

The picture of this factor is far from satisfactory. Only two of the DBT-designed tests are loaded significantly on it, and the leading test was designed for DBS, but it did not go on DBS. Some explanations should be attempted.

In Multiple Story Plots E is given in each part the beginning of a story involving three people. To this story he is to suggest several different completions, changing the nature of the story each time, thus producing transformations. But the secondary loading on DBI indicates that the ending of each story being suggested at least in part by the first part is an implication.

A very similar outcome occurred with Alternate Cartoon Completions. This test gives two frames of a cartoon strip, with E to invent different endings to the story that is started by the given information. His need to change completions gives transformation variance, but because the beginning again suggests the endings, implications are involved.

It should be noted that when the completion to be given is not at the end but in the middle, as in Multiple Cartoon Fill-Ins, no DBI is apparent to any significant degree (the loading on DBI is .20). But why should this test go on DBT rather than on DBS? The resembalnce to other DBT tests is clear; it also requires completions of stories. In the two successful DBS tests, E started his own stories, which means that he had to create frameworks, i.e., systems. In Multiple Cartoon Fill-Ins, frameworks are presented, albeit incomplete ones.

The roles of DBT in the two Consequences scores, obvious and remote were pointed out in discussions of their traditional factors, for DMU and DMT, respectively. Nothing further need be said, except to say that something needs to be done to Consequences to control for DBT. Since it was possible generally to keep DMX variances out of DBX tests, the reverse exclusion should be possible.

DBI - Divergent Production of Behavioral Implications

26.	Multiple Social Problems (DBI)	.53	
23.	Multiple Emotional Expressions (DBU)	.43	(DBU .52)
1.	Alternate Cartoon Completions (DBT)	.40	(DBT .42)
29.	Plot Titles (clever) (DMT)	.39	(DMT .57)
9.	Behavioral Elaboration (DBI)	.38	
35.	Suggested Feelings and Actions (DBI)	.36	(DBU .36)
13.	Creating Social Situations (DBS)	.35	(DBS .43)
27.	Multiple Story Plots (DBT)	.33	(DBT .43)
30.	Plot Titles (nonclever) (DMU)	.33	(DBI .33: DMC .35)
8.	Alternate Social Solutions (DBI)	.32	

All four tests designed for DBI had significant loadings on this factor, three being univocal. In Multiple Social Problems E is to list all the problems he can think of that could arise between two specified people, mostly members of a family. The relation between seeing problems and implications was discussed much earlier. A possible relation of this test to CBI could not be investigated in this analysis for lack of CBI tests in the battery.

In Behavioral Elaboration, E is told that one person performs an action directed at another and is to list things that the second person might do as a consequence. When one thing leads to another, there is an implication. Alternate Social Solutions calls for lists of alternate actions to solve a stated interactional problem. It is in the right direction, but not a strong one for DBI.

The DBI test that had a secondary loading was Suggested Feelings and Actions, which had a loading of equal magnitude on DBU. Reasons for this were mentioned in discussing tests loaded on DBU above.

The unusual number of non-DBI tests having secondary loadings on DBI indicates how poorly controlled the variance in that factor turned out to be. Such secondary involvements were not particularly expected, so no intentional steps were taken to avoid DBI variances. With two exceptions these DBI involvements were in DBX tests, a DBU test, a DBS test, and two DBT tests. In the last two instances the reason was rather clearly that completions of stories were called for. Completions are called for (implied) by what precedes them. Such DBI variances could be avoided in the future. The most surprising secondary DBI loadings were for the Plot Titles test, where both clever and non-clever scores were affected in the same manner. Reasons were discussed earlier.

It happens that all four significant, intended tests for DBI involve verbal presentations of information to which behavioral implications are to be produced, but this should not mean that the ability represented by this factor should be regarded as limited to that kind of task, for Alternate Cartoon Completions appears in the list, with a substantial loading on it.

A Sex Factor

42. Sex 30

A control sex-membership factor had only a minimally significant loading (.30) on its marker variable. The fact that no test variable was loaded on it indicates no sex differences of any consequence in any of the tests, and presumably, in the factors they represent. One might have expected female superiority in some of them.

DISCUSSION

Satisfaction of Hypotheses

The major hypothesis that a set of abilities for divergent production of behavioral information would be demonstrated was amply supported. Six such abilities were represented by orthogonal factors, with 19 of the 22 tests designed for those abilities coming out loaded significantly on the factors for which they were intended. In two of these instances, however, loadings were higher on other factors.

That these DBX abilities are distinct from the traditional IQ is indicated by their lack of relations to CMU, the dominant component of verbal-IQ tests. That they are distinct from behavioral-cognition abilities is shown by the fact that no CBX tests were loaded significantly on DBX factors, and no DBX tests were significantly loaded on CBX factors, of which three were represented. That they are distinct from semantic-divergent-production abilities is shown by almost complete orthogonality between the two kinds of abilities. Two of the DBX tests had significant loadings on DMX factors, and four of the DMX tests had significant loadings on two DBX factors.

Considering these outcomes, we see that the SI model continues to exhibit its power to predict undemonstrated abilities. This test of the model is especially critical in the behavioral area, where only six (cognition) abilities had been previously demonstrated. Thus, the hypothesis that social intelligence constitutes a definite part of intellect, and that its abilities are parallel to those in other content areas is considerably strengthened. By virtue of the six abilities demonstrated in this study, it can be said that the total number of demonstrated SI abilities now exceeds 90.

view that when tests fail to be univocal for their intended abilities, the best explanation is that experimental controls have failed at some point, and that with better controls univocality can be achieved. Indirectly, this suggests that the appearance of oblique factors in other contexts is an artifact due to lack of controls, at least in part. The hypothesis of orthogonality of abilities is a challenge to produce tests of maximal approach to independence, and, where successful, it is thus a means of increasing information by increasing discriminations.

Incidental Findings

Some incidental findings are worth mentioning again here. One success was in the development of a new strong test for CBU in Stick Figure Expression, which also adds to the generality of the conception of that factor. Less reassuring findings were that what were believed to be good tests for DMU and two for DMT proved to have some relations to DBX abilities. The two scores from Consequences had secondary loadings on DBT and the two scores from Plot Titles had secondary loadings on DBI. The result for Plot Titles is less surprising than that for Consequences. Steps will need to be taken to remove the behavioral variances from those test scores in order to make them more univocal.

Recommended Tests for DBX Abilities

In terms of high factor loadings and univocality, at least so far as available information goes, the following new tests may be recommended as markers for their represented abilities:

DBU	Alternate Picture Meanings Expressing Mixed Emotions Alternate Social Meanings
DBC	Multiple Behavioral Grouping Alternate Expressional Groups
DBR	Alternate Facial Relations Multiple Expression Changes Varied Emotional Relations
DBS	Writing Behavioral Stories
DBT	Multiple Cartoon Fill-Ins
DBI	Multiple Social Problems Behavioral Elaborations

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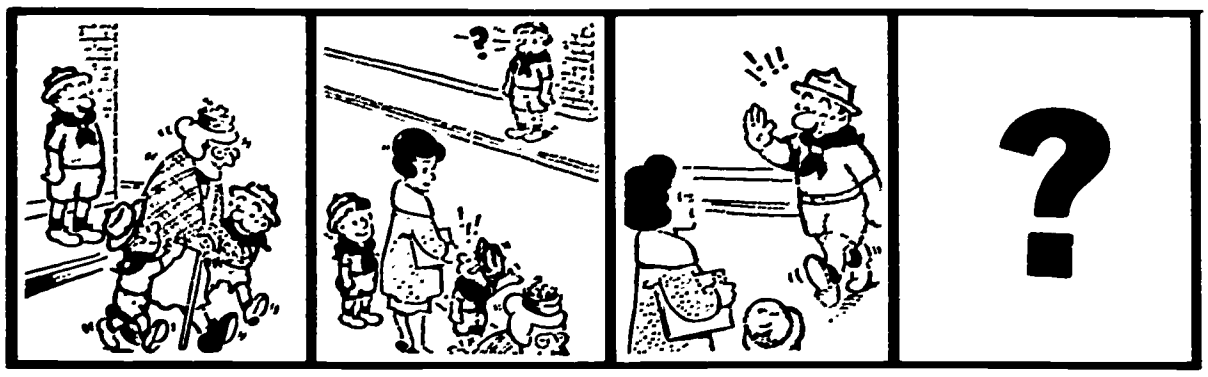
APPENDIX A

DESCRIPTION OF TESTS [1]

1. Alternate Cartoon Completions - DBT01A. Given the first frames of a cartoon strip, write many different and unusual endings that fit the thoughts, feelings or intentions of the characters in all the preceding frames, not just the one directly before it.

Sample Item:



Given Answers:

The man will help the young lady across the street.
He'll chase the boys home.

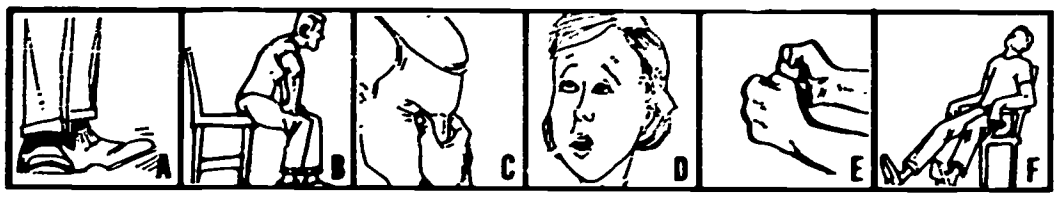
Sample Responses:

1. The girl will say, "Dad, where did you get the shorts?"
2. He'll make a date with the young woman.
3. He'll ask if the boys are bothering her.

Score: Number of responses judged unusual and behaviorally different.
Parts: 3 (Note: only parts I, II, & IV of the test were used); items per part: 1; working time: 9 minutes.

2. Alternate Expressional Groups - DBC03A. Group given expressions in many different ways so that each group of at least 3 pictures expresses a different thought, feeling, attitude, or intention.

Sample Item:



Score: Number of appropriate groups produced that are judged to be behaviorally different.

Group 1 A, B, F Group 2 A, C, E

Parts: 3; items per part: 1; working time: 6 minutes.

3. Alternate Face Groupings - DBC01A. Group given facial photographs in many different ways so that each group of at least 3 photographs expresses a different thought, feeling, or intention.

Sample Item:

GROUPS A. 2, 3, 5 B. 1, 3, 4

Score: Number of appropriate groups produced that are judged to be behaviorally different.
Parts: 4; items per part: 1; working time: 12 minutes.

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1 The code symbol immediately following each test name indicates the hypothesized factor content of the test at the stage of test construction. The additional trigram (SPS) for some of the tests indicates that the test is copyrighted by Sheridan Psychological Services, Inc., Beverly Hills, California, and was adapted with permission.

4. Alternative Facial Relations - DBR01A. Given photographs of different facial expressions and a comment, choose many different pairs of faces such that the first face chosen in each pair is making the comment to the second one.

Sample Item:

Comment: "Wait, that's not what I really meant."

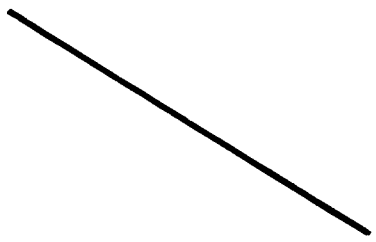
Score: Number of appropriate pairs judged to be behaviorally different.

Parts: 3; items per part: 3; working time: 9 minutes.

Relation 1: B and C Relation 2: _____ and _____ Relation 3: _____ and _____

5. Alternate Line Meanings - DBT03A. Write the names of different feelings or emotions that are represented by a given line.

Sample Item:



1. sad
2. quiet
3. gentle

Score: Number of different feelings or emotions connoted by the lines.

Parts: 2; items per part: 3; working time: 2 minutes.

6. Alternate Picture Meanings - DBU02A. Write many different things that a person might say if he felt as the person in a given picture does.

Sample Item:

1. Let me see. Where was I?
2. I wish he'd shut up!
3. I can't study anymore tonight.
4. Good Grief! What have I done?
5. Why doesn't he leave me alone?

Score: Number of feelings or thoughts judged to be behaviorally distinct.

Parts: 4; items per part: 2; working time: 12 minutes.

7. Alternate Social Meanings - DBU01A. given an action of a person, write many different interpretations, each showing how the person might think or feel.

Sample Item: If one person winks at another, what could he (she) be thinking or feeling?

1. How about a date?
2. Here he comes now.
3. The person is being friendly.
4. You and I know better.
5. You're cute.
6. The person is kidding.
7. Don't give the secret away.

Score: Number of thoughts or feelings judged to be behaviorally different.
Parts: 4; items per part: 1; working time: 8 minutes.

8. Alternate Social Solutions - DBI01A. Given a social situation, list many different social solutions for the situation.

Sample Item:

You are on a weekend trip with a group of close friends. They want you to spend the day hunting with them but you want to go fishing instead. You could:

1. Give in and go hunting with them
2. Tell them to go hunting and you go fishing
3. Convince them that fishing will be more fun
4. Suggest deciding by tossing a coin

Score: Number of possible solutions that are judged behaviorally different.

Parts: 4; items per part: 1; working time: 16 minutes.

9. Behavioral Elaboration - DBI04A. Given an action of one person, write many different responses to show how a second person might feel or react.

Sample Item: IF PERSON A WINKS AT PERSON B, WHAT WILL B DO?

1. smile back timidly
2. look surprised
3. get embarrassed and blush
4. pretend he doesn't see person A
5. get mad at A

Score: Number of behaviorally different responses that are expectable from the given situation.

Parts: 4; items per part: 1; working time: 12 minutes.

10. Consequences - DMT03C (obvious)(SPS). List many different results that would be associated with a new and unusual situation.

Sample Item: What would be the results if people no longer needed or wanted sleep?

1. Get more work done
2. Alarm clocks not necessary
3. No need for lullaby-song books

Score: Number of responses that are direct results of the given situation.
Parts: 1 (only the first part of this test was used in obtaining a DMU score); items: 1; working time: 2 minutes.

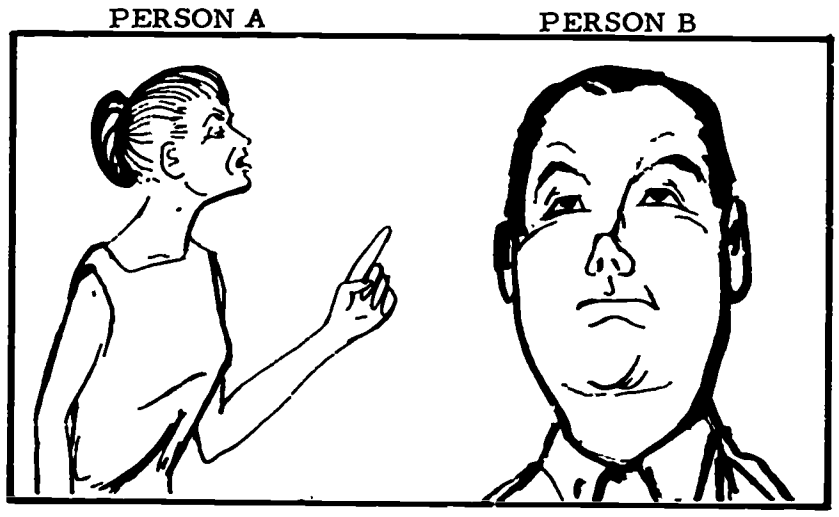
11. Consequences - DMT03C (remote)(SPS). Same as test 10.

Score: Number of responses that indicate remote or unusual results of the given situation.
Parts: 2 (only parts II & III were used in obtaining a DMT score); items per part: 1; working time: 4 minutes.

12. Creating Social Relations - DBR02A. Given the expressions of two people, write many different things that the second person might be saying to the first one.

Sample Item: What might person B be saying to person A? Write as many different things as you can.

PERSON A PERSON B



1. Oh brother, here we go again!
2. I'm sorry, I didn't mean it.
3. Why do you think I did it?

Score: Number of appropriate responses that are judged to be behaviorally different.

Parts: 4; items per part: 2; working time: 8 minutes.

13. Creating Social Situations - DBS01A. Given a description of three persons, each having a given feeling or emotion, describe many different situations, using all three people, that could account for their feelings or emotions.

Sample Items:

A. A fearful woman
B. An angry man
C. An unhappy child

1. C gets a bad report card; B, his father, is mad at C; and A, his mother, is afraid B will hurt C.
2. A has wrecked the car. B, her husband, is angry at her, and C, the child, is sad for his mother.
3. B comes home to find A with another man. He yells at her and C is unhappy his parents are fighting.

Score: Number of behaviorally different situations involving the social interaction of the three persons that can account for their behavior. Parts: 4; items per part: 1; working time: 16 minutes.

14. Expressing Mixed Emotions - DBU04A. Write many different things that a person might say when he is feeling both of two given emotions.

Sample Item: both JEALOUS and DISAPPOINTED.

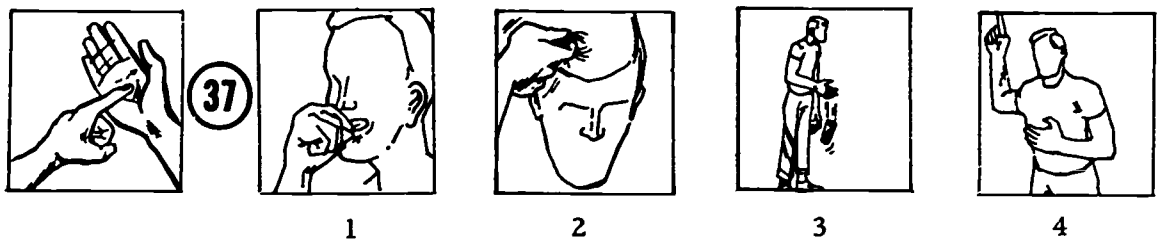
1. You can have it. I don't want it anyway.
2. Yeah, Bill won; he always wins
3. He got it? But I expected to.

Score: Number of behaviorally different responses indicating that both emotions are being experienced.

Parts: 4; items per part: 2; working time: 12 minutes.

15. Expressions - CBU01A. Select the alternative that expresses the same thought, feeling, or intention as the given expression.

Sample Item:

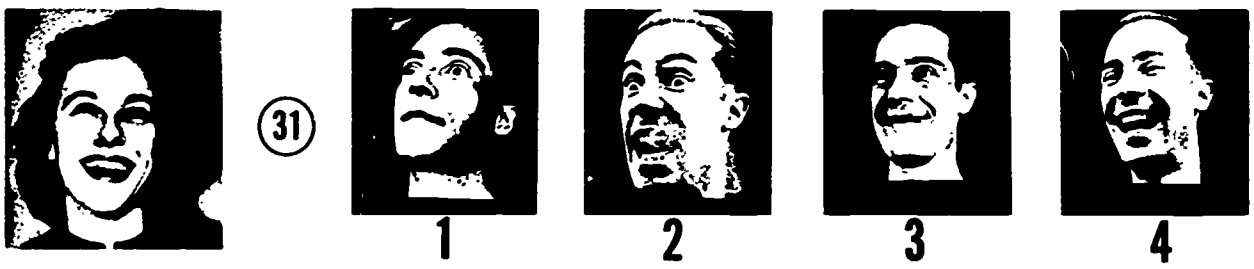


Answer: 2.

Score: Number of right responses minus one-third number wrong. Parts: 2; items per part: 18/18, 14/18; working time: 10 minutes.

16. Faces - CBU02A. Select the man's face that expresses the same feeling or intention as the woman's.

Sample Item:



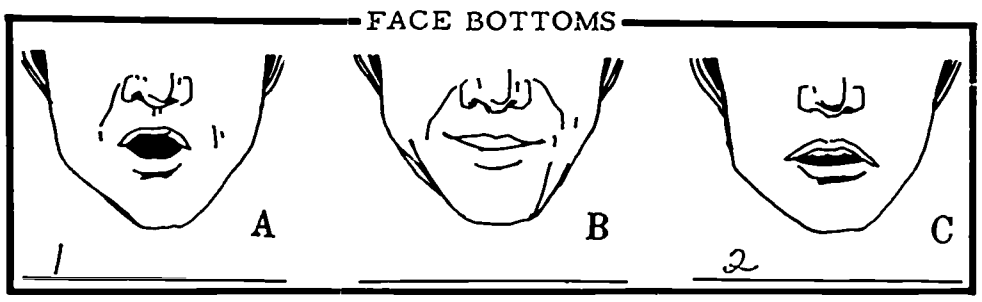
Answer: 4.

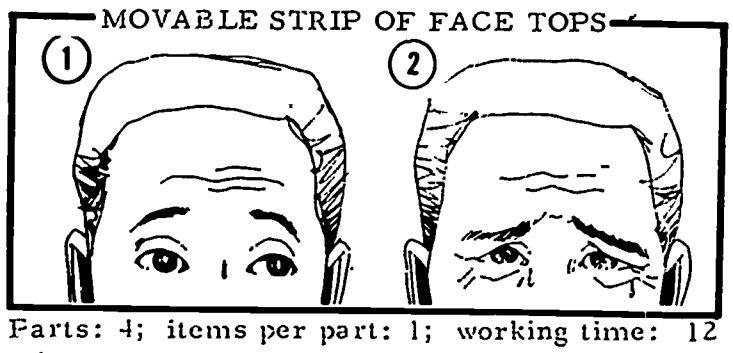
Score: Number of right responses minus one-third number wrong.

Parts: 2; items per part: 12/15, 14/15; working time: 8 minutes.

17. Forming Alternate Faces - DBR04A. Make many different faces to fit given situations. The faces are made by moving a strip of face tops to match different face bottoms.

Sample Item: Ted has just heard bad news.





Parts: 4; items per part: 1; working time: 12 minutes.

Score: Number of appropriate faces that express behaviorally different mental states.

18. Ideational Fluency - DMU01B (SPS). List things that belong to a broadly defined class.

Sample Item: Name FLUIDS that will BURN

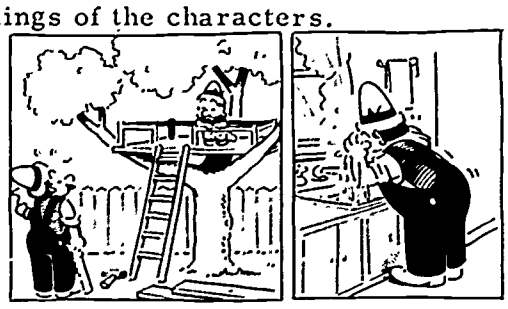
gasoline
kerosene
alcohol

Score: Number of different things listed that belong to the specified class.

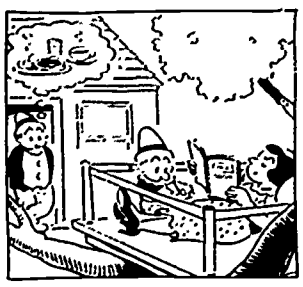
Parts: 2; items per part: 1; working time: 6 minutes.

19. Missing Cartoons - CBS01A (SPS). Choose the alternative that completes the cartoon strip, making sense of the thoughts and feelings of the characters.

Sample Item:



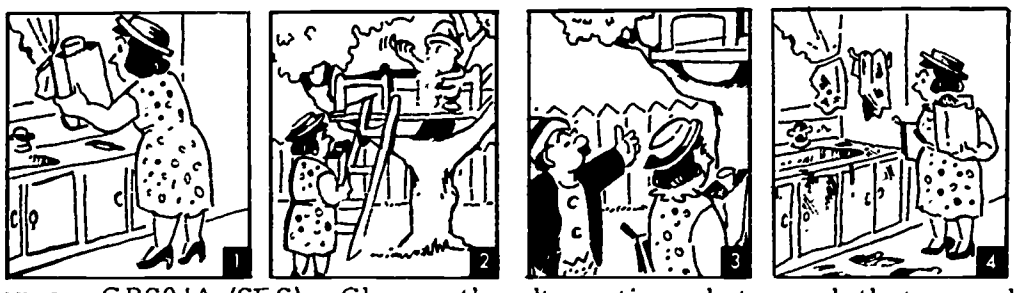
29



Answer: 4.

Score: Number of items right minus one-third number wrong.

Parts: 2; items per part: 14; working time: 16 minutes.



20. Missing Pictures - CBS04A (SPS). Choose the alternative photograph that completes the story, making sense of the thoughts and feelings of the actors.

Sample Item:

ITEM 21

Answer: 3.

Score: Number of items right minus one-half number wrong.

Parts: 2; items per part: 10: working time: 12 minutes.

21. Multiple Behavioral Grouping - DBC02A. Group given comments into many different sets according to the thoughts, feelings, or intentions they express.

Sample Item:

1. You get out of here
2. Are you sure
3. What a bore
4. How could you do such a thing
5. Didn't you listen to me
6. I wonder what time it is

Group A 1 3 4 5

Group B 2 4 5

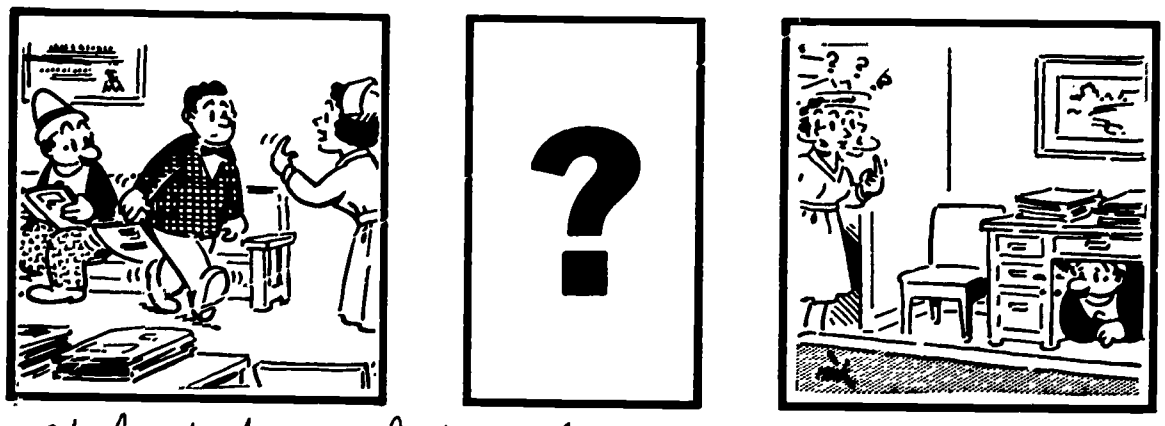
Group C _____

Score: Number of appropriate groups of three or more ments that indicate different behavioral classes.

Parts: 4; items per part: 1; working time: 6 minutes.

22. Multiple Cartoon Fill-Ins - DBS02A. Given the first and last frames of a cartoon strip, write what might have happened between them so that the explanation involves the feelings, thoughts, and intentions of the cartoon characters.

Sample Item:



1. He heard the man holler with pain and became afraid.
2. He thought the nurse was cute and played hide and seek.

Score: Number of behaviorally different responses that interrelate the characters and account for the behavior in both the first and last frames.
Parts: 3 (Note: only parts I, III, & IV were used); items per part: 1; working time: 9 minutes.

23. Multiple Emotional Expressions - DBU03A. Write many different things that a person might say when he is feeling a given emotion.

Sample Item:

ANGRY:

1. Oooh, you make me so mad!
2. I hate you.
3. One more word and I'll belt you!
4. Grrr!
5. Get out!
6. How many times have I told you...

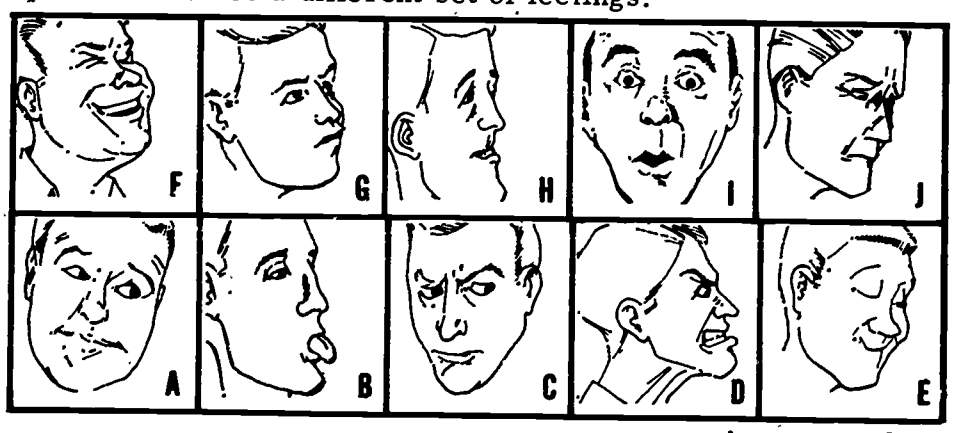
Score: Number of different responses behaviorally appropriate to each emotion.

Parts: 4; items per part: 1; working time: 8 minutes.

24. Multiple Expression Changes - DBT02A. Choose many different sequences of faces that show how a person might feel at different points of a given story, so that each sequence indicates a different set of feelings.

Sample Item:

A man trips a lady who is walking by.
She falls, and the man then apologizes to her.
The lady then becomes angry.



	1	2
Show how the man might feel as he trips the lady:	I	
Show how the man might feel as he apologizes to her:	A	
Show how the man might feel after the lady becomes angry:	C	

Score: Number of appropriate sequences that are judged behaviorally different.

Parts: 4; items per part: 1; working time: 12 minutes.

25. Multiple Grouping - DMC02C. Arange given words into several different meaningful groups.

Sample Item:

1. arrow
2. bee
3. crocodile
4. fish
5. kite
6. sailboat
7. sparrow

Class A: 1, 2, 5, 7 (found in the air)

Class B: 3, 4, 6 (found in water)

Class C: 2, 3, 4, 7 (animals)

Class D: 3, 4, 5, 7 (all have tails)

Class E:

Score: Number of acceptable classes.

Parts: 2; items per part: 1; working time: 4 minutes.

26. Multiple Social Problems - DBI03A. Given two members of a typical family, write many different personal problems that they might have with each other. The problems should involve the feelings, thoughts, and attitudes of the two given people.

Sample Item:

What personal problems can the BROTHER and SISTER have with each other?

1. Sister makes fun of brother's friends.
2. Brother and sister compete for attention of mother.
3. Brother tries to dominate younger sister.

Score: Number of interpersonal problems judged to be behaviorally different.

Parts: 4; items per part: 1; working time: 8 minutes.

27. Multiple Story Plots - DBT04A. Given a story setting that involves three characters, write many different developments of the situation that account in different ways for the feelings or thoughts of all three characters.

Sample Item:

Two sisters, A and B, are romantically interested in the same young man, C. One day he comes to their house unexpectedly.

1. A and B praise each other to C, who becomes more confused than ever about which one of them he likes better
2. A tells C that B does not want to see him. Instead of discouraging him, this news makes C all the more interested in B.
3. Both sisters refuse to see him, because each resents his attention to the other. C gives them both up in disgust.

Score: Number of behaviorally different plots produced that interrelate the feelings or thoughts of all three of the characters.

Parts: 4; items per part: 1; working time: 16 minutes.

28. Planning Elaboration II - DMI01B. Fill in as many details as necessary to make a briefly outlined activity work.

Sample Item: Your club is presenting a play. There will be three performances—Friday evening, Saturday matinee, and Saturday evening. The play is to be presented in the school auditorium. Rehearsals are now in progress. Profits will go to the club treasury.

You have been chosen as manager for the production, which means you have to plan carefully to make the play a success. Write out the details you would include as parts of your plan.

1. get tickets printed
2. arrange for ushers
3. advertise by billboard
4. newspaper ads

Score: Number of different relevant details listed.

Parts: 2; items per part: 1; working time: 8 minutes.

29. Plot Titles - DMT01G (clever)(SPS). Write as many titles as possible for a short story plot. Titles may be clever or not; the only requirement is that they must be clearly related to the plot.

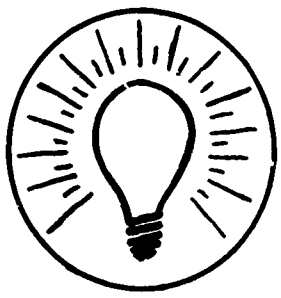
Score: Number of titles that are especially succinct, remotely but cleverly related to the plot, or indicative of a reinterpretation of the plot by a new emphasis. Parts: 1 (Note: only the first part of this test was used in obtaining a DMT score); items: 1; working time: 3 minutes.

30. Plot Titles - DMT01G (non-clever)(SPS). Same as test 29.

Score: Number of titles listed that are clearly related to the plot. Parts: 1 (Note: only the second part of this test was used in obtaining a DMU score); items: 1; working time: 3 minutes.

31. Possible Jobs - DMI03B (SPS). Write as many as six different jobs, occupations, or kinds of people that might be indicated by a pictured emblem.

Sample Emblem:



Possible Jobs:

electrical engineer
light-bulb manufacturer
a bright student

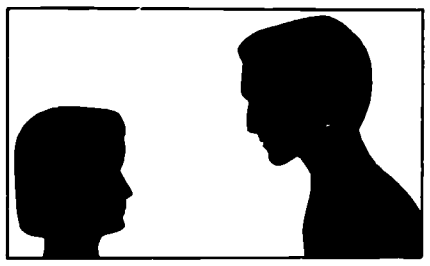
Score: Number of relevant jobs listed.

Parts: 2; items per part: 3; working time: 10 minutes.

32. Silhouette Relations - CBR05A. Choose the photograph that expresses an individual's feeling or intention in the given silhouette relationship. In part one of the test, the alternatives are of men; in part two, they are of women.

Sample Item:

Answer: 3.

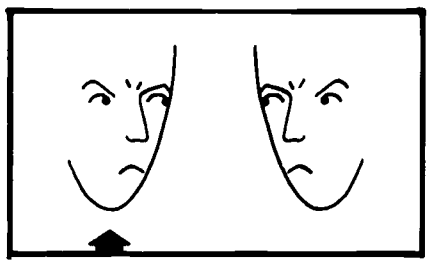


31

Score: Number of items right minus one-half number wrong.
Parts: 2; items per part: 12/15, 13/15; working time: 10 minutes.

33. Social Relations II - CBR02A. Select the statement that expresses the feeling of the face indicated by the arrow, taking into account the relationship between the faces.

Sample Item:



27

1) I didn't like that movie very much.

2) What a bore!

3) Who does he think he is, anyway?

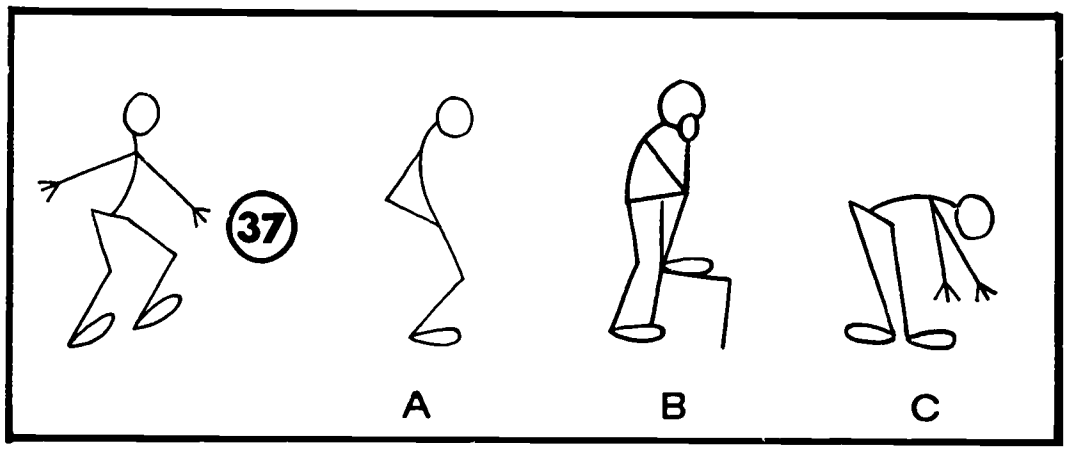
Answer: 3.

Score: Number of items right minus one-half number wrong.

Parts: 2; items per part: 13/13, 12/13; working time: 8 minutes.

34. Stick Figure Expressions - CBU05A. Choose one of three stick-figures that expresses the same feeling or intention as the given (left) figure.

Sample Item:



Answer: C.

Score: Number of right responses minus one-half number wrong.

Parts: 2; items per part: 15/18, 15/18; working time: 10 minutes.

35. Suggested Feelings and Actions - DBI02A. Given a situation, write many different emotions or feelings that might arise, and for each emotion write something one might do because he felt that way.

Sample Item:

Late at night when A and his family are in their mountain cabin, he hears over the radio that a forest fire is raging a few miles away.

FEELING	ACTION
1. fear	pack up and leave
2. interest	tune in other stations to hear more
3. curiosity	pack a lunch and go to see the fire
4. concern	get a shovel and go to fight the fire

Score: Number of appropriate feelings and corresponding actions that are judged to be behaviorally different.

Parts: 4; items per part: 1; working time: 12 minutes.

36. Utility Test - DMC01B (fluency)(SPS). List many possible uses for a common object.

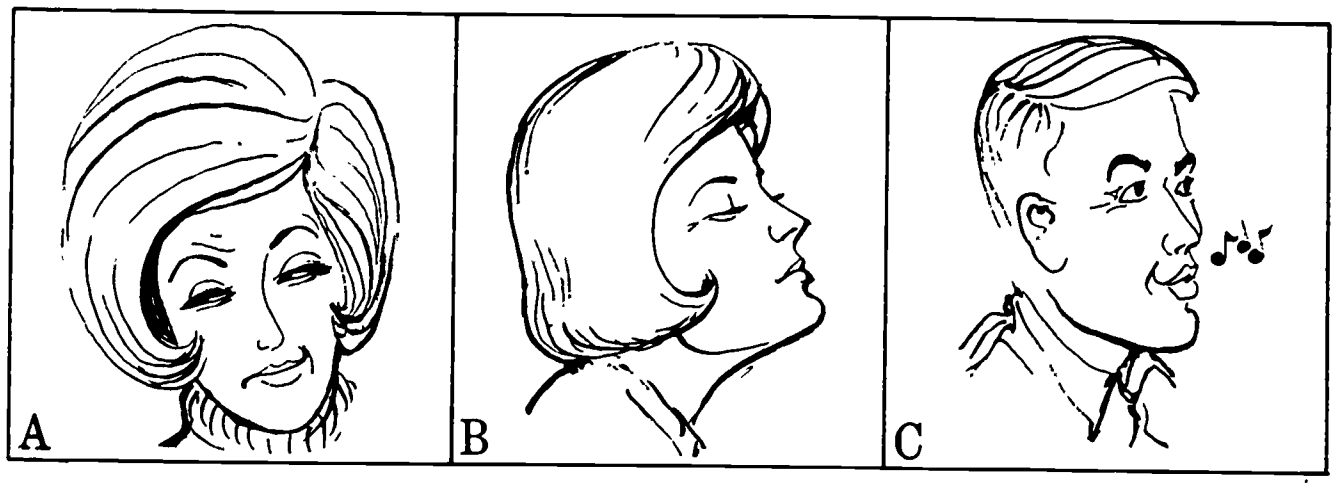
Score: Number of acceptable, different uses for the object. Parts: 2; items per part: 1; working time: 10 minutes.

37. Utility Test - DMC01B (flexibility)(SPS). Same as test 36.

Score: Number of shifts in category in a series of acceptable responses.
Parts: 2; items per part: 1; working time: 10 minutes.

38. Varied Emotional Relations - DBR03A. From many pictures of individuals, choose many different sets of two pictures, each set showing a cause-effect relationship.

Sample Item:



Relation 1. C and A Relation 2. _____ and _____ Relation 3. _____ and _____

Score: Number of appropriate pairs showing behaviorally different relationships.
Parts: 2; items per part: 1; working time: 4 minutes.

39. Verbal Comprehension - CMU02D (SPS). Select from a group of five, a word that means about the same as a given word.

Sample Item: EARTH

A. sugar
B. farm
C. sun
D. soil
E. horse

Answer: D.

Score: Number of correct responses minus one-fourth number wrong.
Parts: 1; items: 24; working time: 4 minutes.

40. Word Completion - CMU01B. Write acceptable meanings for given words.

Sample Item: COURAGEOUS to be brave

Score: Number of acceptable definitions written.
Parts: 1; items: 20; working time: 7 minutes.

41. Writing Behavioral Stories - DBS03A. Given a photograph of three people in a social situation, write many different stories describing how the people feel, and what they are thinking, and why.

Sample Item:

1. The blond girl, B, feels sorry for A because she thinks he is sick. C thinks he's faking, but A likes the attention
2. B tells A she's sorry she can't go to the dance with him. C feels sorry for A, but A is only faking unhappiness, because he really wants to ask C.

Score: Number of behaviorally different stories interrelating the feelings and attitudes of the three people.

Parts: 3; items per part: 1; working time: 12 minutes.

42. Sex. Females were assigned a value of 0; males a value of 1.

APPENDIX B

A PILOT EXPLORATION OF MODES OF EXPRESSION IN SOCIAL CREATIVITY

One of the most challenging problems facing the developer of a psychological test is the demonstration that the behavior measured by the test has generality, which extends to every-day human beings in every-day situations. Perhaps all too often, psychologists define their constructs purely operationally in order to avoid the pitfalls associated with nonempirical or quasi-empirical philosophizing. The problem, of course, is that the empirical method may become so operationally convoluted that it is next to impossible to generalize findings in the form of laws and theories that apply much beyond situations that duplicate the experimental ones.

Some psychologists argue that constructs can only be demonstrated by providing evidence converging from genuinely different sources. Of course, what one means by "genuinely different" is of utmost importance. In the area of social creativity, paper-and-pencil tests were designed to demonstrate the hypothesized constructs, and each test for a construct was different to some degree from any other test. Nevertheless, this operational assessment procedure has as its common characteristic the nature of paper-and-pencil tests. Clearly, the construct of social creativity could not be significant if it were found to be only a paper-and-pencil affair. It is conceived as something that should be expected to have manifestations in the form of facial, postural,and vocal expressions, for example.

A commonsense consideration of socially creative people and of what they do brings to mind not only authors (creative writers about interpersonal activity) but also actors (those who produce gestures and vocalizations reflecting human mental states) and great speakers and singers (creative vocalizers of ideas and personal experiences). In considering social behavior at large, it is probably true that social creativity is more commonly manifested in expressive behavior than in writing.

The defense for utilizing writing behavior in tests of creative social talents rests upon two considerations, one practical and the other theoretical. First, writing behavior can be easily and quickly recorded with large groups of subjects. Second, if social creativity is in the domain of intellectual aptitudes, ideation is its clearest reflection and the thing to be measured. The limited experiment reported in this Appendix was devoted to testing whether that ideation could be reflected in measurable terms in gestural and vocal responses of individuals as well as in what they say in writing.

In paper-and-pencil tests designed to measure the production of behavioral ideas, it is necessary to consider and possibly to control such incidental sources of variance as writing speed. Experience with the same kinds of responses in the area of semantic creativity has been reassuring on this point. Extremely rarely has writing speed affected variances of total scores. In the case of gestural and facial performances, extraneous sources of variance might include such variables as personal extravertive boldness versus reticence and shyness, or habits of mobility and variety of expression. In addition, facial and body muscle groups have been identified in connection with expressive behavior. Habitual uses of psychomotor and kinesthetic elements contribute to a person's expressiveness, responsiveness, and flexibility. In the case of facial and gestural responses within a contrived situation, there is the additional feature of how well E can internalize the situation presented to him. Where writing is commonly an impersonal activity, also a general-purpose activity, facial expressions are not.

What was just said regarding facial and gestural responses also holds true for vocal expressions. The psychomotor skills involving expressive activity of the speech organs are not linguistic, but paralinguistic in nature, although they can be significant components of speech utterances. In using vocal and other expressive responses from which to derive scores to measure creative behavioral ideation, it was assumed that this intellectual component would show through, as it was expected to do in the case of written responses.

The Measures

Just as divergent production of semantic units (DMU) is sort of fundamental to semantic creativity, the corresponding ability, divergent production of behavioral units (DBU) was expected to be basic to creative social intelligence. For this reason, it seemed desirable to begin the exploration of creative expressions with tests that reflect units of information. It also appeared easiest to ask for and to record units in the form of expression rather than some of the other products. Accordingly, three kinds of tests designed for DBU were administered individually, in counterbalanced order, to more than 50 university students, 34 of whom completed all tests. The tests will be described next.

Paper-and-Pencil Tests

Five tests were selected to represent DBU in this analysis. They included four of the DBU tests mentioned in the body of this Report, and one DBR test. The DBR test, Forming Alternate Faces, had been thought to be a measure of DBU during the early phases of pretesting, when this experiment was begun. When pretest results indicated that the test measured DBR rather than DBU, it had already been administered to the first Es in this pilot study, so it was kept as a measure of DBU, even though there was little reason to expect it to aid in the definition of that factor. The tests are listed in Table B-1.

Three tests for DBC were also administered in order to test the possibility that different expressional performances might indicate shifts in behavioral classes, hence DBC. In the general analysis of this

Report, one of them turned out to be a stronger measure of DBR than of DBC, so that there were possibly two DBR tests in this small battery.

Expressive-Photographic Tests

The ability to express creatively emotional states facially and through gestures was measured by scores on performances before a camera.[1] Es were first instructed in the use of a Nikon-F camera with a 50mm., F-2 lens, with a flash attachment, and with motorized drive to advance the film. After they were confident that they could operate the camera, the Es were to photograph their own expressions, isolated in a sound-proof room. Operation of the camera entailed tripping the shutter, by pressing a small button held in the hand, then waiting until the film advanced before taking the next self-photograph. If and when E exhausted the film in the camera the motor drive no longer operated, and he summoned the experimenter to bring new film.

When E stood on a marked area, he was in the camera's focus, but he could move rather freely within those limitations. The camera photographed his head, arms, and upper torso. E knew that his performance was to be used as a measure of his ability to communicate emotions to others by facial expressions and was frankly informed of what kind of performance would be optimal. He was also shown examples of photographs of actors who had done the exercise earlier, in order to provide appropriate examples showing great variety. Two types of photographic exercises were employed.

Photographs - Phrase Only. In two exercises E was given short phrases, selected with the expectation that they should give rise to many different emotional expressions. Each phrase was typed on a card and the latter was placed in view continuously. E was instructed to say the phrase to himself and then to communicate different expressions that might accompany the phrase. He was told not only to express different emotions but also to express the same emotion in different ways. The two phrases utilized, without restricting punctuation, were:

YOU HAVE TO LEAVE NOW

WHAT DO I DO NOW

Photographs - Phrase and Situation. In order to restrict the potential for fluency by giving more structure to E's task and to minimize involvement of flexibility by E's reinterpreting the stimulus, four exercises presented a situation along with each phrase. E was to imagine himself in the situation, to intend the given phrase, then to photograph different facial and gestural expressions appropriate to both aspects--phrase and situation. The four situations were:

YOU AND YOUR FRIEND ARE AT A CIRCUS WATCHING A TRAPEZE ACT

YOU FAIL TO WIN FIRST PRIZE BUT ARE OFFERED THE CONSOLATION PRIZE, WHICH YOU REFUSE TO ACCEPT

YOU AND YOUR FRIEND ARE WORKING THROUGH A VERY HARD PROBLEM

TWO MEMBERS OF YOUR FAMILY ARE RECEIVING INTERNATIONAL AWARDS

The phrase for each of the situations is:

...and you say to your friend: LOOK WHAT'S HAPPENING

Table B-1

Means, Standard Deviations, Interpart Reliability Estimates, Intercorrelations, and Varimax Factor Loadings for Twelve Measures of Social Creativity (N = 34)

Test Name	Mean	Standard Deviation	Reliability	Intercorrelations 1	2	3	4	5	6	7	8	9	10	11	12	13	Varimax Factors Writing	Vocal	Gestural
1. Alternate Picture Meanings (DBU)	33.3	6.58	.66		71	30	31	53	20	67	46	27	25	-05	07	-33	79	-01	24
2. Alternate Social Meanings (DBU)	24.2	4.95	.71	71		17	17	39	30	66	41	21	20	-12	-11	-31	71	-13	19
3. Expressing Mixed Emotions (DBU)	14.4	3.87	.71	30	17		34	43	21	25	21	26	17	20	-24	-29	41	-04	25
4. Forming Alternative Faces (DBU) (DBR)	28.9	7.47	.86	31	17	34		37	04	27	22	15	10	-06	-14	14	34	-07	10
5. Multiple Emotional Expressions (DBU)	17.0	3.67	.66	53	39	43	37		31	46	32	01	06	27	09	-38	67	21	01
6. Alternate Expressional Groups (DBC)	10.2	1.86	.31	20	30	21	04	31		33	35	20	15	20	-04	-19	41	10	10
7. Alternate Face Groupings (DBC) (DBR)	13.9	3.88	.74	67	66	25	27	45	33		53	00	20	03	08	-25	79	09	02
8. Multiple Behavioral Grouping (DBC)	12.1	3.17	.79	45	41	21	22	32	35	53		11	-31	01	-18	-21	67	-11	-27
9. Photographic - Phrase Only	20.2	11.76	.90	27	21	26	15	01	20	00	11		43	16	-03	-15	16	-02	56
10. Photographic - Phrase and Situation	19.9	5.74	.74	25	20	17	10	06	15	20	-31	43		25	34	-16	07	30	78
11. Tape - Phrase Only	20.5	6.61	.78	-05	-12	20	-06	27	20	03	01	16	25		55	10	06	73	09
12. Tape - Phrase and Situation	17.7	5.28	.65	07	-11	-24	-14	09	-04	08	-18	-03	34	55		17	-08	79	06
13. Sex	.5	.51	-	-33	-31	-29	14	-38	-19	-25	-21	-15	-16	10	17		-38	14	-19

Note. — Decimal points omitted for intercorrelations and factor loadings.

The four situations were selected to elicit a broad range of emotional responses and the phrase was neutral so that it could be appropriate to many different social situations or emotional states.

Contact prints of all exposures of Es were prepared and identified for scoring purposes. Within each of the six photographic exercises, two scorers were instructed to credit one point for each expression that was reasonable, appropriate, and not a physical or behavioral duplication of another expression. Estimates of interscorer reliability for the two types of exercise were .99 and .92 respectively.

Vocal-Tape Tests

Vocal behavioral divergent production was measured by scores on performance before a tape

[1] Special thanks are due Mr. Richard Martin, who helped design and who carried out much of the experimentation reported herein.

recorder. Es were instructed in the use of a portable tape recorder and they recorded their vocal expressions in a manner parallel to that for the photographic task.

Tape - Phrase Only. In two exercises E was given short phrases, selected with the expectation that they should give rise to many different emotional expressions. E was to record as many different vocal expressions as he could, appropriate to the given phrases. The two phrases utilized, presented typed on cards without punctuation, were:

I'M GOING TO DO IT

IT CAN'T BE TRUE

Tape - Phrase and Situation. E was also presented with four exercises in which a restraining situation was also to be considered in his vocal expressions. Recordings of different emotional vocal expressions were to be made after E put himself into the situation. The four situations were:

YOU JUST HEARD WONDERFUL NEWS

YOU AND YOUR FRIEND SEE SOMETHING STRANGE AND PUZZLING

A SUPPOSED FRIEND HAS JUST INSULTED YOU AT A PARTY

SOMEONE DID SOMETHING REALLY NICE FOR YOU AND YOUR FRIEND BUT YOU SUSPECT HE MUST HAVE SOME HIDDEN REASON FOR DOING IT

The phrase accompanying each situation was:

...and you say to your friend: I CAN HARDLY BELIEVE IT

Like the situation utilized in the photographic exercises, these situations were selected to elicit a wide range of emotional responses and the phrase was intentionally ambiguous so that it could be appropriate for many different social situations or emotional states.

Because of the inordinate amount of time needed to score the tapes, only one scorer, trained in speech, was instructed to credit one point within each of the six auditory exercises for each expression that was reasonably appropriate and not a behavioral duplication of another expression in the same exercise.

Results

Means, standard deviations, inter-part reliability estimates, intercorrelations and varimax factor loadings are shown in Table B-1. A three-factor solution was selected as best representing the factorial structure of the 13 measures. When one factor was retained, i.e., the first principal axis, none of the performance scores or sex were in the common-factor space. A two-factor solution yielded a paper-and-pencil test factor and a performance factor which did not differentiate the gestural measures from the vocal ones. A four-factor solution yielded two test-method factors, but both of them were DBU-DBC composites. Although the smallness of the N of 34 certainly played a role in the structure of the factor solutions, the three-factor varimax solution appeared decisive in answering the experimental question. No further analytic or graphic adjustments appeared to be worth making on the varimax solution.

The method of extracting trait-specific variance from a multi-method battery that was employed by Kusyszyn and Jackson (1968) was not attempted in this problem. To be free from method-specific variance in the principal axes, Kusyszyn and Jackson substituted correlations of zero within all common-method sub-matrices of the correlation matrix. In this way, only variance common to two or more methods is extracted and rotated. Although this procedure does make it possible to isolate traits independent of their methods of measurement, it was felt that the procedure is not sufficiently mathematically rigorous to justify making generalized conclusions based on it.

Discussion

From the results, it is obvious that tests with the three modes of response do not measure the same variable. Each kind of score has more than ample reliability, so it measures some quality or qualities consistently. It is necessary to consider possible ways of accounting for the essential independence of the three kinds of tests. Major attention will be given to the hiatus between what is measured by verbal-response tests and expressive-response tests.

First, let us consider differences in the ways in which the two kinds of tests were administered, and other differences. One important difference was in amount of time permitted. Every written, verbal-response test had strict time limits, with very short working intervals. The expressive-response tests gave as much time as E would use. We do not know that the same principles with regard to working time apply to all fluency tests, but Christensen and Guilford (1963) found that the factor loading for a fluency test (for ability DMR) drops off for responses after the first two minutes. Permitting E to exhaust his available pool of responses for each item should reflect the extent of this repertoire of responses rather than his facility for production of units of information, in the expressive-response tests.

Another difference is that writing is a common, all-purpose mode of response. It is used to communicate all kinds of information, figural and symbolic as well as semantic and behavioral. It is therefore a rather "neutral" carrier of information. Expressive movements normally carry only behavioral information. Expressive responses are thus specialized. They might still communicate behavioral ideas, as verbal responses can do, but in daily life they do so automatically and spontaneously, not voluntarily, except in the case of the actor, professional or otherwise. The voluntary use of expressive equipment in the tests is an unnatural performance for most Es, whereas writing voluntarily is a natural one.

The assumption that in both kinds of tests E has the same problem, to generate alternative behavioral ideas, and then all he has to do is to make those ideas manifest needs reexamination. With the two different

modes of response, will E generate much the same behavioral ideas? It is reasonable to expect that, realizing the way in which he must communicate ideas, E would produce different ideas and in different quantities. Some ideas may be more easily verbalized and others more readily expressed by the use of expressive organs. Some E who could write a great number of responses may find himself severely limited in making expressive responses, and others may have the talents reversed in rank.

It is also possible that in the expressive tests E gets involved in what the second author has called "executive functions," or "executive abilities," (Guilford, 1967, p. 293). This theory proposes a whole set of executive abilities, concerned with putting ideas into action through implied intentions. Individuals are assumed to differ with respect to facility for carrying out motor responses. The psychomotor abilities of the type already known would not represent these functions, for they are concerned with particular patterns of movement, not aspects of performance of motor equipment. The act of highly practiced, voluntary writing would offer few executive problems. The generally unpracticed, voluntary use of expressive responses would offer executive problems in a way that would show up in individual differences.

The discussion to this point implies that the two expressive methods, facial-postural and vocal, are alike, as contrasted with the written-response approach. The lack of correlation between tests using those two expressive methods introduces another problem. Why don't the two kinds of expressive tests show a common variable? The executive-function hypothesis can account for this. First, it implies many distinct abilities or functions, and one source of difference might naturally be the difference in organs of response. The facial and postural expressions depend upon skeletal muscles, whereas vocal expressions depend more critically upon the non-skeletal muscles involved in speech--of larynx and tongue.

There is still the question as to why, if all three kinds of tests had in common the production of alternate behavioral ideas, there is not at least one factor, DBU, in common? Reasons were given earlier as to why such variance would be likely to appear when responses are of the well-practiced and natural mode of communication in writing. It is supposed that in the expressive-response tests, so much of E's attention and energy is required in framing his motor product that variance due to abilities for producing behavioral ideas cannot have much to do with total-score variance. Most of the time that he had available was probably taken up with his executive activities.

Summary and Conclusions

The problem of this experiment was to determine whether the behavioral-divergent-production abilities that were expected to be demonstrated by a factor analysis of printed tests, in which the usual, multiple alternate responses are given in writing, can also possibly be demonstrated with tests in which the responses of examinees are expressive (facial, postural, or vocal). A battery of tests was administered, in which there were eight printed tests thought to be designed for abilities DBU, DBC, and DBR of the SI model, also two tests designed for DBU calling for facial and postural expressive responses, photographically recorded, and two tests for the same ability calling for vocal expressions.

A correlation matrix derived from a sample of 34 students was factor analyzed, with varimax rotations of three factors. Although the tests were of high reliability, the three factors separated along the lines of the three testing approaches--with written, bodily-expressive, and vocal-expressive responses.

Interpretations argued for the conclusion that the two expressive-response tests were dominated by two different executive abilities or functions, having to do with the human individuals' effector systems. Only in the printed tests, in which little or no attention is needed to the act of writing, as such, could variances in generating behavioral ideas make effective showings.

It must be conceded, however, that the findings suggest one kind of limitation that needs to be placed upon the scope of the behavioral divergent-production abilities in terms of their roles in behavior. Studies will be needed in order to determine generalities and possible limitations in other respects.

CBU	Expressions	Multiple-choice "behavioral-vocabulary" test
	Faces	Same as Expressions, confined to faces
	Stick Figure Expressions	Same, confined to stick figures
CBR	Social Relations	Select comment to go with one of two facing faces
	Silhouette Relations	Select face to go with one of two facing silhouette figures of persons
CBS	Missing Cartoons	Select cartoon frame to fill missing part of cartoon strip
	Missing Pictures	Same, with photographs rather then cartoons
DMU	Ideational Fluency	List objects with two common properties
	Plot Titles (nonclever)	Invent nonclever titles for a story
	Consequences (obvious)	List obvious effects of a given change
DMC	Utility Test (fluency)	List different uses for the same object
	Multiple Grouping	Classify and reclassify word meanings
DMT	Plot Titles (clever)	List clever titles to story plots
	Consequences (remote)	List indirect effects from a change
DMI	Possible Jobs	List jobs for which a given emblem stands
	Planning Elaboration	List detailed steps for an outlined plan

[a] For additional descriptions of tests, see Appendix A.

93.0 per cent of the total variance.

The 15 principal axes (14 for SI abilities and 1 for sex membership) were rotated by Cliff's (1966) orthogonal-rotation program designed to maximize the similarity of the empirical factor matrix to a target matrix. The initial target matrix was patterned in line with the experimental hypotheses, using the square root of each test's communality as its target loading on its own expected factor and zeros elsewhere. After the first rotation, and after each successive rotation, the target matrix was modified in the light of findings in the preceding rotation and also so as to improve positive manifold. The principal-component and final rotated matrices are given in Tables 6 and 7, respectively.

INTERPRETATIONS OF THE FACTORS

The interpretation of each factor is based upon the apparent common-factor content of tests loading .30 or higher on the factor. The factor loadings for each factor are listed along with any additional significant loadings on other factors, where tests proved [6]

[6] For the statistical analysis, computer assistance was obtained from Health Sciences Computer Facility, U.C.L.A., sponsored by NIH Grant FR-3, Western Data Processing Center, U.C.L.A., and Computer Sciences Laboratory, U.S.C.

[4] For this testing we are very much indebted to Dr. R. Leland, Principal, and Miss Carolyn Barnes, Head Counselor, Burbank High School, Burbank, California.

[5] We are especially indebted to Mr. Peter Simer and Mr. Gene Prasse for their diligence and interest in scoring the DB tests.

31. Possible Jobs DMI03B	18.55	6.04	.75[d]	-
32. Silhouette Relations CBR05A	10.88	4.38	.43[d]	0
33. Social Relations II CBR02A	14.18	4.63	.51[d]	-
34. Stick Figure Expressions CBU05A	15.94	4.88	.46[d]	0
35. Suggested Feelings and Actions DBI02A	14.27	4.06	.80	0
36. Utility Test DMC01B (fluency)	20.85	6.76	.73	+
37. Utility Test DMC01B (flexibility)	9.92	7.11	.78	+
38. Varied Emotional Relations DBI03A	18.06	3.58	.64	-
39. Verbal Comprehension CMU02D	10.19	4.24	.75[d]	0
40. Word Completion CMU01B	11.42	3.89	.84[d]	0
41. Writing Behavioral Stories DBS03A	4.29	2.14	.63	0
42. Sex	.57	.50		

[a] Reliability estimates are Spearman-Brown corrections of interpart correlations, unless noted.

[b] Distribution forms are coded: -, slight negative skew; 0, symmetrical; +, slight positive skew; and ++ strong positive skew.

[c] Communality entered as reliability estimate.

[d] Reliability estimates are Kuder-Richardson coefficients.

[e] Reliability estimate is item-alpha coefficient.

for the factor here pertains to a non-face test as well, and all three have higher loadings than were found before. All kinds of expressions are involved in the three tests--of face, hands, feet, and other body parts, as well as postures, either realistic, as in line drawings, or schematized, as in stick figures.

CBR - Cognition of Behavioral Relations

32. Silhouette Relations (CBR)	.48
33. Social Relations (CBR)	.41

This represents a second replication of a CBR factor, the first replication having been achieved using the same tests (Tenopyr, Guilford, and Hoepfner, 1966). The absence of loadings on any DBX factor, especially DBR, indicates that this is a distinct ability and that its variance was controlled in DBX tests, as well as in others.

CBS - Cognition of Behavioral Systems

19. Missing Cartoons (CBS)	.64
20. Missing Pictures (CBS)	.57

This is also a second replication for the CBS factor. In the first analysis (O'Sullivan, et al., 1965), Missing Cartoons had secondary loadings on both CBU and CBI. No secondary CBU loading was found in this analysis, but CBI was not included in this analysis, so this test's relation to that factor could not be re-examined.

The secondary loading on DBT for Consequences (obvious) may reflect behavioral ideas in items of that test. This could be true in items like those asking for consequences of not needing food any more or all individuals losing sense of balance. Some effects would be felt in terms of human emotions and attitudes, and modifications in those features, hence the transformation aspect. Without having both DMX and DBX tests together in an analysis, this kind of behavioral involvement in DMX tests would not be found. One would hardly expect such an involvement in Consequences, a priori. The fact that both the obvious and remote scores had secondary loadings on DBT may be attributed to the fact that an obvious-remote distinction does not hold with respect to the behavioral content as it does for the semantic content; otherwise, one might expect the obvious score to have DBU variance, not DBT. Or it may be that behavioral responses tend to be remote.

The secondary loading on DMI for the Utility Test may come from the fact that in giving uses for a brick or a pencil, one use leads to or suggests another within the same class.

The secondary loading for Plot Titles (non-clever) on DBI is another example of behavioral content showing up in a DMU test. In this instance, however, both the DMU and DMT scores derived from Plot Titles, unlike those from Consequences, both go on

9. Behavioral Elaboration	40	17	30	38	36												
10. Consequences (obvious)	37	22	28	26	24	15											
11. Consequences (remote)	19	15	19	20	19	23											
12. Creating Social Relations	35	19	34	36	36	53											
13. Creating Social Situations	26	22	30	26	21	40											
14. Expressing Mixed Emotions	41	14	23	30	34	55											
15. Expressions	11	09	08	11	18	13											
16. Faces	-01	08	18	04	11	09											
17. Forming Alternate Faces	15	09	29	36	12	24											
18. Ideational Fluency	36	29	21	29	18	34											
19. Missing Cartoons	13	20	00	39	12	15											
20. Missing Pictures	14	18	03	10	09	17											
21. Multiple Behavioral Grouping	42	24	34	38	31	29											
22. Multiple Cartoon Fill-Ins	51	26	30	31	25	33											
23. Multiple Emotional Expressions	48	23	29	37	34	61											
24. Multiple Expression Changes	38	34	46	54	37	36											
25. Multiple Grouping	29	16	32	31	28	21											
26. Multiple Social Problems	48	16	21	34	22	47											
27. Multiple Story Plots	42	24	28	29	31	39											
28. Planning Elaboration II	47	22	33	43	37	46											
29. Plot Titles (clever)	44	24	34	39	22	38											
30. Plot Titles (non-clever)	13	07	11	19	08	14											
31. Possible Jobs	38	15	26	30	23	33											
32. Silhouette Relations	00	09	10	03	00	-03											
33. Social Relations II	09	12	17	16	23	20											
34. Stick Figure Expressions	17	12	15	08	05	02											
35. Suggested Feelings and Actions	43	20	19	20	31	46											
36. Utility Test (fluency)	43	25	28	40	26	38											
37. Utility Test (flexibility)	41	19	04	21	07	26											
38. Varied Emotional Relations	25	31	41	51	31	36											
39. Verbal Comprehension	21	00	-03	19	10	13											
40. Word Completion	25	-05	-03	20	17	19											
41. Writing Behavioral Stories	25	07	19	26	24	35											
42. Sex	-19	-12	-18	-03	-21	-26											

Note. — Decimal points omitted.

4. Alternative Facial Relations - DBR01A. Given photographs of different facial expressions and a comment, choose many different pairs of faces such that the first face chosen in each pair is making the comment to the second one.

Sample Item:

Comment: "Wait, that's not what I really meant."

Relation 1: B and C Relation 2: ___ and ___ Relation 3: ___ and ___

Score: Number of appropriate pairs judged to be behaviorally different.

Parts: 3; items per part: 3; working time: 9 minutes.

5. Alternate Line Meanings - DBT03A. Write the names of different feelings or emotions that are represented by a given line.

Sample Item:

1. sad
2. quiet
3. gentle

Score: Number of different feelings or emotions connoted by the lines.

8. Alternate Social Solutions - DBI01A. Given a social situation, list many different social solutions for the situation.

Sample Item:

You are on a weekend trip with a group of close friends. They want you to spend the day hunting with them but you want to go fishing instead. You could:

1. Give in and go hunting with them
2. Tell them to go hunting and you go fishing
3. Convince them that fishing will be more fun
4. Suggest deciding by tossing a coin

Score: Number of possible solutions that are judged behaviorally different.

Parts: 4; items per part: 1; working time: 16 minutes.

9. Behavioral Elaboration - DBI04A. Given an action of one person, write many different responses to show how a second person might feel or react.

Sample Item: IF PERSON A WINKS AT PERSON B, WHAT WILL B DO?

1. smile back timidly
2. look surprised
3. get embarrassed and blush
4. pretend she doesn't see person A
5. get mad at A

Score: Number of behaviorally different responses that are expectable from the given situation.

Parts: 4; items per part: 1; working time: 12 minutes.

10. Consequences - DMT03C (obvious)(SPS). List many different results that would be associated with a new and unusual situation.

Sample Item: What would be the results if people no longer needed or wanted sleep?

13. Creating Social Situations - DBS01A. Given a description of three persons, each having a given feeling or emotion, describe many different situations, using all three people, that could account for their feelings or emotions.

Sample Items:

1. C gets a bad report card; B, his father, is mad at C; and A, his mother, is afraid B will hit C.
2. A has wrecked the car. B, her husband, is angry at her and C, the child, is sad for his mother.
3. B comes home to find A with another man. He yells at her and C is unhappy. His parents are fighting.

A. A fearful woman
B. An angry man
C. An unhappy child

Score: Number of behaviorally different situations involving the social interaction of the three persons that can account for their behavior.

Parts: 4; items per part: 1; working time: 16 minutes.

14. Expressing Mixed Emotions - DBU04A. Write many different things that a person might say when he is feeling both of two given emotions.

Sample Item: both JEALOUS and DISAPPOINTED.

1. You can have it. I don't want it anyway.
2. Yeah. Bill won; he always wins.
3. He got it? But I expected to.

Score: Number of behaviorally different responses indicating that both emotions are being experienced.

Parts: 4; items per part: 2; working time: 12 minutes.

18. Ideational Fluency - DMU01B (SPS). List things that belong to a broadly defined class.

Sample Item: Name FLUIDS that will BURN

gasoline
kerosene
alcohol

Score: Number of different things listed that belong to the specified class.

Parts: 2; items per part: 1; working time: 6 minutes.

19. Missing Cartoons - CBS01A (SFS). Choose the alternative that completes the cartoon strip, making sense of the thoughts and feelings of the characters.

Sample Item:

Answer: 4.

Score: Number of items right minus one-third number wrong.

Parts: 2; items per part: 14; working time: 16 minutes.

20. Missing Pictures - CBS04A (SFS). Choose the alternative photograph that completes the story, making sense of the thoughts and feelings of the actors.

Sample Item:

ITEM

22. Multiple Cartoon Fill-Ins - DBS02A. Given the first and pened between them so that the explanation involves the feel

Sample Item:

1. He heard the mouse leaving
2. He thought the mouse was

Score: Number of behaviorally different responses that inter the first and last frames.

Parts: 3 (Note: only parts I, III, & IV were used); items p

23. Multiple Emotional Expressions - DBU03A. Write many ing a given emotion.

Sample Item: ANGRY:

1. Oh, yeah, you make me
2. I hate you.
3. One more word and
4. Grrr!
5. Get out!