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A study in expressive motoric action: A simple key-pressing task as a means of personality measurement, and a Russian "signalling-system" theory as a means of conceptualizing the problem.

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A STUDY IN EXPRESSIVE MOTORIC ACTION:

A SIMPLE KEY-PRESSING TASK

AS A MEANS OF PERSONALITY MEASURMENT,

AND A RUSSIAN "SIGNALLING-SYSTEM" THEORY

AS A MEANS OF CONCEPTUALIZING THE PROBLEM.

by

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ABSTRACT

This study in expressive motoric action was designed to investigate the relationship between a simple manual key pressing task and a variety of personality traits measured by the California Psychological Inventory. Rationale for the study was based on a Soviet approach to Pavlovian behavior theory which draws a direct connection between motor behavior and "language", in its broadest sense, and then between language and personality, these being represented as various levels of interrelated primary and secondary conditioned behavior. This theory implied that a relationship between personality and motor variables would occur when the mediating conditioned stimulus of language was encouraged in the motor task, and a decision making motor task was selected accordingly. It was predicted that the motor task would correlate significantly with one or more personality traits, and would correlate most highly with dominance due to characteristics of the task.

Forty-seven high school boys received group CPI administration followed by an individual key-pressing session. A visually presented command, "press key", was paired with a neutral signal light for 20 trials; the command was then discontinued and the signal light presented alone for 20 trials. The subjects made the decision to continue pressing or desist and their pressing score out of 20 was recorded.

Statistical procedures were carried out by computer.

Simple correlations between all possible pairs of variables showed no high relationship between the motor task and any single personality trait. A principal components analysis revealed four main factors among the variables, three factors being C.P.I. traits and the fourth factor

being motor performance alone. A stepwise multiple regression procedure revealed that a largely unrelated cross section of eleven traits provided .45 of the total .48 correlation between traits and motor performance. The highest partial correlation value was .26 while the partial correlation between dominance and key pressing was -.24.

It was concluded that the motor task correlated with a large scatter of traits, and thus revealed little practical trait predicting power. The considerable incidental information obtained through analysis and its implications for further research were discussed.

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CHAPTER 1

INTRODUCTION

The American approach to personality study has been characterized by several different methods of tapping personality traits. One method which has received a great deal of investigation, but little success, is the measurement of expressive motoric action. Contrasted with other current approaches to personality assessment, such as the popular written inventory or the formal verbal interview, the measurement of expressive acts has shown itself comparatively useless in practical situations outside the laboratory. The potential simplicity and speed of execution which it possesses as well as the apparent logic of the method has led to its continued investigation for over 35 years. However, in this length of time no major breakthroughs have been achieved. It seems unlikely that further progress will be made without a fresh approach to the problem.

The method of expressive movements may be defined as the systematic observation, across a sample, of any selected motoric act or acts with the purpose of discovering a consistent relationship between characteristics of the act and a predefined personality trait or traits. This definition encompasses a wide range of experimental studies which have employed a large variety of working definitions for expressive movements and for the determination of traits.

The logical assumption implicit in the definition, and therefore in the design of the studies, has been that personality will consistently take all available avenues of expression, motor or otherwise.

Stated specifically, any stimulus which is designed to elicit a brief motor response is also capable of revealing a relevant trait through the characteristics of the response. It is unfortunate that, while experimental evidence has frequently indicated that personality and motor behavior do covary to some extent, it has not been shown that personality will invariably or even usually be expressed. This omission probably constitutes the main weakness of the approach.

The most thorough early investigation of expressive acts is detailed in Allport and Vernon's book Studies in Expressive Movements (1933). This book reported on a full range of actions including manner of walking, posture, handwriting, gesture and facial expression. Allport illustrated that various actions could be consistently interpreted by his panel of judges as indicative of certain personality attributes in any subject. His findings were often significant and his subjective scoring method was shown to be useful in the laboratory, if not elsewhere.

Two specific branches of investigation developed from Allport's approach. The first of these does not belong under the motor measurement method as defined earlier. It involves the construction of a battery of objective motor tests whose scores can be factored statistically to reveal various traits (Cattell, Dubin, & Saunders 1954; Santostefano, 1960). The second approach, in keeping with the definition, attempts to discover motor tests which will correlate highly with predefined and pre-measured personality traits (Eisenberg 1937; Linton 1962; Tarte & Klugh 1965). Research in this area has not usually been conducted on the comprehensive scale of Allport's earlier

explorations, with the result that much of the relevant literature is in the form of small unrelated studies. These studies have often been designed to investigate an isolated trait of particular interest to the experimenter and have done little to improve the method.

A few examples of the personality dimensions which have been explored are the following: extroversion-introversion (Eysenck 1964); anxiety, neuroticism, psychotic tendencies (Goldstein 1964); sociability, self-acceptance, responsibility and other CPI measures (Hardyck 1966). A trait which has been the object of a very large amount of research is dominance. The most rigorous investigations have quite often succeeded in demonstrating a low correlation between dominance and a specific manner of performing, and it is probable that at least as much success has been achieved with this trait as with most of the others.

Typical examples of dominance studies are numerous. Eisenberg (1937) administered a dominance inventory to 216 men and selected the nine most dominant and eight least dominant for testing on a variety of performance tasks. He noted certain differential trends in mode of performing the requisite gestures. Dominant men tended to move more rapidly, cover more space in writing, apply more pressure in writing and be less persistent at tasks than were submissive men.

Eisenberg and Reichline (1939) administered a dominance inventory to 238 women and selected the eight most dominant and eight least dominant. They obtained a 30-second motion picture of the manner of walking of each of the 16 subjects and showed the films to a group of 99 judges who rated the degree of dominance displayed in the walk. Despite the use of extreme cases of dominance and submission, the judges succeeded

in correctly typing the subject in an average of only 63.5% of the cases. A test of the significance of this percentage showed it to be barely above chance level.

Tarte and Klugh (1965) have found that dominant women, as measured by Maslow's Social Personality Inventory, were more likely to alternate after forced choices in a Denny paper and pencil maze than were submissive women. A significant difference was obtained but, again, extreme cases were used for testing.

A recent innovation in the study of expressive motions has been the correlation among a whole battery of personality traits and the chosen motor act. This method has had the advantage of increasing efficiency but has not greatly altered the conclusions achieved from single-trait or few-trait studies. For example, correlations have been obtained between primary beginning strokes in handwriting and various trait scores obtained by administering subjective and objective personality tests such as the Rorschach, Draw-A-Person test, Authoritarian Personality Questionnaire and others (Linton, Epstein, & Hartford, 1962). The relationships found in this particular study, according to t tests and "chi square" tests, varied from fairly significant (.01 level), to chance expectancy but, on the whole, they were rather low (.05 to .10).

From the typical studies cited here it can be concluded that personality and motor behavior usually show a very low relationship.

Due to the large variety of investigations which have been conducted, it is unlikely that these findings can be totally attributed to errors in method or experimental design, and a more basic flaw in theoretical assumptions must be sought.

A brief examination of the history of intervening variables which have been applied to studies of expressive motions reveals at least one explanation for the unsatisfactory experimental results which have typically been obtained. In early research, it was suggested that personality traits would adopt a motoric mode of expression due to some inherent motivational property of the trait. This theory was so indefinite as to be useful primarily for post hoc explanations and did little to guide experimental design. Later, the motivational view came to be regarded by many as unsatisfactory in the light of fresh personality research (Guilford 1959), and Sarbin (1954) suggested that a more social-psychological approach, viz., that an individual learns the correct motor behavior in an attempt to meet the role demands of the situation. This idea was expanded by Wallace (1966) to the view that personality is regarded as a response capability. According to this approach the individual will strive to learn the set of responses which will win the most success or approval in any particular social situation and the degree to which he succeeds in learning these responses depends on such factors as intelligence, skill in interpreting the situation, and opportunity to observe and to practice for that situation. Again, this theory does not necessarily imply a fixed relationship between a trait and an isolated motor response.

It appears, in retrospect, that none of the intervening processes which has been posited has been developed to the point where accurate

predictions can be made about the relationship between traits and motor performance. Researchers in the past have assumed, or attempted to demonstrate, that personality and motor activity vary in direct and continuous relation to one another, but such an assumption has had no clear theoretical basis, and repeated experimental results have tended to indicate that the relationship is not entirely simple and direct. There is an obvious need to take a more systematic approach to the theoretical considerations before attempting yet another study in expressive action.

One approach which has never been fully utilized in an attempt to establish a firm theoretical framework is the "typical" Soviet, or "Russian", psychology. This omission has been due to two major reasons. First, there is a lack of communication and an unavailability of Soviet literture, which remains a serious obstacle. The greater difficulty, however, has been that personality traits, as referred to by Soviet psychologists, have lacked the behavioral specificity of those developed by Western psychologists. As defined by Soviet psychologists, "traits" have been general descriptive terms, superimposed on a physiological theory of brain functioning. The possibilities of expanding this approach to deal with the concept of the specific trait have gone largely unrealized until recently.

Use of Soviet psychology is made attractive for the present problem by the existence, in the Soviet theoretical framework, of specific connecting links between the various levels of human behavior. There is a well developed theory for relating learned motor performance (called "first signalling system" activity or FSS), to the higher function of language performance (called "second signalling system" activity or SSS). Language, in turn, is seen as the basic structure upon which personality develops and seeks expression. Therefore, it can be concluded that the

relationship between motor activity and language, and that between language and personality, determines the interaction between motor activity and personality. "Language", used in the broad sense of the term, may constitute the missing intervening variable which is required in the study of expressive acts.

This Russian approach is not universally accepted by Russian experimenters. For example, the research and theories offered by Vygotsky, which were suppressed until 1956, are in direct opposition to the more "typical" approach. Vygotsky carried out a series of experiments, observing and manipulating the development of various observable language stages in young children. From these he concluded that there is no rigid correspondence between the units of thought and speech. Thought and speech can originally exist as completely separate entities and a continually changing and evolving interrelationship develops between the two through the medium of "word meanings". Since thought starts as a "dim amorphous whole" and speech starts as single words, the two systems actually develop toward one another rather than in parallel form. A thought can hardly be translated fully into words, according to Vygotsky, since so much language would be required to express one complete thought that many unspoken thoughts are usually left to underlie speech.

Although Vygotsky's approach to speech and thought is of interest it was not considered useful for the present research. The approach retains the same disadvantage as the Western theories described previously, i.e., it is too general to be used for specific hypotheses and predictions. In addition, it does not attempt to account for the type of responses which are seen in everyday social situations where, although thought is obviously required to interpret the events, a fairly predictable and apparently conditioned set of verbal and behavioral responses can be

expected to result from this thought. Under these circumstances, the more usual Russian approach, involving direct interaction between signalling systems and personality, was seen as more suitable for the present research.

This more typical theoretical frame of reference was adopted for the present study of expressive movements. It was taken as a basic assumption that language forms the mediating variable between motor action and personality. All areas of Russian theory which support this viewpoint were accepted intact for the purposes of this study. In the process, it became apparent that many of the differences between Soviet and Western fields of thought exist only as a difference in emphasis or focus of interest and that the existence of specific personality traits, specified in the present research could easily be accommodated in the Russian theory.

The character and development of the two signalling systems, the FSS and the SSS, make explicit how language can function as a mediating factor. These two signal systems, stemming from Pavlov's (1927) formulations, are the basis of the Russian approach to both learning and character formation. They are based on Pavlov's thirty-five years of experience with the classical conditioning paradigm, which he posited as the basic mechanism for all higher mental processes (Pavlov 1941). The classical conditioning process is used to describe the discrete development of each signalling system and also offers an explanation for the tight connection between the two systems.

Pavlov states that the development of CS-CR connections through standard classical conditioning procedures results in the creation of a new physiological link between sensory input and motor output, causing the formerly neutral input to elicit an output similar to the UCR, i.e.,

the CR. This is Pavlov's basic conditioned reflex mechanism through which all learning occurs. Through a wide variety of such learning experiences the simple reflexes elaborate and increase in number, eventually becoming entire complex systems of signalled reflexes -- that is, the two signalling systems. Although formed by the same procedure the properties of the two systems are somewhat different.

The first signalling system is identical to the system of mental development in animals and is developed with direct reference to the environment (Pavlov, 1941). It enables a high degree of adaptation to the environment, but involves no language or concomitant ability to abstract and generalize. The operations of this system have been studied and tested extensively in children who are at a pre-language level. For example, Kasatkin, Mirzoyants, and Khokhitva (1953) investigated an anticipatory orientation response in infants. They repeatedly presented an unconditioned stimulus of flickering light which was designed to elicit the unconditioned response of head turning. The conditioned stimulus was a low tone which commenced at an unspecified time before the onset of the UCS. A conditioned response of orientation toward the potential source of light was soon established to the sound of the tone, and it was noted that the rapidity of the conditioning was related to the age of the infant. Other experiments testing the various characteristics of the FSS in children of all ages are numerous (Babkin, 1958; Dashkovskaya, 1953; Ivanov-Smolensky, 1927).

Pavlov's second signalling system is a theoretical interpretation of how language develops from prior FSS conditioning and imposes its

control on motor behavior in the verbal human. It is a device which, for Pavlov, covered the topics of thought development and human nature, and which, for later theorists, has been expanded into a reflex theory of personality formation (Murphy, 1947).

The SSS develops by the same process of simple classical conditioning as does the FSS. However, development does not start until appropriate conditioned stimuli of the FSS have been sufficiently learned. When the FSS is partially established, the CS's of this system can serve as the UCS's for a higher order conditioning process, following the classical higher order conditioning paradigm. A direct link can be formed between the learned stimuli of the FSS and language, without the necessity of reverting to the original unconditioned stimuli which were frequently painful or harmful in nature. The verbal equivalent of the stimulus is now presented as the CS, paired with the learned FSS response which serves as the UCS for this situation, and the response which was originally conditioned in the FSS system is quickly elicited as a conditioned response to the verbal signal. Therefore, although some reflex connections are probably formed directly between the environmental UCS and the verbal CR, most of the learning of the SSS is a higher order conditioning process based directly upon the FSS. Once fully established and integrated with the other conditioned reflexes of the verbal type, these CR's will not extinguish but become permanent stimuli or signals in their own right, and can elicit either further verbal or motor reflex responses. With continued learning, the human is able to provide his own verbal stimuli so that he can elicit any behavior which he prefers, regardless of the immediate availability of external environmental stimuli.

Bykov (cited by Wells, 1956) attempted to demonstrate the operation of the SSS in a simple conditioning experiment. Using children

of ages eight to 12 he conditioned a reflex hand withdrawal to the ringing of a bell by pairing the ringing with a mildly noxious electric shock. When subsequently the ringing was replaced by either the spoken word "bell" or a visual sign "bell", a similar conditioned reflex hand withdrawal was observed. This experiment illustrates that conditioned stimuli of the SSS become signals which elicit conditioned responses which were probably formed originally by the FSS.

An important property of the SSS is its ability to "cover" or predominate over the action of the FSS in most situations. This has been demonstrated in an experimental situation in which the two systems were in direct opposition (Bykov, 1953). Using direct SSS conditioning, Bykov obtained a CR of blood vessel dilation by pairing the verbal CS "I am going to apply warmth", with a warm unconditioned stimulus. Subsequently he retained the same verbal stimulus of the SSS, but paired it with a UCS of mildly painful heat. Despite the fact that a caloric stimulus of this degree would normally produce vessel constriction, the vessel dilation was retained due to the dominating influence of the SSS. Bykov concludes that the conditioned reflexes of the two systems knit together into a "complex-reflex" act, and that the conscious, intellectual SSS can, under some conditions, dominate the lower, unconscious system (as cited in Wells, 1956).

While it is suggested by the research that the two signalling systems can, when fully developed, operate either independently or jointly, it is not always clear when the SSS will be represented in simple FSS behavior. This becomes a crucial consideration if, as has been suggested, the SSS can mediate between personality and motor activity.

It has been found that the SSS operates in FSS tasks to the extent that there is any verbal mediation, self-given or presented by others, within the situation. This would mean that in a simple motor task which

the subject could perform automatically there might be a little or a great deal of SSS involvement. In practice, however, researchers have discovered that, even in simple motor conditioning situations, the SSS will account for much of the variability to be found in performance, providing that the system is given a chance for even minimal involvement. This discovery is tentatively supported by some research.

Razran (1936) paired a mint candy UCS with a nonsense syllable CS and examined the characteristics of the development of a motor CR to the syllable. He found three types of response patterns which he felt could be described as positive, neutral, and perverse. These took the form of eagerness to learn the response connection quickly, a neutral approach, and a tendency to avoid making the required response even when it was known. These response patterns he attributed to different attitudes mediated by SSS activity, claiming that they revealed SSS activity occurred in the simple motor task.

Murphy (1947) examined the results obtained by Razran and others and plotted learning curves for this data. He found that the number of pairings required for conditioning in a typical task forms a normal distribution in primates and very young children. In humans, with increased age a bimodal or multimodal curve appears. This occurs only in conditioning situations that have considerable cortical control. He concluded that, in humans, attitude or conscious thought (SSS activity) plays an important part in determining motor responses (FSS activity).

In these tasks, in which the FSS alone would have provided the necessary mechanism for task performance, SSS activity is clearly influencing behavior to a considerable extent.

Given that SSS activity is operating in FSS tasks, the question arises regarding the likelihood that this SSS activity will be directly and reliably measurable in the tasks. Under certain conditions, Russian theory justifies the prediction that the verbal reaction will be transmitted directly and observably to the motor act, due to the parallel development of the two signalling systems. Since the conditioned stimuli of the FSS act as the unconditioned stimuli for SSS development, the responses to any given motor or FSS stimulus will tend to be similar in both systems. Similarly, when the SSS comes to have a controlling influence over the FSS, events in the SSS will, in turn, become conditioned stimuli for the FSS and will tend to produce the behavior to which they were originally linked. Therefore, a stimulus which would elicit one type of behavior in one system will produce the logical counterpart of that behavior in the other.

The limitation to this direct transmission of behavior across systems is imposed by the SSS. Since it will be remembered that this comes to be the controlling system, transmission will be direct only to the extent that the language system does not impose restrictions on motor activity. Since it is often evident that individuals, and experimental subjects in particular, do wish to avoid revealing many of their thoughts or verbal impressions through behavior it can be assumed that SSS activity usually does restrict a large amount of expressive behavior.

This indicates that care must be taken in selection of a task for testing expressive movements. A task which permits no verbal mediation or one which permits ready verbal interpretation and subsequent development of defensive response tactics would be very unlikely to produce clear results, while a task which encourages verbal mediation

but has some ambiguous elements or produces a rapid unplanned response would be expected to encourage clear expressive behavior. The earlier assumption that personality was invariably expressed in motor activity was in error from this viewpoint since it did not allow for verbal mediation and control of such expression and it is hoped that an experimental task can be devised which will reduce this problem.

It should be noted at this point that all the Russian conditioning techniques which have been described, whether using FSS or SSS involvement, require far more simple, brief, and repetitive actions from the subjects than any of the typical "expressive acts" studies of Allport, Eisenberg, etc. While the latter have been attempting to examine nature, typical behavior, to find an overall "personal tempo", or a characteristic observable approach to everyday events, the Russians have been concentrating on a formal, limited set of localized motor events in an artificial situation. It is inevitable that the extreme simplicity of the Russian task, which was never designed to measure such general personality variables, drastically reduces the amount of information which is provided. It is clear, on the other hand, that complex studies, such as Allport's, proved almost impossible to measure by any objective means. If, as Razran and Murphy suggest, independent attitudes can be displayed in an extremely simple and easily measurable response, then, for initial studies at least, these simple responses may hold a strong advantage over the more typical response patterns which have been used to measure expressive acts.

Having explored the characteristics of the proposed interconnections between motor and language activity it remains necessary only to discuss the direct link between language and personality. Support for the hypothesis that personality and language are directly related to one another can be seen in such Soviet theoretical positions as those of Pavlov (1932), Brozek (1964), and Myasischev (cited in Brozek, 1964).

In Pavlov's theory we find two distinct approaches to personality. The second of these develops as a logical extension of the first.

In Pavlov's first, or physiological, theory he asserts that the inherited characteristics of the nervous system dictate the type of nervous activity which goes on in the brain and determines the basic personality propensities of man and animal. Since lower animals have no SSS modifying influence (such as thoughts, self instructions, long-range delay of gratification mechanisms, or high levels of communication with others), the basic inherited types of nervous activity completely determine the "personality" of the animal. Pavlov, 1917 (as cited in Wells, 1956), defined and described three natural propensities of the nervous system, viz., force, equilibrium, and mobility. From his dog studies he concluded that various combinations of these variables determine the four characteristic and predictable "personalities" which dogs will display in the laboratory. He generalized his findings to humans, saying that there are four inherited personality types in humans.

Despite the fact that Soviet researchers for many years subsequent to Pavlov's work have concentrated mainly on the physiological interpretation of personality, for example the extensive experiments of Ivanov-Smolensky, 1925 (as cited in Wells, 1956), and Briks (1956), Pavlov's second contribution to personality theory is of far more relevance to the human subject. Pavlov asserted that, in the mentally healthy individual, learned modes of coping with the environment had a controlling influence over inherited modes (Pavlov 1941). In other words, the four personality types take secondary place to the less specific patterns of behavior which are gradually developed. But, as has been illustrated in such studies as Razran (1936), Murphy (1947), Bykov (1953), the form of learning that is typically of the greatest significance in shaping mans behavior is not the unconsciously operating FSS conditioning but the complex, abstract learning of the SSS. Therefore Pavlov (1941) claims (as cited by Wells, 1956), and the experiments quoted so far suggest, that in the healthy human the highest system, the speech system, has the predominant function and the regulating influence over the total individual. That is to say, learned personality characteristics, which are the province of the SSS, are of prime importance in most normal behavior. As Wells (1956) expresses it, "Consciousness, not the 'unconscious', plays the leading and dominant role in man's psychic life".

This view is starting to gain prominence through some well known contemporary Russian psychologists. Myasischev, who is viewed by Brozek as the leading Russian personality theorist in the psychological, educational, and medical frame of reference, sees the core of personality as a "complex, multifaceted system of conscious relations (attitudes)

to objective reality" (cited in Brozek 1964, p. 552). While emphasizing the SSS determinants of personality, he is quick to stress the fact that the Soviets have given inadequate experimental attention to this system.

Still another well known Russian psychologist, Luria, clearly supports the same theoretical approach. He states that "Man's 'higher mental functions' represent complex reflex processes...which are social ...in origin and mediated in structure, with language as the principal instrument of mediation (Luria, 1962)."

From these researchers it can be concluded that the SSS is interpreted as both the main source and the main mode of expression of "personality". Personality variables obtain differential expression through SSS activity. They obtain this expression through no other source, with the occasional exceptions of expressive motor acts through the FSS and the basic physiological correlates of various psychological functions.

Accepting the Soviet approach to human behavior there is now a firm theoretical basis for predicting that personality will be transmitted through SSS activity to FSS or expressive motor behavior. This transmission will be direct and predictable as long as a set of controlled and restricted conditions are applied to avoid distortion or concealment initiated at the SSS level. This will be the working

hypothesis of the present experiment, and will provide a basis for the design and predictions to be made.[1]

The implications of this theoretical position are several. None provide a complete solution to the problem of expressive action but the need for variation from earlier experimental procedures is often indicated.

First, Russian theory indicates the importance of establishing a direct connection between the FSS and SSS in the task situation so that the bridge between personality and behavior will be complete. This connection can be encouraged in several ways. For example, the FSS stimulus will have to be clear, simple and attention-holding to permit direct and accurate perception at the SSS level. The task must allow response choice so that subjects can show differential behavior, but must not indicate the trait attributes which relate to each choice so that little defensive SSS activity can be carried on. The choice situation should be designed to encourage thought and decision rather than allowing reflex response selection; an element of surprise or novelty in the situation would be one method of encouraging this crucial SSS activity. It is also apparent that the incorporation of overt SSS

1. It should be made clear that the present research is not designed to test the validity of the Russian theory which has been described, although the success of this experiment would suggest a more detailed follow-up of the approach with some thought of cross-validation. Russian theory was used in the present case primarily to allow the application of a logical set of concepts to an experimental design for studying expressive acts, in the hope of improving on the observations of previous researchers.

activity in the stimulus or the response segment of the experiment would tend to produce additional SSS vigilance. Since few of these points have been applied to other research, the experimental task to be used in this experiment will differ considerably from that of earlier studies.

Second, the type of trait or traits to be correlated with task performance will be determined partly by the dictates of Russian theory. At this stage of investigation, traits which are typically defined as possessing strong subconscious elements such as anxiety, aggression, or hostility do not fit into the Russian approach of conditioning theory as readily as do traits which are usually conceptualized on a behavioral level such as sociability, dominance, and social adjustment. The Soviet emphasis on the conscious SSS determinants of personality restricts use of trait concepts which rely on other intervening variables, although a re-definition of such trait concepts could be used in future. In keeping with Russian "trait" theory, traits will be operationally defined as predictable response tendencies, and social psychological traits, which are readily described in response terms, will be used in the present experiment.

Third, Russian theory also suggests that the components of a situation can be geared to evoke different intensities of expression of various traits. An SSS activity which did not encourage the traits to be measured might evoke little FSS expression of that trait. Since traits of a social nature are to be measured in this experiment, SSS responses of a social nature should be encouraged. The presence of an experimenter in the situation would be one method of prompting social SSS activity, aiding in producing behavior which would reveal social

trait characteristics. Also, an experimenter attitude which was formal and implied the presence of a distinct set of social demands without specifying the nature of the required responses might be useful in concentrating SSS activity on the social psychological requirements of the task.

The selection of experimental motor task depended on the above requirements and on a few other considerations. It was convenient to parallel earlier Russian experimentation, with its experience in designing simple motor response situations. It was also thought advisable to employ a task which demonstrated a clear dichotomy of behavior into two categories which could be respectively defined as occurring in conjunction with a specified trait or in conjunction with the antithetical trait. In practice, the choice of experimental task was also limited by the lack of information about Russian experimental procedures and was selected partially on the basis of availability of equipment.

The range of components which may appear in the Russian literature and from which an experimental task may be selected vary widely. Many of the studies employ a conditioning method which calls for a simple voluntary action as UCR and CR. This voluntary response may consist of squeezing a pneumatic bulb with the fingers (Briks,1956), pressing a rubber diaphragm (Fadeyeva,1951), or pressing a button (Luria & Vinogradova,1959). Hand or finger responses are almost invariably used.

The CS and UCS for the voluntary conditioning procedures also vary. They may be spoken or written word or words (Ratner,1959), a tone (Myrtycheva,1958; 1959), or a light (Skorunskaia, 1959). The conditioning may be preceded by verbal instruction, which in many cases is used

to identify the UCS for the subject. In other studies no prior information is given and verbal instruction accompanies each presentation of the UCS until the connection is formed between the signal (UCS) and the required response. In either case the connection between the signal and response will be formed and stabilized within a few presentations.

Reinforcement is another dimension which is introduced in different forms into the Russian studies. Although there is considerable ambiguity about the method of reinforcing, there appear to be two major techniques. The first utilizes a primary reinforcement procedure such as rewarding a correct response with a piece of chocolate (Ivanov-Smolensky, 1927). The motor response, consolidated to the appearance of food, may now be conditioned to other stimuli of either verbal or non-verbal nature. The second, more convenient method, of which there seems to be no adequate description available, apparently uses only verbal reinforcement. This is the Ivanov-Smolensky motor method of speech reinforcement (as cited by Hartman, 1965). According to Hartman, the first correctly performed response appearing after the UCS can be rewarded by a favourable comment, for example "that's right", "good", "yes". Subsequently, the response will be elicited repeatedly without any further reinforcement from the external environment, presumably on the basis of the subject's own mediating verbal reinforcing response. This method operates entirely through prior SSS conditioning, and is therefore preferable for studies relating to the speech system.

The task chosen from this range of possibilities was a simple key-pressing situation. In this task, initial verbal instruction was kept at a minimum and the stimulus was a written "press key" sign, both factors serving to encourage maximum SSS participation. The conditioned

stimulus, a red light, was first paired numerous times with the sign, then unexpectedly presented alone, forcing the subject to make a dichotomous choice between continuing to press the key and ceasing to press.

Several months of pilot work were completed to discover which sequence of stimulus presentation and which stimulus and interstimulus time intervals were optimal for producing individual differences among subjects. Since Russian experiments give no specific figures on stimulus intervals, most choices were made on the basis of this trial-and-error method rather than on precedent from earlier studies. The various conditions tried and discarded in the pilot work have been presented in Appendix C only, since they are incidental to the aim of the main study. However the unsatisfactory results obtained using these techniques, which were understood to duplicate Russian techniques, arouses some interesting questions regarding the interpretation of the Russian literature, the methods and perhaps the personalities of the subjects used. The results suggest that an important contribution might be made to the Western literature by carrying out still more detailed studies of Russian experimental conditions before attempting to proceed with further work in this area.

Use of the suggested tactics of formality and control by the experimenter were other measures attempted in the present study to encourage socially oriented behavior. It was suggested that the social trait of dominance would be particularly aroused in the subject in this approach, but the probability that other traits would also be elicited was not overlooked. Dominance (or its reverse, submission) was anticipated because the experimenter's unmistakable attempt to control the situation and to instruct the subject suggested experimenter dominance which could be expected to provoke either self-assertion or submission on the part of the subject.

For the purposes of this experiment, dominance and its contrasting trait, submission, were defined in terms of Gough's (1957, p. 10) descriptive adjectives. According to Gough, dominant people tend to be seen as "aggressive, confident, persistent, and planful; as being persuasive and verbally fluent; as self-reliant and independent; and as having leadership potential and initiative". Submissive people tend to be seen as "retiring, inhibited, commonplace, indifferent, silent and unassuming; as being slow in thought and action; as avoiding of situations of tension and decision; and as lacking in self-confidence".

The personality trait measurement to be compared with the motor task was selected from among standard American personality test batteries. Of the typical personality tests of the objective type, the California Psychological Inventory (CPI) came to attention for several reasons.

The CPI, designed by Gough (1957), consists of 18 scales which measure personality attributes from the required social-interaction point of view.

His scales divide the test into four main categories. These are called:

Class I: Measures of poise, ascendancy and self-assurance.

Class II: Measures of socialization, maturity and responsibility.

Class III: Measures of achievement potential and intellectual efficiency.

Class IV: Measures of intellectual and interest modes.

Titles of individual scales within each class are, for example, Class I: dominance, capacity for status, social presence; Class II: responsibility, self-control, tolerance. Thus the inventory includes not only dominance measures but measures of both closely and less closely related traits.

Reliability of the scales on the test-retest method is, on the whole, fair. The range for a sample of high school males (n=101), is from .74 on the intellectual efficiency scale to .38 on a communality

scale, with all but three scales being at or above n=.60. In this sample the intertest interval was one year. Shorter test-retest intervals on non-high school samples show much higher reliability (.49 to .87 with a median of .80 for a one to three week test-retest period).

Validity is more questionable. Gough typically reports the results of comparing his test ratings with the subjective ratings of high school principals or staff. While the validity appears satisfactory for many scales, it must be emphasized that he selects extreme cases and does not include an intermediate sample. Cronbach (as cited in Buros, 1959) states that the actual validity on an entire sample would be as low as .22 on many scales. However, Kelly (cited in Buros, 1965) reports that the validity is good on more recent samples and, on the whole, the test is regarded with considerable confidence.

Based on the goal of determining the extent of the relationship between the performance and personality measures, the design of the present experiment was simple and straightforward. The personality inventory and then the motor test were administered to a sample group and the individual scores for each S were attained. Subsequently, statistical techniques, largely correlational in type, were carried out to determine the extent of the relationship between the two independent measures.

These techniques included simple multiple correlations, partial correlations, determination of variance, principal component analysis of factors, and goodness of fit.

It was predicted, first, that the motor measure would correlate highly with at least one and probably several of the trait measurements. This prediction was made on two bases, as previously described. First, the findings of experiments show that simple motor actions do correlate with many other personality measures. Second, the theoretical position

previously described hypothesizes that various of the manipulations to be used in this experiment, for example novelty, experimenter attitude, ambiguity, will increase the direct expression of personality in the motor task.

It was further predicted that the trait of dominance would be among those most highly correlated with the motor task, if not the only trait to correlate highly with it. Again, this prediction had two bases. First, the type of decision in the key-pressing activity, whether or not to take over the initiative and continue activity when clear key-pressing orders ceased to be given, suggested that, of all the CPI scales, Dominance would be most closely related. Second, experimenter emphasis on the formality of the situation, E's presence during testing, the emphasis made on the fact that S would have to decide what to do --- all of these were geared to increase the subjects' awareness of his own role and suggest that his position would necessarily be submissive if he did not continuously choose to be dominant.

As well as these two predictions the experiment was expected to determine whether or not a principal factor grouping of traits could accurately foretell the choice of motor behavior, and to determine with what accuracy all or any of the relationships could be predicted.

CHAPTER II

METHOD

Subjects

Fifty-four high school boys from grades 9 and 10 of a local collegiate were chosen at random from over 100 junior students. Of these seven were discarded due to suspected cheating, failure to complete the written section of the experiment, or mechanical problems in the apparatus. The remaining 47, ranging in age from 13 to 19 years, completed all aspects of the experiment and their results were retained for analysis.

Apparatus

The material required for the personality test administration consisted of CPI statement booklets, answer sheets for hand scoring, and hand scoring templates.

The CPI booklets consist of 480 numbered statements such as "I like to be the centre of attention", and "I was a slow learner at school". Brief instructions appear on the face of the booklet, to be supplemented by verbal instructions if desired. The answer sheets consist of 480 double blanks, the number on each pair of blanks corresponding to a number on the statement booklet. The upper blank can be marked with an "X" to signify "true", the lower to signify "false". One hand scoring template is provided for each trait, the score on the trait equalling the number of "X's" which can be counted with the template is aligned with the answer sheet.

The apparatus for the performance task included a sign board which could illuminate to produce the visual UCS and CS, the electrical equipment necessary for automatic operation of the CS and UCS, and the recording apparatus for gaining a permanent record of the subject's responses. The responses were obtained by means of a depressable key anchored to the subjects' desk in front of the sign.

A view of the front and interior of the sign box may be obtained by referring to Figure 1.

The front panel of the box shown in Figure 1 consisted of a square of wood 16 in. by 16 in. into which the CS and UCS signs were cut. The box was eight in. wide and served to house the light bulbs and resistor necessary to produce the desired level of illumination of the signs. Both the interior and exterior were painted flat black and sealed against light so that only the signs were clearly visible when the testing room was in dim illumination.

The UCS consisted of the command "press key", appearing in block letters one inch in height and covering a width of six inches and four inches on the sign board. These words appeared one below the other in a rectangle of colourless plexi-glass which had been covered in flat black cardboard so that the letters permitted transmission of light but the remainder of the glass did not. The plexi-glass was securely fastened behind a rectangular opening which had been cut in the upper centre of the board, two inches below the top.

The CS consisted of a round circle $2\frac{1}{2}$ inches in diameter which was centered in the lower half of the sign board $2\frac{1}{2}$ inches below the press key sign. The circle was covered by an unlettered piece of

Figure 1

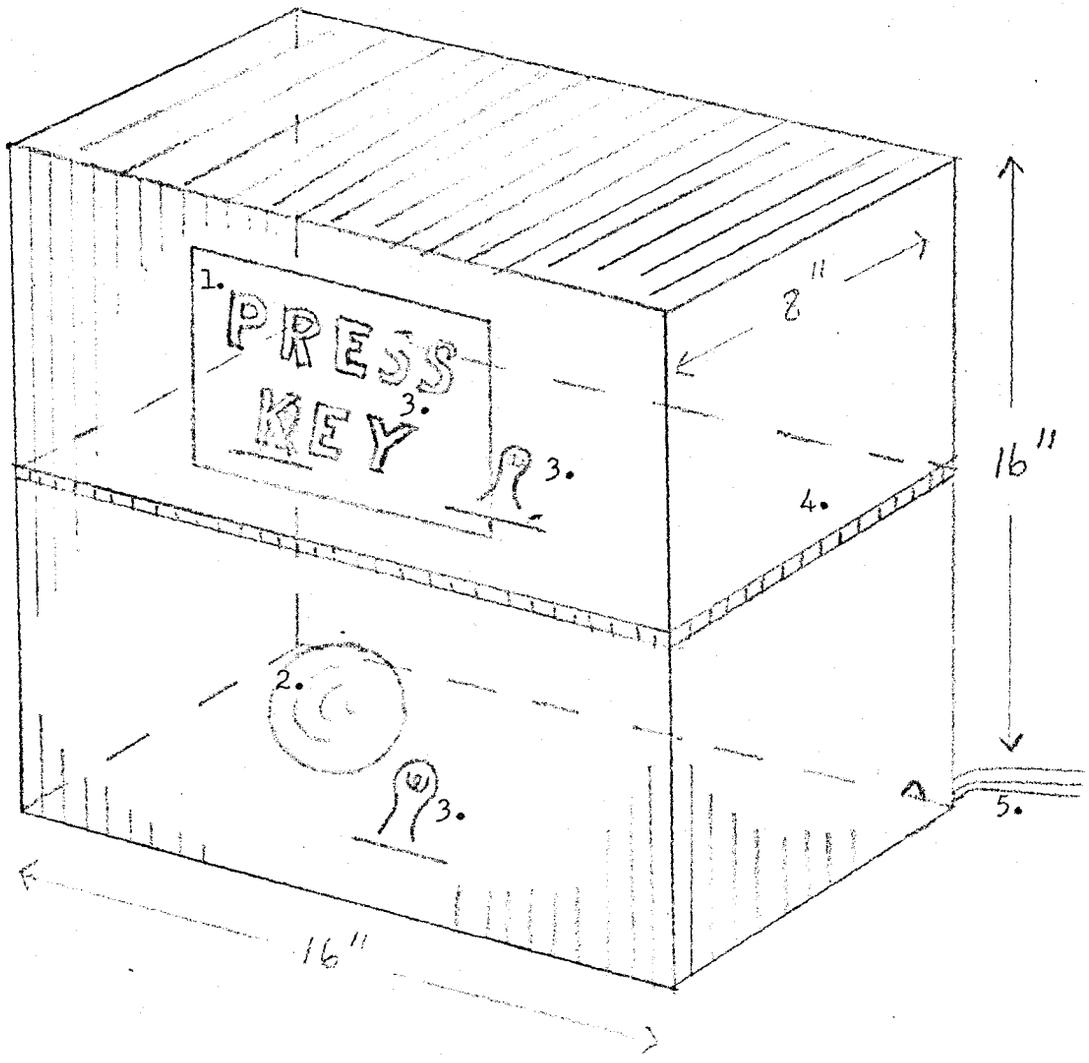


Figure 1. Signal box for producing the visual UCS, press key sign, and CS, illuminated red circle of the motor performance task.

1. UCS "press key" on black plexiglass background.

2. Red CS circle.

3. Light bulbs to illuminate UCS or CS.

4. Partition separating UCS and CS compartments.

5. Wires from lights exit here.

colourless plexi-glass. Behind the plexi-glass was fastened a transparent sheet of red plastic which gave a clear red colour to the CS circle when illuminated from behind.

The plexiglass for both signals was ground on one side so that it was translucent but not transparent. The words and the circle glowed clearly and evenly in a black background when illuminated by light bulbs inside the sign box but were invisible when illumination was switched off.

The interior of the sign box was partitioned into two compartments so that illumination of the CS and the UCS could be accomplished independently. The upper or UCS compartment contained two six-watt bulbs spaced five inches apart and screwed to the floor of the compartment about four inches behind the press key sign. The level of illumination in this compartment was reduced by the insertion of a 10-watt variable resistor so that the sign would glow without illuminating the surrounding area. The lower or CS compartment received illumination from a single six-watt bulb situated approximately two inches behind and one inch below the level of the CS circle. The apparent level of illumination of the CS circle differed little from that of the UCS words, being slightly less.

The sign box was centered on a three foot high table which was placed against the front wall of the experimental room. The front of the box was flush with the outer edge of the table. Both table and wall were of an inconspicuous colour and wires from the box were led away inconspicuously from the rear of the box and out of the room via an opening at floor level behind the table.

Illumination of the UCS and CS was under the remote control of a panel which was constructed from individual pieces of electronic

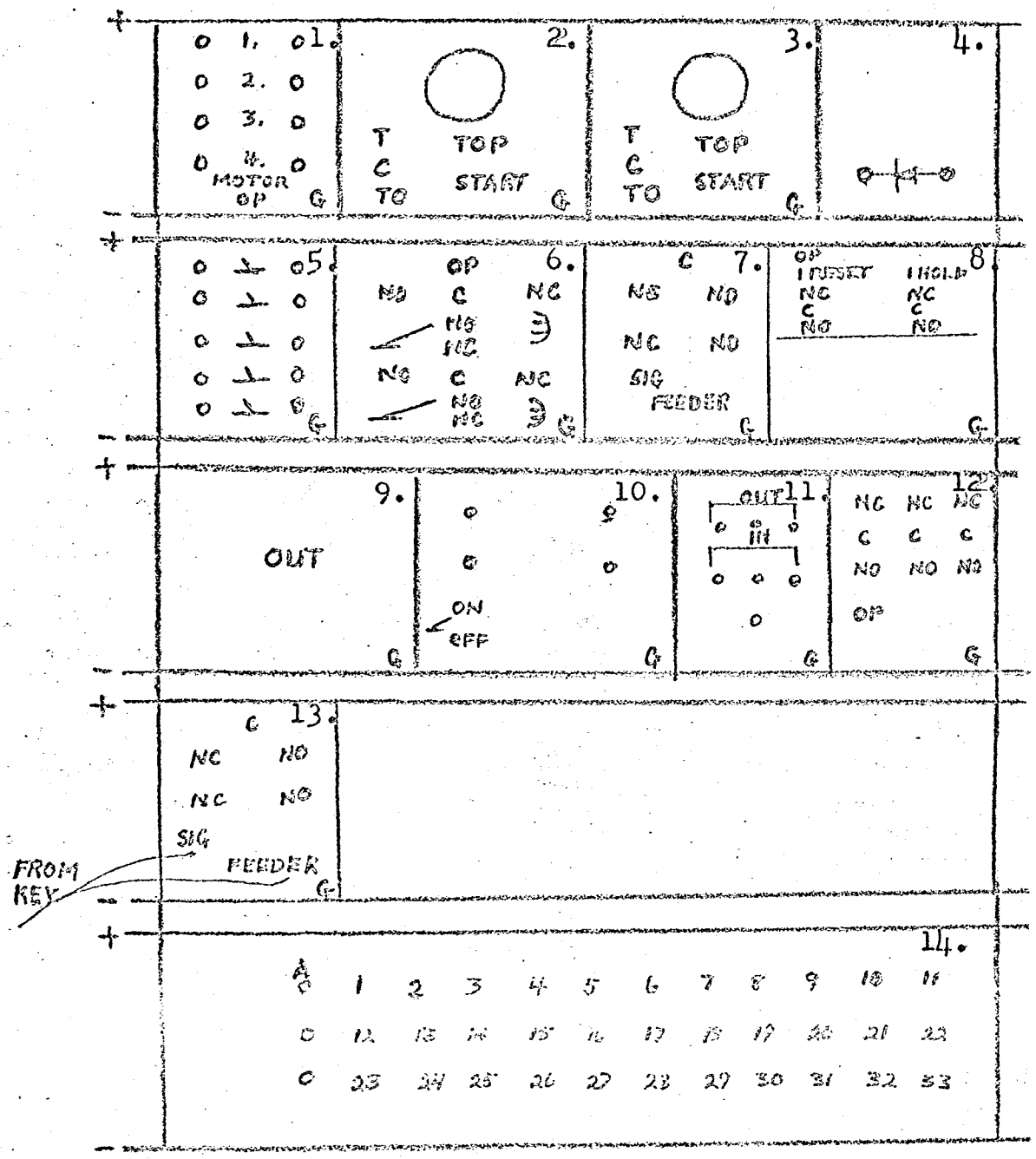
equipment set in a rack, and powered by a 15 amp., 0 to 50 volt DC power supply. Figure 2 depicts the complete control panel including the sections which powered the recording apparatus.

The pieces of equipment of immediate relevance to the experiment consist of numbers 2, 3, and 14 on the diagram.[1] Numbers 2 and 3, recycling interval timers, were directly responsible for the stimulus duration and sequence which was employed. The first timer, set at 900 msec., determined the duration of the UCS light alone, and the second timer, set at 300 msec., determined the duration of the CS light. The offset of the second timer terminated both CS and UCS lights simultaneously while the combined operating periods of the two determined the total stimulus duration.

Presentation of the CS alone was not accomplished by means of the panel, which continued to operate in the above manner during both paired and single trials. The UCS could be turned on or off by means of a knife switch (DP-DT) which was inserted in the UCS light circuit just behind the signal box and wired to a push button near E's chair.

Number 14 on the diagram, the stepping relay panel, was set up to produce a variable intertrial interval. This was done by varying the number of empty terminals between successive connecting points of the wire which initiated the stimulus sequence. Since one pulse was transmitted by each terminal in turn with a one second delay between each, the number of unused terminals equalled the number of seconds before the

1. For a complete description of the function of the various units of Diagram 2, refer to Appendix A.



Control panel for UCS and CS production and response recording.

1. Event Pen Control Panel
2. Recycling Interval Timer
3. Recycling Interval Timer
4. Diode Isolation Panel
5. Toggle Switch Panel
6. AC Relay Panel
7. Pulse Former, 45 ms.
8. Relay Panel (DP-DT) *
9. Pulse Stream Generator (60pps)
10. Pulse Stream Generator*(1pps.)
11. Bistable Relay*
12. Pulse Former*
13. Pulse Former
14. Stepping Relay Panel

* Made by Foringer. All others are Lehigh Valley.

next impulse could be transmitted to the stimulus timers and the desired interstimulus intervals could be accurately produced.

The control panel was built inside a converted sound-resistant telephone booth which stood in a short hall at least 15 feet from the subject. By means of this booth and also by use of high speed air conditioning in the testing room all possible auditory cues were eliminated. The booth contained all parts of the control panel except the main operating switch which was located on one outside wall, and the recording machine which stood on a small shelf built against the opposite booth wall.

Responses were recorded by means of a Lehigh Valley, four pen, Event Recorder which was equipped with three ink filled pens moving over an unwinding roll of paper at a rate of 24 feet per minute. These pens were respectively connected to the onset of the UCS, the subject's response, if any, and the onset of the CS. A fourth pen was not used. The CS and UCS pens also recorded the duration of the CS and UCS signals and the response pen recorded only the onset of the response. Responses and relevant observations were also recorded by E in the testing room. This provided an additional response measure in case of mechanical problems such as clogging of recording pens or unanticipated termination of the recording paper.

The subjects' response key was a standard telegraph key which could be easily depressed with one fore finger. The distance of the key above the contact plate was adjustable by means of a screw and was set at approximately one quarter inch. The telegraph key assembly was securely screwed to a small block of wood which could be anchored to a

desk by means of four nails which protruded below the bottom of the block and fitted into holes drilled in the desk top. One set of holes at each side of the desk permitted shifting of the block for testing of either right or left handed subjects.

The Subjects' desk stood near the rear wall of the experimental room directly facing the signal box and at a distance of 10 feet from it. Directly behind the desk and at a distance of approximately 12 feet from the box was a stool upon which the subject sat during testing. Beside S's stool was an armchair for E. The switch by which E could turn off the UCS hung inobviously among the rungs of the chair arm and the connecting wires were concealed under the carpet.

Illumination of the entire room was provided by a 40 watt bulb in a small desk lamp. To prevent reflections from the plexiglass of the signal box, the lamp was placed under the table upon which the box was located, and its beams were directed toward the wall and floor. In the dim light S could distinguish few of his surroundings and the UCS and CS signals were prominent.

A roll of half inch adhesive tape and a pair of scissors for taping the subject's forefinger to the key completed the apparatus.

Procedure

The testing consisted of two main phases, the first being group administration of the CPI and the second being individual testing of the motor response. The CPI was administered in the high school during school hours under the supervision of both the experimenter and a class instructor. Testing of the motor response was conducted at the university where the necessary apparatus was located.

For the first phase the experimenter was formally introduced to the students as a psychologist who was conducting some research at the school. Emphasis was laid on the importance of cooperating fully with instructions for the purpose of aiding a significant scientific study. Test instructions for the CPI were read and explained by E in a standard manner.[1] E attempted by tone of voice and gesture to maintain a formal and authoritative atmosphere similar to that of an examination situation, in an attempt to encourage clear-cut dominant or submissive responses. The CPI was administered on two days, one group receiving the test in the mid-afternoon of the first day and the remainder being tested at about the same time four days later. The scores from the 18 CPI scales were determined by hand scoring the individual scales on the answer sheet for each S.

The second phase of the experiment commenced approximately two weeks later. The boys came to the university in groups of five and returned to the high school as a group after testing. The number of groups tested each day depended on the boys' class schedule so that the total time required was approximately three weeks with the usual schedule consisting of one group per day in the afternoon. When the boys arrived they were kept under formal supervision in a classroom while awaiting testing and were set at a standard task of composing a list of descriptive phrases portraying their own personality. These lists were not useful to the experiment and were later discarded.

1. For exact wording of introduction and instructions see Appendix B.

The individual performance testing was completed in a separate area to which each boy was led and the procedure was kept as uniform as was possible in each case. Again, a formal atmosphere was maintained. The subject was seated at a desk facing the UCS-CS apparatus, upon which was fastened the key required for the key-pressing performance task. The subject was asked if he was right-handed and if he was not the key was transferred to the left side of the desk. The instructions were given in an authoritative tone as follows:

> This is the key. Press it up and down a few times to see how it works....alright, that's fine. Now I am going to tape your finger to the key to keep it in the same place all the time. What you will do is press the key as fast as you can when the box (pointing at CS-UCS signal box) tells you to. You only have to press the key once each time the box tells you to.
>
> Now I am going out of the room to turn on the apparatus. Do not start to press the key until I come back and tell you it is time to begin. Are there any questions? Remember, do not begin to press until I tell you to.

Questions regarding the function of the CS-UCS box were answered evasively by "You will see when we begin". If S had pressed before E returned to the room E reminded S "Do not press until I tell you to", and those responses were discounted.

The paired stimulus sequence appearing to S consisted of the UCS alone for 900 msec., UCS-CS paired for 300 msec., and simultaneous cessation of UCS and CS. The total stimulus duration for this backward delayed procedure was 1200 msec.

The interstimulus intervals which were employed varied from three to seven seconds with a mean of 4.7 seconds. The sequence was chosen

by random selection of numbers from three to seven with progressive elimination of the selected numbers, and was repeated after every seven trials.[1]

Paired UCS-CS presentation was given for 20 trials, followed by CS alone for the next 20 trials. The CS interval for the second set of 20 trials was 300 msec., as it had been for the first.

On returning to the room after activating the recording apparatus E allowed S to observe two sequences of the paired illumination of the CS and UCS signs, then instructed S to begin pressing at the next illumination. The first two key presses were reinforced by the verbal reinforcer "good", given clearly and emphatically. Subsequent presses were not remarked upon. After the twentieth trial the UCS or press-key sign was switched off by means of a push-button located near the experimenter and 20 trials were given in which the CS or round light appeared alone. If S continued to press upon seeing the red CS light alone his first two responses were reinforced by the word "good", spoken clearly and emphatically and the remaining presses received no comment. If he did not press, the 20 trials were completed in silence. After completion of all 40 trials S was cautioned against discussing his experience with any of the other boys from the collegiate and was returned to the group.

The scores on the performance task could be obtained from either E's hand scoring or the automatic recorder. The automatic recorder was used, being more accurate. The number of responses was counted from the first presentation of CS alone. Voluntary conditioned responses were those

1. The stimulus and interstimulus intervals were selected on the basis of extensive pilot work. For a more detailed review of the pilot work see Appendix C.

which occurred between 100 msec. after CS onset and 300 msec. after CS offset, but if more than one response was given in this time period only the first response was counted.

Statistical Analysis

Eighteen trait measures were obtained for each S from the CPI scoring sheets. The nineteenth variable for each S was the performance score obtained in the conditioning procedure. This score consisted of the number of finger presses which were given by S during the presentation of the CS light alone. The 18 trait scores and one performance score for all 47 S's were submitted to computer analysis and the following steps were performed to obtain the maximum information about the relationships among the performance and personality variables:

1. A simple correlation was calculated between all possible pairs of variables, the remaining 17 variables not necessarily being independent.
2. The amount of variance accounted for by each of the 19 possible factors was found. This was expressed in terms of the values of the latent roots of the matrix and was also converted to percent of total variance. The chi square value was obtained for each possible factor and an F test was carried out comparing each chi square value with all successive chi square values. This step was performed both for its own value and as a preliminary to factor analysis.
3. The weighting of each of 19 possible factors was obtained as a further step to factor analysis of the variables.
4. On the basis of steps 2 and 3 a limited number of principal components were selected. These factors were rotated by the Varimax method to obtain the most simple and clear assignment of variables to factors.

5. The closeness of fit between the 18 variables and variable 19 was determined by means of a regression analysis, giving the overall predictive value of the personality variables.

6. The partial correlations were obtained by means of a stepwise multiple regression procedure for the combination of trait variables which could most profitably be related to the 19th performance variable. By this process the relative contribution of each of the relevant variables in predicting the performance variable was determined.

CHAPTER III

RESULTS

The scores for the 18 CPI scales showed a fairly wide distribution among subjects for each trait. No notable variations were seen in these scores.

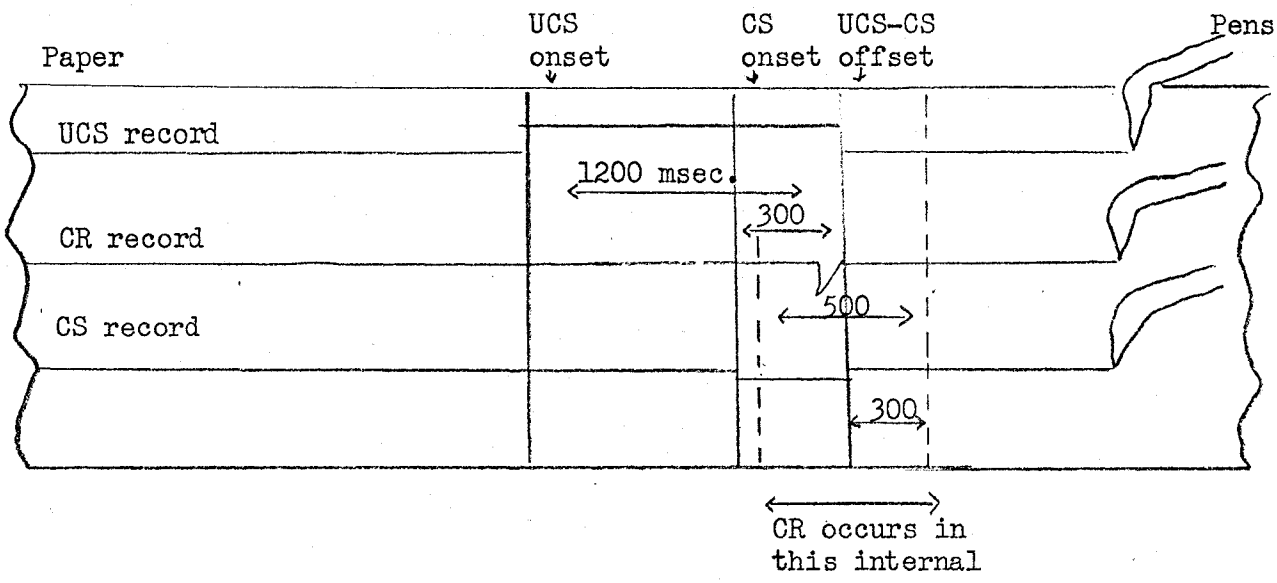
Scores on the performance task varied from zero to 20, the subjects dividing themselves into two groups on the basis of their performance. One group gave no or very few responses, and their scores were usually five or less. The second group responded consistently and received scores of 18 or more. The first group contained about three quarters of the subjects while only eleven high responders were recorded.

Figure 3 illustrates a typical conditioned response as recorded by the automatic event recorder.

As shown on the diagram, the response, seen in the CR record, was marked in the form of a brief clear pen deflection which offered few scoring problems. Note that the UCS, although represented on the recording sheet, was not evident to S during this phase of the procedure. All responses which occurred at least half way within the specified time limits, as they were ruled off on the recording paper, were counted.

Casual comparison of scores for both personality measures showed no obvious relationship between motor performance and dominance, or between motor performance and any of the other traits. The scores were therefore submitted to computer analysis to obtain more detailed information.

Figure 3



Typical stimulus sequence as it was drawn on recording paper by the Lehigh Valley Event Recorder, showing one conditioned response appearing just before stimulus offset. The UCS, although represented on the scoring sheet, was not evident to S.

Table 1 illustrates the simple correlation values which are obtained between all possible pairs of variables.

These values were not independent of each other but reveal the relationship between pairs of variables as they existed in the entire configuration.

The simple correlations between each of the 18 respective trait variables and the 19th, or performance, variable were examined first. The largest correlation, obtained between variable no. 2, Capacity for Status, and variable no. 19 was -.18. This value fails in significance at the 20% level of confidence*, indicating that Capacity for Status is not, by itself, a good predictor of key-pressing activity. The correlation between variable no. 1, the Dominance score, and no. 19, Motor Performance, was -.12, far below any level of significance. These results fail to demonstrate a close relationship between any of the personality trait measures and the performance measure. In particular they fail to show the predicted high correlation between the dominance scale score and the performance task.

In contrast to these low values, correlations within various pairs of trait variables ignoring the 19th variable ranged as high as .78 between Self-Control and Good Impression. At least 24 of the possible 153 combinations of pairs of trait variables showed correlations greater than .50.

These observations indicated that some of the trait variables might cluster in factors and permitted testing of the prediction that such a cluster of related traits would be useful in predicting motor performance where a single trait measure was unable to do so.

* t - 1.23 with 45 df, 2-tailed.

Table 1

Simple correlations obtained between all possible combinations of pairs of variables. The last row represents the correlations between motor performance and each trait variable. All correlations are positive unless otherwise indicated.

Variable

Variable		1 Dominance	2 Capacity for Status	3 Sociability	4 Social Presence	5 Self-Acceptance	6 Sense of Well-being	7 Responsibility	8 Socialization	9 Self-control	10 Tolerance	11 Good Impression	12 Communality	13 Achievement via Conformance	14 Achievement via Independence	15 Intellectual efficiency	16 Psychological mindedness	17 Flexibility	18 Femininity
Capacity for Status	2	.51																	
Sociability	3	.65	.63																
Social Presence	4	.29	.59	.61															
Self-Acceptance	5	.59	.42	.69	.54														
Sense of Well-being	6	.37	.51	.55	.49	.28													
Responsibility	7	.44	.29	.23	-.03	.02	.37												
Socialization	8	.12	.19	.18	.03	.03	.49	.33											
Self-control	9	.17	.35	.25	.14	-.06	.62	.41	.58										
Tolerance	10	.35	.49	.43	.34	.10	.63	.48	.33	.70									
Good Impression	11	.35	.54	.41	.11	.05	.51	.39	.40	.78	.53								
Communality	12	.14	.22	.13	.19	.31	.22	.09	-.05	-.15	-.02	-.08							
Achievement via Conformance	13	.42	.34	.33	.14	.16	.43	.53	.55	.64	.52	.61	-.04						
Achievement via Independence	14	.08	.47	.17	.24	-.07	.42	.40	.24	.49	.72	.32	-.10	.35					
Intellectual Efficiency	15	.25	.22	.32	.36	.24	.55	.16	.07	.10	.35	-.12	.12	.05	.30				
Psychological-mindedness	16	.30	.31	.44	.43	.21	.40	.26	.18	.19	.40	.20	.02	.39	.34	.35			
Flexibility	17	-.41	.09	-.21	.19	-.29	-.01	.03	-.18	.02	.16	-.05	-.09	-.27	.46	.09	.00		
Femininity	18	.08	-.27	-.41	-.40	-.16	-.43	.01	.06	-.11	-.32	-.06	-.26	.05	-.24	-.46	-.14	-.15	
Motor Performance	19	-.12	-.18	-.08	.03	-.01	-.03	-.14	-.11	-.12	-.14	-.16	-.12	.02	-.05	.04	.07	.08	.13

Due to the magnitude of the correlations for some pairs of trait variables, the principal components analysis was completed next. The relevant intermediate steps are summarized in Table 2.

This table expresses, in various forms, the amount of independent variance which was contributed by each of the potential factors to the overall variance which was obtained. Since it could not be determined in advance whether or not the 19th variable, motor performance, would form an independent factor, lists of the values obtained by a separately completed 18 variable analysis as well as by the 19 variable analysis were included in the table so that a comparison could be made between the two. By means of this comparison, and by retaining only those potential factors which made a fairly large independent contribution to the total variability, an economical but accurate number of factors could be chosen for the 19 variable conditions.

The first column of Table 2 lists the amounts of independent variance in terms of the latent root values which were obtained when the common variance was removed from the 19 and the 18 variable conditions respectively. The column indicates that in both cases a large amount of the variation was accounted for by the first factor on the list (root value 6.21 for 19 variables and 6.19 for 18 variables). Less than half this amount of variance was accounted for by the next largest factor (root value 2.70 for both conditions), and a roughly comparable amount was covered by potential factor 3 (root value 2.17 for both). Following no. 3 a sharp reduction in magnitude occurs for the 18 variable condition, latent root no. 4 being approximately half as large as no. 3 (root value 1.13). However a smaller decrease appears in the corresponding 19 variable

Table 2

The amount of variance in subjects' scores which can be independently accounted for by the potential factors for those scores after common variance has been removed. Variability obtained for 19 scores (motor performance included) is compared with variability for 18 scores (CPI traits only), to aid in determining a representative number of factors for 19 variable analysis.

	Potential Factor	Latent Root Values	Percent Variance	Cum. Per-Cent Variance	Chi Square	F Score
19 scores	1	6.21	32.6	32.6	411	6.18
	2	2.70	14.2	46.9	472	3.26
	3	2.17	11.4	58.3	492	3.17
	4	1.26	6.6	65.0	498	2.07
	5	1.13	5.9	71.0	449	2.11
	6	1.03	5.4	76.4	374	2.24
	7	.84	4.4	80.9	258	2.11
	8*	.69	3.6	84.5	183	1.99
18 scores	1	6.19	34.4	34.4	436	6.41
	2	2.70	15.0	49.4	498	3.45
	3	2.17	12.0	61.5	518	3.44
	4	1.13	6.2	67.8	524	2.02
	5	1.07	5.9	73.7	449	2.22
	6	.98	5.4	79.2	352	2.40
	7	.76	4.2	83.4	197	2.14
	8*	.62	3.4	86.9	144	2.06

* No break in the trend of gradually decreasing values occurs between potential factors #8 and #19, or between #8 and #18. Therefore these values have not been included.

condition (root value 1.26), suggesting that a discrepancy between the two conditions occurs at this point. In support of this suggested discrepancy, the root value for the fourth factor of the 18 variables is identical to the root value for the fifth factor of 19 variables (1.13 in both cases). This indicates that factor 4 is more nearly equivalent to factor 5 in the larger group and that an extra factor may have been added in fourth position in the analysis which includes motor performance. This extra factor would not be particularly large, but might be required to account for the motor performance variable.

The percent columns of Table 2 illustrate these observations still more clearly. In the 18 variable analysis the first three factors account for 34.4%, 15.0% and 12.0%, respectively, of the variance, while the fourth potential factor accounts for only 6.2%. In the 19 variable analysis the division between third and fourth factors is less distinct, being between 11.4% and 6.6%, and the separation between fourth and fifth factors is slightly larger.

The table also indicates that a gradual and continuous decrease in value takes place in all potential factors from number 4 onwards in the 18 variable analysis and that a corresponding though less regular decrease occurs after the fourth factor of the 19 variables. From these observations it can be concluded that the 18 variable analysis has only three main factors and the 19 variable analysis has at least three and probably a fourth, small but important factor.

On the basis of these results, factor analysis was continued on the 19 variables, using three factor rotation for purposes of comparison with the 18 variable situation but also considering the weightings obtained

for a fourth possible factor. These factors, i.e., the first four potential ones listed, were termed Factor 1, Factor 2, Factor 3 and Factor 4. Rotation with four factors was not attempted, both because it would be more difficult to achieve a satisfactory rotation in which the fourth factor might contain only one variable and also because the relatively small size of this factor and the few variables it would contain made exact values less important.

Three-factor Verimax rotation was commenced and repeated until maximum separation of the three factors had been achieved. This was judged to have occurred when the maximum-variability score which the computer issued for each rotation consistently failed to increase in size over that of the highest value previously attained. This occurred at a value of 116.

The weightings of the 19 variables on each of the three factors were obtained for the rotation in which maximum variation was achieved. These values indicated the amount of score variation for any individual trait which could be accounted for by each of the three factors. The weightings achieved are given in Table 3, along with the unrotated weightings obtained for Factor 4.

The value of .5 was arbitrarily selected as the criterion for assigning any variable to any factor, as this is a standard level of cut off. All variables meeting this criterion are shown underlined in Table 3 in the column where they occur. It can be seen that Factor 1 contains the traits of

Dominance
Capacity for Status
Sociability
Social Presence
Self-Acceptance
Sense of Well-being

Table 3

Weightings of 19 variables for 47 Ss on each of three principal components, given the Verimax rotation which achieved maximum variation among scores. Weightings for these variables on Factor 4, before rotation, are also given. Weightings greater than .5 are underlined to indicate that they are above the criterion value.

Variable		Factor			
No.	Name	1	2	3	4
1	Dominance	.7090	.3467	-.3216	.0757
2	Capacity for Status	.6323	.3509	.2704	-.1850
3	Sociability	.8577	.2269	.0418	.0160
4	Social Presence	.7142	-.0602	.3972	.1159
5	Self-Acceptance	.8407	-.0977	-.2143	.0556
6	Sense of Well-being	.5544	.4919	.3908	-.0209
7	Responsibility	.1525	.6350	.0719	-.0335
8	Socialization	.0596	.6836	-.0386	.0037
9	Self-Control	.0504	.8562	.2560	-.0890
10	Tolerance	.3047	.6496	.5056	-.0185
11	Good Impression	.1819	.7956	.0311	-.1929
12	Communality[x]	.4270	-.2120	-.0121	-.4316
13	Achievement via Conformance	.2409	.8076	-.1022	.1974
14	Achievement via Independence	.0562	.4815	.7049	.0612
15	Intellectual Efficiency[x]	.4762	-.0508	.4831	.1994
16	Psychological-mindedness[x]	.4342	.2610	.2542	.4611
17	Flexibility	-.2821	-.1312	.7648	-.0107
18	Femininity	-.4101	.1458	-.5786	.2987
19	Motor Performance	-.0791	-.1527	.0362	.7672

[x] Variables which do not fit into any factor on the basis of the criterion.

Factor 2 contains the traits of

Responsibility
Socialization
Self-control
Tolerance
Good impression
Achievement via conformance

Factor 3 contains the traits of

Tolerance*
Achievement via independence
Flexibility
Femininity

Factor 4 contains the trait of

Motor Performance.

Three of the 19 variables fail to fit into the four factors. These are Communality, Intellectual Efficiency and Psychological-mindedness. Of these, the variables of Communality and Psychological-mindedness tend to fit into Factor 4 since their value in this category is somewhat larger than in any of the remaining categories although it does not reach the criterion figure. Intellectual Efficiency tends to split itself evenly between Factors 1 and 3. Only the 19th variable, Motor Performance, clearly belongs in none of the first three factors but can be unmistakably assigned to Factor 4.

Table 3 illustrates that the personality trait measures can be feasibly divided into three main factors. It does not support the suggestion that performance can be accurately predicted by a group of personality traits which compose a single personality factor, since performance is independent of all three groups of traits and is almost totally isolated in a fourth factor.

*Trait appears in more than one factor.

Since it could not be assumed that the clusters of personality traits found for a 19 variable analysis would be identical to those found if the analysis were performed on the 18 traits alone an 18 variable rotation was performed. Table 4 compares the assignment of traits to the first three factors in the 19 and 18 variable rotations.[1]

It can be seen that the two rotations were nearly identical. Eighteen variable rotation resulted in slightly more overlapping of variables (both variables 6 and 14 in the table), and the inclusion of factor 14 which had previously not reached criterion value. No other changes occured. Therefore, it appeared that the 19 variable rotation accurately described the relative positions of the 18 personality traits and that the only major difference between the two rotations resulted from the presence of a nineteenth variable occupying a separate factor space when this variable was included in the analysis. Since motor performance occupies a separate factor it can be concluded that the best group of personality traits for predicting performance may consist of a cross-section of traits drawn from each of the three remaining factors.

Following the assumption that a cross section of factors would provide the highest correlation with performance, the multiple regression procedure and partial correlations were examined next. A step-up multiple regression procedure was used, starting with the most important single trait and adding successive traits in order of the contribution each made to the regression value when combined with the traits which had been previously selected. The partial correlations were derived from the regression procedure.

1. For the exact weightings obtained in the 18 variable analysis refer to Appendix D.

Table 4

Comparison of the personality traits assigned to factors in a three-factor rotation of 19 variables versus 18 variables.

	Rotation of 19 variables	Rotation of 18 variables
Factor 1	*1, 2, 3, 4, 5, 6	1, 2, 3, 4, 5, 6
Factor 2	7, 8, 9, 10, 11, 13	6, 7, 8, 9, 10, 11, 13, 14
Factor 3	10, 15, 17, 18	14, 15, 17, 18

* 1. Dominance
2. Capacity for Status
3. Sociability
4. Social Presence
5. Self-Acceptance
6. Sense of Well-being
7. Responsibility
8. Socialization
9. Self-Control
10. Tolerance
11. Good Impression
12. Communality
13. Achievement via Conformance
14. Achievement via Independence
15. Intellectual Efficiency
16. Psychological-mindedness
17. Flexibility
18. Motor Performance

The overall regression analysis showing the goodness of fit between 18 personality traits and the performance variable yielded an "r" of .48. This "r" value has a very high Coefficient of Alienation[1] ($1-r^2$= .917 for an "r" of .40) which indicates that it does very little to reduce the error of estimate. However the correlation does indicate that all 18 traits collectively bear a clear relationship to the motor measurement. This relationship is presumably linear in nature.

Stepwise multiple regression was next examined by individual steps, as illustrated in Table 5. The regression indicated, first, that the correlation between variable 2, Capacity for Status, and variable 19, Performance, yielded the largest value for any single combination of trait and performance score. This value of "r" was .18, an F test showing this to be non-significant at the 5% level of confidence.[2]

In the second step of the multiple regression procedure all combinations of variable 2 plus one other variable were correlated with performance, the highest "r" being .24 among variables 2, 4, and 19. Table 4 illustrates this procedure, showing each successive variable to yield the highest cumulative "r" value when added to the previous variables selected.

As shown here, Capacity for Status, Social Presence and Femininity occupy the first three positions on the list. They provide more than half of the total correlation and display the largest F values, confirming that their contribution to the overall correlation adds considerably to the

1. McNemar, Q. Psychological Statistics (Ed. 2), New York John Wiley and Sons, 1955, p. 135.

2. F = 1.46 with 1 and 45 df.

Table 5

Stepwise multiple linear regression analysis, showing the order in which successive variables contribute to the overall goodness of fit between motor performance and CPI personality traits, from largest contribution to least.

	Variable (largest to smallest)	"R" Obtained from regression analysis	df	F
1.	2 Capacity for Status	.18	1,45	1.46*
2.	4 Social Presence	.24	2,44	1.36
3.	18 Femininity	.28	3,43	1.21
4.	15 Intellectual Efficiency	.29	4,42	.98
5.	1 Dominance	.31	5,41	.89
6.	13 Achievement in Conformance	.33	6,40	.83
7.	8 Socialization	.38	7,39	.91
8.	3 Sociability	.39	8,38	.87
9.	9 Self-Control	.41	9,37	.81
10.	6 Sense of Well-being	.44	10,36	.85
11.	12 Communality	.45	11,35	.82
12.	7 Responsibility	.45	12,34	.74
13.	17 Flexibility	.46	13,33	.69
14.	10 Tolerance	.47	14,32	.64
15.	11 Good Impression	.48	15,31	.61
16.	5 Self-Acceptance	.48	16,30	.56
17.	16 Psychological-mindedness	.48	17,29	.50
18.	14 Achievement via Independence	.48	18,28	.49

* No F value is significant at the 5% level of confidence.

correlation value provided by the remaining traits. The trait of Dominance, hypothesized to correlate most highly with performance, is fifth in importance according to the multiple regression analysis.

Despite the large proportion of the correlation which is provided by the first three factors alone, this correlation is too low to provide much information. The addition of the next eight traits on the list, from Intellectual Efficiency to Communality, brings the correlation to .45, close to the total value of .48. This value appears to constitute a natural cutting-off place, beyond which the remaining traits add almost no extra information to that which has already been gained. Therefore it can be concluded that the scores from the group of eleven traits provide most of the predictive power of the test. This finding supports the expectation that a limited group of traits could be selected from among the various factors to provide a best guess about the motor task, but shows that the amount of limiting which can usefully be done is not great.

The final statistical operation consisted of obtaining the partial correlation values for those eleven traits which showed themselves most related to the motor performance task. Table 6 lists these values in order of size, from largest to smallest.

Each correlation represents the contribution made by that variable, in interaction with the other ten variables, to the total correlation provided by all eleven.

In this way the partial correlations differ from the cumulative correlations of the stepwise regression analysis, in which each calculation took into consideration all the traits which had preceded it in importance in the list but ignored those following. A brief comparison of Table 6

Table 6

Partial correlations for the eleven traits which are shown by stepwise multiple regression to be most highly related to the motor performance task. The traits are listed in order of their correlation values from largest to smallest.

Number (Order of correlation size)	Variable name and number	Partial Correlation Value
1	13 Achievement via Conformance	.26
2	18 Femininity	.24
3	1 Dominance	-.24
4	8 Socialization	-.21
5	9 Self-Control	-.21
6	6 Sense of Well-being	.20
7	2 Capacity for Status	-.13
8	12 Communality	-.11
9	3 Sociability	.09
10	2 Social Presence	.07
11	15 Intellectual Efficiency	.07

with Table 5 illustrates that the positions of the various traits have been shifted somewhat by this difference in technique. For example, Dominance shifted from fifth position in the multiple regression analysis to third position in the partial correlations. However, as Table 5 indicates, all partial correlation values are small, making the positions of the traits relatively unimportant. The highest partial correlation value is .26, obtained for Achievement via conformance but, again, this is little larger than the values obtained for any of the six highest partial correlations.

CHAPTER IV

DISCUSSION

The first purpose of the present experiment was to test the hypothesis that a motor task, which was selected on the basis of the Soviet approach to personality study, could provide a useful method for measuring one or more personality traits. In view of the unsatisfactory approaches and dubious findings of earlier investigations, it was hoped that this approach would provide fresh insight into the study of expressive movements. An assessment of the results indicates the extent to which the goal has been fulfilled.

The most important step for proving the usefulness of the motor measurement method was the discovery of a correlation of useful magnitude between the motor task and some of the recorded traits. In support of the first experimental hypothesis, that the motor task would correlate highly with personality traits, the statistical analysis has indicated that a group of eleven traits accounted for a multiple correlation value of approximately .45, that is most of the correlation of .48, between motor performance and the 18 traits. A high key-pressing score could be predicted to occur in conjunction with low capacity for status, high social presence, high femininity, high intellectual achievement, low dominance, high achievement via conformance, low sense of well-being and low communality. This finding indicates that the task does, to some extent, fulfill the basic correlational requirement. An overall value of .45 appears fairly adequate when the inaccuracies of the CPI and the other problems inherent in personality studies are taken into consideration, and there is little doubt that a valid relationship is being represented.

On the other hand it would be incorrect to conclude, on the basis of this correlation, that the motor task could serve as a feasible predictor for the traits to which it is related. The major problem is that the task has been found relevant to a large number of traits rather than to one or two main traits. This means that the predictive accuracy of the motor behavior for any single personality attribute is very small since the correlation is broken up among many attributes. As the partial correlations clearly indicate, the highest correlation which can be achieved by any trait in the presence of the remaining ten related traits is .26, not a useful value for making individual predictions.

A second problem is revealed by a comparison of the trait groupings of factor analysis with the group of eleven traits which are found to be most related to key pressing. It is clear that the latter traits do not form a factor, or even cluster predominantly in one factor. On the contrary, they are well distributed across all three divisions within the CPI, indicating that a comprehensive cross section of personality, rather than one main facet, is being represented. This finding suggests that, if the correlations had been much larger, a broad and representative index of social personality attributes might have been available. However, considering the smallness of the correlations, the wide distribution serves rather to reduce the usefulness of the findings. Since the eleven relevant trait attributes are not highly inter-related, the likelihood is reduced that they will repeatedly occur in conjunction across subjects and, therefore, there is little point in making predictions involving all eleven traits. Moreover, the difficulty of interpretation is increased by this distribution since the task was originally designed in the hope of eliciting one main trait

and, possibly, other related traits but not intended for a complete range. If the task is to function in such a comprehensive manner then its complexity and precision must be increased accordingly.

It may be concluded that the main experimental hypothesis was supported, but neither in the manner nor to the extent that was anticipated. While the discovered correlations are interesting, they might be seen as guides to future experimental investigations rather than as immediate answers to the problems of measuring personality.

The finding that a scattering of traits is connected with key pressing activity suggests that subsequent experiments could concentrate entirely on that limited number of traits with the purpose of more precisely determining the relationship which has been found. For this experiment emphasis would be placed on the modification of the motor task to provide finer measurements of the variables involved, and the values of the partial correlations might be improved. Unless the predictive power of the task can be increased by this or some other means there is little to be gained from making precise predictions, since the experiment has shown itself to be no more satisfactory than the numerous earlier experiments on expressive movements whose results tended to be of such little practical value.

Turning to the second hypothesis, that dominance is among the traits most strongly related to the specific task employed, the findings are again not as expected. First, the results show that eleven traits are related to the key pressing activity and a brief examination of the partial correlation values indicates that no single one is clearly predominant over the rest. Second, ignoring the smallness of the difference in order, the results

summarized in Table 6 have indicated that key pressing was correlated most highly with Capacity for Status while Dominance fell into fifth position.

In explanation of the leading position of Capacity for Status, it may be noted that there is very little distinction between this trait and the trait of Dominance as defined by Gough (1957). Low Capacity for Status is described by such adjectives as "apathetic, shy, conventional, dull, mild, simple and slow; as being uneasy and awkward in new or unfamiliar social situations". Dominance is described by such similar adjectives as "retiring, inhibited, commonplace, indifferent, silent and unassuming; ... slow in thought and action; as avoiding situations of tension and decision; and as lacking in self-confidence". Many of the adjectives for each of these descriptions carry the same connotations and Gough suggests that a high correlation exists between the two traits. Therefore the line of reasoning which was used to select Dominance as the relevant trait, namely that the subject would, given the option, attempt to direct or be directed by the situational variables, could apply almost equally well to Capacity for Status.

It is interesting to note that both the main correlations are negative. Despite the fact that the direction of the correlation was not formally predicted in advance it seemed reasonable to expect that dominant subjects would press the key more frequently than submissive subjects when the CS appeared alone, since dominant subjects would be attempting to gain control over their own actions and initiate their own behavior. However in retrospect it was also possible to expect the reverse reaction; that is dominant subjects, when seeing a chance to act in a manner different from that prescribed for them by the experimental conditions, would take the initiative

to do so whereas submissive subjects would obediently continue to respond as they had been initially ordered by the UCS sign.

This latter possibility now appears to be the more plausible in view of the results, but does not alter the importance of the finding that both Dominance and Capacity for Status are among those traits most closely related to the task. The need for this second logical but opposing explanation of the correlational results does, however, suggest that the testing situation contained more ambiguity than was expected. It is possible that more significant results would have been obtained, had the ambiguity been reduced, since it is possible that several of the subjects interpreted and acted on the situation in a way which opposed the interpretation granted by the others.

Aside from the two hypotheses the major purpose of this experiment was to gain all the information which could be provided by the experimental task. This knowledge would serve a twofold purpose of supporting the current theoretical approach and indicating alterations in the technical handling of the problem. Both the principal components analysis and the multiple stepwise regression procedure provided additional experimental information which was not directly related to the main hypothesis.

The principal components analysis demonstrated itself to be the most valuable method for condensing and interpreting the relations among the 19 variables. The occurrence of variable 19 in any one of the first three factors would have been evidence that performance lay on the same axis as the traits in the relevant factor and would vary with them. Since the results showed that motor performance did not belong within any of these factors, it could be immediately assumed that this activity was largely

independent of the trait groups. Thus it could be expected for form Factor 4, a factor which would contain only one variable, and which the Verimax method therefore finds difficulty in handling. The existence of a "Factor 4" gained further indirect support by the comparison between the factor analysis with 19 variables and a further factor analysis with only 18 trait variables. Since variable 19 failed to fit into any factor in the first analysis while all variables fitted in the second analysis, it could safely be concluded that motor performance was orthogonal to each of the other factors.

Unfortunately the exclusion of this 19th variable in factor rotation indicated that the motor performance was fairly independent of the CPI. Other than this, however, the results indicated that the three trait factors could be evaluated separately from the fourth factor, that is, the three discovered CPI factors could be examined separately and the findings used to add interpretive value to the CPI as an independent test.

The first factor contains the traits of Dominance, Capacity for Status, Sociability, Social Presence, Self-Acceptance, Sense of Well-being and, to some extent, Communality, Psychological-mindedness and Intellectual Efficiency. These traits could be subsumed under the title of "Confidence and Social Adjustment", on the belief that these attributes form the common denominator of all the traits. The second group contains the traits of Responsibility, Socialization, Self-control, Tolerance, Good-Impression, and Achievement via Conformance. This component may be titled "Social Responsibility and Awareness of Social Requirements". The final factor, containing the traits of Tolerance, Achievement via Independence, Flexibility, Femininity, and to some extent Intellectual Efficiency, will be termed

"Adaptability and Modes of Independent Thought". According to this assessment the CPI contains three factors, two of which, Confidence and Social Adjustment, and Social Responsibility and Awareness of Social Requirements, are highly socially oriented components, and the third, Adaptability and Modes of Independent Thought, expresses the more individual and personal dimensions of social behavior.

The apparent existence of motor performance as an independent "fourth factor" is in keeping with the failure to achieve higher correlations between key pressing and the CPI. Although the CPI seems to have been a satisfactory experimental tool, the motor task has shown itself to be poorly related to any organized group of traits within it. In spite of the reasons for its selection, such as the advantages of parallelling Russian experimental methods, it appears in retrospect that another task about which more prior information was available might have proved more satisfactory. It is possible that in this experiment the subjects found the task too simple or the situation too unfamiliar and confusing to encourage prompt SSS interpretation, the experimenter may not have sufficiently induced individual subject involvement in the situation, or the task may not have offered enough clues for fully expressive behavior. A new and untried task such as the one used offers many difficulties, not all of which can be foreseen and eliminated in pilot tests. It is impossible to gauge the extent to which such difficulties within the performance test were responsible for failure to achieve higher correlations.

Turning next to the stepwise regression procedure, it can be seen that this analysis offered useful information beyond delimiting the relevant number of factors and placing Dominance. The procedure also placed in

relative positions all the eleven traits which were of interest. This was of importance because a comparison of the relative order in this experiment and in a subsequent one could assist in confirming the reliability of the findings. The cumulative contribution of each variable to the overall "r" value was clearly shown. Since the relative contributions did not differ widely, a lesser degree of emphasis could be placed on the fifth place standing of Dominance, and Dominance could be included as one of the most highly related traits although not the highest. Therefore this statistic served as a summarized description of the relationships which occurred and provided an accurate means for evaluating the importance of these relationships.

One general observation which can be made was that the method of employing a personality test which measures many traits rather than one has many advantages for experiments on expressive movements. The multiple trait procedure can be used to gain maximum information since the failure of any single trait to correlate with performance does not automatically indicate unsatisfactory experimental results but rather serves to place the trait in a comparative position with the other traits. A fairly high correlation of some of the traits with performance also serves to support the authenticity of lower correlations, reducing the common problem of deciding whether or not these results are merely attributable to flaws in procedure and design. Use of the multiple trait approach received particular support in the present research when it was discovered that eleven traits were related to one performance task while seven others were not, and when the trait hypothesized as being most closely related to this task was shown to be of considerably lesser importance than anticipated. Therefore the

experiment clearly advocated the use of multiple trait procedures for future studies of personality correlates.

Moreover it is currently being realized that no single trait procedure provides a true description of a facet of personality, since both factor analysis and stepwise multiple regression procedures have indicated that no single trait is likely to operate independently of all others. A constellation of traits may have greater predictive power than single traits and certainly provides a more realistic representation of the complexities of the human mind. For example, the present experiment indicated that the 18 supposedly different traits could be divided among three principal components, each component consisting of several interrelated attributes, and a cross section of these attributes being related to the personality measure. This complexity of findings provided a much more realistic analysis of human characteristics than would the discovery of a simpler interaction and illustrates the point that oversimplification must be guarded against in such correlational studies.

Some of the practical problems occurring in this experiment should be mentioned. Those of most importance were sample size and scoring scale.

The more serious of the two was sample size. Only 47 Ss were tested due to such factors as the lack of time remaining after pilot work had been completed and the approach of term examinations for the high school students involved. This number was not adequate to ensure the veracity of detailed conclusions, particularly when considering the large number of different trait variables which were measured. Interpretation of any of the experimental findings must take into consideration the restricted sample size.

Turning to the problem of psychometrics, it becomes apparent that the two-point scale of response measurement, i.e. response or no response, which was employed was probably an oversimplification of the behavior pattern of the subject. Russian studies, for example, frequently employ a method of finger pressure recording which includes many degress of responsiveness (eg. Fadeyeva 1951). In the present case the apparatus was not designed to permit fine discrimination of response characteristics, and finer discrimination was probably not recommended at this exploratory stage of research. A more complex scale might have obscured the basic fact of the relationship between traits and motor performance, since no definite knowledge of the magnitude of this relationship was available. However, a more advanced follow-up study would profit by an improvement in the precision and accuracy of the measurement scale. Further investigations should also be geared to discovering whether the task is too simple, and whether a somewhat more involved motion is required for adaptation to a more complex scale.

In view of the lack of improvement of present correlations over those of many earlier experiments, discussion of the theoretical basis for this research will necessarily be brief. The one main distinction between this experiment and previous ones lies in the emphasis on the second signalling system, the stipulation that the language dimension must be present for successful transmission of personality to the overt physical response level. Direct and undistorted SSS participation was encouraged by methods which have been described earlier, such as the use of a written CS, the ambiguity and uncertainty of the situation and experimenter presence and behavior.

In view of the results it is not certain to what extent this SSS emphasis actually changed the experimental format. Considering the almost unavoidable participation of the SSS in any situation which offers complexity and interest it could be suggested that SSS activity has been fairly effective in many of the earlier studies of expressive acts. The present approach may have succeeded in adding little that was not already available in most test situations. Alternately, the methods of inducing SSS activity in this study were not rigorously controlled, introducing a possibility that SSS activity was still too inadequately invoked for clear results. Although it is not possible to make an accurate evaluation of the present theoretical position, the approach has provided a logical manner for conceptualizing the problem, and it suggests fresh approaches for subsequent research. Both these advantages have been absent in earlier studies of expressive actions, and it may therefore be concluded that this theory is worth more specific and rigorous experimental examination in the hope that it can eventually provide an answer to some of the problems of personality measurement.

One obvious follow-up experiment which the theory suggests would make a direct test of the usefulness of SSS participation. This would require the formation of a scale of SSS participation, followed by the testing of a standardized expressive act at various scale levels. An increase in the correlational values between the act and relevant personality traits with an increase in scale value would prove the importance of SSS mediation. The present study would serve as an extensive pilot study to the research.

By this experiment and others it would be possible to determine more precisely the role of the SSS in expressive acts. The approach might eventually lead to increased usefulness and recognition of the motoric

method of personality measurement, and at the same time help to bridge a gap between Russian and Western approaches to personality assessment.

APPENDIX A

Refer to Diagram 2 to follow description of the apparatus. Each unit will be identified by number: (1), (2), etc., each terminal will be referred to by name: OP, NO, etc., and specific terminal connections will be identified by name and number: OP (12), NO (8), etc.

C - common

G - ground

NC - normally closed

NO - normally open

OP - operate

SIG - signal

TO - time out

TOP - time out pulse

IN, OUT - terminals not otherwise identified will be referred to as IN or OUT depending on their use.

The stimulus sequence was initiated by an electrical pulse from the stepping relay panel (14). The impulse led through a pulse from OP (12), NO (12) to a relay panel OP (8) which simultaneously initiated the timing of the UCS OP (8) to START (2) and caused the illumination of the UCS sign in the testing room NO (8) to OP (6). The time out pulse which was generated from the UCS timer, (2), when it completed its set time span initiated the CS timer, (3), TOP (2) to START (3) and also illuminated the CS circle in the testing room, T(3) to OP(6), without, however, shutting off the UCS sign. When the CS timer had completed its sequence it automatically turned off the UCS sign, TOP (3) to RESET (8), breaking the connection OP (8) to START (2), and also turned off the CS sign, breaking connection T(3) to OP (6), causing simultaneous UCS-CS ceasation. TOP from the CS timer (3) also reset the UCS clock (2) so that the stimulus sequence could be repeated upon receiving a fresh signal from (14), to SIGN (7), NO (7) to (11), (11)

to T(2). Resetting the UCS timer also recommenced the operation of the stepping relay (14), OUT (11) to A(14).

The recorder was controlled by UCS and CS onset and offset, and response onset. All connections to the recorder passed through a toggle switch panel (5) so that any part of the recording procedure could be shut off. The UCS impulse controlled pen number 2 lower NO (6) through (5) to In 2 (1). The CS circuit was formed in a similar manner with pen number 4 upper NO (6) through 5 to IN (4). The impulse from S's key was transmitted from the pulse former (13) to pen number 3 KEY to SIG (13), NO (13) through (5) to IN (3). The motor for the recorder was controlled by a pulse stream generator OUT (9) to MOT OP (1).

APPENDIX B

1. Introduction of the experimenter by a teacher supervisor prior to administration of the CPI to a randomly selected group of junior high school boys:

I would like to introduce you to Miss Roberts who is a professional psychologist. She is presently working in cooperation with the Psychology Department at the University of Windsor to conduct an important piece of research. This research may be of benefit to both the high school and the university. She has requested our cooperation and we have agreed to assist her in every way possible.

This morning she is going to conduct one section of her experiment here at Assumption High School. I hope you will give her your complete cooperation. Here is Miss Roberts to give you your instructions.

2. Explanation and instructions given by the experimenter to the group of subjects who are about to begin the CPI:

Thank you Father Coughlin. Good morning boys. As Father Coughlin explained to you, I am here to conduct some research. The purpose of this research will be explained to you after the entire experiment has been completed. At the present time we prefer not to let you know what our aim is.

Since this experiment is important I must insist that you follow the directions completely.

There will be absolutely no talking from the time you open your question booklet until everyone is finished. Treat this as if it were an examination. Talking will automatically disqualify you.

You will find that there are 480 statements in your test booklet. I want you to be completely honest in deciding if each statement applies to you. Your scores will be kept strictly confidential and will not be seen by either your friends or your teachers. If you are not completely honest your test will be of no use to us. If you have trouble deciding on an answer, try to remember some specific situation that you have been in that fits the statement, then remember what you did in that situation and answer accordingly.

Now I will read the instructions on the outside of the booklet. Follow these instructions on your own booklets.

> This booklet contains a series of statements. Read each one, decide how you feel about it, and then mark your answer on the special answer sheet. MAKE NO MARKS ON THE TEST BOOKLET. If you agree with a statement, or feel that it is true about you, answer TRUE. If you disagree with a statement, or feel that it is not true about you, answer FALSE.
>
> If you find a few questions which you cannot or prefer not to answer, they may be omitted. However, in marking your answers on the answer sheet, make sure that the number of the statement is the same as the number on the answer sheet.

Now look at your special answer sheet. First take your pen or pencil and fill out the required information on the side. I want you to underline your last name. For example, if your name is John Smith, you will print Smith first, then underline it and put John after. On your answer sheet are 480 numbers for the 480 statements in your book. Each number has a space above it and a space below it. If the statement corresponding to that number is true for you, place a large X clearly in the upper box. If it is false, place the X in the lower box. You can take as much time as you need. This is not a speed test. But do not spend a long time on one question if you

cannot decide on the answer. If you have completed the test before a quarter to 12, (3), you may bring it to me and then continue studying. If you have not completed it by then, you will remain until you have finished, then you can leave.

Are there any questions?

I needn't remind you again to do your best on this test. You may begin now.

Appendix C

Stimulus conditions used in pilot studies to determine the parameters of the motor performance task. Variables manipulated were colour, brightness and location of CS light, stimulus duration, interstimulus and intertrial intervals including forward and backward conditioning procedures, and number of paired and unpaired trials.

1. Foreward Conditioning	1. CS, red, bright, central	1. CS-UCS paired, simultaneous; 1 sec. duration; intertrial interval, (ITI), random, mean 10.7 sec.	1. 5 paired trials; 1 CS trial; repeated for 15-20 sequences. 2. 10 paired trials; 1 CS trial; repeated for 10 sequences. 3. 20-30 paired trials; CS alone for 20-80 trials.
		2. CS-UCS paired, simultaneous; 1.5 sec. duration; ITI random, mean 10.7 sec.	4. 15 paired trials; 50 delayed trials of CS, .75 sec., CS-UCS, .75 sec.
		3. CS-UCS paired, simultaneous; 1.5 sec. duration; ITI constant, 5 sec.	5. 15 paired trials; 45 CS alone trials.
		4. CS-UCS paired; delayed; CS 2.5 sec., UCS 1 sec., CS-UCS cease simultaneously; ITI constant, 5 sec.	6. 50-100 paired trials.
	2. CS, red, dim, central	5. CS-UCS paired, trace; CS 1 sec., ISI 400 msec., UCS 1 sec.; ITI constant, 5 sec.	7. 70 paired trials

1. Foreward Conditioning	3. CS, white, bright, central	6. CS-UCS paired, simultaneous; 1.5 sec. duration; ITI constant, 5 sec.	8. 20-30 paired trials; CS alone for 20-80 trials.
		7. CS-UCS paired, delayed; CS 250 msec., paired 500 msec. CS-UCS cease simultaneously, ITI 5 sec.	9. 20-30 paired trials; CS alone for 20-80 trials.
		8. CS-UCS paired, delayed. CS 750 msec., paired 750 msec., CS-UCS cease simultaneously; ITI 5 sec.	10. 15 paired simultaneous trials, 45 delayed.
		9. CS-UCS paired, delayed. CS 1 sec., paired 1 sec.; CS-UCS cease simultaneously; ITI 10 sec.	11. 15 paired simultaneous trials, 35 paired delayed trials; 5 CS trials alone.
		10. CS-UCS paired, simultaneous; 1 sec. duration; ITI random, mean 15 sec.	12. Paired trials, random presentation of 1 CS trial between trial 3 to 8; 10-15 sequences.
		11. Verbal UCS, trace procedure; ITI random, mean 15 sec.	13. 50 paired trials.

1. Foreward Conditioning	4. CS, red, bright, peripheral	12. CS-UCS paired, delayed; CS 2.5 sec., UCS cease simultaneously; ITI constant 5 sec.	14. 50-100 paired trials.
	5. CS, red, dim, peripheral	13. CS-UCS paired, trace; CS 1 sec., ISI 400 msec., UCS 1 sec.; ITI constant, 5 sec.	15. 70 paired trials.
2. Backward Conditioning	6. CS, red, bright, central	14. UCS-CS paired, delayed; UCS 900 msec., UCS-CS paired 300 msec., UCS-CS ceasation simultaneous. ITI random, mean 4.7 sec.	16. 10-30 paired trials; 15-75 trials of CS alone.

Appendix D

Weightings of 18 variables for 47 Ss on each of 3 principal components, given the Verimax rotation which achieved maximum variation among scores.

Weightings greater than .5 are underlined to indicate that they are above the criterion value.

No.	Name	Factor F1	F2	F3
1	Dominance	.2603	-.3500	<u>.7316</u>
2	Capacity for Status	.3950	.2257	<u>.6222</u>
3	Sociability	.2249	.0380	<u>.8587</u>
4	Social Presence	.0281	.4362	<u>.6917</u>
5	Self Acceptance	-.1475	-.1415	<u>.8497</u>
6	Sense of Well-being	<u>.5653</u>	.2993	<u>.5431</u>
7	Responsibility	<u>.6321</u>	-.0607	.1599
8	Socialization	<u>.6569</u>	-.1873	.0747
9	Self-control	<u>.8909</u>	.0615	.0530
10	Tolerance	<u>.7429</u>	.3658	.2891
11	Good impression	<u>.7792</u>	-.1337	.1945
12	Communality	-.2173	.0687	.4208
13	Achievement via Conformance	<u>.7676</u>	-.2739	.2638
14	Achievement via Independence	<u>.6273</u>	<u>.5809</u>	.0278
15	Intellectual efficiency	.0579	<u>.5042</u>	.4497
16	Psychological-mindedness	.3141	.2034	.4274
17	Flexibility	.0464	<u>.7568</u>	-.3249
18	Femininity	.0198	<u>-.6265</u>	-.3739

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