

EXTRAVERSION - INTROVERSION AS  
RELATED TO RESPONSE TIME  
AND ACCURACY



WILLODENE S. AGNEW

EXTRAVERSION-INTROVERSION AS RELATED TO RESPONSE  
TIME AND ACCURACY

---

An Abstract  
Presented to  
the Graduate Council of  
Austin Peay State University

---

In Partial Fulfillment  
of the Requirements for the Degree  
Master of Arts

---

by  
Willodene S. Agnew

August, 1981



## ABSTRACT

This study is an investigation of the commonly accepted idea that extraverted individuals are impulsive, carefree people while introverts are more cautious, more persistent, and more reflective.

The subjects were 48 student volunteers from psychology classes at Austin Peay State University. Subjects were classified as introverts or extraverts on the basis of their extraversion scores on Cattell's Sixteen Personality Factor Questionnaire. They were then administered 26 items from Cattell's Culture Fair Intelligence Test. A record was made of the response time and response accuracy for each of the 26 items.

The results showed practically identical accuracy scores for the two groups. When response time was analyzed, extraverts and introverts took approximately the same amount of time to respond when they responded correctly; however, when responding incorrectly, the extraverts took significantly longer to respond than did the introverts.

This study suggests the need for further investigation into personality variables and response patterns.

EXTRAVERSION-INTROVERSION AS RELATED TO RESPONSE  
TIME AND ACCURACY

---

A Thesis  
Presented to  
the Graduate Council of  
Austin Peay State University

---

In Partial Fulfillment of  
the Requirements for the Degree  
Master of Arts

---

by  
Willodene S. Agnew

August, 1981



To the Graduate Council:

I am submitting herewith a Thesis written by Willodene S. Agnew entitled "Extraversion-Introversion as Related to Response Time and Accuracy." I recommend that it be accepted in partial fulfillment of the requirement for the degree of Master of Arts, with a major in Psychology.

Garland E. Blair  
Major Professor

We have read this thesis and  
recommend its acceptance:

John S. Martin  
Second Committee Member

Linda Rudolph  
Third Committee Member

Accepted for the  
Graduate Council:

William H. Ellis  
Dean of the Graduate School

## ACKNOWLEDGEMENTS

I would like to extend my appreciation to Dr. Garland E. Blair, Professor of Psychology, Austin Peay State University, for his assistance and understanding throughout the long course of this study. I also wish to thank Dr. John D. Martin and Dr. Linda Rudolph for their cooperation and suggestions.

Gratitude is extended to my brother, Ronnie Stout, for his invaluable assistance with preparing the final copy of the manuscript.

A very personal "thank you" goes to Coy and to Claire who convinced me I could do it, and to Jason who had to give up a lot of time with his "mama" while this study was conducted.

## TABLE OF CONTENTS

CHAPTER	PAGE
I. INTRODUCTION . . . . .	1
II. METHOD . . . . .	21
Subjects . . . . .	21
Apparatus. . . . .	22
Procedure. . . . .	22
III. RESULTS. . . . .	24
IV. DISCUSSION . . . . .	26
REFERENCES. . . . .	30



Personality study has gone through three phases: a few thousand years of acute literary observation, a century or so of deeper but still nonexperimental and rarely quantitative clinical observation; and roughly in the last 50 years, a phase of truly experimental research.

Raymond B. Cattell

Preface, Handbook of  
Modern Personality  
Theory

## CHAPTER I

### INTRODUCTION

Attempts to explain behavior are perhaps as old as man himself. Hippocrates attributed human behavior to "humors" within the body which determined whether a person was sociable or withdrawn, energetic or moody, passive or excitable. This idea, that something within the individual determines his temperament, his outlook on the world around him, and indeed his uniqueness as a person, is the basis of many personality theories.

As long as man has written about human nature, he has included a descriptive dimension concerning the degree to which a person avoids social interaction and prefers solitude in contrast to the individual who actively seeks and enjoys social interaction. This concept of the quiet, retiring, thoughtful person and the sociable, gregarious fun-lover has existed across centuries of human history and across cultural lines to the point that introversion-extraversion is accepted readily by laymen as a true means of personality classification.

The terms "extraversion" and "introversion" were introduced in psychological literature by Jung in his

Psychological Types (1924), but the distinction connoted by the terms had been made previously by other writers. Extraversion refers to the kind of outward orientation which makes a person highly aware of what is going on around him and causes him to direct his energy and thoughts toward objects and people outside himself. On the other hand, introversion is the inward-turning tendency which makes a person sensitive to his own feelings and experiences and causes him to direct his efforts toward understanding them (Tyler, 1965, pp. 167-70). Jung did not see extraversion and introversion as mutually exclusive categories, but as an orientation toward life, a point misunderstood by some of his critics.

Such typological concepts as extraversion-introversion, cognitive styles, constitutional types, and interest patterns all played a significant part in the research on human differences in the 1960's. One of the major theorists emerging in that decade was H. J. Eysenck whose research in the field of extraversion-introversion has continued until the present. Eysenck's work has, in some respects, affirmed Jung's categorization of internally and externally oriented people. Nevertheless, neither



Eysenck's concept of extraversion-introversion nor his approach to the topic are identical to Jung's. Eysenck's dichotomous typology labeled introversion-extraversion is constructed of a number of objective variables in combination. Introversion and extraversion represent behavior patterns based on psychophysiological activities and functions. Eysenck and his associates have spent over 30 years in observing, measuring, and analyzing these behavior patterns and in attempting to find physiological explanations for them. Those 30 years have seen a shift in Eysenck's work away from the more general, descriptive outlines of his Biological Basis of Personality (1967) toward the sharper, more empirical, more specific focus of his experiments in salivary response, paired-associates learning, and response patterns as they relate to introversion-extraversion.

Typically an extravert (high E scorer) tends to be outgoing, impulsive, uninhibited, carefree, easygoing, and frequently takes part in group activities. He commonly has many social contacts. He is optimistic, likes to keep moving, and tends to be aggressive. Since his feelings are not always under tight control, he loses his temper easily and is not always reliable. In contrast, an introvert is a person who tends to be quiet, introspective, retiring, and fond of books instead of

people. He is reserved, keeps his distance socially, keeps his feelings under close control, and seldom behaves aggressively or loses his temper. He plans ahead, is not impulsive, and takes life seriously. He is reliable and places great value on ethical standards (Eysenck and Eysenck, 1969).

Eysenck tried to explain these behavioral differences in physiological terms by falling back on Teplov's studies in nervous system functioning (Nebylitsyn and Gray, 1972). Teplov's idea of "strong" and "weak" nervous systems became Eysenck's basis for explaining excitatory and inhibitory tendencies in the central nervous system which, in turn, account for the differences in introverted and extraverted behavior. According to Eysenck, introverts manifest a relatively strong excitatory central nervous system and weak inhibitory tendencies while in extraverts this pattern is reversed. Introverts are, therefore, more highly aroused than extraverts; they need less stimulation to reach maximum excitation and experience as aversive lower levels of stimulation than do extraverts (1967a). This differential in cortical arousal explains the higher activity level, greater sociability, and more impulsive behavior in terms of the extravert's need for stronger stimulation.

Since the introvert, in Eysenck's opinion, is normally more highly aroused, he will not seek out new stimulation but will instead persevere longer at a given task. Introverts are thus easier to condition, find repetitive tasks more enjoyable, retain learned material for a longer period of time, and are more difficult to inhibit. Introverts are also more socialized and less impulsive than their extraverted counterparts (Eysenck, 1976b).

In his earlier work, especially The Biological Basis of Personality, Eysenck emphasized the role of reactive inhibition and habituation in introverted and extraverted behavior patterns. Rapid habituation, one of the characteristics of the extravert's neural functioning, would lead to a habit of rapidly shifting attention, while slow habituation would mean longer concentration on a novel stimulus, the task persistence of the introvert.

Eysenck defines excitation as the cortical process of an "unknown character which facilitates learning, conditioning, memory, perception, discrimination, thinking, and mental processes generally" (1967, p. 75). The cerebral cortex serves to restrain lower brain structures; therefore, an increase in cortical excitation would result in behavior showing decreased excitability and increased inhibition. On the other hand, inhibition



of cortical activity would decrease the control of lower centers and would manifest itself behaviorally in increased excitability and decreased inhibition.

By 1970 when The Structure of Human Personality was published, Eysenck had lessened the emphasis on the role of excitation and reactive inhibition in his theory. Instead he proposed that the ascending reticular activating system (ARAS) is responsible for introversion-extraversion by controlling the activation levels of certain nuclei within the brain stem and midbrain. Cortical arousal mediated by the ARAS is higher for introverts than for extraverts. Extraverts, with their lower level of arousal, would show greater tendencies to habituation, would quickly get used to new stimuli, would respond less and less, would exhibit boredom and disinterest, and would be motivated to search for new stimulation. For example, in discussing reactions observed in an experiment involving the viewing of pornographic movies, Eysenck writes, "extraverts are genetically predisposed to seek strong stimuli, to be less likely to be inhibited from searching for . . . strong and novel stimuli by social taboos" (1976b).

Eysenck makes a distinction between "arousal" and "activation." In fact, he uses the terms "cortical arousal," "reticular arousal," and "limbic/autonomic

activation" to represent three separate, yet interrelated constructs. Both reticular arousal and limbic/autonomic activation lead to cortical arousal. Reticular arousal relates to and sustains the normal range of activity required for day-to-day functioning of the individual. It is mediated by the ARAS. Limbic/autonomic activation is dependent on systems in the brain related to the emotions and is intimately involved in the functioning of the autonomic nervous system. Since the cortex, the reticular system, and the limbic system are interconnected, cortical arousal may result from either reticular arousal or from limbic/autonomic activation. Reticular arousal leads to cortical arousal but not necessarily to limbic/autonomic activation. Nevertheless, limbic/autonomic activation will lead necessarily to both reticular and cortical arousal. Extraversion-introversion is a function of reticular (and cortical) arousal. Since it is postulated that the reticular system of introverted persons is more aroused than that of extraverted persons, then introverts would also be more aroused cortically (Gale, 1973).

Eysenck has been criticized for presenting physiological explanations for behavior when scientific studies have not been able to confirm the existence of the structures or of the physiological functioning on which much of

his theory is based. Kline (1973) has accused him of engaging in "full-blooded neurophysiologizing" in an attempt to give scientific explanations for behaviors observed in the laboratory.

Although staunchly defending his terminology and methodology, Eysenck has admitted that his reactive inhibition hypothesis has been shown to be wrong. However, he cautions against considering an entire theory a failure when it is only a supporting hypothesis that has failed to hold up under newly developed research procedures in studying central nervous system structures and functioning (1976a).

In recent years Eysenck has become less dogmatic in his statements. He still stresses arousal levels as the differentiating factor between extraverts and introverts, but admits that his physiological explanations may be affected by new research findings in the fields of anatomy and physiology. In The Measurement of Personality he reiterates his belief that differential arousal levels account for introverted and extraverted behavior. Still he has moderated his stance on the ARAS as the facilitator of this process; he now states that while the ARAS is probably responsible to some extent, other as yet undefined structures may be more crucial (p. 45).



Nevertheless, 30 years of study have left him more convinced than ever that patterns of behavior are biologically based and are determined to a great extent by genetic causes.

This does not imply any disrespect for, or disregard of, environmental and social factors; these are obviously important for biosocial organisms. What is suggested, rather, is that invariance is more likely to be found in behaviour largely determined by biosocial causes, including genetic ones (p. xi).

In Eysenck's personality theory extraversion-introversion (E) is a higher-order factor based on the interaction of several primary factors. Sociability, impulsiveness, activity, optimism, liveliness, and excitability are all E-related primaries which are subject to empirical investigation. However, an attempt to describe E merely in terms of correlated traits overlooks what may be the most important variable of all: the interaction between these primary factors which comprise the higher-order E. Eysenck's research has dealt with higher-order factors almost exclusively since he considers them to be of greater importance and relevance than the primaries. Even so, in recent years he has focused much of his laboratory investigation on two of

the primaries, namely impulsiveness and sociability, which he believes are closely connected (Eysenck and Eysenck, 1969) and which correlate highly with the measurement of E (Eaves and Eysenck, 1975).

Other researchers have also approached typology from an empirical point of view. McQuitty (1957) developed a method called "agreement analysis" which groups persons into similar categories according to the number of attributes they possess in common. Every person in a type would have more traits in common with any other person in that type than he would with anyone not in that type.

Cattell (1957) developed a technique of factoring a number of measures of an individual and then clustering persons into types having similar factor structures. He states that classificatory types must first be discovered by objective, non-arbitrary procedures, by measuring subject profiles on a multidimensional instrument and applying a pattern-similarity coefficient to the resulting factors to create natural groupings (1973). Utilizing this method, Cattell identified 131 clusters of ratings, reduced them to 50 nuclear clusters, and then arranged those to identify 20 relatively independent traits to cover the external aspects of personality. These include 16 primary and 4 broader, more complex secondary factors.

Of these secondaries, one designated  $Q_I$  (Exvia-vs.-Invia) corresponds to Eysenck's concept of extraversion-introversion. Exvia-vs.-Invia is a source trait statistically derived from primary factors with appreciable hereditary contribution. It is the product of the interaction of five primary factors: sizothymia (reserved) and affectothymia (outgoing), threctia (shy) and parmia (venture-some), desurgency (sober) and surgency (happy-go-lucky), group adherence and self sufficiency, and, finally, submissiveness and dominance (Cattell, Eber, and Tatsuoka, 1970). Cattell's approach has been to design a self-report questionnaire to reveal these primary- and secondary-level personality factors, and then to do multiple correlational analyses within the framework of his test, the Sixteen Personality Factor Questionnaire.

Cattell's test, commonly referred to as the 16PF, and Eysenck's extraversion scales (formerly the Maudsley Personality Inventory, revised and renamed the Eysenck Personality Inventory) are the most frequently used tests to measure extraversion-introversion. However, other tests do exist. The MMPI gives an extraversion measurement on one of its scales. The Edwards Personal Preference Schedule, the Thurstone Temperament Schedule, the Guilford-Zimmerman Temperament Survey, and even the



Rorschach have been used by some experimenters to classify subjects along the extraversion-introversion continuum.

Other researchers have also studied introversion-extraversion from a behavioral standpoint in an attempt to determine and account for response and cognitive differences between introverts and extraverts. For example, it has been demonstrated with EEG studies that extraverts have a higher resting rate of cortical arousal than introverts (Gale, 1973) and that administration of CNS depressants may have differential effects in sedation across the two groups (Sloane, Davidson, and Payne, 1965). As a cortical arousal theory would predict, extraverts have less tolerance for isolation (Francis, 1969) and tend to exhibit "stimulus hunger" (Gale, 1969). That is, extraverts in experimental situations have shown a greater tendency to seek out additional stimulation while introverts prefer less stimulation. This difference in orientation toward external stimuli has been demonstrated in a number of sensory modes. Extraverts prefer more complex geometric shapes (Bartol and Martin, 1974) and choose bright primary colors as opposed to more muted colors (Götz and Götz, 1975). Extraverts have been shown to prefer the presence of extraneous



auditory stimuli while engaged in a performance task; the reverse is true for introverts (Stelmack and Campbell, 1974).

Introverts have shown a higher average pupillary response to emotionally laden words presented auditorily, again suggesting a higher level of initial cortical arousal (Stelmack and Mandelzys, 1975). Along those same lines, introverts display more salivation to a lemon juice stimulus (Eysenck and Eysenck, 1967). Also, when presented with a light-tracking task, extraverts tend to employ the more stimulus-salient velocity cues, while introverts prefer to employ position-prediction cues (Frith, 1971). Extraverts also indulge more in imaging to elevate arousal levels (Morris and Gale, 1974).

Evidence for the effect of differential cortical arousal can be seen in learning and memory experiments with extraverts and introverts. Extraverts have faster retrieval of verbal items because higher arousal in introverts inhibits retrieval of less accessible items (M. W. Eysenck, 1975). On the other hand, high arousal facilitates long-term memory of verbal items via consolidation. Nevertheless, high arousal inhibits retrieval while consolidation proceeds (Howarth and Eysenck, 1968). This then probably accounts for the greater fluency of

extraverts, since lower arousal promotes short-term retrieval, which is in turn related to fluency (Di Scipio, 1971). However, introverts tend to recheck learned material in the course of a learning task (Cameron and Myers, 1966) which may, in itself, inhibit retrieval.

It has been shown that introverts are more easily verbally conditioned, but this may depend on the nature of the feedback obtained during the learning experience (Gupta, 1973). For instance, negative feedback on task performance creates higher anxiety (suggestive again of higher arousal) in introverts, while extraverts do not evidence this effect. In the same study neutral- and no-feedback conditions created no significant differences. Strangely though, the effects of incentives may have an effect, an effect that seems to be related to the time of day that a task is performed. Under conditions of no incentive, introverts perform better in the morning, while extraverts perform better in the afternoon and evening hours. When incentives are offered, performance in the morning is comparable across the two groups; the extraverts' performance in the evening falls off when an incentive is available (Blake and Corcoran, 1972).

Types of errors may also be related to arousal, and thus to extraversion. It has been found that errors of commission are more often made by extraverts in a low-arousal state. These errors may be due to low vigilance (Krupski, Raskin, and Bakan, 1971).

Experiments have shown that decrements in task performance across time may likewise be related to introversion-extraversion. Introverts, being more vigilant, tend to persevere on series and vigilance tasks and do not exhibit the decrease in performance across time that extraverts do (Keister and McLaughlin, 1972). It has also been suggested that the greater impulsivity of extraverts may account for this effect to some extent (Thackray, Jones, and Touchstone, 1974). In terms of stimulus value, extraverts have been observed to evidence performance decrement across time when the task in which they are involved is of low stimulus value (Brebner and Cooper, 1974). To extend the stimulus value effect, extraverts have been shown to learn verbal items more quickly on more difficult tasks (Allsopp and Eysenck, 1975) and are more successful in performing under distracting conditions (Howarth, 1969). In regards to verbal items, this relatively better performance has been observed in tests of stimulus interference. Extraverts are not as likely to become distracted by



unassociated (mismatched) verbal items and can thus remember them better than introverts can; introverts rely on stimulus association for recall to a greater degree (Bone, 1971). Hypothetically, the lack of association between unrelated verbal items may represent a distraction for introverts.

From these studies it would appear that differential cortical arousal levels in introverts and extraverts produce measurable behavioral differences in the laboratory.

Keeping these findings in mind, one would expect extraverts to opt for speed over accuracy and to be less cautious and to commit more errors than their introverted counterparts. They would also be expected to exhibit faster retrieval speed and to respond more quickly than introverts on recall tasks. All in all, this emphasis on response speed on the part of extraverts gives rise to the conclusion that extraverts are more impulsive than introverts. It is to that topic which we now turn our attention.

One of the terms most often used to describe extraverts is that they are impulsive. Impulsivity is one of the primary factors contributing to the higher-order concept of extraversion in the personality theories of both Eysenck and Cattell. In several of the experiments



discussed earlier, impulsivity was credited with the response differential between introverted and extraverted subjects (e.g., Krupski et al., 1971; Thackray et al., 1974). Let us then consider what impulsivity is, how it is measured and studied, and what contribution it makes to extraversion.

Reflection-impulsivity is defined as the tendency to reflect on the validity of problem solving under the condition that several possible alternatives are available and there is some uncertainty as to which alternative is the most appropriate response. When forced to choose from among several plausible alternatives, subjects who respond quickly often err, whereas those who take longer to consider response alternatives are more often correct (Messer, 1976). The first group is labeled "impulsive," the second "reflective." Commonly impulsivity studies involve the analysis of response time and number of errors; however, in some cases only response time is considered with the underlying assumption that longer response times necessarily indicate fewer errors. Experiments also sometimes reveal two other response groups which are termed "fast accurates" and "slow inaccurates." These two groups are ordinarily omitted from data analysis altogether, but in some studies they are

classified according to response time without regard to accuracy. There is little inter-study consistency on this point.

Various hypotheses have been offered to account for the reflective-impulsive differential. One explanation ties reflection-impulsivity to the evaluation process. The impulsive subject responds quickly and often erroneously because he is either not evaluating his comprehension of the problem, or he is not performing rechecks, or he is not considering the plausibility of his response. Kagan, Pearson, and Welch (1966) have reported a decrease in impulsivity after requiring subjects to wait for a predetermined period of time before responding and to verbalize the reasons for their choice of response.

Another hypothesis considers impulsivity a result of distractibility and low attention level. Kagan, Rosman, Day, Albert, and Phillips (1964) found that impulsive children are significantly more distractible and less attentive than non-impulsive children.

Cognitive style also differs in reflective and impulsive subjects. Reflectives more often display analytic thinking while impulsives more often rely on relational concepts when solving problems (Kagan, 1965). Reflectives gather more information before making a



decision and gather information more systematically than do impulsives (Messer, 1976).

Even so, it is interesting to note that Young (1973) found no significant correlation between reflection-impulsivity and short-term memory, habituation of response, or introversion-extraversion. However, the experimenter grouped his subjects in such a manner that several of the so-called impulsive subjects may actually have been reflectives. Therefore, a direct refutation of Eysenck's hypothesized relationship between impulsivity and extraversion did not materialize. It is with this relationship between introversion-extraversion on one hand and reflection-impulsivity on the other that the present study is concerned.

If, as Eysenck postulated, impulsivity is a primary factor of extraversion, then extraverts would be expected to act more impulsively (i.e., shorter response time, lower accuracy) when presented with a task in an experimental setting structured to minimize the environmental variables which interact with the inherent response-functioning differences in extraverts and introverts. The purpose of this study is to examine the difference in response times between introverts and extraverts on a non-verbal task and to examine what correlation (if

any) exists between response time and accuracy on any given item across the two groups. Based on Eysenck's theory of personality, it is hypothesized that extraverted subjects will respond more rapidly and make more incorrect responses than do introverted subjects on the same non-verbal, undistracted task.



## CHAPTER II

## METHOD

Subjects

The subjects were 48 college students enrolled in freshman- and junior-level psychology classes at Austin Peay State University. Initially the 16PF was administered as a class activity in several psychology classes. The students were not aware that the 16PF was related in any way to the experiment that took place sometime later. Of the 121 students who took the 16PF, 56 later volunteered to participate in a "learning" experiment for extra credit in their class. Of this number, 8 were eliminated due to incomplete data, leaving 48 subjects (12 males and 36 females) who took the 16PF and then participated in the study. The ages of the subjects ranged from 18 to 47. For purposes of statistical analysis of the data, subjects were grouped according to extraversion-introversion sten scores on the 16PF. Following a median split the introvert scores ranged from 0.8 to 5.6 and extravert scores ranged from 5.8 to 9.2. To prevent experimenter bias, 16PF scores were not matched with response time data until all subjects had been tested.

## Apparatus

The experimental apparatus consisted of a screen at eye level placed directly in front of the subject, a slide projector, headphones for auditory instructions and to block room noise, a response panel with four buttons on the table at which the subject sat, an electronic timer, and electrode connectors. The electrodes fed information into an Offner type RN six-channel chart recorder which recorded the subject's GSR, heart rate, and blood volume (data to be used in another study) in addition to the subject's response on each item of the test.

The visual material consisted of 26 test items and 4 sample items taken from Test I and Test II of Cattell's Culture Fair Intelligence Test. These items had been made into slides and were projected on the screen in front of the subject.

A partition separated the subject from the chart recorder, projector, and timer on the other side of the room; it also covered the room's only window.

## Procedure

Subjects signed up for testing appointments with both morning and afternoon sessions available. When reporting for his appointment, the subject was met at the door by the experimenter. After first washing his



hands in a sink at the side of the room, the subject was seated at a desk. He was then connected by means of three electrodes and a photocell unit on the fingers of his left hand and another plethysmograph measuring device on his forehead to the chart recorder. The response box was placed near his right hand, and headphones were placed over his ears. Instructions were given via the headphones which remained in place throughout the experiment. After the room was darkened, the experimenter walked behind the screen, switched on the taped instructions, and began the projection of test items on the screen. Items remained in view until a response had been recorded. The experimenter recorded the subject's response time (amount of time between appearance of each item and the response elicited by it) for each item on the test. A 5-second delay preceded the presentation of the next item after a response was made. When the subject completed the last test item, the experimenter reappeared, removed the electrodes, and recorded the subject's student number.

## CHAPTER III

## RESULTS

Performance accuracy was not significantly different for the two groups,  $t(47) = 1.22$ ,  $p > .05$ . Extraverts made a mean score of 15.28 correct responses; introverts did slightly less well with a mean score of 13.68 items correct (see Table 1).

The mean response time per item for introverts was 15.51 seconds while the mean response time for extraverts was 16.63 seconds per item. Therefore, across the 26 items on the test, the extraverts actually took more time to respond than did the introverts, but the difference was not statistically significant,  $F(1, 48) = 0.2332$ ,  $p > .05$ .

Item accuracy was inversely related to the amount of time spent on the item. All subjects except six spent more time on incorrect responses than on correct ones, and five of those subjects were introverts. The mean response time for correct answers was 13.21 seconds as compared to 21.23 seconds for incorrect ones, a significant difference,  $F(1, 48) = 108.67$ ,  $p < .001$ .

There was a significant difference between the response times of introverts and extraverts when the



answer given was incorrect with extraverts responding more slowly,  $F(1, 48) = 8.97$ ,  $p < .005$ . This was not the case when responses were correct (see Table 1).

Table 1

Mean Response Times and Accuracy Scores  
of Extraverts and Introverts

Variables	Extraverts	Introverts
Response time per item	16.63	15.51
Response time		
Correct items	13.21	13.2
Incorrect items	23.39	19.07
Number correct items	15.28	13.68

## CHAPTER IV

## DISCUSSION

It would seem from the results obtained here that Eysenck's inclusion of impulsivity within the framework of the extraverted personality structure is a gross oversimplification of the interactions of complex personality variables. If extraverts are also impulsives, then one would expect them to respond quickly, certainly more quickly than do the supposedly more cautious introverts, even at the risk of responding incorrectly. This did not happen. On the contrary, when unsure of the answer, the extraverts actually took significantly longer to respond than did the introverts working at the same task. At the same time, the accuracy scores of the two groups were practically identical.

Nor is the assumption that slower response time correlates with greater accuracy supported. The mean score of all 48 subjects was 14.48 correct answers; the 10 slowest subjects averaged 14.5 correct responses while the 10 quickest subjects achieved a score of 14.1 even though there was a difference of more than 20 seconds per item in the mean response times of these 2 groups.

Many studies dealing with extraversion-introversion, response time, and task performance have overlooked the possibility that experiment design, not personality variables, may account for the results. By presenting semantic tasks and by limiting response time, researchers have either encouraged extraverts to respond more quickly or have given them material which they process more easily than do introverts. These factors would account for the generally faster response times usually recorded for extraverts. This study was designed to eliminate as far as possible those elements, leaving two uncontrolled variables: the subject's personality and his response (measured in both time and accuracy) to the task.

Steps were taken to control as many intervening variables as possible. Subjects were told to take as long as needed to answer the test items correctly in an attempt to eliminate the advantage extraverts have when retrieval time is short. Conceptual rather than semantic items comprised the test to eliminate the advantage of extraverts when immediate-recognition, fluency, and verbal intelligence are involved. No feedback about response accuracy was available during the test. The test items followed the previous response at 5-second



intervals without regard to whether or not the item had been answered correctly. This was an attempt to reduce subjective feelings about success or failure which could influence responses and response times. In order to reduce distractions, light, noise, and movement were kept at a minimal level since extraverts perform better than introverts under distracting circumstances.

In view of the steps taken to prevent a biased result and considering the data obtained, it is clear that this study refutes the hypothesis that extraverts are quick-thinking, impulsive, and carefree while introverts are slow, cautious, and reflective. The opposite certainly is not confirmed either. Instead an explanation is needed for the quicker response times of introverts on incorrect items. Eysenck's cortical arousal hypothesis may hold the key. Already more highly aroused than the extraverts, the introverts would possibly have reached a level of extreme arousal when faced with the novel stimuli of the laboratory (i.e., being met by a stranger at the door, having electrodes attached to their body, responding to test items unfamiliar to them). Thus instead of displaying their characteristic response patterns, they may have responded defensively in an uncharacteristic manner to reduce the level of

stimulation. In accordance with the hypothesis of differential arousal levels, introverted subjects may actually have found the testing situation to be aversive and may have been responding more quickly than usual to get finished with the task. On the other hand, the extraverted subjects with their lower level of arousal may have been enjoying the stimulation provided by their session in the laboratory, and this additional stimulation may have actually aided them to perform at or near their optimal performance level.

Future research should possibly focus on personality types as fluid, not static, categories based on factor interaction and situational variables.

## REFERENCES

- Allsopp, J. F., & Eysenck, H. J. Extraversion, neuroticism, and verbal reasoning ability as determinants of paired-associates learning. British Journal of Psychology, 1975, 66, 15-24.
- Bartol, C. R., & Martin, R. B. Preference of complexity as a function of neuroticism, extraversion, and amplitude of orienting response. Perceptual and Motor Skills, 1974, 38, 1155-1160.
- Blake, M. J. F., & Corcoran, D. W. J. Introversion-extraversion and circadian rhythms. Aspects of Human Efficiency, 1972, 5, 261-272.
- Bone, R. N. Interference, extraversion, and paired-associate learning. British Journal of Social and Clinical Psychology, 1971, 10, 284-285.
- Brebner, J., & Cooper, C. The effect of a low rate of regular signals upon the reaction times of introverts and extraverts. Journal of Research in Psychology, 1974, 8, 263-276.
- Cameron, B., & Myers, J. L. Some personality correlates of risk taking. Journal of General Psychology, 1966, 74, 51-60.
- Cattell, R. B. Personality and motivation structure and measurement. Yonkers: World, 1957.



- Cattell, R. B. Personality and mood by questionnaire.  
San Francisco: Jossey-Bass, 1973.
- Cattell, R. B., & Dreger, R. M. (Eds.). Handbook of modern personality theory. New York: Wiley & Son, 1977.
- Cattell, R. B., Eber, H. W., & Tatsuoka, M. W. Handbook for the sixteen personality factor questionnaire.  
Champaign: Institute for Personality and Ability Testing, 1970.
- Di Scipio, W. J. Divergent thinking: A complex function of interacting dimensions of extraversion-introversion and neuroticism-stability. British Journal of Psychology, 1971, 62, 545-550.
- Eaves, L., & Eysenck, H. J. The nature of extraversion: A genetical analysis. Journal of Personality and Social Psychology, 1975, 32, 102-112.
- Eysenck, H. J. The biological basis of personality.  
Springfield: Charles C. Thomas, 1967.
- Eysenck, H. J. The structure of human personality (3rd ed.). London: Methuen, 1970.
- Eysenck, H. J. (Ed.). The measurement of personality.  
Baltimore: University Park Press, 1976. (a)
- Eysenck, H. J. Sex and personality. Austin: University of Texas Press, 1976. (b)

- Eysenck, H. J., & Eysenck, S. B. G. Personality structure and measurement. San Diego: Robert R. Knapp, 1969.
- Eysenck, M. W. Arousal and speed of recall. British Journal of Social and Clinical Psychology, 1975, 14, 269-277.
- Eysenck, S. B. G., & Eysenck, H. J. Salivary response to lemon juice as a measure of introversion. Perceptual and Motor Skills, 1967, 24, 1047-1053.
- Francis, R. D. Introversion and isolation tolerance. Perceptual and Motor Skills, 1969, 28, 534.
- Frith, C. D. Strategies in rotary pursuit tracking. British Journal of Psychology, 1971, 62, 187-197.
- Gale, A. "Stimulus hunger": Individual differences in operant strategy in a button-pressing task. Behaviour Research and Therapy, 1969, 7, 265-274.
- Gale, A. The psychophysiology of individual differences: Studies of extraversion and the EEG. In P. Kline (Ed.), New approaches in psychological measurement. New York: John Wiley & Sons, 1973.
- Götz, K. O., & Götz, K. Color preferences, extraversion, and neuroticism of art students. Perceptual and Motor Skills, 1975, 41, 919-930.
- Gupta, B. S. The effects of stimulant and depressant drugs on verbal conditioning. British Journal of Psychology, 1973, 64, 553-557.

Howarth, E. Extraversion and increased interference in paired-associate learning. Perceptual and Motor Skills, 1969, 29, 403-406.

Howarth, E., & Eysenck, H. J. Extraversion, arousal, and paired-associate recall. Journal of Experimental Research in Personality, 1968, 3, 114-116.

Jung, C. G. Psychological types. New York: Harcourt, Brace, & Co., 1924.

Kagan, J. Individual differences in the resolution of response uncertainty. Journal of Personality and Social Psychology, 1965, 2, 154-160.

Kagan, J., Pearson, L., & Welch, L. Modifiability of an impulsive tempo. Journal of Educational Psychology, 1966, 57, 359-365.

Kagan, J., Rosman, B. L., Day, D., Albert, J., and Phillips, W. Information processing in the child: Significance of analytic and reflective attitudes. Psychological Monographs, 1964, 78, 1-37.

Keister, M. E., & McLaughlin, R. J. Vigilance performance related to extraversion-introversion and caffeine. Journal of Experimental Research in Psychology, 1972, 6, 5-11.

Kline, P. (Ed.). New approaches in psychological measurement. New York: John Wiley & Sons, 1973.



- Krupski, A., Raskin, D. C., & Bakan, P. Physiological and personality correlates of commission errors in an auditory vigilance task. Psychophysiology, 1971, 8, 304-311.
- McQuitty, L. Agreement analysis: Classifying persons by predominant patterns of response. British Journal of Statistical Psychology, 1957, 9, 5-16.
- Messer, S. B. Reflection-impulsivity: A review. Psychological Bulletin, 1976, 83, 1026-1052.
- Morris, P. F., & Gale, A. A correlational study of variables related to imagery. Perceptual and Motor Skills, 1974, 38, 659-665.
- Nebylitsyn, V. D., & Gray, J. A. Biological bases of individual behavior. New York: Academic Press, 1972.
- Sloane, R. B., Davidson, P. O., & Payne, R. W. Anxiety and arousal in psychiatric patients. Archives of General Psychology, 1965, 13, 19-23.
- Stelmack, R. M., & Campbell, K. B. Extraversion and auditory sensitivity to high and low frequency. Perceptual and Motor Skills, 1974, 38, 875-879.
- Stelmack, R. M., & Mandelzys, N. Extraversion and pupillary response to affective and taboo words. Psychophysiology, 1975, 12, 536-540.
- Thackray, R. I., Jones, K. N., & Touchstone, R. M. Personality and physiological correlates of performance decrement on a monotonous task requiring

- sustained attention. British Journal of Psychology, 1974, 65, 351-358.
- Yler, L. The psychology of human differences. New York: Appleton-Century-Crofts, 1965.
- Young, J. Some correlates of reflection-impulsivity in adults. Unpublished master's thesis, Rutgers University, 1973.