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COMPETITION IN MOTOR PERFORMANCE: AN EXPERIMENTAL ANALYSIS OF MOTIVATIONAL COMPONENTS

by

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A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled COMPETITION IN MOTOR PERFORMANCE: AN EXPERIMENTAL ANALYSIS OF MOTIVATIONAL COMPONENTS submitted by Leonard Manley Wankel in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

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ABSTRACT

The primary purpose of this thesis was to attempt to analyze a competitive situation into separate motivational components, and to investigate their influence on the performance of a motor task. From a review of the literature, three components - rivalry, coaction, and audience - were hypothesized to jointly constitute the overall motivational effects of competition. The various combinations of the three proposed components constituted the eight treatment conditions for the study.

Twenty different junior high school boys were randomly assigned to each of the eight treatment conditions and tested on a simple and complex reaction time - movement time task. Heart rate measures, to indicate physiological arousal level, and ratings of alertness, to assess cognitive alertness, supplemented the behavioural data. The IPAT High School Personality Questionnaire was administered to all subjects in an attempt to identify which personality traits characterize good competitors.

The behavioural data supported the conjecture that rivalry is a motivational component in a competitive situation. Little supportive evidence for the existence of the hypothesized coaction and audience motivational components was derived. No relationship was demonstrated between performance, level of physiological arousal, and cognitive alertness. No personality traits were found to consistently distinguish good from poor competitors.

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CHAPTER I

I. INTRODUCTION

Competition is of fundamental importance to physical education and athletics. It constitutes the very essence of the major sporting spectacles and is the basis of many drills used in the development of physical skills. Despite this focal importance, little real understanding of the phenomenon has been achieved. Physical educators in the main have been content to "use" competition without really understanding its theoretical structure. It has generally been left to psychologists to carry out what research has been done pertaining to the underlying theoretical basis of competition.

In the first clear statement on the subject, Allport (1924:262) wrote that all competitive performance is comprised of two social factors - rivalry and social facilitation. He defined rivalry as "an emotional reinforcement of a movement accompanied by the consciousness of a desire to win" and social facilitation as "an increase of response merely from the sight or sound of others making the same movements". Although considerable literature concerning "competition" has appeared since Allport's early work, little clarification has occurred with respect to the conceptual make-up of this construct. The majority of the studies have merely described the effects of a competitive situation upon the performance of various tasks without attempting to explain why such effects have occurred.

With the exception of one inconclusive attempt (Evans 1968), no research has been conducted to test Allport's early views on the bi-

component composition of competition. There has been a tendency by writers in the area to equate rivalry with competition and to treat social facilitation as a separate construct.

Research findings in the investigation of rivalry (i.e. where instructions to compete and try to win are given) are far from conclusive. Such writers as Berridge (1935), Church (1962), Church, Millward, and Miller (1963), and Wilmore (1968) report studies wherein rivalry facilitated performance; whereas others, Whittemore (1924), Dashiell (1930), and Shaw (1958) report negative effects of rivalry upon performance; still others, Triplett (1897), Strong (1963), Evans (1966), and Evans (1968) report that rivalry had no significant effect upon performance. These diverse results could be due to any number of differences from study to study. There would appear to be at least three different types of variables which could influence the effect of rivalry upon a subject's performance: (a) subject characteristics (e.g., personality traits, ability level, sex, age, past experience), (b) task variables (e.g., complex vs simple tasks, discrete vs continuous tasks, emphasis on speed vs accuracy), and (c) situational variables (e.g., presence of others, distracting cues, effectiveness of rivalry-inducing instructions).

Although the majority of research on competition over the years has focussed on rivalry, Allport's other postulated motivational component - social facilitation - has received renewed interest since Zajonc's (1965) proposal that it can be interpreted in terms of Hull-Spence behaviour theory. This theory maintains that general drive interacts multiplicatively with habit strength to determine excitatory

potential which is directly related to performance; thus, the effect of an increase in drive or arousal upon performance depends upon the nature of the task. In tasks where the correct response is dominant, performance will be facilitated; whereas, in more complex tasks, where incorrect responses tend to be stronger than the correct ones, an increase in drive will result in a decrement in performance.[1]

Zajonc theorized that social facilitation can be sub-divided into audience and coaction effects which refer respectively to the effect of the "mere presence" of other individuals and the effects due to others simultaneously performing the activity. He hypothesized that either of these conditions would result in an increase in general drive level.

Zajonc's proposal has been partially substantiated by recent research. Audience effects supporting his proposal have been reported by Cox (1966), Zajonc and Sales (1966), Cottrell, Rittle and Wack (1967), Cottrell, Wack, Sekerak and Rittle (1968), Ganzer (1968), Cox (1968), Martens (1969), Zajonc, Heingartner and Herman (1969), and Quarter and Marcus (1971). In the only studies reviewed which utilized the coaction paradigm, Zajonc, Heingartner and Herman (1969) and Martens and Landers (1969a) gained supportive evidence for the proposal while Evans

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[1] J.T. Spence and K.W. Spence (1968:304) point out that it is not the complexity of a task 'per se' which determines how a change in drive will affect task performance but rather the "degree of intratask competition between correct and incorrect response tendencies". They do add, however, that "other things being equal" more complex or difficult tasks generally will have greater intratask response competition.

(1968) did not.

Cottrell (1968) has made an important criticism of Zajonc's theory. He disagrees with Zajonc's definition of an audience condition, suggesting that "mere presence" is not a significant explanation for audience effects. Instead, he prefers a learned or secondary drive explanation. Cottrell says:

> "It does not appear that the simple presence of others increases drive level. I believe the additional process involved is the anticipation of positive or negative outcomes; the presence of others has nondirective energizing effects upon performance only when their presence creates anticipations of positive or negative outcomes." (1968:103)

It is of considerable importance to determine which of the two expressed views is more correct as different behavioural hypotheses result from the two positions. Whereas, Zajonc's theory suggests that all audience conditions are basically the same, Cottrell's revision suggests that different audiences have different potentials for giving "positive or negative outcomes" and thus differentially affect a performer's drive and consequently his performance.

The views of Allport, Zajonc, and Cottrell constitute the underlying theory for this study. An attempt will be made to experimentally isolate separate motivational components from a competitive situation and to show how these components interact with such factors as task complexity and personality traits in influencing motor performance.

II. THE PROBLEM

The purposes of this study are:

1. To analyze the conceptual components of the term "competition" and to examine the effects of these separate components upon perceptual-motor performance.
2. To examine the relationship of arousal states to different competitive situations.
3. To identify those personality traits which are of importance in understanding the effects of competition upon performance.
4. To test the following hypotheses:
   (a) That rivalry, coaction, and audience components can be isolated from a competitive situation.
   (b) That the level of arousal will be successively greater for the following test conditions: (1) control, (2) audience, (3) coaction, (4) coaction plus audience, (5) rivalry, (6) rivalry plus audience, (7) rivalry plus coaction, (8) rivalry plus coaction plus audience.
   (c) That the optimal arousal level will be higher for the simple task than for the complex task.
   (d) That there will be an interaction of ability level and arousal (i.e., as skill improves on the motor tasks, the optimal arousal level for each will become greater).

III. IMPORTANCE OF THE STUDY

Despite the fact that nearly half a century has passed since Allport first suggested that two distinct motivational factors, rivalry and social facilitation are present in competitive situations, no substantial evidence has yet been brought forward to support or negate

this claim. The proposal by Zajonc (1965) that social facilitation can be sub-divided into audience and coaction effects further complicates the picture as it would then follow that competitive situations may involve three distinct motivational components.

The failure on the part of competition researchers to consider the conceptual make-up of competitive situations may help to explain the mass of contradictory reports on how competition affects performance. If, in fact, there are distinct coaction and audience motivational components which may or may not accompany rivalry in a competitive situation, then varying effects might be expected.

In addition to isolating the separate motivational components in a competitive situation, it would be valuable to know what other variables interact with these components to affect performance. In this regard, task complexity and the personality profile of the subjects are two factors of interest.

The present thesis will attempt to answer some of these questions in an endeavor to bring new insight into what actually takes place during competition and how competition affects performance.

IV. DELIMITATIONS

1. The sampling of subjects was limited to one hundred and sixty grade seven and eight boys at St. Cecelia Junior High School, Edmonton, Alberta.
2. The study was limited to self-competition and individual (pair) competition. It did not include group competition.

V. DEFINITION OF TERMS

Competition. Competition is that situation in which an individual's success is determined by some characteristic of his response relative to that of another individual.

Rivalry. Rivalry refers to the proposed motivational component of competition which involves a cognitive desire to win.

Coaction. Coaction refers to the proposed motivational component of competition which is due to the presence of another subject simultaneously performing the same activity but when aspects of rivalry are minimal.

Audience. Audience refers to the proposed motivational component of competition which is due to a performer's expectation of positive or negative outcomes from spectators who are observing his performance.

Social Facilitation. Social Facilitation refers to the proposed motivational effects upon behaviour resulting from the awareness of the presence of spectators (i.e., audience) and/or the presence of others performing the same activity (i.e., coaction).

Arousal. The level of arousal refers to the extent of release of potential energy stored in the tissues of an organism, as this is evidenced in activity or response. A subject's arousal level in this study is operationally defined by deviations in his heart rate from a resting level.

Personality. Personality is the more or less stable and enduring organization of a person's character, temperament, intellect, and physique, which determine his unique adjustment to his environment. A subjects' personality in this study is operationally defined as his derived profile on the fourteen factors of the IPAT High School Personality Questionnaire.

Simple Task. The simple task is a simple visual stimulus reaction time-movement time task. Reaction time is the elapsed time in hundredths of seconds between the onset of the stimulus light and the removal of the subject's right index finger from the "start" button. Movement time is the elapsed time in hundredths of seconds between the release of the "start button" and the closing of the illuminated stimulus switch which is twelve inches away.

Complex Task. The complex task is similar to the simple task except that instead of one, there are eight stimulus-response switches which are placed twelve inches from the "start button" in an arc arrangement.

Reaction time is the elapsed time in hundredths of seconds between the onset of one of the eight stimulus lights and the removal of the subject's right index finger from the "start button". Movement time is the elapsed time in hundredths of seconds between the release of the "start button" and the closing of the illuminated stimulus switch.

CHAPTER II

REVIEW OF THE LITERATURE

The review of literature deals with four main areas. The first section includes studies pertaining to the general topic of competition and its effects upon performance. The second section includes more specific studies which deal with the effects of competition upon the performance of tasks of varying complexity. The third section consists of studies which relate personality factors to performance in competitive situations. The final section presents a discussion of the major theories relating motivational intensity to performance and reviews those studies pertaining to the relationship between physiological arousal and performance.

I. THE EFFECTS OF COMPETITION UPON PERFORMANCE

Previous studies of competition have not analyzed competition in the same conceptual context as is proposed in this study. Rather, rivalry has generally been treated as being synonymous with competition while coaction and audience effects have almost exclusively been studied as distinct and separate factors. In this review of the effects of competition upon performance, rivalry, coaction, and audience effects are all included. Although the majority of studies generally held to be "competition studies" are included in the rivalry section, some may also be included under the coaction heading.

As this study is delimited to an investigation of individual

competition, those studies pertaining to the effects of cooperation and competition upon group processes (e.g., Deutsch, 1949) or those competition studies involving non-zero sum games (e.g., Jones and Gerard, 1967) are not included in this review.

Rivalry

Church (1962), Church, Millward and Miller (1963), Plunkett (1967), Hurlock (1927), Maller (1963), Sims (1928), Wilmore (1968), Moede (1931), and Nelson (1962) all report studies wherein rivalry improved performance.

Both the Church (1962) and Church, Millward, and Miller (1963) studies used male college students and a simple and discriminative reaction time task. Plunkett (1967) utilized female college students and a tennis reaction-movement task. The competitive effects reached the .05 level of significance in all three studies.

Hurlock (1927), using an arithmetic task with male and female school children of different ages, found that a rivalry group did 41 per cent better than the control group; with the girls gaining slightly more than the boys and the younger children being more responsive to rivalry than the older children. Maller (1963) in a similar study, also found that rivalry facilitated better scores on arithmetic tasks for both boys and girls. Sims found that rate of reading and rate of letter substitution increased more under conditions of individual competition than either control or team competition conditions.

In an ergocycle output study, Wilmore (1968) found that college

students significantly ($P < .05$) improved their performance under competitive conditions. Similarly, Moede (1931) found that hand grip scores were markedly (no significance test) better under rivalry conditions. Nelson (1962) found that various rivalry conditions facilitated better performance on an elbow flexion endurance task.

Several researchers report differential effects of rivalry upon performance. Triplett (1897) found that the speed of winding fishing reels by children might either be improved or hindered by rivalry. Of the forty subjects included in his study, twenty improved with competition, ten were unaffected, and ten did less work.

Moede (1931) found that competition differentially affected the tapping speed of subjects of different ability levels. Poorer individuals improved with competition while the superior subjects did worse. Opposite results were found by Strong (1963) in his studies of physical fitness tests with grade six children. He found that individual competition was only effective in improving the fitness scores of good performers. The differences in the results of these studies may be due to the fact that Strong matched his subjects so that each pair was comprised of individuals of approximately equal ability while Moede did not.

Whittemore (1924) found that college students worked faster on a type setting task when rivalry was present; their accuracy, however, decreased with rivalry. Hurlock, in her previously mentioned arithmetic study, reports opposite results with accuracy improving under rivalry conditions. Again this difference may be explained by procedural differences as in Whittemore's study, subjects were pressed for time while in Hurlock's study they were not.

Gerdes (1958) found that competing against the stated scores of others (scale scores) facilitated performance of a chin-up task and that team competition improved basketball wall volley performance. Competitive conditions did not significantly affect the performance of a sixty yard run, a basketball accuracy test, a zig-zag run, a push-up test, and a volleyball wall volley test.

Non-significant effects of rivalry upon performance have been reported by Dashiell (1930), Hesse (1955), Evans (1966), Evans (1968), Wankel (1969), and Martens and Landers (1970). The tasks used in these respective studies were: mental tests (i.e., multiplication, analogies, and word associations), gross motor tests (i.e., broad jump and thirty yard dash), reaction time, form board, stabilometer balancing, and coincident timing.

Although the results of rivalry studies present a rather confusing picture some trends or consistencies do appear.

1. Rivalry generally facilitates better performance on simple forceful acts.
2. Rivalry tends to facilitate speed of performance at the expense of accuracy when time is limited.
3. Reaction time may either be improved or not affected by rivalry.
4. Performance of more complex motor skills, which require greater degrees of precision and coordination, generally are not significantly affected by rivalry, although examples of both facilitative and detrimental effects are also reported.

Coaction

The coaction paradigm entails two or more subjects performing the same task in the presence of one another but with rivalry de-emphasized. Although it is highly unlikely that a pure form of this paradigm is ever found, i.e. some aspects of rivalry and/or audience effects are generally also present, situations can be structured wherein coaction effects are emphasized while rivalry and audience effects are minimized. The ensuing studies appear to have followed this pattern and thus they have been classified as "coaction studies".

Berridge (1935) found that college men performed better on a strength test under coaction conditions than when alone. Similarly, Mukerji (1940) found that performance of a cancellation task in a group situation exceeded that in isolation by 20 to 27 per cent. Studying the pencil maze performance of mentally sub-normal girls, Abel (1939) found that performance was facilitated by the presence of others. She also found that the most intelligent group of girls benefited most from the social facilitation.

Noble, Fuchs, Robel, and Chambers (1958) found social facilitation to have differential effects on different tasks. Discriminative reaction time performance was significantly improved by social facilitation; whereas, pursuit rotor performance was unaffected.

Dashiell (1930) found coaction to have no significant effect upon the performance of multiplication, analogies, and word-association tests. Evans (1968) gained similar non-significant effects with a form-board task.

In their study of muscular endurance performance, Martens and Landers (1969a) found coaction effects to be influenced by the size of the coacting group. Individuals in quadrads performed significantly better than individuals in dyads and alone. No significant difference was found between individuals performing alone and in dyads.

Zajonc (1965) and Tolman (1968) have written excellent reviews of animal studies dealing with social facilitation. The results of these studies coincide closely with those of the above studies using human subjects; several examples of improved performance due to coaction are given, however, instances of detrimental and nil effects are also reported.

Like rivalry then, coaction can have diverse effects upon performance. It would seem that Zajonc's "arousal and competing response hypothesis" might be one way of meaningfully interpreting these diverse results.

Audience

The studies in this section have not generally been associated with work on competition; however, in terms of Zajonc's analysis of social facilitation they have relevance to the present study.

Travis (1925) found that of twenty-two individuals trained singly on a pursuit rotor task, eighteen had a higher average of ten consecutive scores when tested before an audience than when alone. Gates (1924) studied the effects of a small audience (N = 4 to 6) and a large audience (N = 30 to 40) upon the performance of a Three Hole Coordination

Task, the Woodworth-Wells Analogies Test, and the Woodworth-Wells Colour Naming Test. Although there were no reliable differences for the different conditions, performances generally were poorer when a large audience was present. Dashiell (1930) found that an audience facilitated speed at the expense of accuracy on multiplication, analogies, and work-association tasks.

Husband (1931) and Pessin and Husband (1933) report conflicting results concerning the effects of spectators upon the learning of a finger maze. In the former study, spectators interfered with learning while in the latter they did not affect the rate of learning though they caused performance to be more variable.

In another study, Pessin (1933) found that an audience interfered with the learning of a list of nonsense syllables. The subjects who learned the seven-item list in the presence of spectators not only needed more trials to learn the list but they also made considerably more errors.

These early studies were fundamental to the development of Zajonc's (1965) proposal that audience effects could be explained in terms of increased arousal and Hull-Spence behaviour theory.[1] Recent research generally tends to support this proposal.

Zajonc and Sales (1966) had college students perform a type of pseudo-recognition word task, with or without the presence of two passive spectators. The presence of the spectators enhanced the emission of

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[1]See Zajonc (1965) for a more detailed interpretation of how these early audience studies relate to the proposed social facilitation theory.

responses governed by stronger habits at the expense of those governed by weaker habits.

Similar results were gained by Cottrell, Rittle and Wack (1967) with a paired-associate learning task involving varying degrees of response competitiveness. The presence of an audience (2 male students) improved performance on the non-competitive list and impaired performance on the competitive list.

Martens (1969) found that an audience hindered the learning of a coincident timing task but improved performance after considerable learning had occurred. Quarter and Marcus (1971) found that subjects performed less effectively on a digit-span test when observers were present than when they were absent.

Singer (1970), on the other hand, reports a study wherein the results do not correspond to those expected on the basis of social facilitation theory. Subjects were given ten learning trials on a star tracing task either under audience or non-audience conditions. Forty-eight hours later the subjects were given a three-trial retest. All possible combinations of learning and retest conditions (i.e. spectators - no spectators; spectators - spectators; no spectators - no spectators; no spectators - spectators) were utilized. The presence or absence of spectators had no noticeable effect on the initial learning phase as contrasted to later stages of performance. Less errors were made when subjects performed the task under the same conditions on both testing occasions.

Physical Education studies of the effects of an audience or spectators upon performance have not generally been set up on the basis of

any well formulated theoretical basis but rather have merely described the effects of different situations on the performance of some physical task.

Singer (1965), in a study of the effects of an audience upon the stabilometer balancing performance of athletes and non-athletes, found the presence of an audience to have no significant effect upon performance.

Chevrette (1968) tested fourth grade children under various audience conditions on the vertical hang, grip strength, and AAHPER shuttle run tests. The test conditions were: control, audience of same sex, audience of opposite sex, and mixed audience. The only significant differences found were for the performance of the boys on the shuttle run when girls were present in the audience (i.e., conditions three and four).

Hartrick (1960) studied the effects of an audience, a money reward, and a set-goal upon the ergocycle work output of ninety seven university physical education students. All three incentives were significantly better than the control condition but none were significantly better than the others.

Evidence, in support of Zajonc's "mere presence" interpretation of audience effects, or on the other hand for Cottrell's suggested revision, is negligible. Zajonc, Heingartner and Herman (1969) performed two experiments with cockroaches involving runway and maze performance to test the "mere presence" view. The first experiment, wherein live cockroaches were kept in the "audience boxes" adjacent to the runway and maze, provided results in support of the proposed theory. Results

from the second study, however, which utilized partial presence of conspecifics (i.e., olfactory traces but no actual presence), were ambigious and did not lend additional support.

Cottrell, Wack, Sekerak and Rittle (1968), in the most stringent test of the "mere presence" view using human subjects, found that an attentive audience significantly affected performance of a "pseudo recognition task" but that the "mere presence" of blindfolded others did not. Earlier studies by Basler (1948) and Laird (1923) also tend to support the view that mere presence of an audience is not a sufficient explanation, but rather, the audiences reaction or the subject's expectation of its reaction are vital factors in determining how an audience influences performance. Basler found that whereas a passive audience increased a subject's output on a hand-grip ergometer one and one half times, a "cheering" audience increased the work output two and one half times. Laird found that "razzing" by peers caused a decrement in performance of steadiness tasks. It had a less detrimental effect upon performance of coordination and tapping tasks.

The foregoing studies of audience effects suggest that:

1. The presence of an audience generally facilitates better performance on simple, forceful tasks.
2. The presence of an audience may facilitate better performance of more complex tasks after considerable practice, i.e. when the task is well learned.
3. The presence of an audience generally interferes with the learning of new skills.
4. Although the presence of passive spectators may significantly

affect performance, the effects due to active spectators, i.e. "cheering" and "razzing", are considerably greater.

II. COMPETITION AND TASK COMPLEXITY

Task complexity appears to be one variable which may help to explain why competition in some cases improves performance while in other cases it detracts from it. As previously mentioned, in terms of Spence's competing response theory, greater task complexity usually, but not necessarily, corresponds to greater intra-task response competition. In this regard, the system used for classifying level of task complexity is of vital importance. This short review will deal only with those studies wherein aspects of competition have been studied with respect to tasks of differing complexity levels.

Wickens (1942) in a study involving competition and arithmetic tasks of varying complexities, gained results congruous with Spence's theory. The presence of competition facilitated greater improvement on the easy problems than on the more difficult problems.

In the only study specifically designed to assess the effects of competition upon the performance of tasks of differing complexity levels, Bruning, Sommer, and Jones (1966) gained results partially in agreement with their expectations. As expected, performance of the simple task (predictive reaction time) was facilitated by competition; however, performance of the purported complex task (pursuit rotor) did not suffer the expected decrement. The authors attributed this later result to the fact that the pursuit rotor task was not sufficiently

complex to insure the occurrence of competing responses.

Noble, Fuchs, Robel, and Chambers (1958), in an earlier study, using basically the same tasks gained similar results; however, they interpreted them differently. They found that social facilitation had a greater effect on a discrete task (discriminative reaction time) than on a serial task (pursuit rotor). They interpreted these results as indicating that where continuous attention is required social facilitation effects will be less.

Wankel (1969) found that competition facilitated the performance of high ability subjects on a stabilometer balancing task; whereas, it hindered the performance of low ability subjects. These results can be interpreted in terms of level of task difficulty by saying that the task was less difficult for the high ability subjects than for the low ability subjects.

The previously discussed "audience studies" of Zajonc and Sales (1966), Cottrell, Rittle, and Wack (1967), and Cottrell, Wack, Sekerak, and Rittle (1968) lend stronger support to the view that social motives can meaningfully be interpreted in terms of social facilitation and competing response theory.

On the basis of the above studies, it can be concluded that task difficulty is one important variable to consider when predicting the effects of competition upon performance.

III. THE RELATIONSHIP OF PERSONALITY FACTORS TO COMPETITION

Although Zajonc's theory of social facilitation does not consider

individual differences in personality, some recent research has been reported wherein personality measures were related to social facilitation effects. Ganzer (1968), using the Test Anxiety Scale as a measure of anxiety, found that the presence of an audience was detrimental to learning a list of nonsense syllables for high and medium anxiety women but not for low anxiety subjects. Cox (1966, 1968) also found that test anxiety and the presence of an audience had an interaction effect on performance in a marble dropping task. The presence of passive observers increased the response rate of low anxiety boys and decreased the response rate of high anxiety boys.

Martens (1969), however, observed that audience presence and general anxiety level, as measured by the Taylor Manifest Anxiety Scale, did not have an interaction effect upon performance, as after initial learning had occurred, the high anxious subjects performed better than the low anxious subjects independent of the audience factor.

Quarter and Marcus (1971) in their digit span study also failed to obtain a significant audience x anxiety interaction. The high anxious subjects (Achievement Anxiety Scale) did not exhibit poorer recall than the low anxious subjects in the audience present condition.

Kenyon and Loy (1966) studied the effects of a small audience, a person of high prestige, and persons of the opposite sex on the performance of a wrist flexion strength test, a wrist flexion endurance test, and two manipulative peg placement tasks. Self-esteem and need for recognition measures were taken on all subjects. It was found that the social stimuli had no significant influence on the performance of the four tasks. Although there were individual differences in

reactivity to the social stimuli, these were not a function of the two assessed personality measures.

Ryan and Lakie (1965) measured subjects on the Manifest Anxiety Scale (MAS) and French's Test of Insight (nAch) and then observed their competitive and non-competitive performance on a mirror image "ring peg" task. The high MAS-low nAch group performed significantly better under non-competitive conditions while the low MAS-high nAch group performed better during competition. Vaught and Newman (1966) demonstrated that low anxious subjects (MAS) made fewer errors than high anxious subjects in a steadiness test (multi-holed steadiness box) and that competition exacerbated performance differences between the two groups.

Another study investigating the interaction of anxiety level, as assessed by the Taylor Manifest Anxiety Scale, and competition was carried out by Martens and Landers (1969). They found that subjects low in anxiety performed significantly better than high anxiety subjects during the initial learning of a coincident timing task. No difference was found between subjects extreme in anxiety once the task was well learned. Competition did not affect performance or interact with the anxiety level of subjects.

Mogar (1962) carried out the only study which investigated the interaction of competition with a complete personality inventory. He found that the dominance and succorance traits of the Edwards Personality Preference Scale were positively related to competitive facilitation of the laboratory performance on a Wechsler-type block test by female subjects. In a follow up competitive real life study, involving

an investigation of personality traits associated with improved performance on a college examination, dominance was again found to be a significant factor but succorance was not. No personality traits of male subjects were found to significantly interact with competition in influencing performance.

In summary, little evidence has been presented to indicate which, if any, personality traits are important in determining how competition affects performance. The majority of the research in this area has been confined to an examination of the interaction of competition and anxiety level. Generally, in studies utilizing Test Anxiety, significant interactions have been reported with high anxious subjects performing better under non-competitive conditions and low anxious subjects performing better under competitive conditions. Researchers utilizing General Anxiety measures, such as the Taylor Manifest Anxiety Scale, on the other hand, have generally not found significant competition x anxiety interactions.

IV. MOTIVATIONAL INTENSITY AND PERFORMANCE

Although Zajonc (1965) has clearly placed social facilitation in motivational terms (i.e., he relates its effects to the intensity rather than the directional or cue giving dimension), there is still considerable controversy as to how this increased motivational intensity relates to behaviour. At present there appears to be two major schools of thought pertaining to this question. On the one hand are proponents of the Hull-Spence "generalized drive" interpretation of behaviour,

while on the other are supporters of the "inverted-U hypothesis" relating arousal or activation to performance (e.g., Hebb, 1955; Duffy, 1962; Malmo, 1966). Although similar in certain respects, these two positions have basic fundamental differences which can lead to different behavioural hypotheses.

The major difference is in the postulated relationship between motivational intensity (i.e., drive, arousal, activation) and performance. Hull-Spence theory holds that the relationship is of a monotonic nature while activation theory postulates an inverted-U (nonmonotonic) relationship.

Although considerable research has been conducted pertaining to each theory separately (e.g., Spence and Spence, 1966; Malmo, 1966), conclusions in regard to the relative merits of the two views are tenuous.

In a recent study which examined the relative merits of the two theories with respect to motor performance, Martens and Landers (1970) interpreted their results as being supportive of the arousal position. The results are far from conclusive, however, as although arousal as indicated by palmar sweating and heart rate was curvilinearly related to tracking performance as arousal theory predicts, this does not necessarily contradict drive theory. Supporters of the Spence position could explain these results by saying that although drive and performance were linearly related, the highest drive condition was accompanied by additional stimuli which accounted for the performance decrement.

A major difficulty in attempting to empirically validate the two theories is that both are of such generality that by themselves they

appear to be able to "post hoc" account for any possible results. At the same time, they lack precision and are unable "a priori" to predict results in many cases.

As Spence and Spence (1966) have aptly pointed out, in order to make any accurate predictions about behaviour, in addition to a motivational theory of performance, we must have a theory pertaining to situational variables and task requirements. This has not generally been done in research relating motivational intensity to performance. Thus, at the present time neither theory can be conclusively accepted or rejected.

In terms of the present study, it is not critical if one accepts the "competing response theory" or the "inverted-U hypothesis", as similar predictions can be made from each. In regards to the simple task, both theories would predict increased performance with higher levels of motivational intensity. Arousal theory would make this prediction by saying that simple tasks have low arousal properties, thus by adding motivational arousal to this low level the overall arousal level would approach nearer to the optimum and thus performance would be facilitated. Drive theory would make the same prediction by saying that in the simple task correct responses are dominant over the non-correct competing responses and increased drive would facilitate the expression of these correct responses resulting in improved performance.

Both theories could also predict a decrease in performance on the complex task with increasing motivational levels. The inverted-U hypothesis would make this prediction on the basis of task difficulty

adding arousal to motivational arousal thus raising it over the optimal level resulting in a decrement in performance. Competing response theory would explain these results on the basis of wrong responses being dominant and thus increasingly interfering with performance as motivational intensity increased.

Another important difference between the two theories pertains to the question of using physiological measures as indicators of level of motivational intensity. Spence and Spence (1966) comment on this difference:

> "In these physiological theories the term drive or such alternate expressions as motivation or arousal appear to be used to refer to an assumed physiological state of the organism thus making it legitimate to seek methods of measuring this state and to compare proposed methods of measurement on the basis of directness, purity, etc. In the Hull-Spence system, on the other hand, the drive concept is purely mathematical in nature, being defined in terms of observable manipulations and related mathematically to other similarly defined concepts, deductions from the entire theoretical network permitting predictions to be made about behaviour." (1966:298)

While acknowledging the plausibility of the Spence position, because in many studies performance changes do not correspond to apparent motivational changes (e.g. Duffy, 1962; Malmo, 1966), in this study it was felt advisable to include another possible measure of motivational intensity. Thus, Duffy's position is accepted. She says (1962:9) "If it is desired to measure the intensity (as opposed to the direction) of the motivation, measurement should be made of the physiological processes indicative of the level of activation." Although advocating the use of physiological measures, Duffy also realized the problems involved. She states:

> "At present, we can point to a number of still imperfect techniques of measurement, any one of which, taken separately from a group of subjects and correlated with factors of stimulation and of response, will reveal significant relationships. Though the general line of approach seems to be reasonably clear, we do not as yet know how our measures may best be combined, which single measures are most significant, or even, in many cases the best technique for securing the single measures." (1966:280)

The measurement situation has not noticeably improved since the writing of Duffy's (1966) article. Some researchers (e.g., Lacey, 1967) have questioned the existence of a general level of physiological arousal; others (Taylor and Epstein, 1967; Elliot, 1969, 1970) have stated their belief that situational variables determine how various measures of arousal correlate with one another; while still others (Opton and Lazarus, 1967) attribute low inter-correlations of arousal measures to inadequate measurement procedures and attempt to overcome these by seeking new methods, transformations, and methods of data reduction.

These varying points of view have not been sufficiently developed to be of much value to the applied researcher in motivation. Thus the two most popular traditional measures, heart rate and palmar skin conductance, continue to be extensively used despite criticisms of them. They are also the most common physiological measures used in studies of competitive arousal.

Evans (1966) found no significant differences in either reaction time or heart rate scores for competitive and non-competitive test conditions. Furthermore, there was no significant correlation between the two measures. In a later study (1968), Evans found that heart rate was significantly higher for rivalry than for non-rivalry conditions

and that social facilitation also tended to increase heart rate. There was no significant correlation between activation and performance. Evans explained this result by saying:

> "The occurrence of the inverted-U phenomenon makes it very difficult to demonstrate the effects of increased motivation on performance. Furthermore, it may be that the inverted-U phenomenon was responsible for the lack of correlation between activation and performance. As activation increased, some subjects' performance improved and some subjects' performance degenerated, negating any overall group correlations." (1968:31)

Church (1962) found that competition had a significant effect upon both reaction time and palmar skin conductance; however, there was no evidence of a causal relationship between the two measures.

Martens (1969), in his study of audience effects upon coincident timing performance, found that the presence of an audience significantly increased palmar sweating. The relationship of the level of arousal to performance was in accordance with social facilitation theory.

Voor, Lloyd, and Cole, (1969) used electromygraphy (EMG) recordings as an indicator of level of motivation in a study of the effects of competition upon isometric endurance. Although competition did not improve performance, EMG activity significantly increased.

A series of experiments conducted at the Florida State University (i.e., Hokanson and Burgess, 1964; Burgess and Hokanson, 1964; Doerr and Hokanson, 1965; and Wood and Hokanson, 1965) successfully used heart rate as a measure of activation. In these studies, utilizing various intellectual tasks, activation and performance were found to be related in the hypothesized inverted-U manner.

In a recent article, Elliot (1970) has pointed out several

advantages of using heart rate as a measure of arousal. This rationale, the fact that heart rate has been used in previous competition studies and the ease of deriving such measures in the present experimental setting, were decisive factors in the decision to use heart rate as a measure of arousal in the current study.

In summary, motivational intensity appears to be one important dimension which influences performance. At present, two motivational theories - drive theory and arousal theory - appear to be equally defensible. Although different in certain respects, they are not mutually exclusive and it is possible to defend the hypotheses for the present study on the basis of either theory.

The arousal position, with respect to using physiological measures to assess motivational intensity, has been accepted in this study; as it was felt desirable to derive as much information as possible about the motivational strength of each proposed component of competition. Considerable controversy still exists as to how arousal can most appropriately be evaluated. Various measures have been utilized in different studies and have yielded widely fluctuating results. At the present time, no single measure or battery of measures is available that has proven totally satisfactory. The galvanic skin response and heart rate measures have been the most widely accepted.

It was decided to incorporate heart rate measures into the present study because of the ease of measurement, the widespread use of heart rate in previous competition studies, and the advantage of this measure in cross-laboratory comparison of results.

CHAPTER III

METHODS AND PROCEDURE

The subjects were divided into eight treatment groups and required to perform at two levels of complexity on a reaction time-movement time (RT-MT) task. The eight treatment conditions, which consisted of varying combinations of the hypothesized motivational components of competitive situations, were as follows:

1. Control. The subject performed the task in isolation.
2. Audience. The subject performed the task in the presence of two spectators.
3. Coaction. Two subjects performed the task simultaneously.
4. Coaction + Audience. Two subjects performed the task simultaneously in the presence of two spectators.
5. Rivalry. The subject performed the task in isolation after having been given rivalry inducing instructions to try to perform better than other students.
6. Rivalry + Audience. The subject performed the task in the presence of two spectators after having been given rivalry inducing instructions to try to perform better than other subjects.
7. Rivalry + Coaction. Two subjects performed the task simultaneously, after having been given rivalry inducing instructions.
8. Rivalry + Coaction + Audience. Two subjects performed the task simultaneously, in the presence of two spectators, after having been given rivalry inducing instructions.

Simple reaction time and complex reaction time were the two levels of complexity required in the performance of the task.

I. EXPERIMENTAL DESIGN

The experimental design was an 8 x 2 x 5 factorial design with repeated measures on the last factor. The eight levels of the first factor were randomly assigned between subjects; rivalry, coaction, and audience effects were nested in the overall competition factor. The respective eight levels of the competition factor were: control, audience, coaction, coaction + audience, rivalry, rivalry + audience, rivalry + coaction, and rivalry + coaction + audience. The two levels of task complexity were assigned within subjects in a counter-balanced manner. The third factor, trials, was also assigned within subjects and consisted of five blocks of five trials each.

The dependent variables were reaction time in one-hundredth seconds, movement time in one-hundredth seconds and heart rate in beats per minute. As additional measures, alertness ratings for the two levels of task complexity and personality profiles were obtained for each subject after completion of the behavioural testing.

II. THE SUBJECTS

The one hundred and sixty subjects involved in this study were right-handed male grade seven and eight students at St. Cecelia Junior High School, Edmonton, Alberta.

Junior high school students were utilized as subjects in the study for two main reasons. Firstly, competition is advocated as an effective teaching device for this age group (Alberta Curriculum Guide, 1966). Secondly, it was felt that older subjects might perceive the purpose of the study and thus bias the results, whereas junior high

school students would be more inclined to accept the information given to them at "face value".

The sampling of subjects was restricted to males, as different studies (e.g. Hurlock, 1925; Moede, 1941; Strong, 1963; and Chevrette, 1968) have shown that the sexes react differently to competition. Only right handed subjects were utilized as it was felt that handedness might influence the speed of responding to the various switches.

All testing was carried out at St. Cecelia Junior High School, the school made available for this study by the Edmonton Separate School Board.

III. THE APPARATUS

The two main pieces of apparatus used in this study were a RM-MT apparatus and a Beckman RS Dynograph.

The RT-MT Apparatus

The RT-MT apparatus (Figure 1) consisted of a control panel, four Standard electric (1/100 sec.) chronoscopes, a masonite vision-proof screen, and two performance consoles. Each console was comprised of eight illuminable licon switches and one micro-switch mounted in a wooden chasis. The licon switches were mounted in a 360° arc, twelve inches from the micro-switch.

The electrical circuitry was wired in such a manner so that the experimenter could, by closing a switch at the control panel,

simultaneously close the circuit to any of the eight Licon switches and the two chronoscopes. The RT chronoscope would start running as soon as the control switch was closed provided that the micro-switch "start button" was depressed. Immediately when the subject released the "start button" the RT chronoscope would stop and the MT chronoscope would start. Depression of the correct Licon switch would break the circuit to stop the MT chronoscope.

The Beckman RS Dynograph

The Beckman Dynograph was equipped with two heart rate couplers, and two sets of hook-up leads and electrodes so that the heart rates of two subjects could be monitored simultaneously. The chart speed of the recorder was set at five millimetres per second.

IV. THE TASK

Simple RT-MT Task

The simple task (Figure 2) required the subject to respond to a visual stimulus which was located twelve inches directly in front of the "start button". The same stimulus-response light (i.e., Licon switch) was used on all twenty five trials. The other seven lights of the apparatus were concealed under cloth coverings. On a "ready" signal the subject was required to depress the "start button" with his right index finger while watching the stimulus light. As soon as the light came on the subject was required to move his finger as quickly

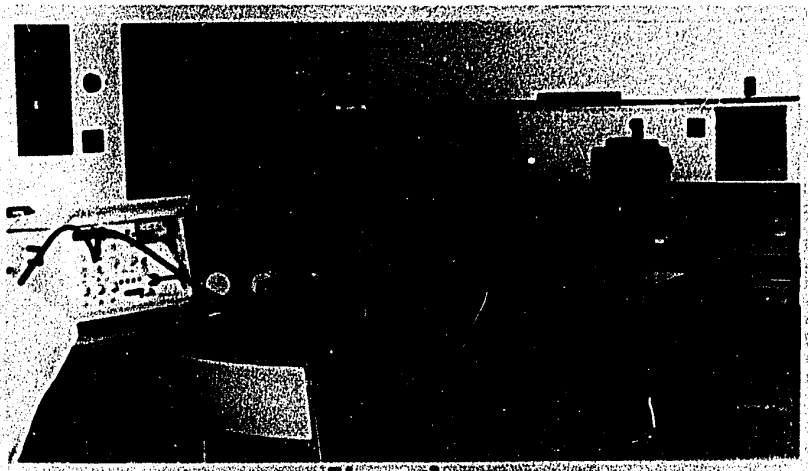

Figure 1

RT-MT Apparatus Together with Beckman RS Dynograph

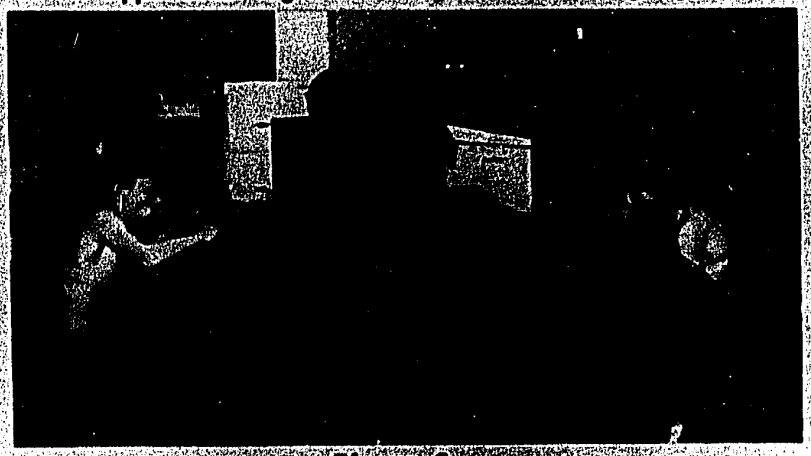

Figure 2

Coacting Subjects Performing Simple RT-MT Task

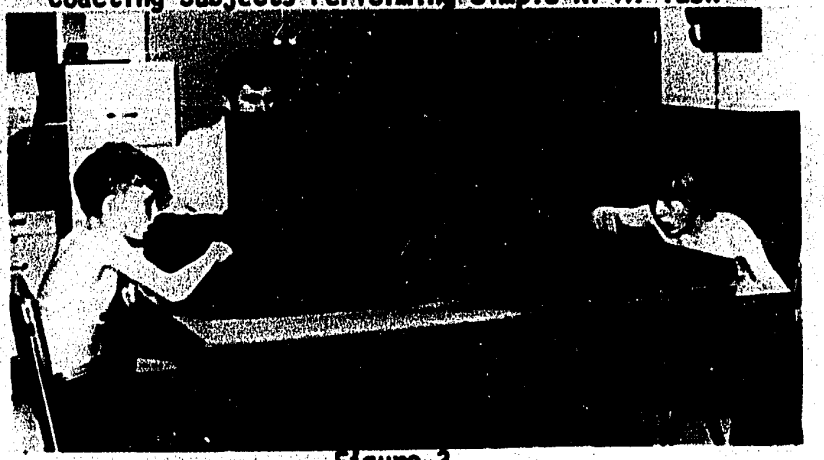

Figure 3

Coacting Subjects Performing Complex RT-MT Task

Figure 1

RT-MT Apparatus Together with Beckman RS Dynograph

Figure 2

Testing Subjects Performing Simple RT-MT Task

as possible from the "start button" to the Licon switch.

Complex RT-MT Task

The complex task (Figure 3) required the subject to respond to any one of the eight stimulus-response lights. The order of presentation was randomized so that, on every trial, each light had an equal probability of being the stimulus light.

V. PROCEDURE

The two RT-MT apparatuses together with the Beckman RS Dynograph were assembled in a large testing room at the junior high school. The subjects were randomly selected from the school population and then randomly assigned to one of the eight treatment groups. Subjects were admitted to the testing room either individually or in pairs, depending upon the experimental condition to which they were assigned. Upon entering the room each subject was ushered to a chair where he was seated and read the common instructions concerning the experiment and the physiological apparatus (Appendix A). He was then asked to relax while Sanborn heart rate electrodes were attached to his chest and back in the usual manner. A three minute rest period was given after the electrodes were attached. At the end of this time, pre-test heart rate measures were recorded. (Subsequent, fifteen-second duration, recordings of heart rate were made throughout the experiment at the end of each block of five performance trials).

The appropriate detailed instructions for the test condition were then read to the subject(s) (Appendix B). Ten randomly selected subjects from each group performed the simple task first while the remaining ten subjects in each group performed the complex task first. Also, ten subjects from each group were randomly assigned to one RT-MT apparatus (i.e., apparatus number 1) while the remaining ten were assigned to the other (i.e., apparatus number 2).

Before the presentation of the light stimulus for each trial a verbal warning signal "ready" was given by the experimenter. The interval between the warning signal and the presentation of the stimulus was randomly varied between one and five seconds. There was a twenty second interval between trials.

Upon completion of the twenty five trials on the first task, subjects were given the instructions for the second task together with the appropriate motivational instructions.

At the end of the twenty fifth trial on the second task, the electrodes were removed and the subject completed an alertness rating scale and a qualitative data questionnaire (Appendix C). Before leaving the testing room subjects were asked not to speak to their peers about the experiment. If the experimenter was asked about the purpose of the experiment he replied that he was studying the response of heart rate to different task situations. The basic purpose of the experiment was not revealed until all testing had been completed.

Approximately one week after completion of the behavioural testing, the IPAT High School Personality Questionnaire was administered to the subjects. From the one hundred and sixty four questionnaires which

were collected, the means and standard deviations were calculated for each of the fourteen factors. These were then used to convert the raw scores for each subject into sten scores.

VI. DATA ANALYSIS

The data collected for each subject included eleven heart rate scores (i.e., ten test scores and one pre-test score), twenty five simple RT scores, twenty five complex RT scores, twenty five simple MT scores, twenty five complex MT scores, a level of alertness rating for the simple task, a level of alertness rating for the complex task, and qualitative data pertaining to the experiment.

All heart rate test scores were converted to difference scores (i.e., heart rate during a performance stage - pre-test heart rate) in order to minimize the individual differences in heart rate.

Thus, there were ten heart rate scores (HR) for each subject, i.e., one for each performance stage on each of the two tasks.

The twenty five simple RT scores were blocked into five stages consisting of five trials each, e.g., Stage I (trials 1-5); Stage II (trials 6-10); Stage III (Trials 11-15); Stage IV (trials 16-20); Stage V (trials 21-25). Similarly, five stage scores were derived from the original twenty five complex RT time scores. The same procedure was followed to obtain five simple MT stage scores and five complex MT stage scores for each subject.

The analysis of the data consisted of the following procedures. The means and standard deviations for each of the five trials,

for each of the eight treatment groups, were calculated and tabulated for simple RT, complex RT, simple MT, complex MT, simple HR, and complex HR. The means and standard deviations for the alertness ratings of the eight groups on the simple and complex tasks were also calculated and tabulated.

Three way analyses of variance (ANOVA 34) were performed on the RT, MT, and HR stage scores and a two way analysis of variance (ANOVA 25) was performed on the alertness rating data. Duncan's New Multiple Range Test was carried out to determine which means were significantly different.

To gain information regarding the relationship between performance and other indicators of motivation in the study, inter-correlations between simple RT, complex RT, simple MT, complex MT, simple HR, complex HR, simple alertness, and complex alertness were calculated.

Finally, the personality profiles of the top quartile of subjects (in terms of MT performance on the simple task and on the complex task) in each treatment group were compared with the personality profiles of the bottom quartile to determine if there were any personality traits which accompanied top performance under various competitive conditions.

CHAPTER IV

RESULTS AND DISCUSSION

I. RESULTS[1]

Reaction Time

An analysis of variance for the RT data (Table I) yielded significant differences for the competition, task complexity, and stages, main effects and the task complexity x trials interaction.[2] These results in conjunction with the profiles of the various groups (Figures 4 and 5) indicate that: (a) treatment condition (i.e., level of competition) significantly affected RT performance, (b) performance was better on the simple task than on the complex task, (c) averaged over both levels of task complexity, performance improved with trials, and (d) performance improved more over trials on the complex task than on the simple task.

An application of Duncan's New Multiple Range Test to the eight competition level means (Table II) indicated that the means of the rivalry, rivalry + audience, rivalry + coaction, and rivalry + coaction + audience groups all differed significantly from the control, audience and coaction group means.

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[1] The descriptive statistics (i.e., means and standard deviations for the RT, MT, HR, and rating of alertness data) can be found in Appendix D.

[2] $p < .05$ was accepted as the criterion level for significance in this study.

TABLE I

RT: ANALYSIS OF VARIANCE

Source of Variation	Sum of Squares	Degrees of Freedom#	Mean Square	F
Between Subject	34214	159		
Competition	6302	7	900.29	4.9**
Subjects Within Groups	27912	152	183.63	
Within Subject	66530	1440		
Task Complexity	44711	1	44711.00	1105.05**
Competition x Task Complexity	213	7	30.43	<1.00
Task Complexity x Subjects Within Groups	6150	152	40.46	
Trials	569	4(1)	142.25	13.21**
Competition x Trials	184	28(7)	6.57	<1.00
Trials x Subjects Within Groups	6547	608(152)	10.77	
Task Complexity x Trials	1144	4(1)	286.00	25.36**
Competition x Task x Trials	156	28(7)	5.57	<1.00
Task x Trials x Subjects Within Groups	6856	608(152)	11.28	

** $p < .01$ *$p < .05$

#Numbers in brackets indicate the degrees of freedom for the Greenhouse and Geisser Conservative F-test.

TABLE II

RT: DUNCAN'S NEW MULTIPLE RANGE TEST

Means	Rivalry	Riv ± Aud	Riv + Co + Aud	Riv + Co	Co + Aud	Control	Audience	Coaction
	29.47	30.16	30.32	30.61	32.25	33.98*	34.12*	34.91*
29.47		.69	.85	1.14	2.78	4.51*	4.65*	5.44*
30.16			.16	.45	2.09	3.82*	3.96*	4.75*
30.32				.29	1.93	3.66*	3.80*	4.59*
30.61					1.64	3.37*	3.51*	4.30*
32.25						1.73	1.87	2.66
33.98							.14	.93
34.12								.79

(@ = .05 $S_{\bar{X}}$ = .96 Shortest Significant Ranges: R_2 = 2.66, R_3 = 2.80 R_4 = 2.90, R_5 = 2.97, R_6 = 3.02, R_7 = 3.07, R_8 = 3.10)

*P <.05

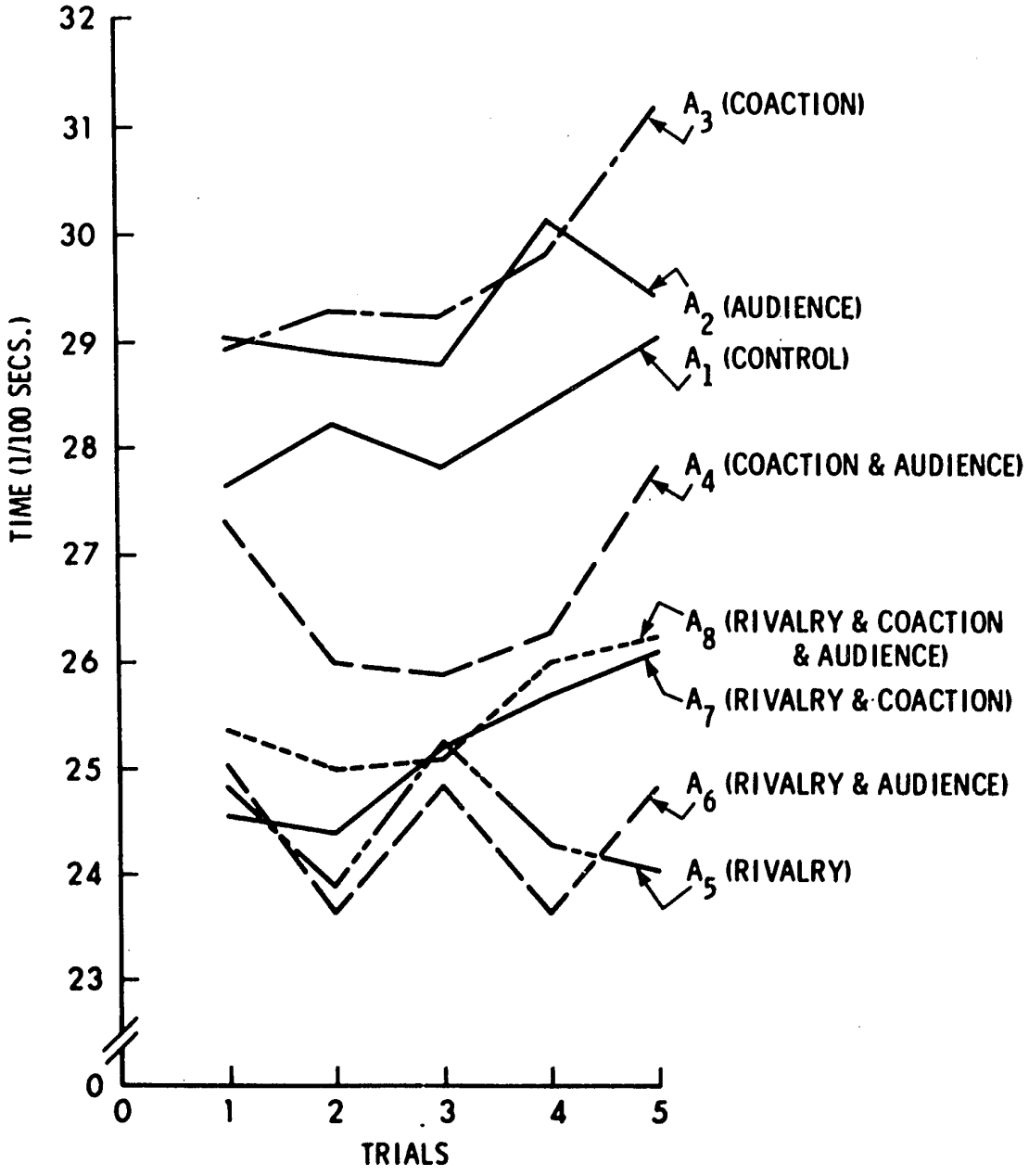

Figure 4

Simple RT: Competition x Stages Interaction

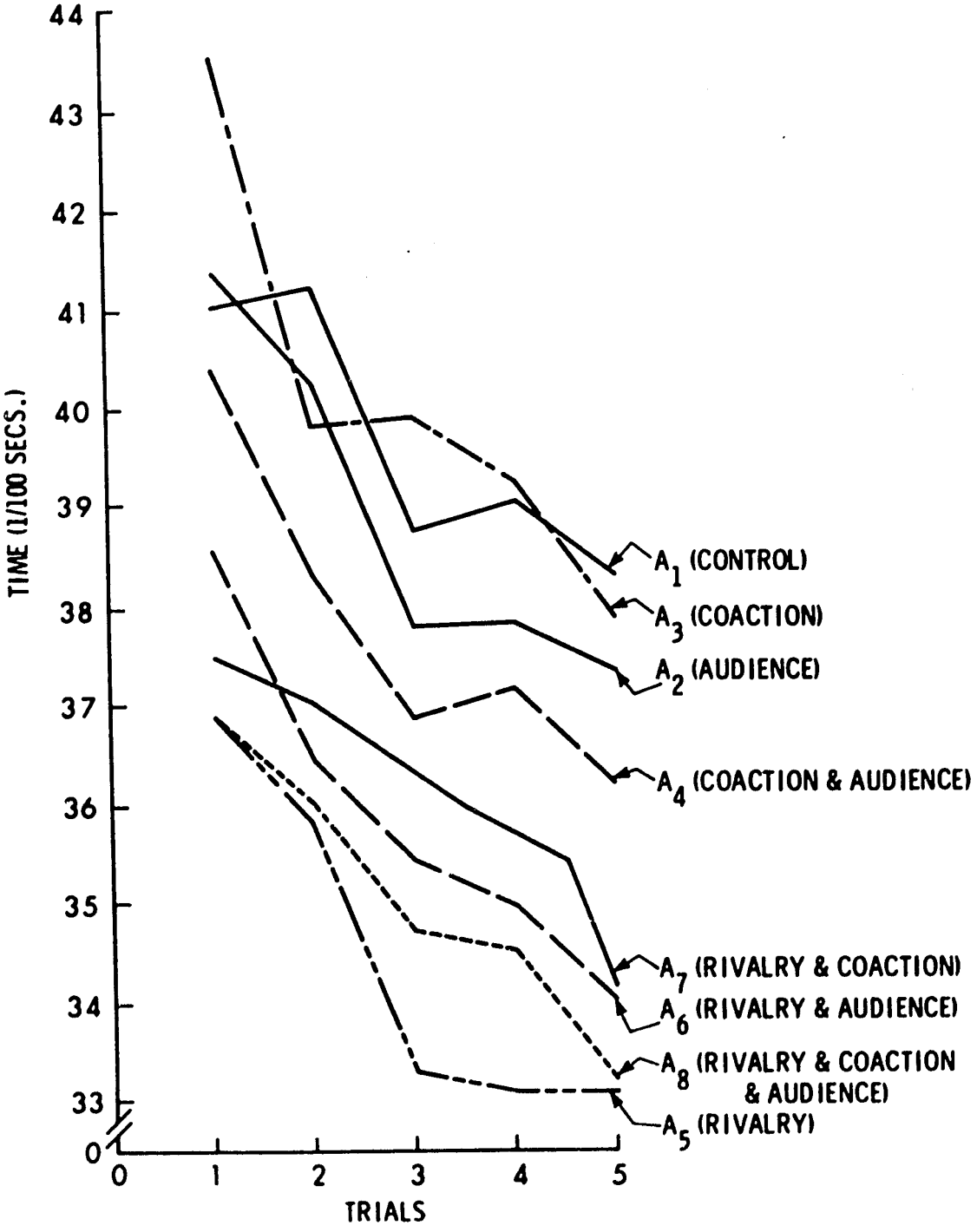

Figure 5

Complex RT: Competition x Stages Interaction

Movement Time

An analysis of variance for the MT data (Table III) yielded significant differences for the competition, task complexity, and stages main effects and the task complexity x stages, and competition x task complexity interactions. In conjunction with the performance profiles of the various groups (Figures 6 and 7), these results indicate that: (a) MT was not the same for all eight treatment groups, (b) performance was better on the simple task than on the complex task, (c) averaged over both levels of task complexity, performance improved with trials, (d) performance improved more over trials on the complex task than on the simple task, and (e) level of task complexity did not affect the performance of all eight treatment groups to the same extent.

Because the competition x task complexity interaction was significant, a test of the simple effects of task complexity for different levels of competition was performed. It was found that MT performance for all groups was significantly affected by task complexity. A summary of the analysis of variance of the simple effects is presented in Table IV.

An application of Duncan's New Multiple Range Test to the eight treatment group means (Table V) revealed that the rivalry, rivalry + audience, rivalry + coaction, and rivalry + coaction + audience groups all performed significantly better than the control, audience, and coaction + audience groups. The coaction group performed significantly better than the control group.

TABLE III

MT: ANALYSIS OF VARIANCE

Source of Variation	Sum of Squares	Degrees of Freedom#	Mean Square	F
Between Subject	86198	159		
Competition	17396	7	2485.14	5.49**
Subjects Within Groups	68802	152	452.64	
Within Subject	65989	1440		
Task Complexity	22433	1	22433.00	509.76**
Competition x Task Complexity	753	7	107.57	2.44*
Task x Subjects Within Groups	6689	152	44.01	
Trials	3906	4(1)	976.50	39.59**
Competition x Trials	696	28(7)	24.86	1.01
Trials x Subjects Within Groups	14996	608(152)	24.66	
Task x Trials	1474	4(1)	368.50	15.59**
Competition x Task x Trials	673	28(7)	24.04	1.02
Task x Trials x Subjects Within Groups	14369	608(152)	23.63	

*P < .05 **P < .01

#Numbers in brackets indicate the degrees of freedom for the Greenhouse and Geisser Conservative F-test.

TABLE IV

MT: ANALYSIS OF VARIANCE FOR SIMPLE

EFFECTS OF COMPETITION x TASK COMPLEXITY

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F
Task for Control	2715.84	1	2715.84	61.71**
Task for Audience	3942.72	1	3942.72	89.59**
Task for Coaction	1357.20	1	1357.20	248.12**
Task for Aud + Co	2408.18	1	2408.18	54.72**
Task for Rivalry	2570.44	1	2570.44	58.41**
Task for Riv + Aud	5100.50	1	5100.50	115.89**
Task for Riv + Co	2224.44	1	2224.44	50.54**
Task for Riv + Co + Aud	2865.24	1	2865.24	65.10**
Error (MS x Subjects Within Groups)	6689.00	152	44.01	

*P < .05 **P < .01

TABLE V

MT: DUNCAN'S NEW MULTIPLE RANGE TEST

Means	Riv + Co + Aud	Riv + Co	Rivalry	Riv + Aud	Coaction	Co + Aud	Audience	Control
	30.36	30.75	30.90	30.91	34.57	36.14	37.66	39.10
30.36		.39	.54	.55	4.21	5.78*	7.30*	8.74*
30.75			.15	.16	3.82	5.39*	6.91*	8.35*
30.90				.01	3.67	5.24*	6.76*	8.20*
30.91					3.66	5.23*	6.75*	8.19*
34.57						1.57	3.09	4.53*
36.14							1.52	2.96
37.66								1.44

(@ = .05, S_x = 1.5, Shortest Significant Ranges: R_2 = 4.16, R_3 = 4.38, R_4 = 4.53, R_5 = 4.63, R_6 = 4.72, R_7 = 4.79, R_8 = 4.85)

*P < .05

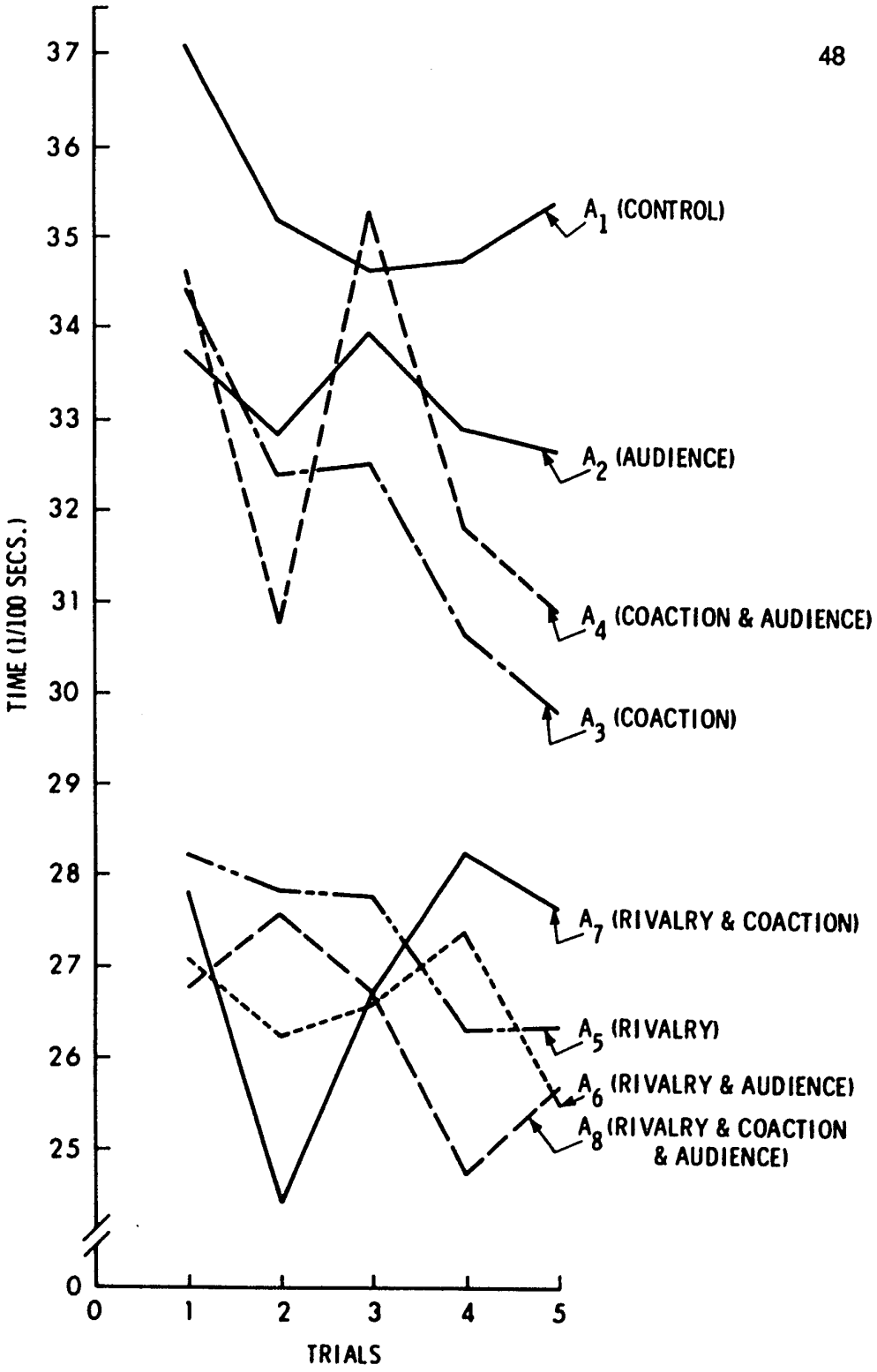

Figure 6

Simple MT: Competition x Stages Interaction

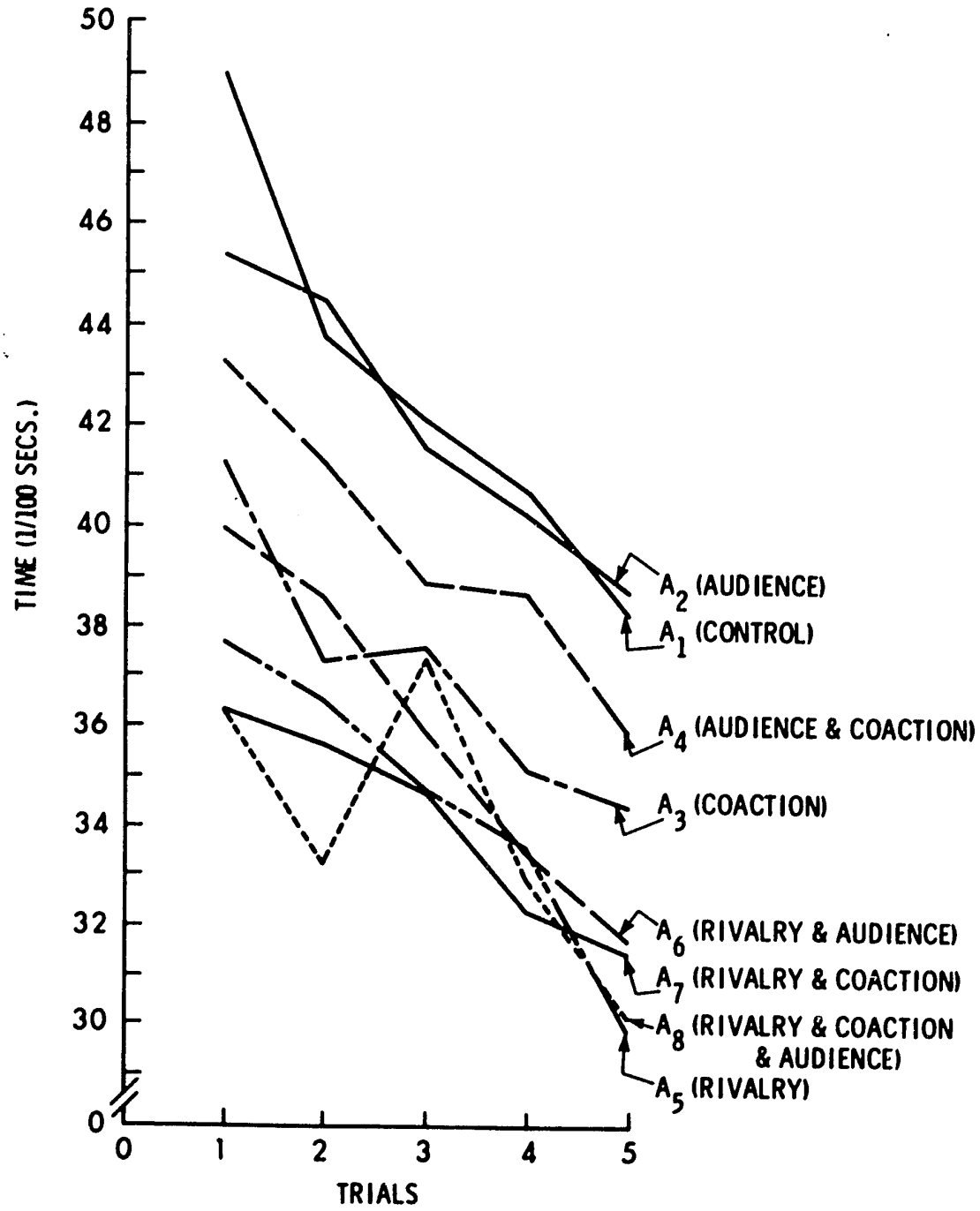

Figure 7

Complex MT: Competition x Stages Interaction

Heart Rate

An analysis of variance for the HR data (Table VI) indicated that only the three main effects were significant. Interpreted in conjunction with the graphed profiles of heart rate changes over trials for each group (Figures 8 and 9), these results indicate that: (a) the eight treatment groups did not all experience the same HR increases during performance of the tasks, (b) the simple task caused a greater increase in heart rate than did the complex task, and (c) HR increases above the resting level decreased over trials.

Through an application of Duncan's New Multiple Range Test to the HR data (Table VII), it was determined that the mean heart rate increase for the rivalry group was significantly higher than the mean HR increases for the control, audience, and rivalry + coaction groups.

TABLE VI

HR: ANALYSIS OF VARIANCE

Source of Variation	Sum of Squares	Degrees of Freedom#	Mean Square	F
Between Subjects	76575.94	159		
Competition	8110.69	7	1158.67	2.57*
Subjects Within Groups	68465.25	152	450.43	
Within Subjects	37440.44	1440		
Task Complexity	232.19	1	232.19	3.76*
Competition x Task Complexity	325.63	7	46.52	<1.00
Task Complexity x Subjects Within Groups	9375.38	152	61.68	
Trials	725.13	4(1)	181.28	8.33**
Competition x Trials	549.75	28(7)	19.63	<1.00
Trials x Subjects Within Groups	13235.56	608(152)	21.77	
Task Complexity x Trials	50.13	4(1)	12.53	<1.00
Competition x Task Complexity x Trials	584.25	28(152)	20.87	1.03
Task Complexity x Trials x Subjects Within Groups	12363.56	608	20.33	

*P < .05 **P < .01

#Numbers in brackets indicate the degrees of freedom for the Greenhouse and Geisser Conservative F-test.

TABLE VII

HR: DUNCAN'S NEW MULTIPLE RANGE TEST

Means	Audience	Riv + Co	Control	Aud + Co	Riv + Aud	Riv + Co + Aud	Coaction	Rivalry
	1.76	2.22	2.57	2.80	4.96	5.84	6.20	8.56
1.76		.46	.81	1.04	3.20	4.08	4.44	6.80*
2.22			.35	.58	2.74	3.62	3.98	6.34*
2.57				.23	2.39	3.27	3.63	5.99*
2.80					2.16	3.04	3.40	5.76*
4.96						.88	1.24	3.60
5.84							.36	2.72
6.20								2.36

(@ = .05, $S_{\bar{x}}$ = 1.5, Shortest Significant Ranges: R_2 = 4.16, R_3 = 4.38, R_4 = 4.53, R_5 = 4.63, R_6 = 4.72, R_7 = 4.79, R_8 = 4.85)

*P < .05

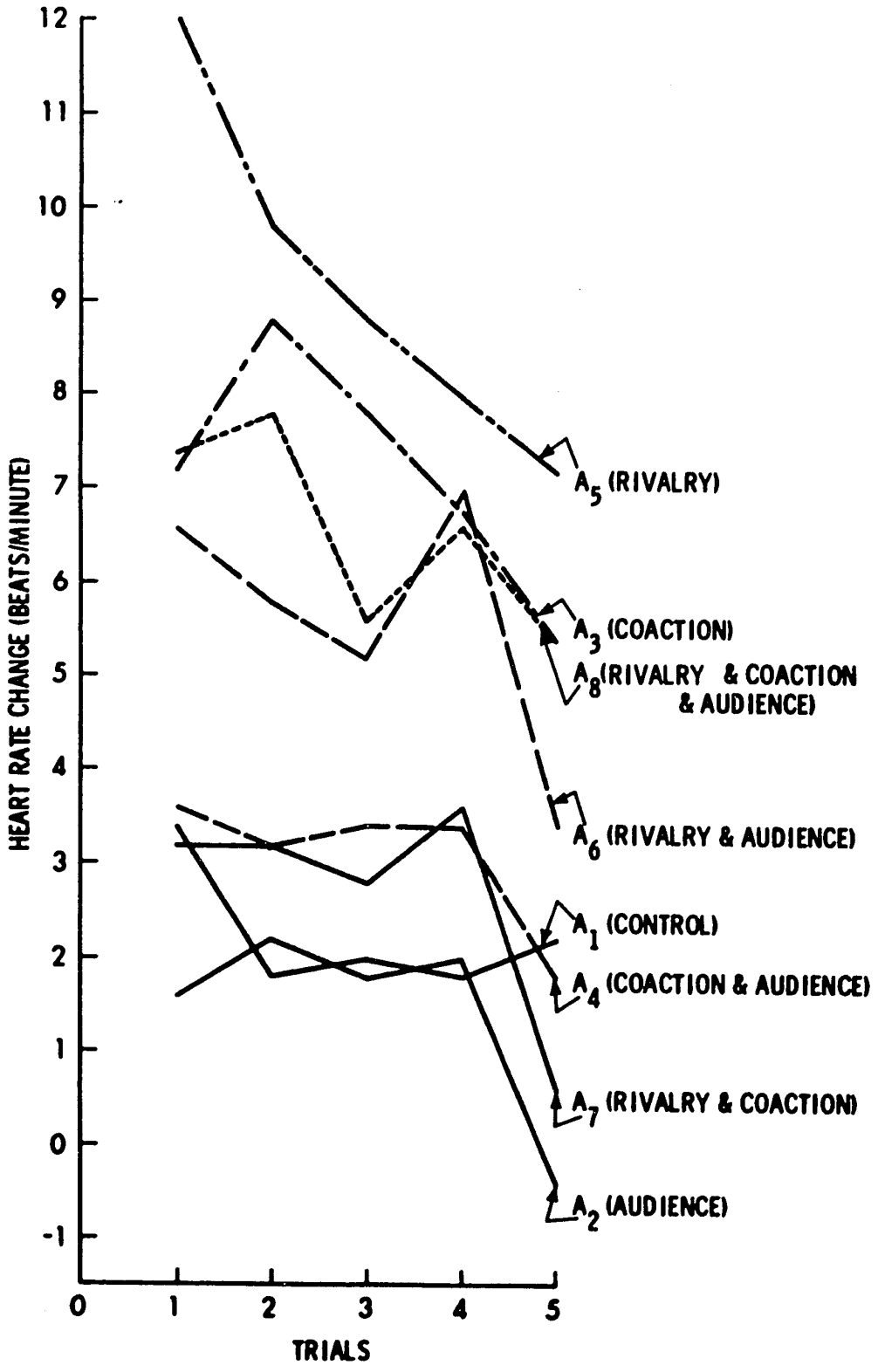

Figure 8

Simple HR: Competition x Stages Interaction

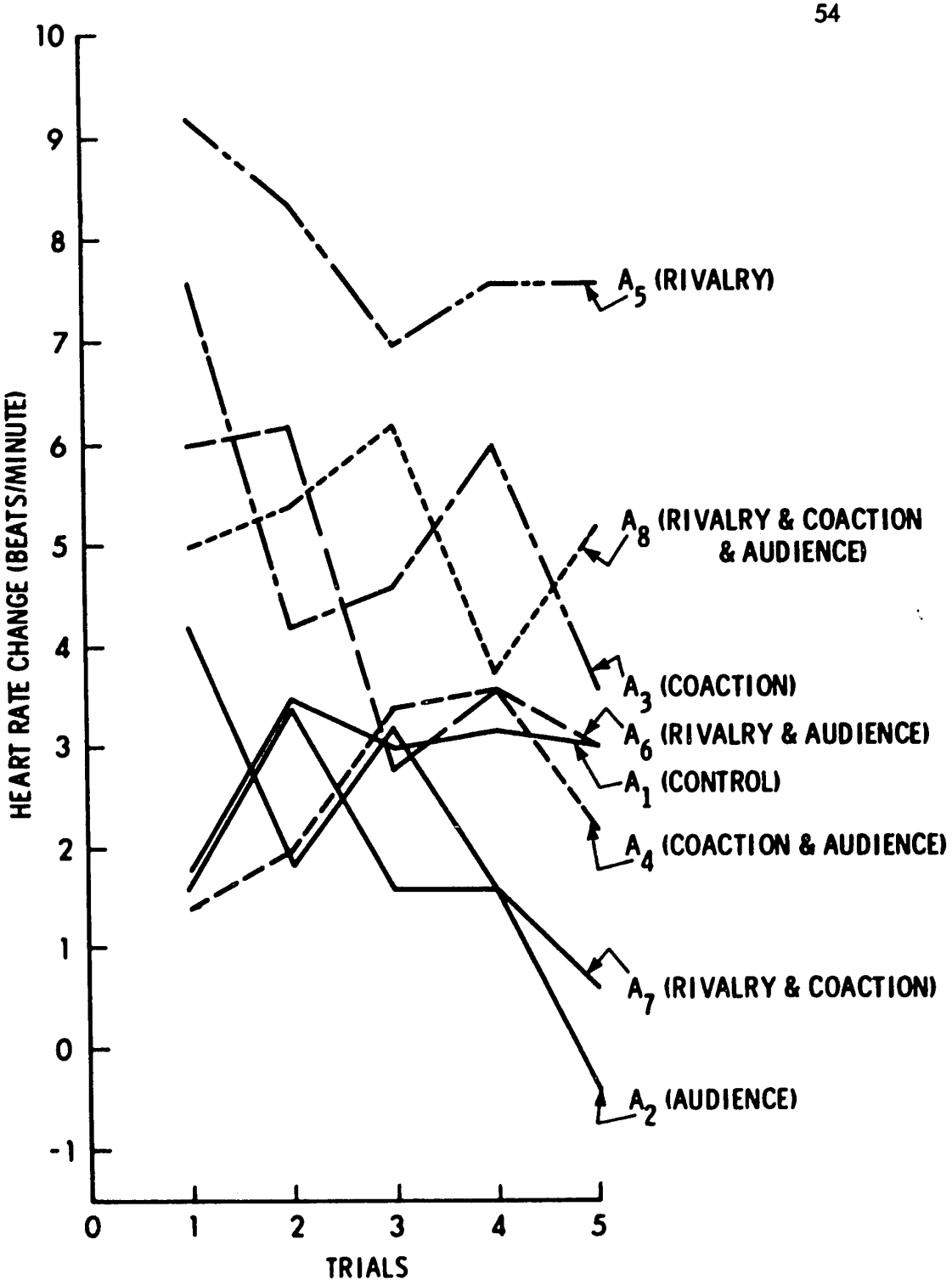

Figure 9

Complex HR: Competition x Stages Interaction

Alertness Scores

An analysis of variance of the alertness scores (Table VIII) yielded significant differences for the competition and task complexity main effects. These differences indicate that the alertness scores for the different treatment groups were not all the same and that the alertness scores were not the same for the two levels of task complexity. The graphed alertness rating means (Figure 10), together with the significant task complexity effects, indicate that subjects rated themselves as being more alert during performance of the simple task than during performance of the complex task. An application of Duncan's New Multiple Range Test (Table IX) to the means of the eight treatment groups did not reveal any pair of means to be significantly different.

TABLE VIII

ALERTNESS RATINGS: ANALYSIS OF VARIANCE

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F
Competition	40.48	7	5.78	2.37*
Task Complexity	9.45	1	9.45	3.87*
Competition x Task Complexity	4.80	7	.69	<1.00
Error	743.07	304	2.44	

*$p < .05$

TABLE IX

ALERTNESS RATINGS: DUNCAN'S NEW MULTIPLE RANGE TEST

	Riv + Aud	Rivalry	Control	Co + Aud	Audience	Riv + Co	Coaction	Riv + Co + Aud
Means	5.62	5.87	6.10	6.15	6.22	6.30	6.45	6.90
5.62		.25	.38	.53	.60	.68	.83	1.28
5.87			.23	.28	.35	.43	.58	1.03
6.10				.05	.12	.20	.35	.80
6.15					.07	.15	.30	.75
6.22						.08	.23	.68
6.30							.15	.60
6.45								.45

(@ = .05, $S_{\bar{x}}$ = .55, R_2 = 1.52, R_3 = 1.60, R_4 = 1.66, R_5 = 1.70
R_6 = 1.73, R_7 = 1.76, R_8 = 1.78)

*P < .05

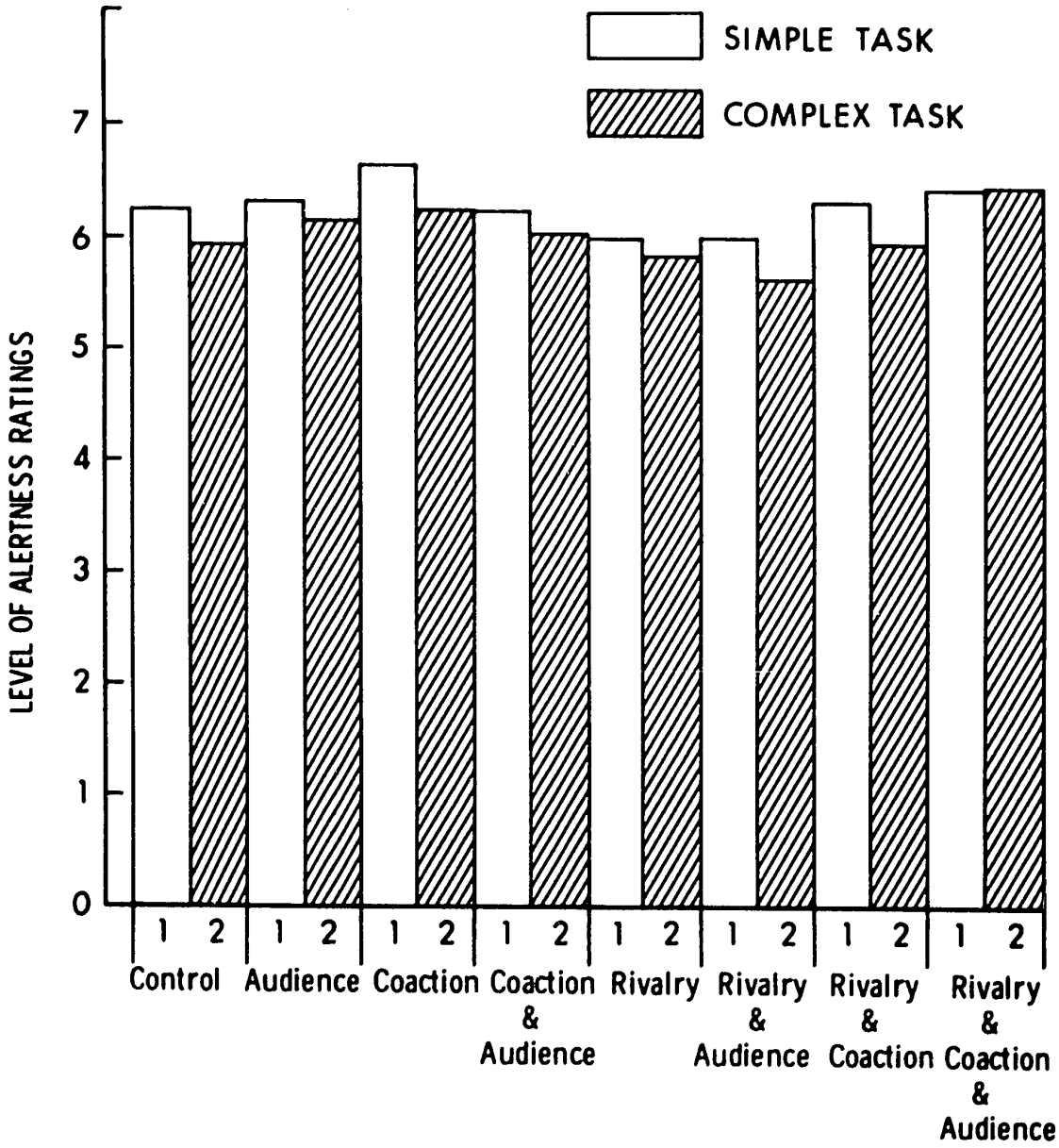

Figure 10

Simple and Complex Alertness Ratings
for Eight Treatment Groups

Correlations

The inter-correlation between the eight dependent variables are presented in Table X. Significant correlations were found between simple RT, complex RT, simple MT, and complex MT; simple HR and complex HR; simple alertness and complex alertness; simple HR and simple MT; and simple HR and complex MT.

TABLE X

CORRELATION MATRIX OF EIGHT DEPENDENT VARIABLES

	1	2	3	4	5	6	7	8
1. RT_1		.69**	.55**	.49**	-.07	-.01	-.11	-.03
2. RT_2	.69**		.43**	.45**	-.11	-.03	-.08	-.09
3. MT_1	.55**	.43**		.84**	-.18*	-.08	-.06	-.05
4. MT_2	.49**	.45**	.84**		-.25**	-.14	-.08	-.09
5. HR_1	-.07	-.11	-.18*	-.25**		.78**	.01	.01
6. HR_2	-.01	-.03	-.08	-.14	.78**		-.03	-.04
7. AR_1	-.11	-.08	-.06	-.08	.01	-.03		.64**
8. AR_2	-.03	-.09	-.05	-.09	.01	-.04	.64**	

*P < .05 **P < .01

Qualitative Data

The qualitative data obtained from the general questionnaire administered at the end of the experiment did not reveal anything detrimental to the findings of the present study. The vast majority of subjects said that they enjoyed participating in the experiment and that they tried their best on every trial. No subject indicated that he had trouble seeing any of the eight stimulus lights.

Personality Profiles

The personality profiles of the top movement time performers in each of the eight groups were compared with those of the poorest performers in the corresponding groups. Also, the profiles of good and poor performers on a composite rivalry group (i.e. groups 5, 6, 7 and 8 combined) were compared. No single personality trait was observed to consistently distinguish better performers from poorer ones under any particular treatment condition.

The personality profiles of the high and low scorers for each treatment group on the simple and complex movement time tasks can be found in Appendix E.

II. DISCUSSION

Performance Data

Rivalry. The analyses of variance and accompanying Duncan's New

Multiple Range Tests for the RT and MT data indicate that rivalry was the most significant motivational component within the competition factor. This is clearly shown by the fact that the four levels of competition, which incorporated the rivalry component, performed significantly better, in each case, than three of the four non-rivalry levels. For the RT data, only the coaction + audience condition did not significantly differ from the four rivalry conditions, while for MT only the coaction group was not significantly different.

The significant beneficial effect of rivalry upon RT concurs with the results of Church (1962) and Church, Millward, and Miller (1963). Similar positive effects of competition upon the performance of other tasks have been reported by Hurlock (1927), Moede (1931), Maller (1963), Stitt (1964), Plunkett (1967), and Wilmore (1968).

Coaction. Minimal evidence was derived from this study for the existence of a separate coaction motivational component within competition. Although the coaction group performed significantly better than the control group on the MT task, this result is difficult to interpret because of the lack of a significant difference between the coaction + audience group and the control group. One possible explanation of these results is that the significant coaction finding was a chance occurrence and that coaction was not a significant motivational factor in the study.

An alternate explanation is that coaction was in fact a significant motivational factor in the study; however, the audience had a distracting influence which hindered performance. This distracting

property of audiences is supported by Thibaut and Kelley (1954) and Jones and Gerard (1967). Although observations by the experimenter during the testing sessions would support the view that audience presence in some cases had a distracting effect upon subjects, this view is not consistent with other results from the study. If audience presence had a detrimental effect upon performance then the audience group should have performed poorer than the control group. This was not the case. Also, the RT data presents evidence contradictory to the distraction interpretation as the coaction + audience group performed better than the coaction group.

Considering all aspects of the performance results, it is concluded that little evidence of a coaction motivational component is presented in this study.

Audience. Audience presence had no significant effect upon performance. This result, although contrary to that expected on the basis of Zajonc's (1965) social facilitation theory, can be explained by Cottrell's (1968) suggested revision of the theory. According to this view, it can be argued that the audience in the present study resembled a "mere presence" condition and thus had no significant motivational effect as the subjects did not "anticipate positive or negative outcomes" from the audience.

Several procedural variables in the study support this interpretation. Firstly, when the two spectators were brought into the experimental room, the subjects were told not to pay any attention to the two observers as they were just present in the room in order to

learn the task. Secondly, the two passive observers were explicitly instructed, before entering the experimental room, to sit quietly and observe the subject's performance without disturbing him. Thirdly, the RT-MT task does not lend itself to easy subjective evaluation. It would be difficult for the subject or the observers to realize how well the subject was performing; thus evaluative apprehension on the part of the subject would be minimal.

Competition and Task Complexity. Although the competition x task complexity interaction was significant, as expected, the graphed results (Figures 4, 5, 6, 7) do not clearly support the hypothesis that the optimal arousal level for the simple task would be greater than that for the complex task. A test of the simple effects of task complexity within each level of competition (Table IV) indicated that level of task complexity had a significant effect upon MT for each of the treatment levels. The failure of an inverted-U relationship between arousal and performance to occur may be due to the fact that the "complex task" was not in actuality complex enough.

The absence of any stimulus-response incompatibility, which is known to contribute to task complexity (Fitts and Posner, 1967), lends credence to this interpretation despite the fact that the subjects had to respond to eight lights in the complex task and only one in the simple task.

More substantial evidence for competition having beneficial effects on simple tasks and detrimental effects on complex tasks was obtained by Wickens (1942), Noble et al (1958), and Bruning, Sommer, and Jones

(1966).

Competition and Rate of Learning. The failure of a significant competition x trials interaction to appear indicates that the rate of learning was not influenced by treatment conditions. This result is contrary to the results of Wankel's (1970) study, wherein competition affected the rate of learning in a stabilometer balancing task. These opposing results can be explained in terms of task differences, as the RT-MT task is much simpler than the stabilometer balancing task and scores on it are more invariant.

The nonsignificant competition x task complexity x trials interaction indicates that the different treatment conditions did not differentially affect the rate of learning the simple and complex tasks. This result may also be attributable to the total compatibility of the stimulus-response codes.

Heart Rate

The hypothesized successively higher arousal levels for the various test conditions, i.e., control, audience, coaction, coaction + audience, rivalry, rivalry $\pm$ audience, rivalry + audience, rivalry + coaction, rivalry + coaction + audience, were not supported by the HR data. The results did, however, except for two groups, tend to correspond to those of the behavioural data. For some unexplained reason, the HR of the coaction and the rivalry + coaction groups were reversed; otherwise, the HR for all rivalry conditions increased more than did those of the non-rivalry conditions (Tables VI, VII; Figures

8, 9). If the one reversal is disregarded, the results tend to support Evans' (1968) findings wherein rivalry significantly affected HR but social facilitation did not.

Audience presence did not have a significant effect upon heart rate. This is contrary to Martens' (1969) results in which palmar sweating was used as an index of arousal. The differing results may be due to any of a number of differences in the two studies: the subjects used, i.e., college students vs junior high school students; the task involved, i.e., coincident timing vs RT-MT; the size of the audience, i.e., ten vs two; or the arousal measure utilized, i.e., palmar sweating vs heart rate.

Ratings of Alertness

The alertness rating data in this study contributed little to a better understanding of competition. Although a two way analysis of variance revealed that the competition main effect was significant, Duncan's New Multiple Range Test did not locate significant differences between any of the pairs of means. This failure of cognitive alertness to accompany the competitive situation is in contradiction to Church's (1962) findings but corresponds to those of Evans (1966, 1968). These inconsistencies can logically be explained because in Church's study the same subjects performed the task under both competitive and non-competitive conditions, while in the two Evans' studies as in this study, each subject performed under only one treatment condition. Thus, Church's subjects had a reference point against which to compare their

ratings while the subjects in the other studies did not. Subjective observation of the subjects in this study indicated that they did not have a good reference point to help them in accurately rating their alertness. An interesting result is that subjects rated their alertness level higher for the simple task than for the complex task (Figure 10). This result is contrary to expectations on the basis of exploratory drive theory. Researchers in this area, e.g. Dember and Earl (1957), Fiske and Maddi (1961), and Berlyne (1966), have generally found that complex tasks are more arousing than simple tasks. The present results can be attributed to the fact that the subjects perceived that they performed faster on the simple task and thus they rated themselves as being more alert on it. This interpretation is supported by Evans' (1968) finding that alertness ratings were positively related to performance on a form-board task.

Intercorrelations

There were no meaningful significant relationships between performance, physiological arousal, and cognitive alertness in the present study.[1] Although, such correlations would be predicted on the basis

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[1] Although a significant negative correlation occurred between simple HR and simple MT, this correlation was not considered meaningful for several reasons. Firstly, the correlation was only -.18 so that less than 4 per cent of the total variance was shared by the two variables. Secondly, the simple HR-complex MT correlation, which was a non-meaningful, chance relationship, was larger than the simple HR-simple RT correlation. Finally, the experimentwise error rate in the present case was extremely high as twenty-eight separate comparisons were made and thus some significant correlations would be expected strictly on the basis of chance, (i.e., the occurrence of a Type I error was highly probable).

of social facilitation theory, the negative results are far from unique. Church (1962) found that, although both reaction time and palmar skin conductance were significantly affected by competition, the two measures did not correlate with each other. Similarly, Elliott (1965), Evans (1966), and Evans (1968) found no relationships between heart rate and performance. Positive relationships between activation and intellectual performance were reported by Hokanson and Burgess (1964), Burgess and Hokanson (1964), Doerr and Hokanson (1965), and Wood and Hokanson (1965).

This lack of relationship between heart rate and performance may be due to any of several different reasons. As was pointed out in Chapter Two, some writers (Lacey and Lacey, 1967; Taylor and Epstein, 1967) have questioned the existence of a general level of physiological arousal. Others (Lacey and Lacey, 1958; Schnore, 1959; Duffy, 1962) have suggested that one measure is not adequate to obtain an accurate assessment of activation level. Still others (Taylor and Epstein, 1967; Elliott, 1969; Elliott et al, 1970) have pointed out that situational variables must be considered in order to adequately assess the validity of physiological measures in tapping motivational intensity.

The cognitive alertness ratings in the present study did not correlate significantly with any other parameter. This negative result corresponds to those reported by Church (1962) and Evans (1966). They are contradictory to the results of Evans' (1968) study wherein alertness ratings correlated positively with performance. These inconsistent results are explainable on the basis of different task

requirements in the studies. In the Church and earlier Evans study, as in the present study, reaction time tasks were utilized; whereas, the later Evans study utilized a form board task. The tasks differ in that it is very difficult for a subject to know how well he is doing on a reaction time task while on the form board task, with repeated trials, the subject can compare his performances quite accurately.

Personality Data

The personality profiles of the good vs the poor performers on the MT tasks for each treatment condition did not contribute any meaningful information in this study. There are several possible reasons for such negative findings. Firstly, it is possible that personality is not a meaningful variable for distinguishing between good and poor competitive performers. Secondly, perhaps although certain personality traits are important in distinguishing good from poor competitors, the HSPQ is not a suitable instrument for tapping the pertinent personality variables. Finally, the inconclusive results may be due to procedural inadequacies in the current study, which if rectified could lead to meaningful results using the HSPQ.

The author tends to accept the later explanation. Previous research using the HSPQ (HSPQ Handbook, 1969) has shown it to be a useful test for distinguishing between those apt to be successful on certain types of activities, and those not apt to be successful. However, samples have been uniformly large in studies where meaningful results have been derived. Therefore, the fact that, in this study, there

were only twenty subjects in each group, within which an attempt was made to isolate good from poor performers, is probably responsible for the poor results. The various profiles of the good or poor performers were based on just four to seven subjects, thus any chance occurrences would have a profound effect upon the derived group profiles.

CHAPTER V

SUMMARY AND CONCLUSIONS

I. SUMMARY

The purpose of this study was to conceptually analyze a competitive situation into its motivational components and to investigate how these separate components influence performance on a motor task. On the basis of a review of the related literature, three separate motivational components - rivalry, coaction, and audience - were hypothesized to jointly constitute the overall motivational effects of competition.

One hundred and sixty junior high school boys were tested on a reaction time-movement time task under various combinations of the hypothesized components. The task involved two levels of difficulty, a simple task which consisted of a single stimulus light and response switch, and a complex task, which involved eight different stimulus-response switches. Twenty different boys were randomly assigned to each of the following eight treatment conditions: control, audience, coaction, coaction + audience, rivalry, rivalry + audience, rivalry + coaction, rivalry + coaction + audience.

To supplement the performance data, heart rate measures (i.e., deviation from resting levels) were taken as measures of physiological arousal and self-ratings of alertness were obtained as measures of cognitive alertness. The IPAT High School Personality Questionnaire was administered to all subjects, in an attempt to identify which, if any, personality traits distinguished between good and poor competitors.

Each subject's raw scores for reaction time, movement time, and heart rate were averaged over blocks of five trials. From the raw data for each of the three parameters, the following scores were derived for each subject: five simple reaction time mean scores, five simple movement time mean scores, five simple heart rate mean scores, five complex reaction time mean scores, five complex movement time mean scores, and five complex heart rate mean scores.

Separate 8 x 2 x 5 (competition x task complexity x trials) analyses of variance with repeated measures on the last factor were performed on the reaction time, movement time, and heart rate data. An 8 x 2 (competition x task complexity) analysis of variance was performed on the ratings of alertness.

Personality profiles were derived for the good and poor movement time performers in each of the eight treatment groups.

It was found that rivalry significantly facilitated performance; however, coaction and audience effects did not. Arousal as indicated by heart rate changes did not correlate with performance. The only significant effect upon heart rate was that due to simple rivalry (i.e., treatment group #5).

Both reaction time and movement time were faster for the simple task than for the complex task; however, heart rate changes and alertness ratings for the simple task exceeded those for the complex task.

Performance improved over trials on both the reaction time and movement time tasks while heart rate decreased over trials. There was a greater degree of learning on the complex task than on the simple task.

No personality traits were found to consistently distinguish good from poor competitors.

II. CONCLUSIONS

1. A competitive situation was demonstrated to include a strong rivalry component; however, little evidence was derived to support the existence of the hypothesized coaction and audience components.
2. The hypothesized increases in motivational intensity for the successive competitive treatments were not supported by the physiological arousal measures (i.e. heart rate changes).
3. Evidence was not derived to show that the optimal arousal level for task performance varies with the degree of task complexity nor that the optimal arousal level increases with the amount of practice.
4. The different competitive conditions did not differentially affect cognitive alertness; however, subjects rated themselves as being more alert on the simple task than on the complex task.
5. Task complexity had a major influence on performance. Performance was better on the simple task than on the complex task; however, more learning occurred with respect to the complex task than the simple task.
6. Good and poor competitors on the movement time task did not differ from each other with respect to any of the fourteen primary factors of the High School Personality Questionnaire.

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APPENDICES

APPENDIX A

GENERAL INSTRUCTIONS

GENERAL INSTRUCTIONS

I am carrying out an investigation dealing with the heart rates of junior high school boys. To do this I am going to attach electrodes to your body. You will not be hurt in any fashion as these electrodes just rest on the skin. Now would you please remove your shirt so that I can attach the electrodes to your chest.

... electrodes were attached ...

Now you can forget about the electrodes and just relax. Sit still and be as calm as possible so that your heart rate will reach a resting level. Please do not ask questions or speak until the testing session is finished and I have removed the electrodes from your body.

APPENDIX B

INSTRUCTIONS FOR DIFFERENT COMPETITIVE TREATMENT CONDITIONS

I. INSTRUCTIONS FOR CONTROL GROUP

Simple Task - Complex Task

Good, I have a record of your heart rate while resting now I want to measure it while you perform a simple task.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus which measures how long it takes you to press a switch after the light inside it comes on. I will demonstrate how it works.

... demonstrate simple task ...

Remember to keep your right index finger pressed down on the "start button" until the light comes on in the switch and then as quickly as possible move your finger to depress the illuminated switch. You must push down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to reset it and then return to the "start button" and get ready for the next trial. I will give you a warning signal before each trial. Do as well as you can on every trial, all right, let's start.

... twenty five test trials on simple task ...

Good, now I want you to do a slightly different task.

... uncover other seven switches ...

This time any one of the switches may be lit and you must move your finger as quickly as possible from the "start button" to the proper switch. Make sure that you keep the "start button" pushed down until a light comes on in one of the switches. Also, make sure that you depress the light switch until it "clicks". O.K., try and do as well as you can on every trial.

Complex Task - Simple Task

Good, I have a record of your heart rate while resting now I want to measure it while you perform a movement task.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus that measures how long it takes you to press a switch after its' light comes on. I will now demonstrate how it works.

... demonstrate complex task ...

Remember to keep your right index finger pressed down on the "start button" until one of the eight lights come on and then as quickly as possible move your finger to push down on the illuminated switch. You must press down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to re-set it and then return to the "start button" and get ready for the next trial. I will give you a warning signal before each trial. Do as well as you can on every trial, all right let's start.

... twenty five trials on complex task ...

Good, now I want you to do a slightly different task. This time we will only use one of the switches.

... cover seven switches which won't be used ...

You must do exactly as before only now you will only have one switch to watch. Remember to keep the "start button" pushed right down until the light comes on and then as quickly as you can move your finger to the light switch. Press the light switch until it "clicks". O.K., try to do as well as you can on every trial.

II. INSTRUCTIONS FOR 'AUDIENCE GROUP'

Simple Task - Complex Task

Good, I have a record of your heart rate while resting now I want to measure it while you perform a movement task. Before we begin, I will ask two boys to come in and watch so that they can learn how to do the task. Please do not pay any attention to them or talk to them but concentrate on the instructions and do as well as you can on the task.

... two boys brought in who had previously been briefed on the passive role they were to play in the experiment ...

All right, let's start.

... uncover simple Reaction Time - Movement Time apparatus ...

This is an apparatus that measures how long it takes you to press a switch after the light inside it comes on. I will now demonstrate how it works.

... demonstrate simple task ...

Remember to keep your right index finger pressed down on the "start button" until the light comes on in the switch and then as quickly as possible move your finger to push down on the illuminated switch. You must press down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to re-set it and then return to the "start button" and get ready for the next trial. I will give you a warning signal before each trial. Do as well as you can on every trial, all right let's start.

... twenty five trials on simple task ...

Good, now I want you to do a slightly different task.

... uncover other seven switches.

This time any one of the eight switches may be lit and you must move your finger as quickly as possible from the "start button" to the proper switch. Make sure that you keep the "start button" pushed down until a light comes on in one of the switches. Also, make sure that you depress the light switch until it "clicks". O.K., try to do as well as you can on every trial.

Complex Task - Simple Task

Good, I have a record of your heart rate while resting now I want to measure it while you perform a movement task. Before we begin, I will ask two boys to come in and watch so that they can learn how to do the task. Please do not pay any attention to them or talk to them but concentrate on the instructions and do as well as you can on the task.

... two boys brought in who had previously been briefed on their roles as passive spectators ...

All right, let us proceed.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus which measures how long it takes you to press a switch after the light inside it comes on. I will now demonstrate how it works.

... demonstrate complex task ...

Remember to keep your right index finger pressed down on the "start button" until one of the eight lights come on and then as quickly as possible move your finger to push down on the illuminated switch. You must press down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to reset it and then return to the "start button" and get ready for the next trial. I will give you a warning signal before each trial. Do as well as you can on every trial, all right, let's start.

... twenty five trials on complex task ...

Good, now I want you to do a slightly different task. This time we will only use one of the switches.

... cover seven switches which won't be used ...

You must do exactly as before only now you will only have one switch to watch. Remember to keep the "start button" pushed right down until the light comes on and then as quickly as you can move your finger to the light switch. Press the light switch down until it "clicks". O.K., try to do as well as you can on every trial.

III. INSTRUCTIONS FOR COACTION GROUP

Simple Task - Complex Task

Good, I have a record of your heart rate while resting, now I want to measure it while you perform a simple task.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus which measures how long it takes you to press a switch after the light inside it comes on. I will demonstrate how it works.

... demonstrate simple task ...

Remember to keep your right index finger pressed down on the "start button" until the light comes on in the switch and then as quickly as possible move your finger to depress the illuminated switch. You must push down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to reset it and then return to the "start button" and get ready for the next trial. I will give you a warning signal before each trial.

Do not worry about the other boy, it does not matter who shuts his switch off the fastest, I am just interested in your individual performance and how your heart rate reacts. Do as well as you can on every trial, all right let's start.

... twenty five test trials on simple task ...

Good, now I want you to do a slightly different task.

... uncover other seven switches ...

This time any one of the switches may be lit and you must move your finger as quickly as possible from the "start button" to the proper switch. Make sure that you keep the "start button" pushed down until a light comes on in one of the switches. Also, make sure that you depress the light switch until it "clicks". O.K., do not worry about each other, just do as well as you can on every trial.

Complex Task - Simple Task

Good, I have your resting levels now I want to measure your heart rate while you perform a movement task.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus that measures how long it takes you to press a switch after its' light comes on. I will now demonstrate how it works.

... demonstrate complex task ...

Remember to keep your right index finger pressed down on the "start button" until one of the eight lights come on and then as quickly as you can move your finger to push down on the illuminated switch. You must press down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to reset it and then return to the "start button" and get ready for the next trial. I will give you a warning signal before each trial.

Do not worry about the other boy, it does not matter who shuts off his switch the fastest. I am just interested in your individual performance and how your heart rate reacts. Do as well as you can on every trial, all right, let's start.

... twenty five trials on simple task ...

Good, now I want you to do a slightly different task. This time we will only use one of the switches.

... cover seven switches which won't be used ...

You must do exactly as before only now you will only have one switch to watch. Remember to keep the "start button" pushed right down until the light comes on and then as quickly as you can - move your finger to push the light switch. Press the light switch down until it "clicks". O.K., do not worry about each other just try to do as well as you can on every trial.

IV. INSTRUCTIONS FOR AUDIENCE PLUS COACTION GROUP

Simple Task - Complex Task

Good, I have a record of your heart rate while resting, now I want to measure it while you perform a simple task.

Now before we begin, I will ask two boys to come in and watch so that they can learn how to do the task. Please do not pay any attention to them or talk to them but concentrate on the instructions and do as well as you can on the task.

... two boys brought in who had been previously briefed on the passive role they were to play in the experiment ...

All right, let's begin.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus which measures how long it takes you to press a switch after the light inside it comes on. I will demonstrate how it works.

... demonstrate simple task ...

Remember to keep your right index finger pressed down on the "start button" until the light comes on in the switch and then as quickly as possible move your finger to depress the illuminated switch. You must push down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to reset it and then return to the "start button" and get ready for the next trial. I will give you a warning signal before each trial.

Do not worry about the other boy, it does not matter who shuts his switch off the fastest, I am just interested in your individual performance and how your heart rate reacts. Do as well as you can on every trial. All right, let's begin.

... twenty five test trials on simple task ...

Good, now I want you to do a slightly different task.

... uncover other seven switches ...

This time any one of the switches may be lit and you must move your finger as quickly as possible from the "start button" to the proper switch. Make sure that you keep the "start button" pushed down until a light comes on in one of the switches. Also, make sure that you depress the light switch until it "clicks". O.K., try and do as well as you can on every trial.

Complex Task - Simple Task

Good, I have a record of your heart rate while resting now I want to measure it while you perform a movement task. Before we begin, I will ask two boys to come in and watch so that they can learn how to do the task. Please do not pay any attention to them or talk to them but concentrate on the instructions and do as well as you can on the task.

... two boys brought in who had been previously briefed on the passive role they were to play in the experiment ...

All right, let's begin.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus which measures how long it takes you to press a switch after its' light comes on. I will now demonstrate how it works.

... demonstrate complex task ...

Remember to keep your right index finger pressed down on the "start button" until one of the eight lights come on and then as quickly as possible move your finger to push down on the illuminated switch. You must press down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to reset it and then return to the "start button" and get ready for the next trial. I will give you a warning signal before each trial.

Do not worry about the other boy, it does not matter who shuts his switch off the fastest, I am just interested in your individual performance and how your heart rate reacts. Do as well as you can on every trial, all right, let's begin.

... twenty five trials on complex task ...

Good, now I want you to do a slightly different task. This time we will only use one of the switches.

... cover seven switches which won't be used ...

You must do exactly as before only now you will only have one switch to watch. Remember to keep the "start button" pushed right down until the light comes on and then as quickly as you can move your finger to push the switch. Press down on the switch until it "clicks". O.K., do not worry about each other just do as well as you can on every trial.

V. INSTRUCTIONS FOR RIVALRY GROUP

Simple Task - Complex Task

Good, I have a record of your heart rate while resting now I want to measure it while you perform a simple task.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus which measures how long it takes you to press a switch after the light inside it comes on. I will demonstrate how it works.

... demonstrate simple task ...

Remember to keep your right index finger pressed down on the "start button" until the light comes on in the switch and then as quickly as possible move your finger to depress the illuminated switch. You must push down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to reset it and then return to the "start button" and get ready for the next trial. I will give you a warning signal before each trial.

As you probably know, I have been testing other boys in the school on this task. I want to compare your scores with those of other boys in the school so try to do your best so that you will score better than the others. I will post the results of the study later so try to do your best so that your name will be near the top of the list. All right, let's begin.

... twenty five trials on simple task ...

Good, now I want you to do a slightly different task.

... uncover other seven switches ...

This time any one of the switches may be lit and you must move your finger as quickly as possible from the "start button" to the proper switch. Make sure that you keep the "start button" pushed down until a light comes in one of the switches. Also, make sure that you depress the light switch until it "clicks".

Remember that you are competing against the scores of other boys in the school. Try to do your best so that your name will be near the top of the results list. O.K., let's start.

Complex Task - Simple Task

Good, I have a record of your heart rate while resting now I want to measure it while you perform a movement task.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus that measures how long it takes you to press a switch after its' light comes on. I will now demonstrate how it works.

... demonstrate complex task ...

Remember to keep your right index finger pressed down on the "start button" until one of the eight lights come on and then as quickly as possible move your finger to push down on the illuminated switch. You must press down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to reset it and then return to the "start button" and get ready for the next trial. I will give you a warning signal before each trial.

As you probably know, I have been testing other boys in the school on this task. I want to compare your scores with those of other boys in the school so try to do your best so that you will score better than the others. I will post the results of the study later so try to do your best so that your name will be near the top of the list. All right, let's start.

... twenty five trials on complex task ...

Good, now I want you to do a slightly different task. This time we will only use one of the switches.

... cover seven switches that won't be used ...

You must do exactly as before only now you will only have one switch to watch. Remember to keep the "start button" pushed right down until the light comes on and then as quickly as you can move your finger to the switch. Press the light switch down until it "clicks".

Remember that you are competing against the scores of other boys in the school. Try to do your best so that your name will be near the top of the results list. O.K., let's start.

VI. INSTRUCTIONS FOR AUDIENCE PLUS RIVALRY GROUP

Simple Task - Complex Task

Good, I have a record of your heart rate while resting now I want to measure it while you perform a simple task. Before we begin, I will ask two boys to come in and watch so that they can learn how to do the task. Please do not pay any attention to them or talk to them but concentrate on the instructions and do as well as you can on the task.

... two boys brought in who had previously been briefed on the passive role they were to play in the experiment ...

All right, let us proceed.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus which measures how long it takes you to press a switch after the light inside it comes on. I will now demonstrate how it works.

... demonstrate simple task ...

Remember to keep your right index finger pressed down on the "start button" until the light comes on in the switch and then as quickly as possible move your finger to depress the illuminated switch. You must push down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to reset it and then return to the "start button" to get ready for the next trial. I will give you a warning signal before each trial.

As you probably know, I have been testing other boys in the school on this task. I want to compare your scores with those of other boys in the school so try to do your best so that you will score better than the others. I will post the results of the study later so try to do your best so that your name will be near the top of the list. All right, let's start.

... twenty five trials on simple task ...

Good, now I want you to a slightly different task.

... uncover other seven switches ...

This time any one of the switches may be lit and you must move your finger as quickly as possible from the "start button" to the proper switch. Make sure that you keep the "start button" pushed down until a light comes on in one of the switches. Also, make sure that you depress the switch until it "clicks". Remember that you are competing against other boys' scores. Try to do your best so that your name will be near the top of the results list. O.K., let's start.

Complex Task - Simple Task

Good, I have a record of your heart rate while resting now I want to measure it while you perform a movement task. Before we begin, I will ask two boys to come in and watch so that they can learn how to do the task. Please do not pay any attention to them or talk to them but concentrate on the instructions and do as well as you can on the task.

... two boys brought in who had previously been briefed on the passive role they were to play in the experiment ...

All right let us proceed.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus that measures how long it takes you to press a switch after its' light comes on. I will now demonstrate how it works.

... demonstrate complex task ...

Remember to keep your right index finger pressed down on the "start button" until one of the eight lights comes on and then as quickly as possible move your finger to push down on the illuminated switch. You must press down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to reset it and then return to the "start button" to get ready for the next trial. I will give you a warning signal before each trial.

As you probably know, I have been testing other boys in the school on this task. I want to compare your scores with those of other boys in the school so try to do your best so that you will score better than the others. I will post the results of the study later so try to do your best so that your name will be near the top of the list. All right, let's start.

... twenty five trials on complex task ...

Good, now I want you to a slightly different task. This time we will only use one of the switches.

... cover seven switches which won't be used ...

You must do exactly as before only now you will only have to watch one switch. Remember to keep the "start button" pushed right down until the light comes on and then as quickly as you can move your finger to the light switch. Press the light switch until it "clicks".

Remember that you are competing against the scores of other boys. Try to do your best so that your name will be near the top of the results list. O.K., let's start.

VII. INSTRUCTIONS FOR RIVALRY PLUS COACTION GROUP

Simple Task - Complex Task

Good, I have a record of your heart rate while resting now I want to measure it while you perform a simple task.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus that measures how long it takes you to press a switch after the light inside it comes on. I will demonstrate how it works.

... demonstrate simple task ...

Remember to keep your right index finger pressed down on the "start button" until the light comes on in the switch and then as quickly as possible move your finger to depress the illuminated switch. You must push down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to reset it and then return to the "start button" and get ready for the next trial. I will give you a warning signal before each trial.

I want to see which of you can do best on this task so try to do better than your partner on every trial. Later I will post the results indicating who won the contest and what your times were. Also, as you probably know, I have been testing other boys in the school. You are competing with their scores as well as I will post a list of the times of all the boys in the school. Do your best so that you not only beat your partner but so that your name will be as high up on the school list as possible.

... twenty five test trials on the simple task ...

Good, now I want you to do a slightly different task.

... uncover other seven switches ...

This time any one of the switches may be lit and you must move your finger as quickly as possible from the "start button" to the proper switch. Make sure that you keep the "start button" pushed down until a light comes on in one of the switches. Also, make sure that you depress the light switch until it "clicks".

Try to do as well as you can so that you will win the contest with your partner and so that your name will be high up on the school list.

Complex Task - Simple Task

Good, I have a record of your heart rate while resting now I want to measure it while you perform a movement task.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus that measures how long it takes you to press a switch after its' light comes on. I will now demonstrate how it works.

... demonstrate complex task ...

Remember to keep your right index finger pressed down on the "start button" until one of the eight lights comes on and then as quickly as possible move your finger to depress the illuminated switch. You must press down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to reset it and then return to the "start button" and get ready for the next trial. I will give you a warning signal before each trial.

I want to see which of you can do best on this task so try to do better than your partner on every trial. Later I will post the results indicating who won the contest and what your times were. Also, as you probably know, I have been testing other boys in the school. You are competing against their scores as well as I will post a list of the times of all the boys in the school. Do your best so that you not only beat your partner but so that your name will be as high on the school list as possible.

... twenty five test trials on the complex task ...

Good, now I want you to do a slightly different task. This time we will only use one of the switches.

... cover seven switches which won't be used ...

You must do exactly as before only now you will only have one switch to watch. Remember to keep the "start button" pushed right down until the light comes on and then as quickly as possible move your finger to the light switch. Press down on the light switch until it "clicks".

Try to do as well as you can so that you will win the contest with your partner and so that your name will be high up on the school list.

VIII. INSTRUCTIONS FOR AUDIENCE PLUS COACTION PLUS RIVALRY GROUP

Simple Task - Complex Task

Good, I have a record of your heart rate while resting now I want to measure it while you perform a simple task. Before we begin I will ask two boys to come in and watch so that they can learn how to do the task. Please do not pay any attention to them or talk to them but concentrate on the instructions and do as well as you can on the task.

... two boys brought in who had been previously briefed on the passive role they were to play in the experiment ...

All right, let's begin.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus that measures how long it takes you to press a switch after its' light comes on. I will now demonstrate how it works.

... demonstrate simple task ...

Remember to keep your right index finger pressed down on the "start button" until the light comes on in the switch and then as quickly as possible move your finger to depress the illuminated switch. You must push down on the switch until it "clicks". The light will not go off immediately but do not worry about it as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to re-set it and then return to the "start button" to get ready for the next trial. I will give you a warning signal before each trial.

I want to see which of you can do best on this task so try to do better than your partner on every trial. Later I will post the results indicating who won the contest and what your times were. Also, as you probably know, I have been testing other boys in the school. You are competing with their scores as well as I will post a list of the times of all the boys in the school. Do your best so that you not only beat your partner but so that your name will be as high up on the school list as possible.

... twenty five test trials on the simple task ...

Good, now I want you to do a slightly different task.

... uncover other seven switches ...

This time any one of the switches may be lit and you must move your finger as quickly as possible from the "start button" to the proper switch. Make sure that you keep the "start button" pushed down until a light comes on in one of the switches. Also, make sure that you depress the light switch until it "clicks". Try to do as well as you can so that you will win the contest with your partner and so that your name will be high on the school list.

Complex Task - Simple Task

Good, I have a record of your heart rate while resting now I want to measure it while you perform a motor task. Before we begin I will ask two boys to come in and watch so that they can learn how to do the task. Please do not pay any attention to them or talk to them but concentrate on the instructions and do as well as you can on the task.

... two boys brought in who had been previously briefed on the passive role they were to play in the experiment ...

All right, let's begin.

... uncover Reaction Time - Movement Time apparatus ...

This is an apparatus that measures how long it takes you to press a switch after its' light comes on. I will now demonstrate how it works.

... demonstrate complex task ...

Remember to keep your right index finger pressed down on the "start button" until one of the eight lights comes on and then as quickly as possible move your finger to depress the illuminated switch. You must press down on the switch until it "clicks". The light will not go off immediately but do not worry as the clock will stop when the switch "clicks". When the light has gone off push the switch once more to reset it and then return to the "start button" to get ready for the next trial. I will give you a warning signal before each trial.

I want to see which of you can do best on this task so try to do better than your partner on every trial. Later I will post the results indicating who won the contest and what your times were. Also, as you probably know, I have been testing other boys in the school. You are competing with their scores as well as I will post a list of the times of all the boys in the school. Do your best so that you not only beat your partner but so that your name will be as high up on the school list as possible.

... twenty five test trials on the complex task ...

Good, now I want you to do a slightly different task. This time we will only use one of the switches.

... cover seven switches which won't be used.

You must do exactly as before only now you will only have one switch to watch. Remember to keep the "start button" pushed right down until the light comes on and then as quickly as possible move your finger to the light switch. Press down on the light switch until it "clicks".

Try to do as well as you can so that you will win the contest with your partner and so that your name will be high up on the school list.

APPENDIX C

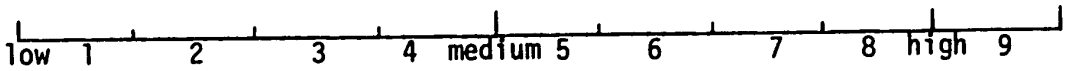
RATING SCALE FOR ALERTNESS

AND QUALITATIVE DATA QUESTIONNAIRE

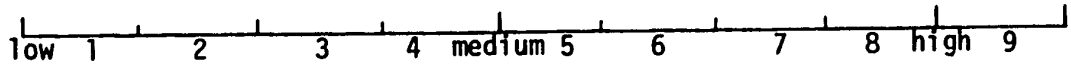
RATING SCALE FOR ALERTNESS

Please rate your level of alertness during

(a) The Simple Task



(b) The Complex Task



QUALITATIVE DATA QUESTIONNAIRE

1. Did you enjoy participating in this experiment? ___yes, ___no.
2. Were you bored during the experiment? ___yes, ___no.
3. Do you think that you could do better on this task if given another chance? ___yes, ___no.
4. Did you have difficulty seeing any of the lights? ___yes, ___no.
5. Did you hurt your finger on any of the switches? ___yes, ___no.
6. Did you try your best on every trial? ___yes, ___no.
7. Had you heard about this experiment before coming to the experimental room? ___yes, ___no.
8. If answer to question seven is yes comment briefly on what you heard.

_____

_____

_____

_____

_____

_____

APPENDIX D

DESCRIPTIVE STATISTICS

DESCRIPTIVE STATISTICS: SIMPLE RT

Group	First		Second		Third		Fourth		Fifth	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Control	27.65	5.18	28.25	5.66	27.85	4.99	28.45	5.01	29.05	5.58
Audience	29.05	6.85	28.90	6.60	28.80	6.76	30.15	8.02	29.45	7.57
Coaction	28.95	5.39	29.30	6.27	29.25	5.73	29.85	4.17	31.20	8.39
Co + Aud	27.35	6.94	26.00	4.25	25.90	4.11	26.30	5.69	27.85	6.05
Rivalry	24.85	6.10	23.90	3.34	25.25	4.52	24.30	3.64	24.15	4.56
Riv + Aud	25.05	3.72	23.65	3.20	24.85	4.06	23.65	2.94	24.85	3.86
Riv + Co	24.55	3.15	24.40	4.25	25.20	4.69	25.70	4.44	26.10	5.31
Riv + Co + Aud	25.35	4.91	25.00	3.77	25.10	3.71	26.00	4.86	26.25	3.80

DESCRIPTIVE STATISTICS: COMPLEX RT

Group	First		Second		Third		Fourth		Fifth	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Control	41.05	8.47	41.25	7.83	38.80	7.37	39.10	7.11	38.35	6.16
Audience	41.40	8.12	40.30	5.97	37.85	5.54	37.90	5.28	37.40	6.39
Coaction	43.55	7.23	39.85	3.96	39.95	4.16	39.30	5.48	37.95	4.97
Co + Aud	40.45	7.99	38.35	7.01	36.90	6.72	37.20	5.87	36.25	7.36
Rivalry	36.90	5.15	35.85	4.50	33.30	5.05	33.10	4.38	33.10	4.35
Riv + Aud	38.60	6.87	36.45	5.35	35.45	4.81	35.00	4.79	34.05	4.35
Riv + Co	37.50	6.99	37.05	5.38	36.00	5.39	35.45	5.24	34.15	4.49
Riv + Co + Aud	36.90	5.48	36.05	5.35	34.75	4.61	34.55	4.89	33.25	5.52

DESCRIPTIVE STATISTICS: SIMPLE MT

Group	First $\bar{X}$	First S.D.	Second $\bar{X}$	Second S.D.	Third $\bar{X}$	Third S.D.	Fourth $\bar{X}$	Fourth S.D.	Fifth $\bar{X}$	Fifth S.D.
Control	37.10	10.56	35.20	9.13	34.65	10.06	34.75	8.77	35.35	10.88
Audience	33.75	7.72	32.85	7.31	33.95	9.13	32.90	8.30	32.65	10.38
Coaction	34.45	8.89	32.40	7.29	32.50	8.89	30.65	6.63	29.80	6.83
Co + Aud	34.65	10.01	30.75	8.05	35.25	9.29	31.80	8.65	30.90	8.25
Rivalry	28.25	6.45	27.85	5.62	27.80	6.22	26.30	5.22	26.35	5.11
Riv + Aud	27.65	8.17	24.45	5.20	26.75	7.77	24.75	6.04	25.70	5.02
Riv + Co	26.80	6.17	27.60	7.39	26.75	7.14	28.25	7.76	27.65	6.70
Riv + Co + Aud	27.10	8.50	26.25	8.63	26.60	5.27	27.40	7.07	25.50	6.19

DESCRIPTIVE STATISTICS: COMPLEX MT

Group	First $\bar{X}$	First S.D.	Second $\bar{X}$	Second S.D.	Third $\bar{X}$	Third S.D.	Fourth $\bar{X}$	Fourth S.D.	Fifth $\bar{X}$	Fifth S.D.
Control	49.00	16.02	43.80	10.96	42.15	9.39	40.70	11.45	38.25	9.98
Audience	45.40	10.24	44.55	9.01	41.55	6.64	40.30	8.91	38.70	11.22
Coaction	41.35	8.99	37.35	8.24	37.60	8.00	35.15	6.16	34.40	5.91
Co + Aud	43.30	7.50	41.30	7.48	38.90	7.55	38.65	8.40	35.90	9.81
Rivalry	37.70	8.15	36.45	8.73	34.75	6.82	33.60	7.11	29.90	6.74
Riv + Aud	40.00	8.52	38.60	7.39	35.95	9.72	33.50	8.70	31.75	7.73
Riv + Co	36.35	8.61	35.65	8.64	34.65	7.51	32.30	6.52	31.45	8.32
Riv + Co + Aud	36.35	7.45	33.20	7.04	37.30	11.42	32.95	8.24	30.90	7.02

DESCRIPTIVE STATISTICS FOR HR ON SIMPLE TASK

Group	First		Second		Third		Fourth		Fifth	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Control	3.40	6.65	1.80	5.73	2.00	7.17	1.80	8.36	2.20	7.40
Audience	1.60	9.75	2.20	8.36	1.80	7.51	2.00	7.51	-.40	9.70
Coaction	7.20	9.41	8.80	9.32	7.80	9.84	6.80	8.01	5.40	7.02
Co + Aud	3.60	9.87	3.20	9.85	3.40	9.20	3.40	9.91	1.80	5.27
Rivalry	12.00	8.51	9.80	7.05	8.80	7.74	8.00	5.95	7.20	7.52
Riv + Aud	6.60	8.03	5.80	6.80	5.20	5.67	7.00	9.07	3.40	6.26
Riv + Co	3.20	7.63	3.20	6.82	2.80	5.37	3.60	7.88	.60	10.48
Riv + Co + Aud	7.40	12.86	7.80	11.93	5.60	14.12	6.60	12.26	5.40	9.73

DESCRIPTIVE STATISTICS FOR HR ON COMPLEX TASK

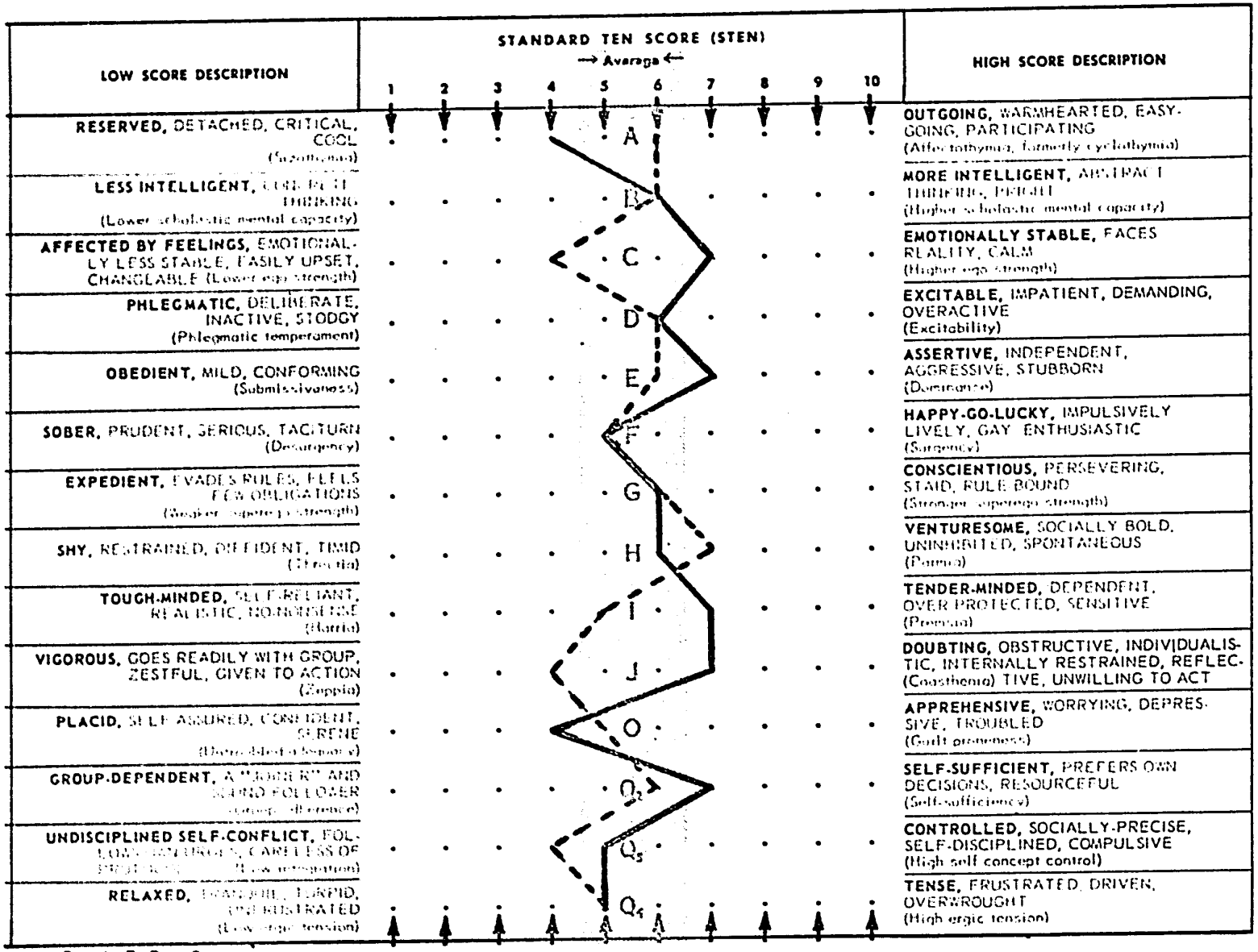
Group	First		Second		Third		Fourth		Fifth	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Control	1.80	7.16	3.50	7.28	3.00	5.33	3.20	7.41	3.00	6.34
Audience	4.20	6.92	1.80	6.68	3.20	6.82	1.60	7.94	-.40	8.20
Coaction	7.60	8.09	4.20	8.75	4.60	7.49	6.00	7.62	3.60	8.20
Co + Aud	1.40	9.99	2.00	8.26	3.40	7.37	3.60	11.82	2.20	8.94
Rivalry	9.20	10.63	8.40	7.44	7.00	6.97	7.60	7.44	7.60	6.98
Riv + Aud	6.00	8.66	6.20	8.65	2.80	7.80	3.60	7.10	3.00	6.60
Riv + Co	1.60	7.04	3.40	6.65	1.60	5.41	1.60	6.67	.60	6.78
Riv + Co + Aud	5.00	6.85	5.40	8.83	6.20	8.05	3.80	7.84	5.20	8.91

DESCRIPTIVE STATISTICS FOR ALERTNESS SCORES

Group	Simple Task $\bar{X}$	Simple Task S.D.	Complex Task $\bar{X}$	Complex Task S.D.
Control	6.25	1.25	5.95	1.39
Audience	6.30	1.30	6.15	1.63
Coaction	6.65	1.50	6.25	1.65
Coaction + Audience	6.25	1.94	6.05	1.70
Rivalry	6.00	1.69	5.75	1.94
Rivalry + Audience	6.00	1.12	5.25	1.52
Rivalry + Coaction	6.65	1.63	5.95	1.90
Rivalry + Coaction + Audience	6.90	1.25	6.90	1.25

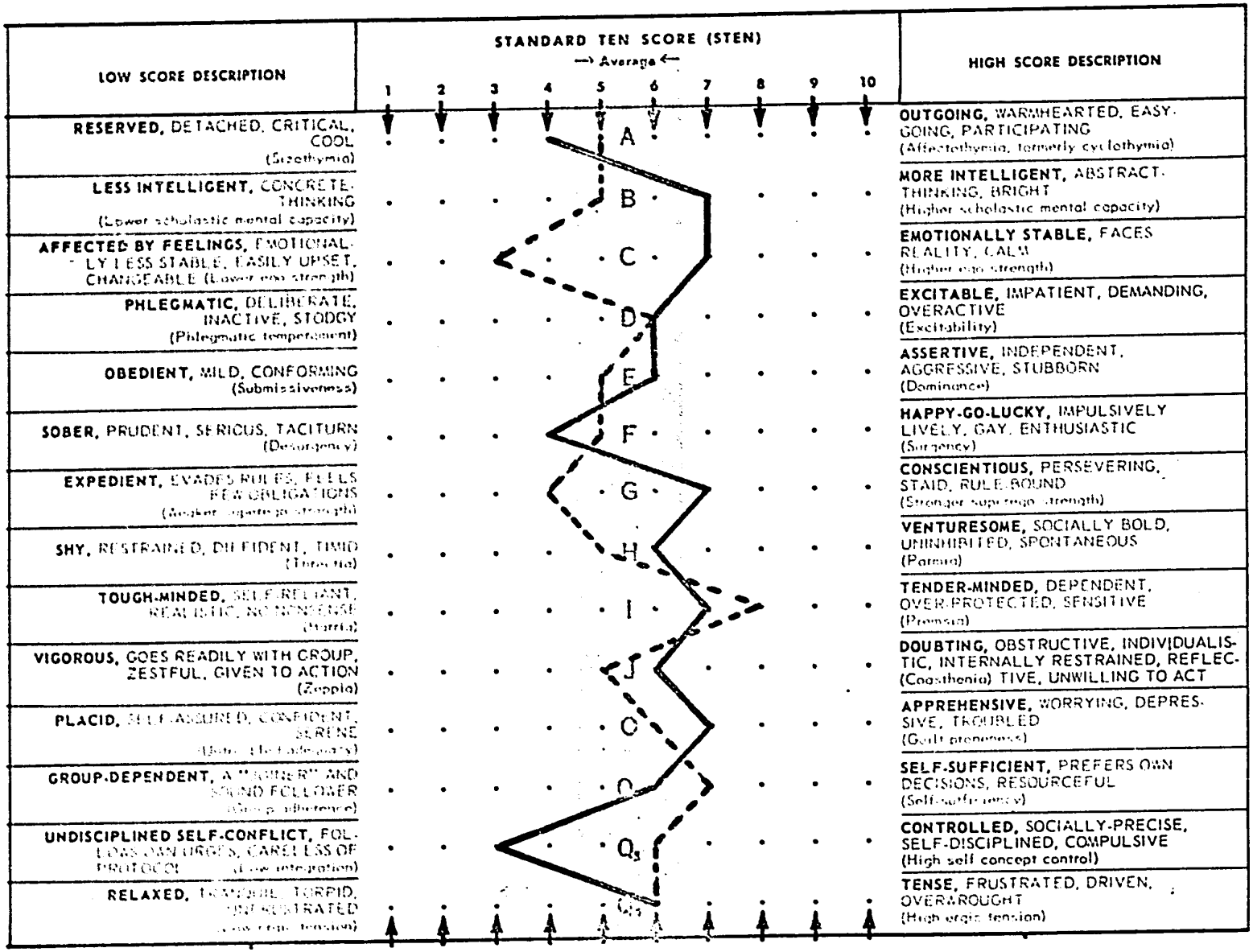
APPENDIX E

HIGH SCHOOL PERSONALITY PROFILES OF GOOD VS POOR PERFORMERS ON SIMPLE AND COMPLEX MOVEMENT TIME TASK FOR EIGHT TREATMENT CONDITIONS



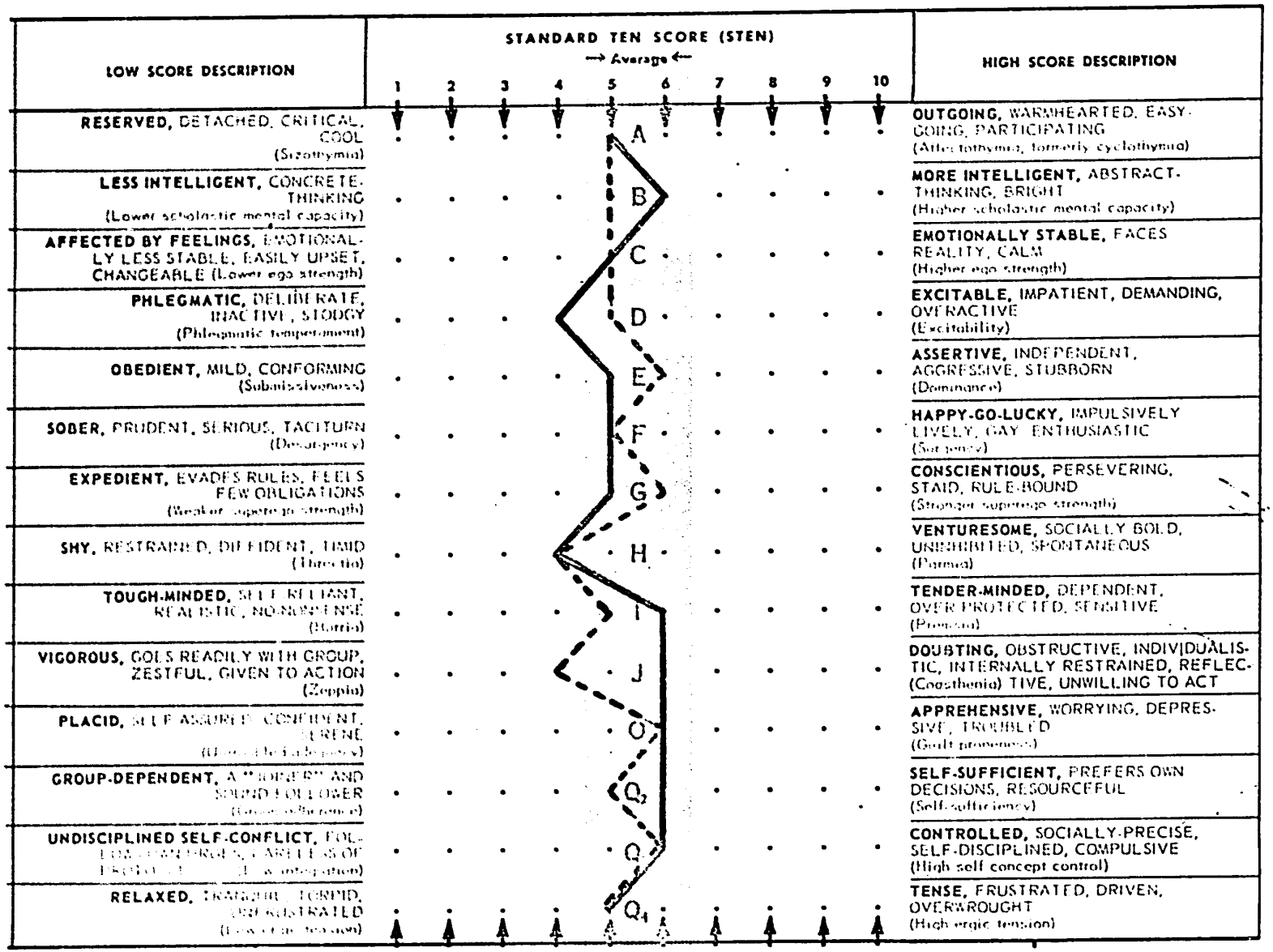
—— Best 5 Performers
--- Poorest 5 Performers

SIMPLE MT: CONTROL



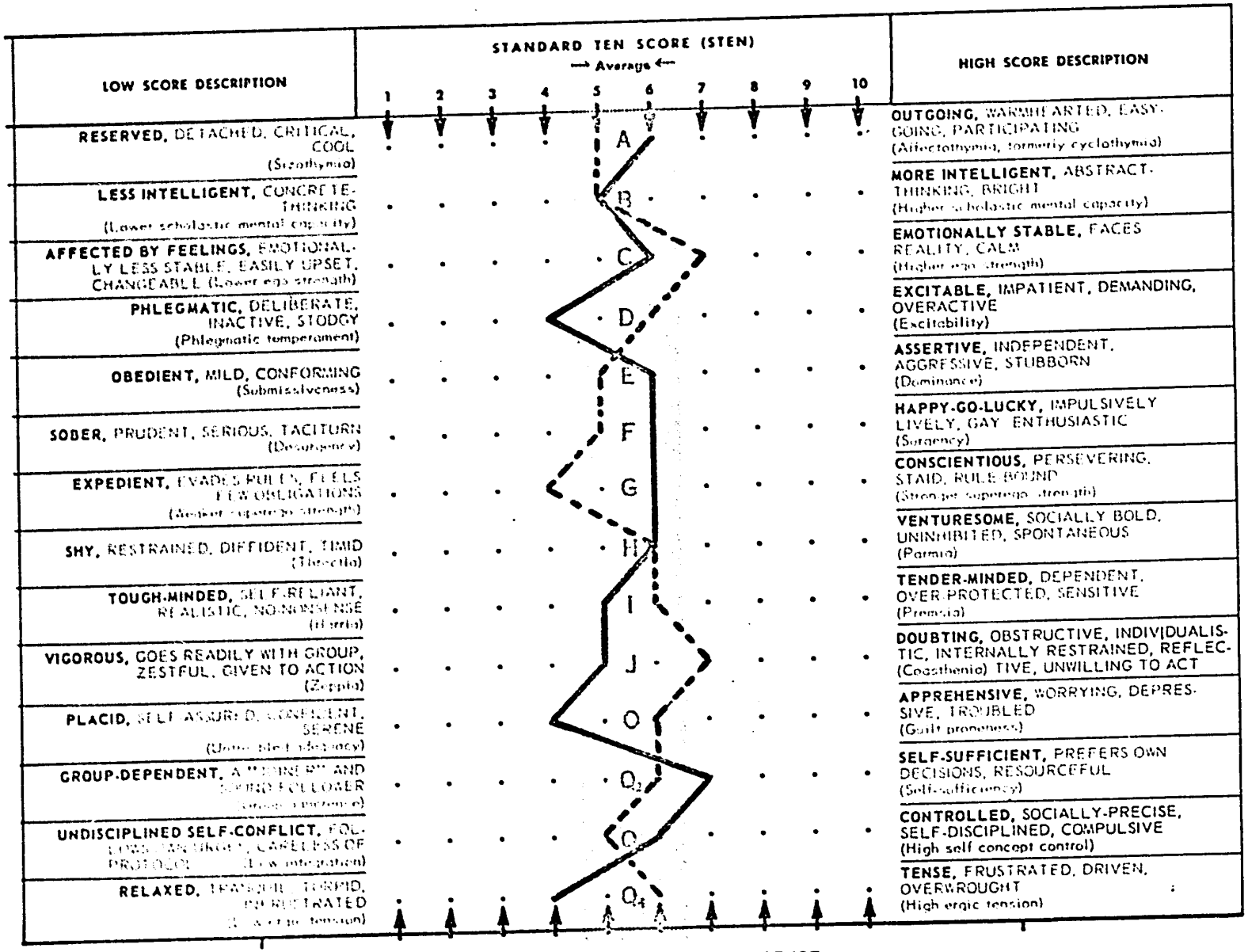
—— Best 5 Performers
--- Poorest 5 Performers

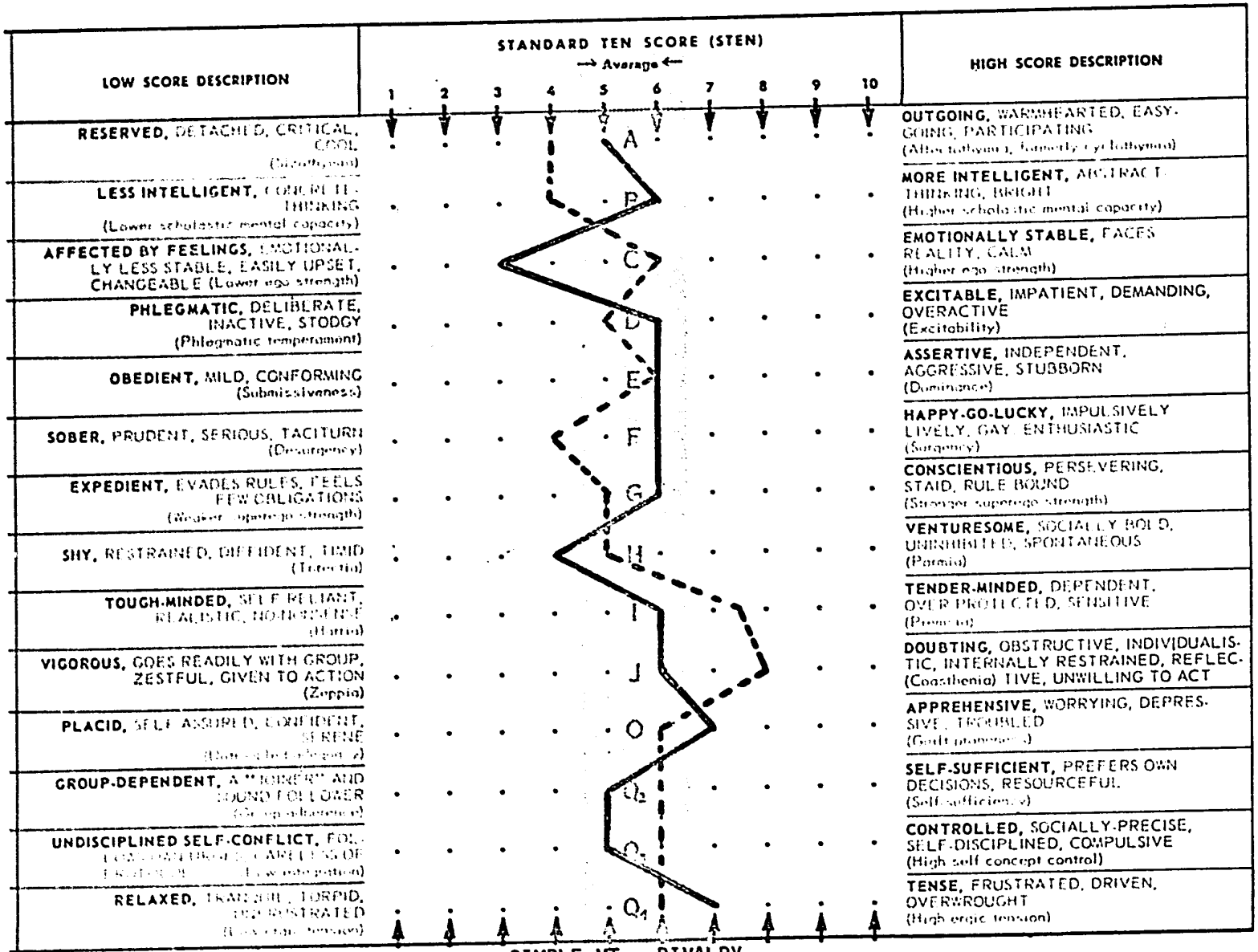
SIMPLE MT: AUDIENCE

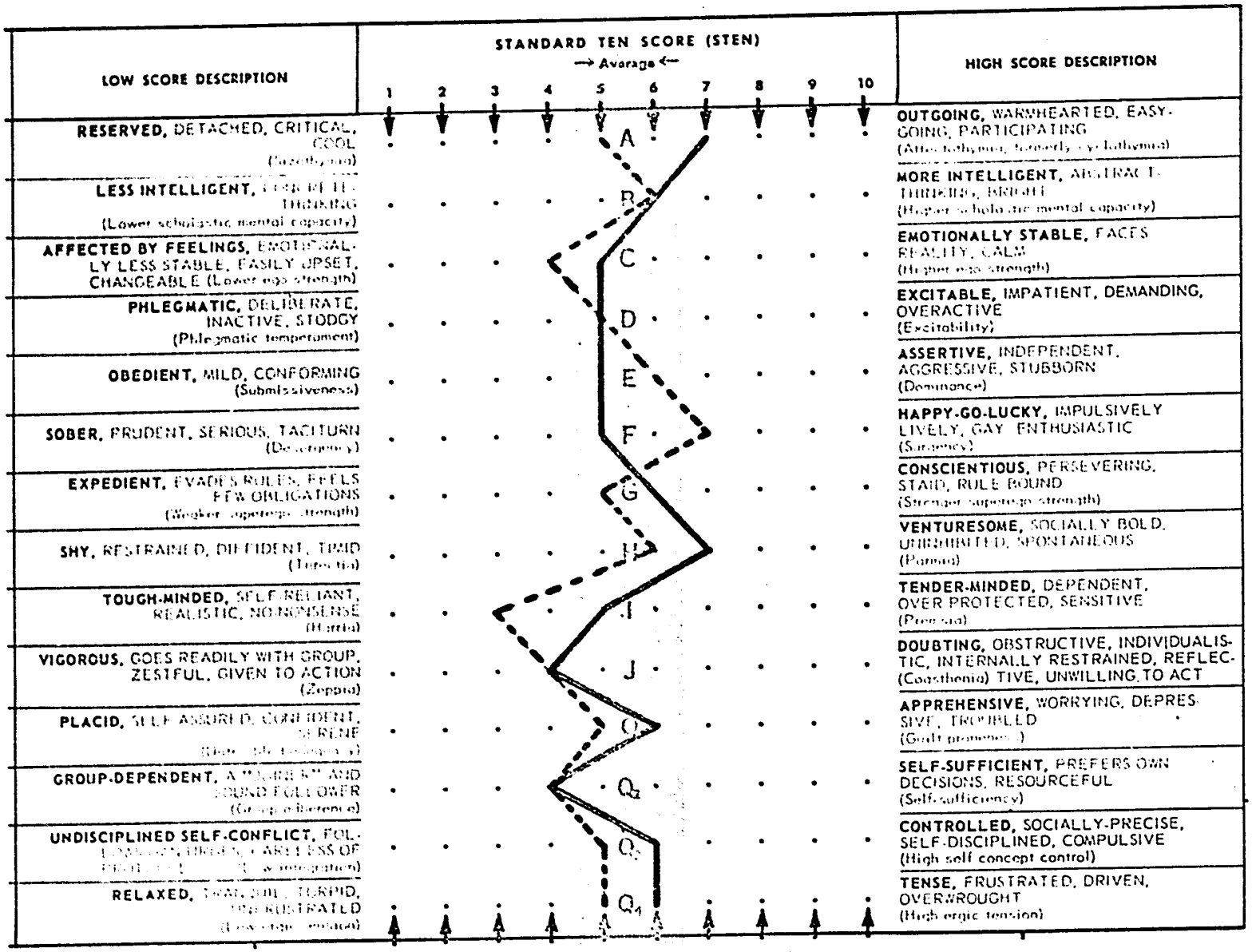


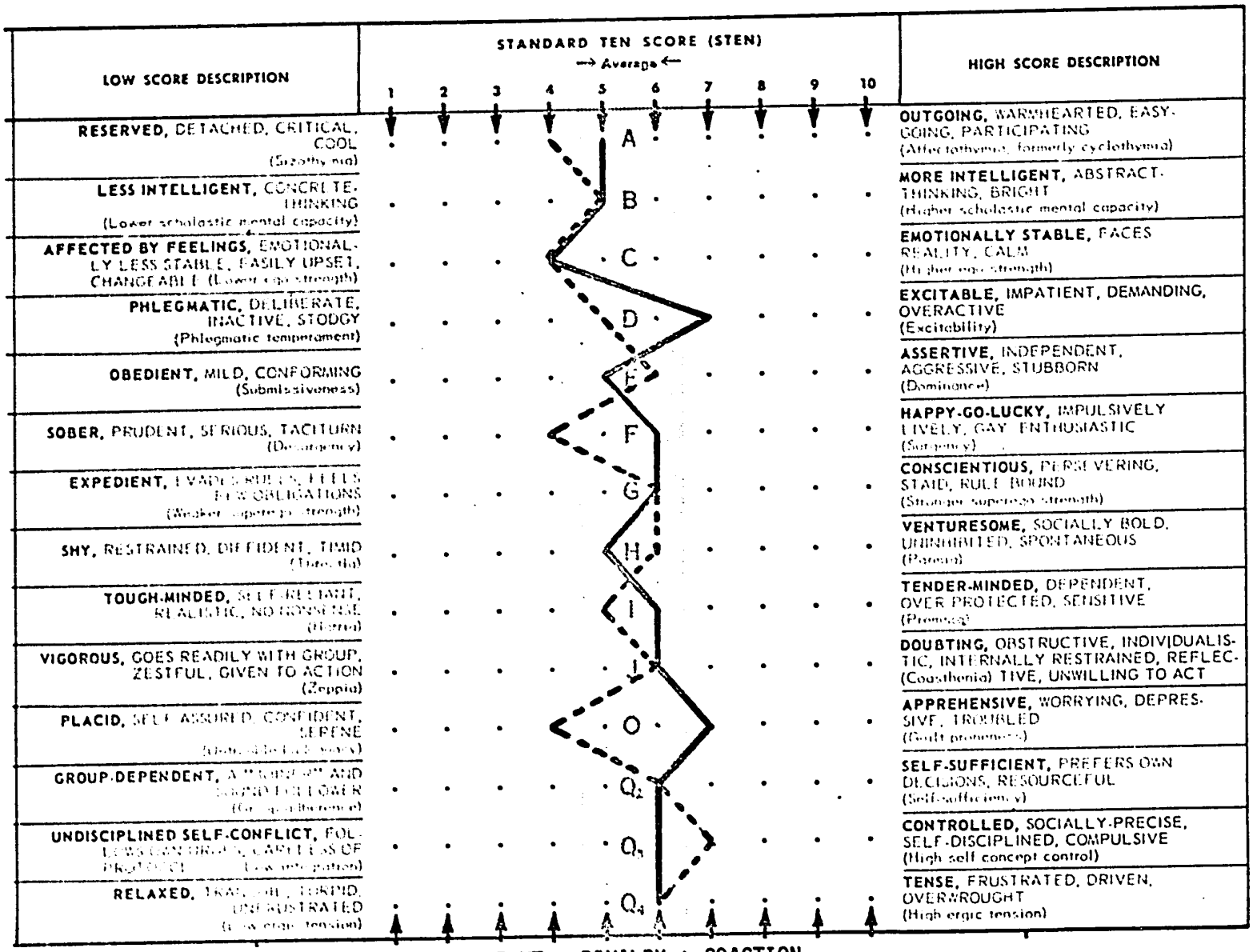
—— Best 5 Performers
--- Poorest 5 Performers

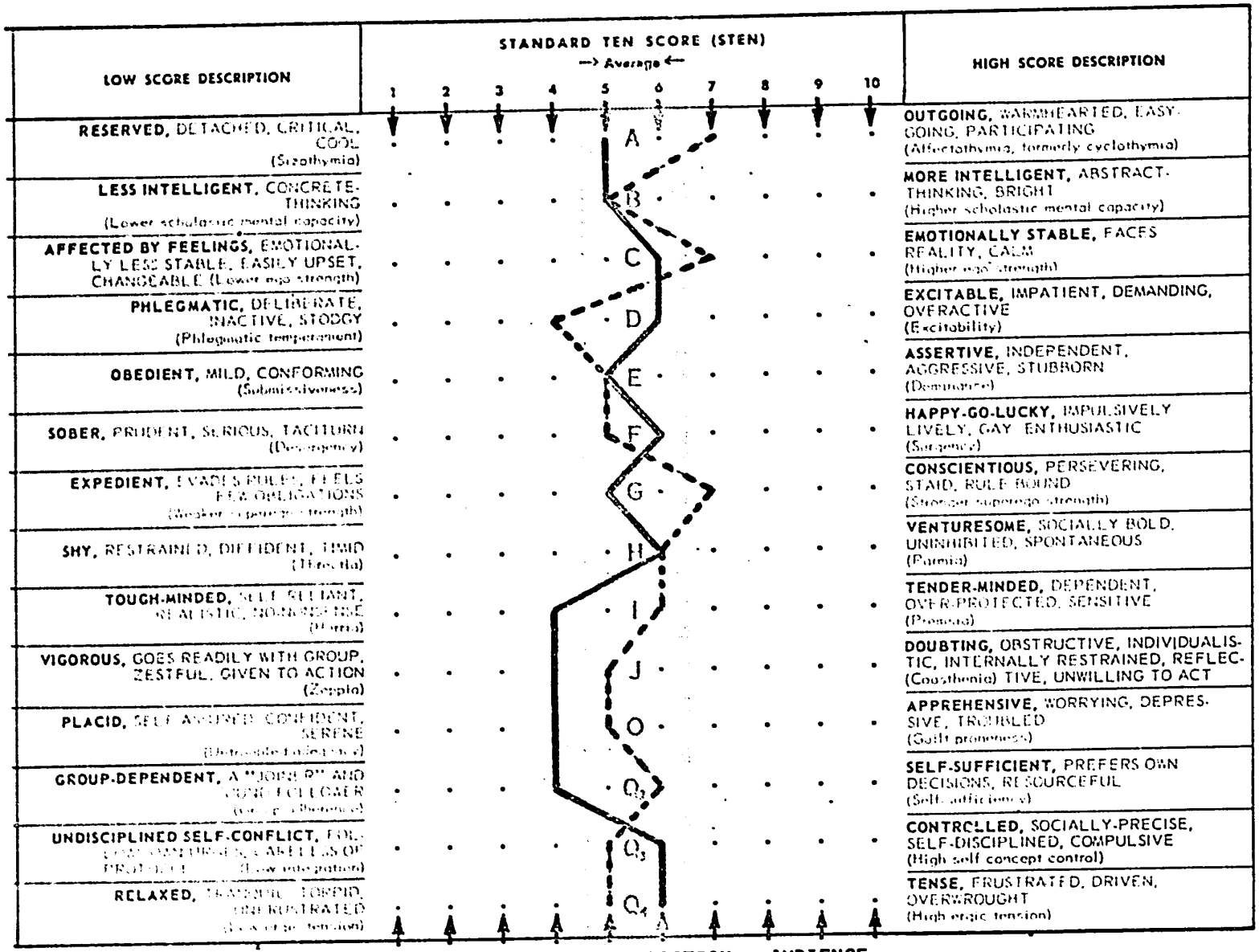
SIMPLE MT: COACTION


LOW SCORE DESCRIPTION
STANDARD TEN SCORE (STEN)
→ Average ←
1 2 3 4 5 6 7 8 9 10
HIGH SCORE DESCRIPTION
RESERVED, DETACHED, CRITICAL, COOL (Sizothymia)
OUTGOING, WARMHEARTED, EASY-GOING, PARTICIPATING (Affectothymia, formerly cyclothymia)
LESS INTELLIGENT, CONCRETE-THINKING (Lower scholastic mental capacity)
MORE INTELLIGENT, ABSTRACT-THINKING, BRIGHT (Higher scholastic mental capacity)
AFFECTED BY FEELINGS, EMOTIONALLY LESS STABLE, EASILY UPSET, CHANGEABLE (Lower ego strength)
EMOTIONALLY STABLE, FACES REALITY, CALM (Higher ego strength)
PHLEGMATIC, DELIBERATE, INACTIVE, STODGY (Phlegmatic temperament)
EXCITABLE, IMPATIENT, DEMANDING, OVERACTIVE (Excitability)
OBEDIENT, MILD, CONFORMING (Submissiveness)
ASSERTIVE, INDEPENDENT, AGGRESSIVE, STUBBORN (Dominance)
SOBER, PRUDENT, SERIOUS, TACITURN (Desurgency)
HAPPY-GO-LUCKY, IMPULSIVELY LIVELY, GAY ENTHUSIASTIC (Surgency)
EXPEDIENT, EVADES RULES, FEELS FEW OBLIGATIONS (Weaker superego strength)
CONSCIENTIOUS, PERSEVERING, STAID, RULE BOUND (Stronger superego strength)
SHY, RESTRAINED, DIFFIDENT, TIMID (Threctia)
VENTURESOME, SOCIALLY BOLD, UNINHIBITED, SPONTANEOUS (Parmia)
TOUGH-MINDED, SELF-RELIANT, REALISTIC, NO-NONSENSE (Harria)
TENDER-MINDED, DEPENDENT, OVER-PROTECTED, SENSITIVE (Premsia)
VIGOROUS, GOES READILY WITH GROUP, ZESTFUL, GIVEN TO ACTION (Zeppia)
DOUBTING, OBSTRUCTIVE, INDIVIDUALISTIC, INTERNALLY RESTRAINED, REFLECTIVE (Coasthenia) TIVE, UNWILLING TO ACT
PLACID, SELF ASSURED, CONFIDENT, SERENE (Unperturbed adequacy)
APPREHENSIVE, WORRYING, DEPRESSIVE, TROUBLED (Guilt proneness)
GROUP-DEPENDENT, A "JOINER" AND SOUND FOLLOWER (Group adherence)
SELF-SUFFICIENT, PREFERS OWN DECISIONS, RESOURCEFUL (Self-sufficiency)
UNDISCIPLINED SELF-CONFLICT, FOLLOWS ANOMIC, CARELESS OF PROTOCOL (Low integration)
CONTROLLED, SOCIALLY-PRECISE, SELF-DISCIPLINED, COMPULSIVE (High self concept control)
RELAXED, TRANQUIL, TORPID, UNFRUSTRATED (Low ergic tension)
TENSE, FRUSTRATED, DRIVEN, OVERWROUGHT (High ergic tension)
A
B
C
D
E
F
G
H
I
J
O
Q2
Q3
Q4
—— Best 4 Performers
--- Poorest 4 Performers
SIMPLE MT: COACTION + AUDIENCE


LOW SCORE DESCRIPTION
STANDARD TEN SCORE (STEN)
Average
1 2 3 4 5 6 7 8 9 10
HIGH SCORE DESCRIPTION
RESERVED, DETACHED, CRITICAL, COOL
(Sizothymia)
OUTGOING, WARMHEARTED, EASY-GOING, PARTICIPATING
(Affectothymia, formerly Cyclothymia)
A
LESS INTELLIGENT, CONCRETE-THINKING
(Lower scholastic mental capacity)
MORE INTELLIGENT, ABSTRACT-THINKING, BRIGHT
(Higher scholastic mental capacity)
B
AFFECTED BY FEELINGS, EMOTIONALLY LESS STABLE, EASILY UPSET, CHANGEABLE (Lower ego strength)
EMOTIONALLY STABLE, FACES REALITY, CALM
(Higher ego strength)
C
PHLEGMATIC, DELIBERATE, INACTIVE, STODGY
(Phlegmatic temperament)
EXCITABLE, IMPATIENT, DEMANDING, OVERACTIVE
(Excitability)
D
OBEDIENT, MILD, CONFORMING
(Submissiveness)
ASSERTIVE, INDEPENDENT, AGGRESSIVE, STUBBORN
(Dominance)
E
SOBER, PRUDENT, SERIOUS, TACITURN
(Desurgency)
HAPPY-GO-LUCKY, IMPULSIVELY LIVELY, GAY, ENTHUSIASTIC
(Surgency)
F
EXPEDIENT, EVADES RULES, FEELS FEW OBLIGATIONS
(Weaker superego strength)
CONSCIENTIOUS, PERSEVERING, STAID, RULE BOUND
(Stronger superego strength)
G
SHY, RESTRAINED, DIFFIDENT, TIMID
(Threctia)
VENTURESOME, SOCIALLY BOLD, UNINHIBITED, SPONTANEOUS
(Parmia)
H
TOUGH-MINDED, SELF RELIANT, REALISTIC, NO-NONSENSE
(Harria)
TENDER-MINDED, DEPENDENT, OVER PROTECTED, SENSITIVE
(Premsia)
I
VIGOROUS, GOES READILY WITH GROUP, ZESTFUL, GIVEN TO ACTION
(Zeppia)
DOUBTING, OBSTRUCTIVE, INDIVIDUALISTIC, INTERNALLY RESTRAINED, REFLECTIVE, UNWILLING TO ACT
(Coasthenia)
J
PLACID, SELF ASSURED, CONFIDENT, SERENE
(Untroubled adequacy)
APPREHENSIVE, WORRYING, DEPRESSIVE, TROUBLED
(Guilt proneness)
O
GROUP-DEPENDENT, A "JOINER" AND SOUND FOLLOWER
(Group adherence)
SELF-SUFFICIENT, PREFERS OWN DECISIONS, RESOURCEFUL
(Self-sufficiency)
Q_2
UNDISCIPLINED SELF-CONFLICT, FOLLOWS SELF-IMAGE, CARELESS OF PROTOCOL
(Low integration)
CONTROLLED, SOCIALLY-PRECISE, SELF-DISCIPLINED, COMPULSIVE
(High self concept control)
Q_3
RELAXED, TRANQUIL, TORPID, UNFRUSTRATED
(Low ergic tension)
TENSE, FRUSTRATED, DRIVEN, OVERWROUGHT
(High ergic tension)
Q_4
Best 4 Performers
Poorest 4 Performers
SIMPLE MT: RIVALRY


LOW SCORE DESCRIPTION
STANDARD TEN SCORE (STEN)
→ Average ←
1 2 3 4 5 6 7 8 9 10
HIGH SCORE DESCRIPTION
RESERVED, DETACHED, CRITICAL, COOL
OUTGOING, WARMHEARTED, EASY-GOING, PARTICIPATING
A
LESS INTELLIGENT, CONCRETE-THINKING
(Lower scholastic mental capacity)
MORE INTELLIGENT, ABSTRACT-THINKING, BRIGHT
(Higher scholastic mental capacity)
B
AFFECTED BY FEELINGS, EMOTIONALLY LESS STABLE, EASILY UPSET, CHANGEABLE (Lower ego strength)
EMOTIONALLY STABLE, FACES REALITY, CALM
(Higher ego strength)
C
PHLEGMATIC, DELIBERATE, INACTIVE, STODGY
(Phlegmatic temperament)
EXCITABLE, IMPATIENT, DEMANDING, OVERACTIVE
(Excitability)
D
OBEDIENT, MILD, CONFORMING
(Submissiveness)
ASSERTIVE, INDEPENDENT, AGGRESSIVE, STUBBORN
(Dominance)
E
SOBER, PRUDENT, SERIOUS, TACITURN
HAPPY-GO-LUCKY, IMPULSIVELY LIVELY, GAY, ENTHUSIASTIC
(Surgency)
F
EXPEDIENT, EVADES RULES, FEELS FEW OBLIGATIONS
(Weaker superego strength)
CONSCIENTIOUS, PERSEVERING, STAID, RULE BOUND
(Stronger superego strength)
G
SHY, RESTRAINED, DIFFIDENT, TIMID
(Threctia)
VENTURESOME, SOCIALLY BOLD, UNINHIBITED, SPONTANEOUS
(Parmia)
H
TOUGH-MINDED, SELF-RELIANT, REALISTIC, NO-NONSENSE
(Harria)
TENDER-MINDED, DEPENDENT, OVER PROTECTED, SENSITIVE
(Premsia)
I
VIGOROUS, GOES READILY WITH GROUP, ZESTFUL, GIVEN TO ACTION
(Zeppia)
DOUBTING, OBSTRUCTIVE, INDIVIDUALISTIC, INTERNALLY RESTRAINED, REFLECTIVE, UNWILLING TO ACT
(Coasthenia)
J
PLACID, SELF-ASSURED, CONFIDENT, SERENE
APPREHENSIVE, WORRYING, DEPRESSIVE, TROUBLED
(Guilt proneness)
O
GROUP-DEPENDENT, A "JOINER" AND SOUND FOLLOWER
(Group adherence)
SELF-SUFFICIENT, PREFERS OWN DECISIONS, RESOURCEFUL
(Self-sufficiency)
Q2
UNDISCIPLINED SELF-CONFLICT, FOLLOWS OWN URGES, CARELESS OF PROTOCOL
(Low integration)
CONTROLLED, SOCIALLY-PRECISE, SELF-DISCIPLINED, COMPULSIVE
(High self concept control)
Q3
RELAXED, TRANQUIL, TORPID, UNFRUSTRATED
TENSE, FRUSTRATED, DRIVEN, OVERWROUGHT
(High ergic tension)
Q4
—— Best 5 Performers
--- Poorest 5 Performers
SIMPLE MT: RIVALRY + AUDIENCE


LOW SCORE DESCRIPTION
STANDARD TEN SCORE (STEN)
→ Average ←
1 2 3 4 5 6 7 8 9 10
HIGH SCORE DESCRIPTION
RESERVED, DETACHED, CRITICAL, COOL
(Sizothymia)
OUTGOING, WARMHEARTED, EASY-GOING, PARTICIPATING
(Affectothymia, formerly cyclothymia)
A
LESS INTELLIGENT, CONCRETE-THINKING
(Lower scholastic mental capacity)
MORE INTELLIGENT, ABSTRACT-THINKING, BRIGHT
(Higher scholastic mental capacity)
B
AFFECTED BY FEELINGS, EMOTIONALLY LESS STABLE, EASILY UPSET, CHANGEABLE (Lower ego strength)
EMOTIONALLY STABLE, FACES REALITY, CALM
(Higher ego strength)
C
PHLEGMATIC, DELIBERATE, INACTIVE, STODGY
(Phlegmatic temperament)
EXCITABLE, IMPATIENT, DEMANDING, OVERACTIVE
(Excitability)
D
OBEDIENT, MILD, CONFORMING
(Submissiveness)
ASSERTIVE, INDEPENDENT, AGGRESSIVE, STUBBORN
(Dominance)
E
SOBER, PRUDENT, SERIOUS, TACITURN
(Desurgency)
HAPPY-GO-LUCKY, IMPULSIVELY LIVELY, GAY, ENTHUSIASTIC
(Surgency)
F
EXPEDIENT, EVADES RULES, FEELS FEW OBLIGATIONS
(Weaker superego strength)
CONSCIENTIOUS, PERSEVERING, STAID, RULE BOUND
(Stronger superego strength)
G
SHY, RESTRAINED, DIFFIDENT, TIMID
(Threctia)
VENTURESOME, SOCIALLY BOLD, UNINHIBITED, SPONTANEOUS
(Parmia)
H
TOUGH-MINDED, SELF-RELIANT, REALISTIC, NO-NONSENSE
(Harria)
TENDER-MINDED, DEPENDENT, OVER PROTECTED, SENSITIVE
(Premsia)
I
VIGOROUS, GOES READILY WITH GROUP, ZESTFUL, GIVEN TO ACTION
(Zeppia)
DOUBTING, OBSTRUCTIVE, INDIVIDUALISTIC, INTERNALLY RESTRAINED, REFLECTIVE, UNWILLING TO ACT
(Coasthenia)
J
PLACID, SELF-ASSURED, CONFIDENT, SERENE
(Untroubled adequacy)
APPREHENSIVE, WORRYING, DEPRESSIVE, TROUBLED
(Guilt proneness)
O
GROUP-DEPENDENT, A "JOINER" AND SOUND FOLLOWER
(Group adherence)
SELF-SUFFICIENT, PREFERS OWN DECISIONS, RESOURCEFUL
(Self-sufficiency)
Q2
UNDISCIPLINED SELF-CONFLICT, FOLLOWS SOCIAL IMAGE, CARELESS OF PROTOCOL (Low integration)
CONTROLLED, SOCIALLY-PRECISE, SELF-DISCIPLINED, COMPULSIVE
(High self concept control)
Q3
RELAXED, TRANQUIL, TORPID, UNFRUSTRATED
(Low ergic tension)
TENSE, FRUSTRATED, DRIVEN, OVERWROUGHT
(High ergic tension)
Q4
—— Best 5 Performers
--- Poorest 3 Performers
SIMPLE MT: RIVALRY + COACTION


LOW SCORE DESCRIPTION
STANDARD TEN SCORE (STEN)
→ Average ←
1 2 3 4 5 6 7 8 9 10
HIGH SCORE DESCRIPTION
RESERVED, DETACHED, CRITICAL, COOL (Sizothymia)
OUTGOING, WARMHEARTED, EASY-GOING, PARTICIPATING (Affectothymia, formerly cyclothymia)
LESS INTELLIGENT, CONCRETE-THINKING (Lower scholastic mental capacity)
MORE INTELLIGENT, ABSTRACT-THINKING, BRIGHT (Higher scholastic mental capacity)
AFFECTED BY FEELINGS, EMOTIONALLY LESS STABLE, EASILY UPSET, CHANGEABLE (Lower ego strength)
EMOTIONALLY STABLE, FACES REALITY, CALM (Higher ego strength)
PHLEGMATIC, DELIBERATE, INACTIVE, STODGY (Phlegmatic temperament)
EXCITABLE, IMPATIENT, DEMANDING, OVERACTIVE (Excitability)
OBEDIENT, MILD, CONFORMING (Submissiveness)
ASSERTIVE, INDEPENDENT, AGGRESSIVE, STUBBORN (Dominance)
SOBER, PRUDENT, SERIOUS, TACITURN (Desurgency)
HAPPY-GO-LUCKY, IMPULSIVELY LIVELY, GAY ENTHUSIASTIC (Surgency)
EXPEDIENT, EVADES RULES, FEELS FEW OBLIGATIONS (Weaker superego strength)
CONSCIENTIOUS, PERSEVERING, STAID, RULE BOUND (Stronger superego strength)
SHY, RESTRAINED, DIFFIDENT, TIMID (Threctia)
VENTURESOME, SOCIALLY BOLD, UNINHIBITED, SPONTANEOUS (Parmia)
TOUGH-MINDED, SELF RELIANT, REALISTIC, NO-NONSENSE (Premsia)
TENDER-MINDED, DEPENDENT, OVER-PROTECTED, SENSITIVE (Premsia)
VIGOROUS, GOES READILY WITH GROUP, ZESTFUL, GIVEN TO ACTION (Zeppia)
DOUBTING, OBSTRUCTIVE, INDIVIDUALISTIC, INTERNALLY RESTRAINED, REFLECTIVE, UNWILLING TO ACT (Coasthenia)
PLACID, SELF ASSURED, CONFIDENT, SERENE (Untroubled adequacy)
APPREHENSIVE, WORRYING, DEPRESSIVE, TROUBLED (Guilt proneness)
GROUP-DEPENDENT, A "JOINER" AND SOUND FOLLOWER (Group adherence)
SELF-SUFFICIENT, PREFERS OWN DECISIONS, RESOURCEFUL (Self sufficiency)
UNDISCIPLINED SELF-CONFLICT, FOLLOWS SELF-IMAGE, CARELESS OF PROTOCOL (Low integration)
CONTROLLED, SOCIALLY-PRECISE, SELF-DISCIPLINED, COMPULSIVE (High self concept control)
RELAXED, TRANQUIL, TORPID, UNFRUSTRATED (Low ergic tension)
TENSE, FRUSTRATED, DRIVEN, OVERWROUGHT (High ergic tension)
A
B
C
D
E
F
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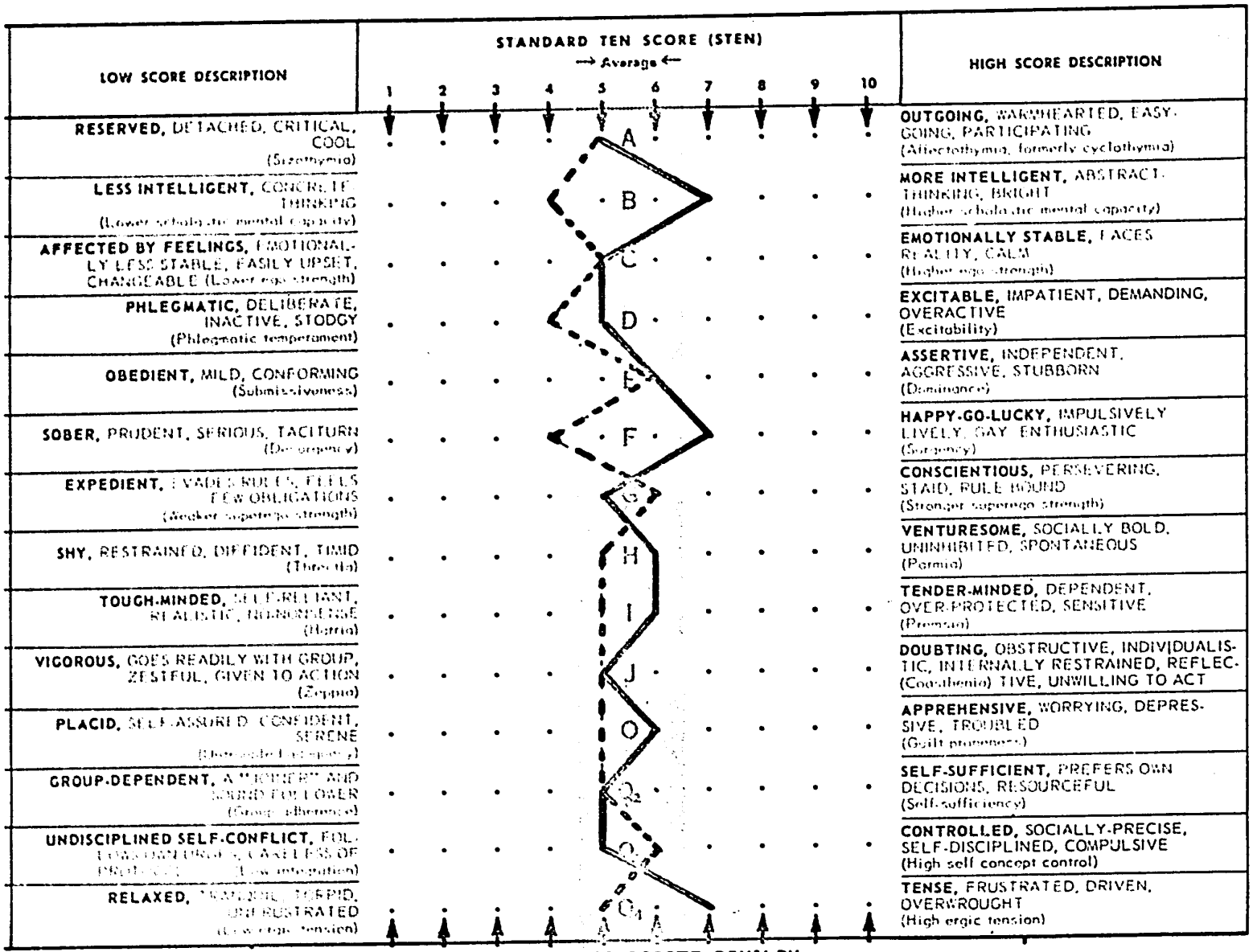
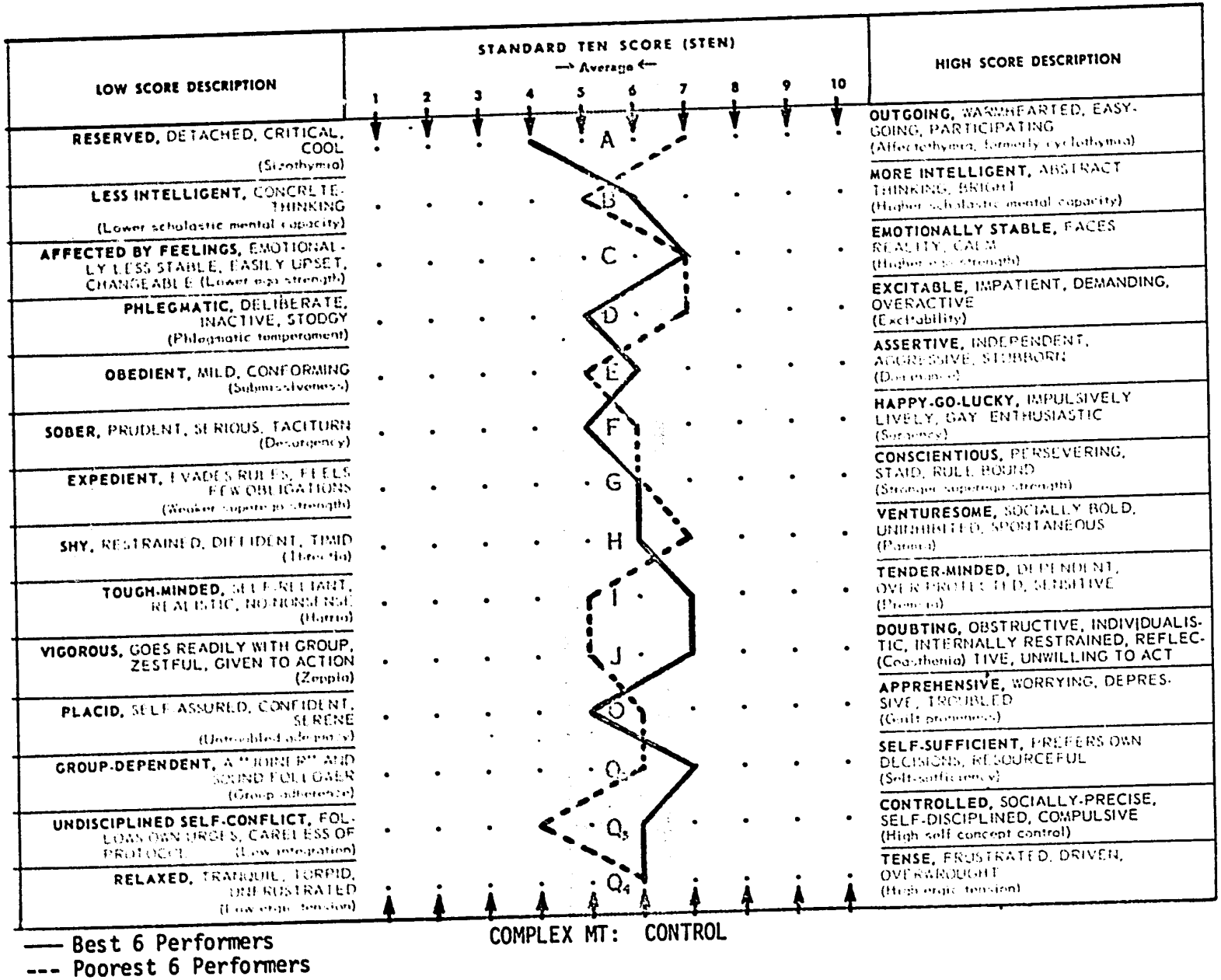
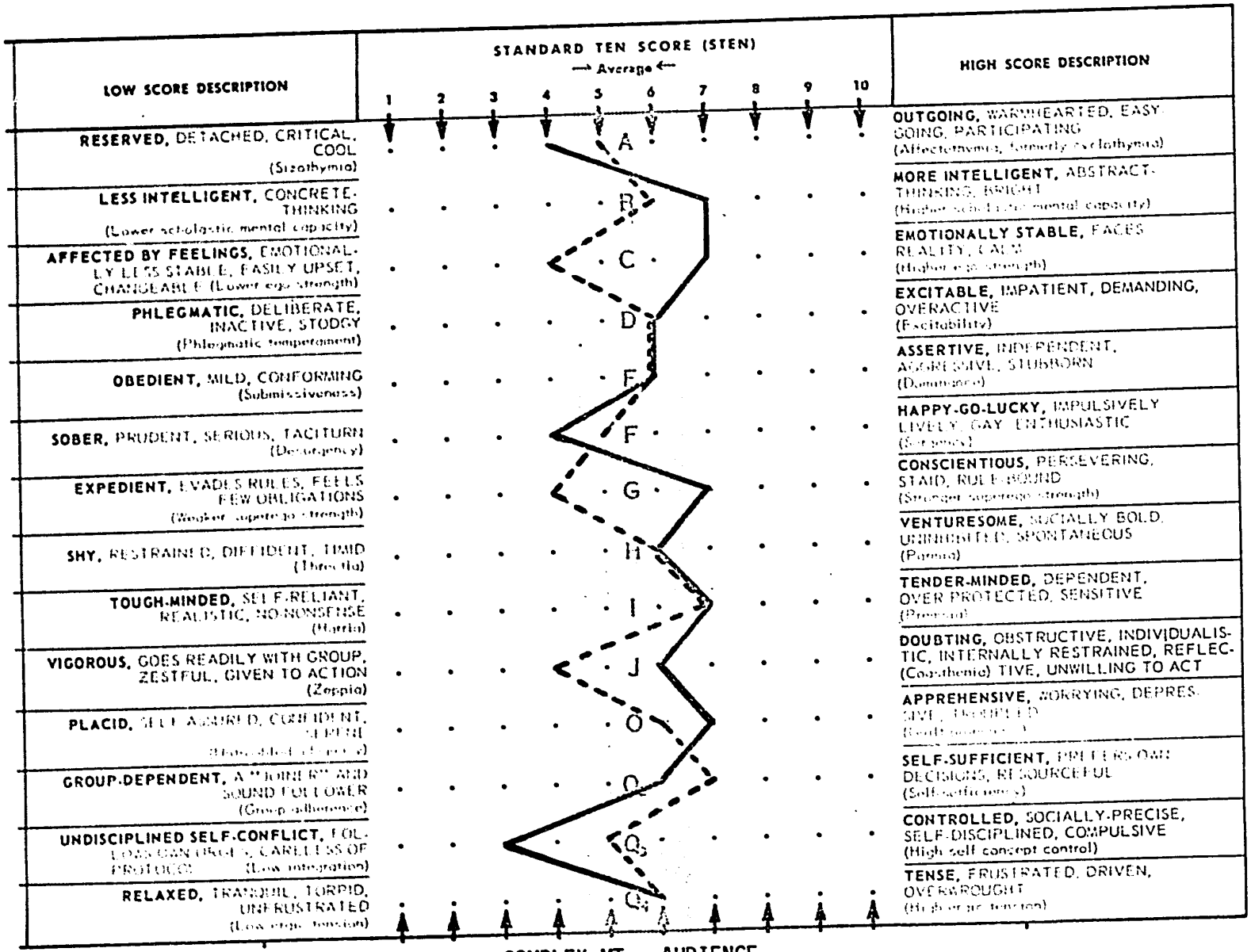
H
I
J
O
Q2
Q3
Q4
—— Best 5 Performers
--- Poorest 5 Performers
SIMPLE MT: RIVALRY + COACTION + AUDIENCE

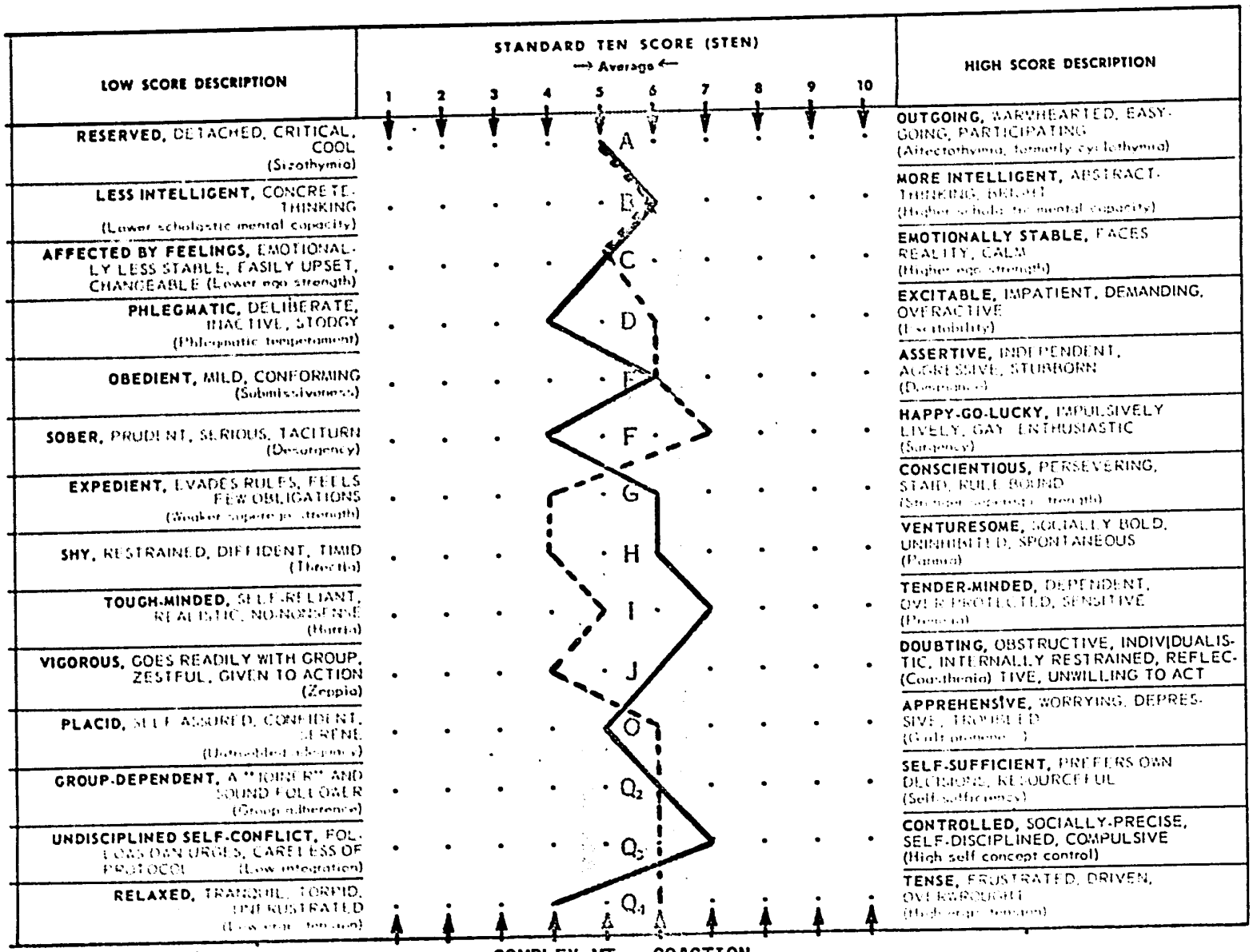


—— Best 7 Performers
--- Poorest 7 Performers

SIMPLE MT: COMPOSITE RIVALRY
(i.e. GROUPS 5,6,7,8)

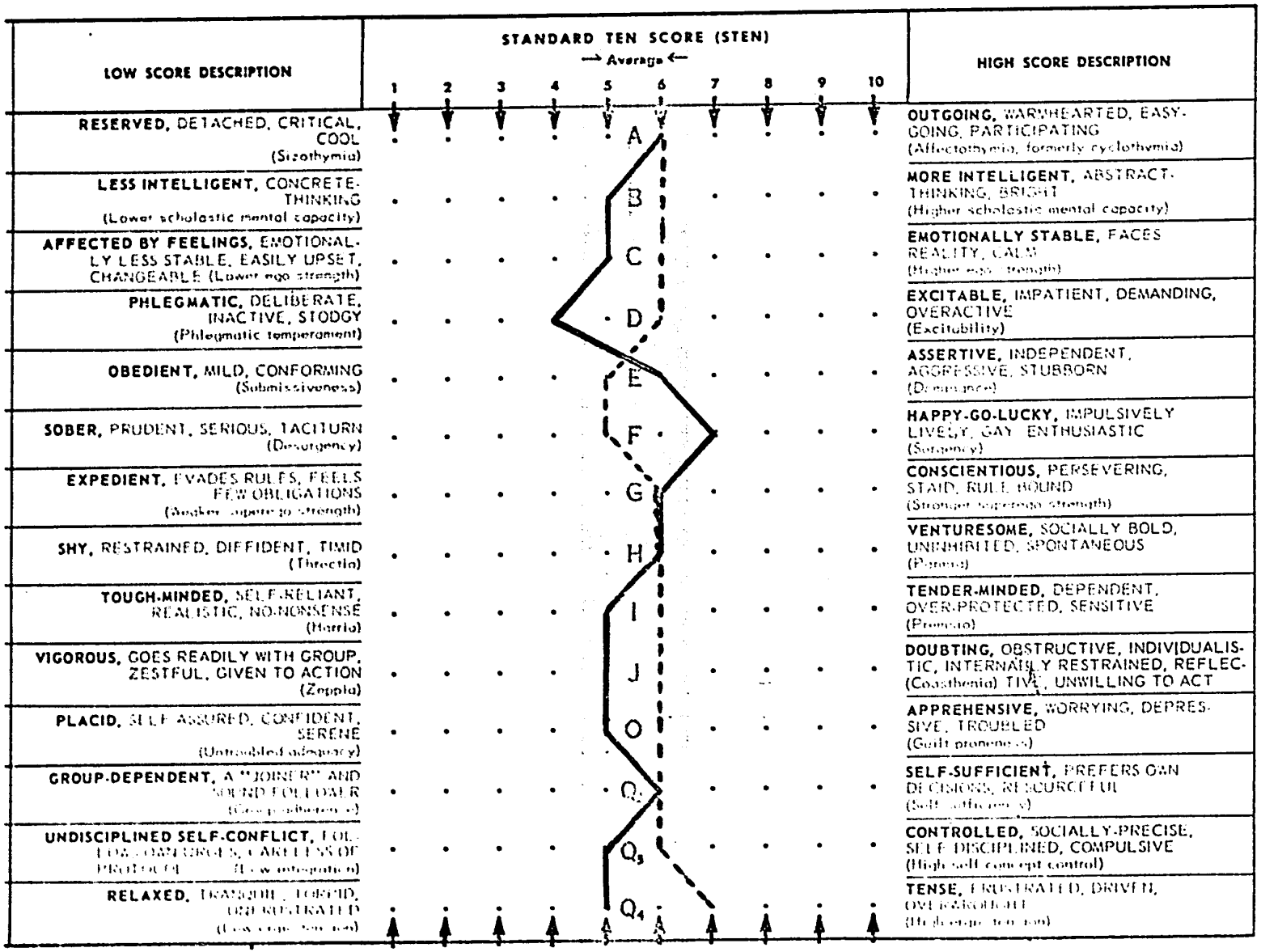

LOW SCORE DESCRIPTION
STANDARD TEN SCORE (STEN)
Average
1 2 3 4 5 6 7 8 9 10
HIGH SCORE DESCRIPTION
RESERVED, DETACHED, CRITICAL, COOL (Sizothymia)
OUTGOING, WARMHEARTED, EASY-GOING, PARTICIPATING (Affectothymia, formerly cyclothymia)
A
LESS INTELLIGENT, CONCRETE-THINKING (Lower scholastic mental capacity)
MORE INTELLIGENT, ABSTRACT THINKING, BRIGHT (Higher scholastic mental capacity)
B
AFFECTED BY FEELINGS, EMOTIONALLY LESS STABLE, EASILY UPSET, CHANGEABLE (Lower ego strength)
EMOTIONALLY STABLE, FACES REALITY, CALM (Higher ego strength)
C
PHLEGMATIC, DELIBERATE, INACTIVE, STODGY (Phlegmatic temperament)
EXCITABLE, IMPATIENT, DEMANDING, OVERACTIVE (Excitability)
D
OBEDIENT, MILD, CONFORMING (Submissiveness)
ASSERTIVE, INDEPENDENT, AGGRESSIVE, STUBBORN (Dominance)
E
SOBER, PRUDENT, SERIOUS, TACITURN (Desurgency)
HAPPY-GO-LUCKY, IMPULSIVELY LIVELY, GAY ENTHUSIASTIC (Surgency)
F
EXPEDIENT, EVADES RULES, FEELS FEW OBLIGATIONS (Weaker superego strength)
CONSCIENTIOUS, PERSEVERING, STAID, RULE BOUND (Stronger superego strength)
G
SHY, RESTRAINED, DIFFIDENT, TIMID (Threctia)
VENTURESOME, SOCIALLY BOLD, UNINHIBITED, SPONTANEOUS (Parmia)
H
TOUGH-MINDED, SELF-RELIANT, REALISTIC, NO-NONSENSE (Harria)
TENDER-MINDED, DEPENDENT, OVER-PROTECTED, SENSITIVE (Premsia)
I
VIGOROUS, GOES READILY WITH GROUP, ZESTFUL, GIVEN TO ACTION (Zeppia)
DOUBTING, OBSTRUCTIVE, INDIVIDUALISTIC, INTERNALLY RESTRAINED, REFLECTIVE (Coasthenia)
J
PLACID, SELF-ASSURED, CONFIDENT, SERENE (Unperturbed adequacy)
APPREHENSIVE, WORRYING, DEPRESSIVE, TROUBLED (Guilt proneness)
O
GROUP-DEPENDENT, A "JOINER" AND SOUND FOLLOWER (Group adherence)
SELF-SUFFICIENT, PREFERS OWN DECISIONS, RESOURCEFUL (Self-sufficiency)
Q_2
UNDISCIPLINED SELF-CONFLICT, FOLLOWS OWN URGES, CARELESS OF PROTOCOL (Low integration)
CONTROLLED, SOCIALLY-PRECISE, SELF-DISCIPLINED, COMPULSIVE (High self concept control)
Q_3
RELAXED, TRANQUIL, TORPID, UNFRUSTRATED (Low ergic tension)
TENSE, FRUSTRATED, DRIVEN, OVERWROUGHT (High ergic tension)
Q_4
COMPLEX MT: CONTROL
Best 6 Performers
Poorest 6 Performers


LOW SCORE DESCRIPTION
STANDARD TEN SCORE (STEN)
Average
1 2 3 4 5 6 7 8 9 10
HIGH SCORE DESCRIPTION
RESERVED, DETACHED, CRITICAL, COOL (Sizothymia)
OUTGOING, WARMHEARTED, EASY GOING, PARTICIPATING (Affectothymia, formerly Cyclothymia)
LESS INTELLIGENT, CONCRETE-THINKING (Lower scholastic mental capacity)
MORE INTELLIGENT, ABSTRACT-THINKING, BRIGHT (Higher scholastic mental capacity)
AFFECTED BY FEELINGS, EMOTIONALLY LESS STABLE, EASILY UPSET, CHANGEABLE (Lower ego strength)
EMOTIONALLY STABLE, FACES REALITY, CALM (Higher ego strength)
PHLEGMATIC, DELIBERATE, INACTIVE, STODGY (Phlegmatic temperament)
EXCITABLE, IMPATIENT, DEMANDING, OVERACTIVE (Excitability)
OBEDIENT, MILD, CONFORMING (Submissiveness)
ASSERTIVE, INDEPENDENT, AGGRESSIVE, STUBBORN (Dominance)
SOBER, PRUDENT, SERIOUS, TACITURN (Desurgency)
HAPPY-GO-LUCKY, IMPULSIVELY LIVELY, GAY, ENTHUSIASTIC (Surgency)
EXPEDIENT, EVADES RULES, FEELS FEW OBLIGATIONS (Weaker superego strength)
CONSCIENTIOUS, PERSEVERING, STAID, RULE-BOUND (Stronger superego strength)
SHY, RESTRAINED, DIFFIDENT, TIMID (Threctia)
VENTURESOME, SOCIALLY BOLD, UNINHIBITED, SPONTANEOUS (Parmia)
TOUGH-MINDED, SELF-RELIANT, REALISTIC, NO-NONSENSE (Harria)
TENDER-MINDED, DEPENDENT, OVER PROTECTED, SENSITIVE (Premsia)
VIGOROUS, GOES READILY WITH GROUP, ZESTFUL, GIVEN TO ACTION (Zeppia)
DOUBTING, OBSTRUCTIVE, INDIVIDUALISTIC, INTERNALLY RESTRAINED, REFLECTIVE, (Coasthenia) TIVE, UNWILLING TO ACT
PLACID, SELF-ASSURED, CONFIDENT, SERENE (Untroubled adequacy)
APPREHENSIVE, WORRYING, DEPRESSIVE, INSECURE (Guilt proneness)
GROUP-DEPENDENT, A "JOINER" AND SOUND FOLLOWER (Group adherence)
SELF-SUFFICIENT, PREFERS OWN DECISIONS, RESOURCEFUL (Self-sufficiency)
UNDISCIPLINED SELF-CONFLICT, FOLLOWS OWN URGES, CARELESS OF PROTOCOL (Low integration)
CONTROLLED, SOCIALLY-PRECISE, SELF-DISCIPLINED, COMPULSIVE (High self concept control)
RELAXED, TRANQUIL, TORPID, UNFRUSTRATED (Low ergic tension)
TENSE, FRUSTRATED, DRIVEN, OVERWROUGHT (High ergic tension)
A
B
C
D
E
F
G
H
I
J
O
O
Q3
Q4
Best 5 Performers
Poorest 5 Performers
COMPLEX MT: AUDIENCE



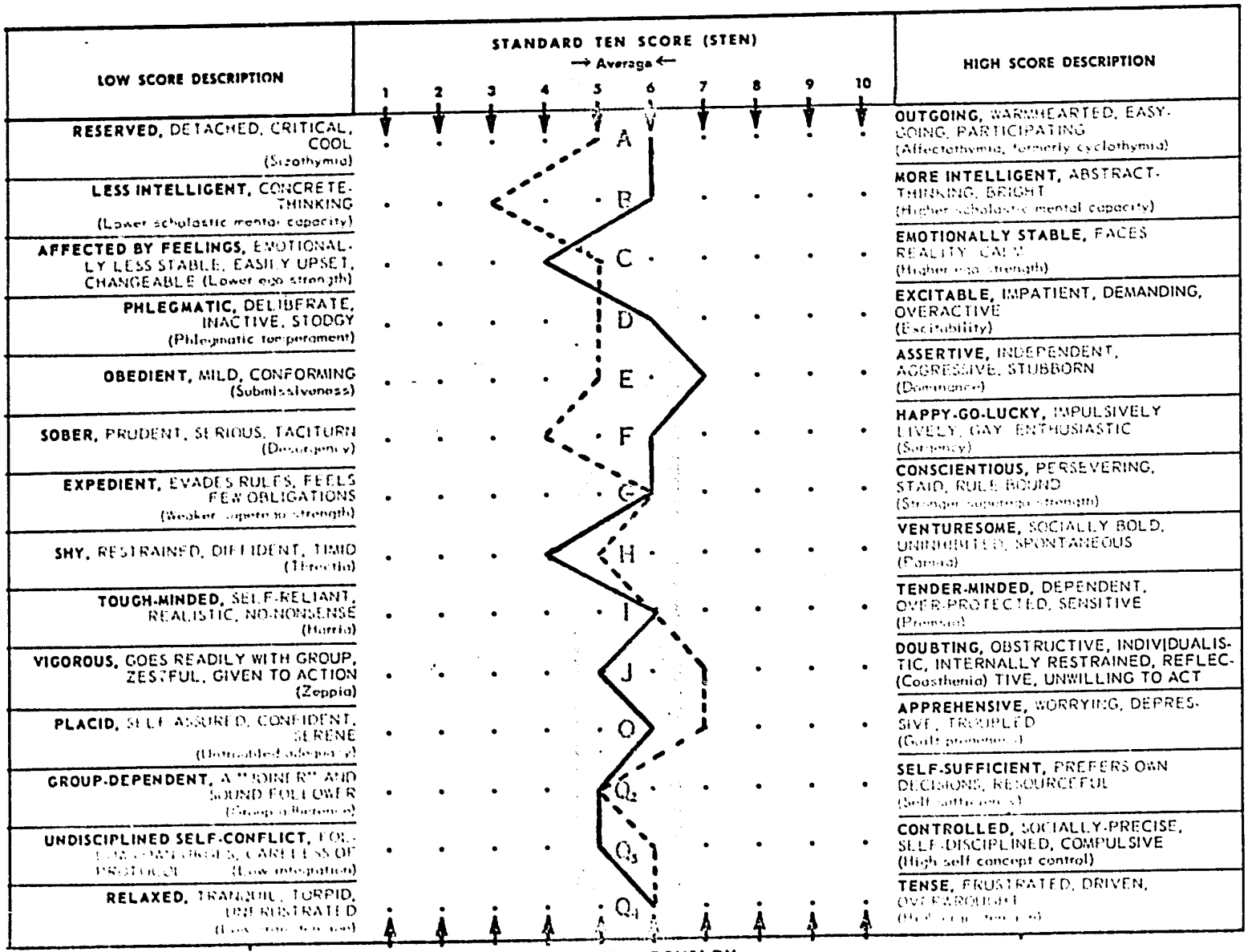
—— Best 5 Performers
--- Poorest 5 Performers

COMPLEX MT: COACTION

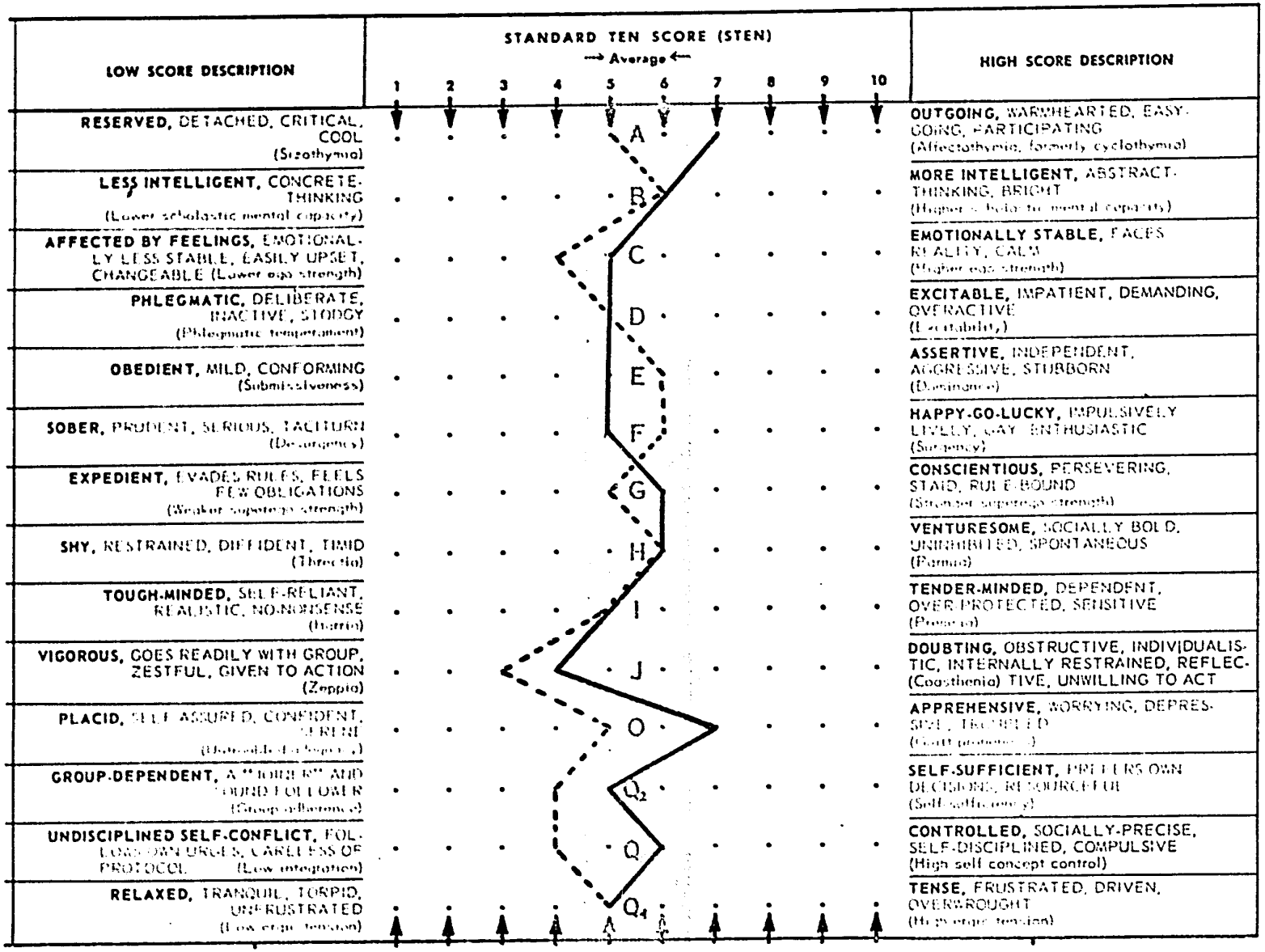


—— Best 5 Performers
--- Poorest 6 Performers

COMPLEX MT: COACTION + AUDIENCE



—— Best 6 Performers
--- Poorest 4 Performers



—— Best 5 Performers
--- Poorest 5 Performers

COMPLEX MT: RIVALRY + AUDIENCE