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PERSONALITY FACTORS AND RESPONSIVENESS TO TREATMENT AMONG HYPERACTIVE BOYS

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of Graduate Studies of the
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Abstract

Twenty-six personality measures were gathered for each of 102 hyperactive boys ranging in age from 7 to 12 years. These consisted of the 13 Early School Personality Questionnaire factor scores (or those of the Children's Personality Questionnaire if the child was over the age of nine), the eight Conners Parent Symptom Questionnaire factor scores, the four Conners Teacher Rating Scale factor scores, and the Vineland Social Maturity Scale Social Quotient. Each subject was treated with Ritalin and was classified as being a responder or a non-responder on the basis of his improvement from baseline on six post-treatment criterion measures. The six included: an omission and commission score on the Continuous Performance Test, the mean and standard deviation on the Reaction Time Test, his hyperactivity score on the Conners Parent Symptom Questionnaire, and his score on the Matching Familiar Figures Test. Nine definitions of response to treatment were employed but none of the resulting direct discriminant functions could significantly distinguish between responders and non-responders. The possible theoretical implications of these results were discussed and avenues for future research in this field were suggested.

Personality Factors and Responsiveness to Treatment Among Hyperactive Boys

Although the syndrome which is known as hyperactivity is said to be characterized by a number of traits, a concise description of it would include attentional difficulties, motor activity inappropriate to the situation, impulsivity, and distractability (Ross & Ross, 1976). A constellation of so-called "secondary symptoms" which includes irritability, aggressive interpersonal behavior, and low self-esteem is also frequent but not necessarily common to all hyperactive children (Paternite, Loney, & Langhorne, 1976). When the syndrome was first described, brain damage was cited as its cause (Ebaugh, 1923; Kahn & Cohen, 1934). Research since that time, however, has revealed that its causes are in fact quite diverse; indeed today it is generally believed that only a minority of hyperactive children have a definite history of neurological impairment (Chess, 1960; Clements & Peters, 1962; Minde, Webb, & Sykes, 1968; Stewart, Pitts, Craig, & Dieruf, 1966).

The Role of Stimulant Medication

Although the utility of various modes of treating hyperactive

children have been explored, considerable emphasis has been placed on pharmacological interventions. There is currently some consensus, for example, that stimulant medication, particularly methylphenidate (Ritalin) is effective in treating such children (Barkley, 1977; Sroufe, 1975; Whelan & Henker, 1976; Wolraich, 1977). The benefits of stimulants were first described more than four decades ago (i.e., Bradley, 1937) and involve a reduction in distractability and impulsivity as well as improved abilities to attend and concentrate (Barkley, 1977; Sroufe, 1975). In effect then, stimulant medication, rather than enlivening hyperactive children further, appears both to calm them and to reduce their inappropriate motor activity in a manner which some researchers consider to be paradoxical. In an attempt to explain this phenomenon, Wender (1971, 1972) has hypothesized that stimulant drugs stimulate functionally underactive neurotransmitters so that specific areas of the central nervous system function more effectively. As a consequence, there is less need for self-stimulation and a better response to reinforcement.

The Need for Prediction

Ritalin and other stimulants are useful in treating some hyperactive children. There is ample scientific evidence to

support this claim. These stimulants, however, are not "wonder drugs"; they are not panaceas. This is due, in no small part, to the simple fact that many hyperactive children respond negatively to them. Their undesirable side effects can include social withdrawal, sadness, obsessiveness, and a loss of weight, appetite, or sleep (Cohen, Douglas, & Morganstern, 1971; Mash & Dolby, 1979; Schliefer, Weiss, Cohen, Elmon, Cvejic, & Kruger, 1975).

In addition to these unfortunate negative reactions, there remains the irrefutable fact that many children who are hyperactive simply do not respond at all to stimulants, neither positively nor negatively. The proportion of children who fall into this category has been estimated as being anywhere from 25% (Barcai, 1971; Rapaport, Quinn, Bradford, Riddle, & Brooks, 1974; Weiss, Minde, Douglas, Werry, & Sykes, 1971) up to 75% (Conrad & Insel, 1967). A major source of this discrepency doubtlessly involves the fact that some investigators are more rigorous and exact in choosing their dependent variables than others. Thus differences between the estimated proportions on non-responding hyperactive children may, in effect, be a reflection of the differing criteria used in so classifying them. For example, in some investigations children are classified simply on the basis of their parents' global ratings. The researcher asks the subject's mother if her

hyperactive son has improved noticeably since receiving Ritalin, and if she says no, he is classified as a non-responder. Other investigators, however, are considerably more rigorous and exact in choosing the criteria upon which they categorize subjects and typically use clearly defined scores on standardized tests or rating scales to that end.

Regardless of the reliability and validity that they may demand of their dependent variables, most authorities would agree that for a significant proportion of hyperactive children, stimulant medication is simply not the answer. This has prompted some to speak of the "inappropriateness of static diagnostic formulations and monolithic treatment plans" for such children (Paternite et al., 1976, p.299). It raises the obvious but pertinent question, "Why not?" Why is it that some hyperactive children respond well to stimulants and others do not at all? Answers to this question might shed more light on the effects of stimulant medication, the nature of hyperactivity, and might establish urgently needed criteria for predicting which hyperactive children will benefit from stimulants and which will not.

The most effective way of examining this issue would be to conduct a carefully controlled study of known hyperactive responders and non-responders to stimulant medication in order to delineate any fundamental differences between the two groups. A number of published studies have in fact adopted this strategy

and they will be described below. In his excellent review of the literature, Barkley (1976) has classified these studies according to the type of predictor with which each deals. In the present paper a number of his classifications will be used and include: psychophysiological, neurological, rating scale, and familial predictors. Barkley refers to one cluster of predictors as being "psychological", in that they deal almost exclusively with performances on standardized tests of intelligence and achievement. It is felt that this category has been misleadingly named; hence, in the present paper, it will be called "cognitive and academic predictors".

Psychophysiological Predictors

Although the electorencehalogram (EEG) has been repeatedly used in attempts to study the differences between responders and non-responders to stimulant medication, its predictive utility is uncertain at this time. In one promising study (Satterfield, Cantwell, Saul, Lesser, & Podosin, 1973), 57 hyperactive boys between the ages of five and ten years were treated with Ritalin for a period of three weeks and those who improved by at least 30% on teacher ratings were classified as responders. Boys

with abnormal EEGs were significantly more likely to be classified as responders than those without. In other investigations, however, no relationship between response and EEG abnormality was indicated (e.g., Knights & Hinton, 1969; Lytton & Knobel, 1958; Rapoport et al., 1974; Weiss, Werry, Minde, Douglas, & Sykes, 1968; Weiss et al., 1971) and in some (e.g., Burks, 1964; Schain & Reynard, 1975) abnormal EEGs predicted non-response.

Satterfield, Cantwell, Lesser, & Podosin (1972) studied 31 hyperactive boys treated with Ritalin and once again classified them as responders ar non-responders an the basis of teacher ratings. They concluded that responders had higher pre-treatment mean resting EEG amplitudes, greater resting EEG amplitude ranges, and more EEG movement artifacts than non-responders.

A variation in the EEG technique, namely the use of average evoked responses (AERs) may also hold promise in predicting response to stimulant medication. In this procedure a subject is presented with a stimulus (usually auditory or visual) and its effects are studied by means of the EEG. In their examination of 31 hyperactive boys, Satterfield et al. (1972) concluded that responders had significantly higher evoked response amplitudes and lower recovery of evoked response amplitudes than non-responders. In a study of 12 hyperactive children (eight boys and four girls) treated with Ritalin, Weber and Sulzbacher

(1975) also used and employed auditory stimuli. They classified their subjects as responders or non-responders on the basis of changes in classroom behavior ratings. Although this study is limited by the fact that it had so few subjects and that the duration of the medication period was not reported, it was revealed that the responders had lower AER thresholds both on and off medication. On the basis of these results, investigators dealing with AERs as predictors conclude that there is a fundamental difference between responders and non-responders which is related to their central nervous system (CNS) arousal levels.

Another psychophysiological measure which may have some degree of effectiveness in predicting response to stimulant medication involves the skin conductance response (SCR). At this time, however, published results appear to be rather contradictory. Zahn, Abate, Little, and Wender (1975) examined 42 hyperactive children (32 boys and 10 girls) who had been treated with Ritalin for approximately two and a half months. Subjects were divided into responding and non-responding groups on the basis of a psychiatrist's rating of inattention. It was discovered that non-responders had slower pre-treatment rises and recoveries of both spontaneous and elicited SCRs with less frequent and larger latency specific responses. They also had a greater increase in SCR latency to tones during their program of treatment.

On the basis of these results the authors concluded that the non-responders were less autonomically aroused than the responders. Satterfield et al. (1972), however, found that their non-responders had higher SCRs than their responders and therefore concluded that the former were more autonomically aroused. On the basis of these two investigations it would appear that SCRs may indeed have some predictive utility, but the nature of that utility is uncertain at this time.

Yet another psychophysiological measure which seems useful in predicting response to stimulant medication involves the hyperactive child's heart rate. Porges, Walter, Karb, & Sprague (1975) studied 16 hyperactive children (15 boys and one girl) between the ages of six and twelve who were treated with Ritalin for a period of 13 weeks. Classification into a response group was contingent upon response to a reaction time test and behavioral classroom ratings. They discovered that their responders had lower pre-medication heart rate levels, and during medication, both a greater increase in heart rate and a greater reduction in heart rate variability. This suggests that of the two groups, the responders were less autonomically aroused.

In two studies (Zahn et al., 1975; Porges et al., 1975), the possibility of using heart rate deceleration on reaction time tasks as a predictor of response to stimulants was examined.

In neither, however, was sufficient evidence gathered to suggest such a relationship.

Another useful predictor of stimulant response involves the use of the electropupillogram (EPG). Knopp, Arnold, Andras, and Smeltzer (1973) studied 22 hyperactive children who were treated with dextroamphetamine for an unspecified period. Placement in a response group was contingent upon ratings of each subject by parents and clinicians. Changes in their pupil diameters in response to light were examined before and after the medication period. Those children who had unusually high or low pre-drug EPG contractions tended to respond well to treatment and those who had normal contractions tended to fall into the non-responding category.

A final psychophysiological measure which appears to have predictive utility involves free amphetamine recovery from the hyperactive subject's urine. Epstein, Lasagna, Conners, and Rodriguez (1968) examined ten hyperactive children ranging in age from five to ten years who were treated with dextroamphetamine for a two week period and concluded that responders have a higher mean percentage of free amphetamine recovery than non-responders.

In summary, despite the fact that research with psychophysiological measures as predictors of response to stimulant medication has not always yielded clear or consistent results, it can be

concluded that such research does seem to indicate that hyperactive children do not form a homogeneous group. Responders and non-responders to stimulants do appear to differ on a number of measured psychophysiological dimensions.

Neurological Predictors

Current research suggests that the number of "soft" neurological signs found in hyperactive children is associated with their response to stimulant medication. Steinberg, Troshinsky, and Steinberg, for example, examined this variable in their study (1971) of 46 predominantly black American hyperactive children who had received dextroamphetamine for a period of four weeks. Subjects were classified as responders and non-responders on the basis of behavioral ratings made by their teachers. Those subjects who had two or more soft neurological signs contributed disproportinately to the responding group. These soft signs include: failure of the eye's to converge, spooning, awkward alternating movements of the upper extremities or tongue, choreic movements, head circumference 1.5 cm. above the standard deviation, motor overflow, mild pronator sign, head 1.0 cm. above two standard deviations, cafe au lait spots (5 cm. or less with irregular borders),

mild asymmetry of the perioral musculature, diminished auditory accuity in the right ear, and marked pes cavus with mild hammer toeing.

In their study of 57 hyperactive children, Satterfield et al. (1973) attempted to examine the predictive utility of this variable by conducting a pre-treatment neurological examination based on the technique described by Paine and Oppe (1966) on all of their subjects. The results indicated that children with four or more soft neurological signs responded with significantly more improvement to Ritalin than subjects without such signs. In a study of 31 hyperactive children, Conrad and Insel (1967) similarly discovered that subjects with three or more soft signs tended to respond more favorably to stimulants than similar children with fewer signs. Ferguson and Trites (1979) also found the presence of minor physical anomalies to be related to drug response among hyperactive boys. Despite these significant findings, investigations reported by Rapoport et al. (1974) and Weiss et al. (1968, 1971) have not found such a relationship, hence the predictive utility of this variable is still somewhat uncertain.

Some researchers have classified their hyperactive subjects as being "organic" or "non-organic" on the basis of a number of dimensions and have examined membership in one of these groups for its ability to predict response to stimulants. Weiss et

al. (1968), for example, examined 40 hyperactive subjects ranging from six to twelve years of age who had been treated with dextro-amphetamine for periods of three to five weeks. They discovered a tendency for those children with a history suggestive of brain damage to respond to medication. Major flaws in this study, however, center around the facts that the contingencies upon which subjects were classified as responders or non-responders were not reported and the authors tended to be vague as to what constituted a "history suggestive of brain damage".

In their study of ten hyperactive children described earlier, Epstein et al. (1968) classified as organic those of their subjects who were deemed likely to have incurred damage to their central nervous systems on the basis of a detailed psychiatric interview, a psychological evaluation, a diagnostic questionaire, and a neurological examination. The remaining subjects were considered to be non-organic. While medicated, the members of the organic group improved more on the Porteus Maze test than the non-organics, and were more likely to be perceived as improved by their parents and psychiatrist. Results from these studies tend to suggest that hyperactive children with organic complications respond better to medication than others. Rie, Rie, Stewart, and Ambuel (1976), however, have presented evidence which challenges this conclusion. They examined 28 hyperactive children (17 boys

and 11 girls) who had been treated with Ritalin for a period of 12 weeks. Subjects were divided into responders and non-responders on the basis of a variety of standardized tests and behavioral ratings. The subjects' degree of neurological impairment was assessed by means of an organicity scale which consisted of various cognitive measures. Results suggested that pre-treatment organicity ratings correlated negatively with post treatment behavioral improvements. Thus, contrary to earlier findings, it was the members of the non-organic group who tended to respond. In yet another attempt to examine the predictive utility of this variable, Knights and Hinton (1969) found no relationship between organicity and drug response. In conclusion then, although there is some evidence which suggests that this predictive variable may be useful, the evidence as a whole is inconsistent.

A final neurological variable which has received some attention in predicting resonse to stimulants involves a finger twitch test which was first described by Barcai (1971). In this test the child sits with his hands hung between his knees and his head forward. He isasked to leave his hands in a normal position with his fingers moderately flexed. The interval between the beginning of the test and the appearance of the first twitch of his fingers or hands is measured by a stopwatch. His score is that interval of time in seconds. Barcai administered the

test to 53 hyperactive children prior to their six week treatment program of dextroamphetamine. On the basis of teacher behavior ratings, subjects were classified as responders and non-responders. It was revealed that the former group had a significantly lower mean finger twitch score, that is, those subjects who were later classified as non-responders were able to keep their hands still for a longer period of time than those later classified as responders. In the study of Rapoport et al. (1974) these results were replicated with 76 hyperactive children treated with Ritalin. It is uncertain at this time, however, if finger twitch test differences between responders and non-responders is due to motoric phenomena, attentional phenomena or both.

Cognitive and Academic Predictors

Considerable effort has been focused on discovering whether or not various measures of cognitive and academic performances can predict response to stimulant medication. The strategy here has typically involved comparing the pre-treatment performances of responders and non-responders on standardized psychological tests in the hope of discovering significant differences between the two groups. Despite the extensive attention this issue has received in the literature, little seems to have come of it; most cognitive and academic predictors have not proven useful.

There are, however, notable exceptions.

Rie et al. (1976), for example, demonstrated that Wechsler Intelligence Scale for Children (WISC) full scale IQs correlated positively with measures of attention derived from a parental behavior rating scale developed by one of the authors. In other words, improved attention was somewhat more likely to occur among brighter hyperactive subjects in response to Ritalin. The same was true of WISC performance IQs. The authors also concluded that the scores on the WISC's object assembly subtest correlated positively with improvements in teacher ratings of achievement.

Although Epstein et al. (1968) did not examine the predictive utility of WISC scores per se, their results are related to this issue. It was not the intention of these authors to compare the test performances of responders and non-responders but instead to compare the performances of organics and non-organics. As it happened, however, the members of their organic group were in fact responders, and their non-organics were in fact non-responders. Under stimulant treatment then, it was discovered that hyperactive responders showed a significantly greater decrease in WISC verbal IQs than did non-responders.

Despite these relatively positive findings, most research has suggested that the WISC is not an effective tool in discriminating

responders from non-responders. It has proven itself to be of little predictive value in numerous investigations (e.g., Buchsbaum & Wender, 1973; Hoffman, Englehardt, Margolis, Palizos, Waizer, & Rosenfeld, 1974; Knights & Hinton, 1969; Rapoport, Abramson, Alexander, & Lott, 1971; Rapoport et al., 1974; Satterfield et al., 1972; Weiss et al., 1968; Werry & Sprague, 1974; Zahn et al., 1975).

The Illinois Test of Psycholinguistic Ability (ITPA) is another standardized psychological test whose ability to distinguish between responders and non-responders prior to treatment has been explored. Rie et al. (1976) discovered a positive correlation between pretreatment ITPA auditory association scores and an improvement in actometer measures of arm activity among their hyperactive subjects. Unfortunately, it would be all but impossible to replicate their findings on the basis of the information presented in their article, for they were rather vague as to the manner and time in which the actometer was employed. Another note of caution which must be kept in mind in considering the results of this study is that its authors examined a large number of variables and tended to rely on univariate analyses. As a result one might expect some of their discriminating variables to be significant simply by chance. In any case, Satterfield

et al. (1972) considered the ITPA as a tool in predicting response to stimulants and their results suggested that it was not particularly effective.

In a study of 19 hyperactive boys four to ten years of age who were treated with dextroamphetamine for a period of three weeks, Rapoport et al. (1971) examined the predictive utility of the number of toy changes they made during free play. Prior to treatment, each subject was observed for a 20 minute play session and the number of toy changes he made was recorded by two observers. Interobserver reliabilities were acceptable. Subjects were divided into responding and non-responding groups after medication on the basis of teacher ratings. The results suggested that non-responders made significantly more toy changes than did responders.

Pre-treatment performances on the Kagan Matching Familiar Figures Test have been used to differentiate hyperactive responders to stimulants from non-responders. Rapoport et al. (1974), for example, reported a positive correlation between Matching Familiar Figures Test scores and improved behavior as determined by parental ratings.

Barkley (1976) has concluded that each of the cognitive and academic measures which appears to be useful in predicting response to stimulant medication, with the possible exception

of the WISC verbal IQ, is related to the hyperactive child's attention span. It thus appears that the more inattentive the child is initially, the more positive is his response to stimulant treatment.

As noted earlier, however, most efforts to discover effective academic or cognitive measures in predicting response to medication have not proven fruitful. Among the psychological tests which do not appear to be effective in discriminating response groups are: the Wide Range Achievement Test (Hoffman et al., 1974; Rapoport et al., 1974; Satterfield et al., 1972), the Goodenough Draw-A-Man Test (Rapoport et al., 1971, 1974; Satterfield et al., 1972; Weiss et al.; 1968; Zahn et al., 1975), the Burt Reading Test (Werry & Sprague, 1974), the Primary Mental Abilities Test (Weiss et al., 1968), the Bender Gestalt Test of Visual Motor Integration (Knights & Hinton, 1969; Rapoport et al., 1974; Satterfield et al., 1972; Weiss et al., 1968), and the Lincoln Osertsky Motor Development Test (Satterfield et al., 1968; Weiss et al., 1968).

Rating Scale Predictors

The predictive variables which have been reviewed up to this point have entailed a direct examination of the hyperactive

child and his behavior. The use of rating scales as predictors, on the other hand, involves a less direct consideration of the child. It typically means that the investigator explores the predictive utility of pre-treatment judgements and observations of the child made by others, be they his parents, teachers, or a clinician. The use of rating scales is, in a sense, an attempt to make these judgements and observations as objective and as comparable as possible.

Although rating scales have played a major role in many, if not most of the studies reviewed in previous sections, their predictive utilities were not considered. They were used merely as a contingency upon which hyperactive children were divided into response groups following medication. Investigators who have examined their predictive utilities, however, have typically used them to assess the child's pre-treatment degree of hyperactivity in order to see if this is related to his response to stimulant treatment.

Hoffman et al. (1974) studied 34 hyperactive children who were treated with Ritalin for a period of 12 weeks. On the basis of teacher ratings, they divided the subjects into "variable" and "consistent" responders to medication, as opposed to responding and non-responding groups. Prior to treatment, the parents of each child filled out a Werry-Weiss-Peters Activity Rating Scale

and a Conners Parent Symptom Questionaire (PSQ). Results suggested that the former was not effective in predicting response group membership. Four of the PSQ scales, however, discriminated between the two groups, in that variable (i.e., inconsistent) responders had higher scores on the conduct problem, hyperactivity-impulsivity, learning problem, and perfectionism scales. Zahn et al. (1975) examined the effectiveness of the Werry-Weiss-Peters Activity Rating Scale and also concluded that it was not effective in predicting response group membership. The predictive utility of the PSQ was also questioned in studies by Rapoport et al. (1974) and Werry and Sprague (1974), but the latter suggested that had the contingencies upon which they divided subjects into response groups been more rigorous, the predictive success of this instrument would have been greater. Thus, although the results from these studies of parent ratings tend to be equivocal, the PSQ appears to have some degree of discriminatory effectiveness.

Examinations of teacher rating scales have also been somewhat encouraging. Schleifer et al. (1975), for example, considered the predictive utility of a simple Hyperactivity Rating Scale which they themselves developed for teachers. In their study of 26 hyperactive nursery school children who were treated with Ritalin for a period of three weeks, subjects were assigned

to response groups on the basis of a variety of structured playroom measures and standardized psychological tests. The results suggested that responders tended to have the highest pre-treatment hyperactivity ratings.

Denhoff, Davids, and Hawkins (1971) have demonstrated the predictive effectiveness of the David's Rating Scale for Hyperkinesis. They studied 42 children between the ages of six and thirteen who were treated with dextroamphetamine for a period of three weeks. Subjects were assigned to response groups on the basis of post treatment teacher ratings. Those children who initially received the highest hyperactivity ratings tended to show the most improvement as a result of medication. In a similar fashion Steinberg et al. (1971) found a modification of the hyperactivity score on the Conners Teacher Rating Scale to be effective in predicting response to stimulant medication; once again teachers tended to rate responders as having higher hyperactivity ratings prior to stimulant treatment. Although Rapoport et al. (1974) did not find the Conners Teacher Rating Scale to be effective in distinguishing responders from non-responders to Ritalin prior to treatment, its conduct disorder score was effective in discriminating between subjects in response to imipramine, another stimulant. Specifically, it was reported that non-responders tended to have higher Conners conduct disorder scores than did

responders. Werry and Sprague (1974) did not find the Conners Teacher Scale to be effective in predicting response to medication in their study, but as in the case of the PSQ, they concluded that had the contingencies upon which they classified subjects into response groups been more rigorous, the predictive power of this instrument would have been, in all likelihood, more impressive. In some studies, however, teacher ratings were not useful in predicting response to stimulants (Hoffman et al., 1974; Rie et al., 1976). As in the case of parent ratings then, research suggests that although the evidence may be somewhat equivocal, teacher ratings do appear to have some degree of utility in predicting response to medication.

A number of studies have also explored the ability of clinicians' ratings of children's behavior to predict response to stimulant treatment. Butter and Lapierre (1975), for example, did so in their investigation of 32 hyperactive children aged six to thirteen years. Each child was treated with Ritalin for a period of two weeks and assigned to a response group on the basis of improvement on ITPA scores and stimulation detection tests. Prior to treatment, each child was individually assessed and rated by three child psychiatrists on the David's Rating Scale for Hyperkinesis. It was reported that responders had the highest pre-treatment hyperactivity ratings. Zahn et al. (1975) similarly had a psychiatrist

rate their hyperactive subjects on acting out and anxiety scales prior to treatment. Responders and non-responders to medication differed significantly on the two of them, the latter receiving higher scores on both measures. The nature of these scales is uncertain, however, for the authors were somewhat vague in describing them. Despite these promising results it must be noted that clinicians' ratings have not proved effective in predicting response to medication in a number of studies (e.g., Hoffman et al., 1974; Lytonn & Knobel, 1958; Rapoport et al., 1974).

Familial Predictors

A number of investigators have examined the relationship between characteristics of the hyperactive child's family and his response to stimulant medication. As was noted earlier, rating scale predictors are somewhat indirect in that they usually do not involve observations of the child by the researchers themselves, but in most cases rely on the observations of others. In this sense then, familial predictors are still more removed and indirect, for they do not entail characteristics of the child himself, but of his immediate social environment. The strategy in this area has typically involved a comparison of various attitudes and qualities of the parents of the stimulant responders and non-responders in order to determine if there are significant differences

between the two groups.

Loney, Comly, and Simon (1975), for example, considered familial predictors in their study of 50 hyperactive elementary school boys under the age of eleven. The subjects were treated with Ritalin for an unspecifed period and a psychologist divided them into response groups on the basis of progress notes written by parents and teachers. Prior to treatment, and on the basis of reviewing information contained in their medical charts, subjects were divided into a Good Management group (GM) and a Poor Management group (PM). The GM parents were described as being firm, consistent, predictable, sensitive, alert to subtle cues, sensible, and realistic. As parents they were considered to be placid, easygoing, accepting, and affectionate. Boys in the PM group often had histories of rejection or neglect. Their parents were described as being overprotective or overindulgent and supplied few external controls for their children. Results suggested that subjects in the GM group were more likely to respond to medication than those in the PM group. The authors concluded that this difference in response to medication arose because their poorly managed subjects were more likely to have secondary problems such as learning handicaps which were not as easily influenced by medication as were attentional problems

which both the PM and GM groups shared. There are, however, a number of unfortunate flaws in this study. The authors' interpretation of results assumes that their poorly managed subjects indeed had more secondary problems, yet no evidence was reported to support this hypothesis. Subjects were divided into response groups and parental management groups on the basis of judgements stemming from information in their medical charts. No attempt was made, however, to determine inter-judge reliability.

In their study, Weiss et al. (1971) examined 89 hyperactive children who were treated with Ritalin for a period of four to six weeks. Results suggested that a pre-medication measure of the quality of the mother-child relationship correlated positively with drug response. The authors postulated that a mother who has a good relationship with her child will successfully reinforce the pharmacological drug effect and thus enhance the level of his improvement. This study, however, is plagued by a number of egregious omissions. For example, the pre-treatment measure of the mother-child relationship is not described, neither are the criteria upon which subjects were assigned to response groups. The postulated manner in which a mother can enhance her child's response to medication was also poorly explained and defined.

Conrad and Insel (1967) studied 31 hyperactive children who were treated with stimulants for an unspecified period of

time. Judges examined medical charts and had conversations with parents following treatment and on this basis assigned subjects to response groups. Interjudge reliability was acceptable. The competence of each parent was also assessed on the basis of information contained in the subjects' medical charts. The results suggested that those children with at least one parent rated as "grossly deviant" or "socially incompetent" were less likely to respond to medication than children with parents who were both regarded as being stable. No explanation for this phenomenon was hypothesized.

Despite methodological errors and omissions, each of these investigations dealing with familial predictors has concluded that there is a relationship between a child's having competent and warm parents and his positive response to stimulant medication. None of these studies, however, have offered an adequate explanation for this phenomenon.

Loney, Prinz, Mishalow, and Joad (1978) examined parenting styles as predictors of response to medication in their study of 84 hyperactive boys who were treated with Ritalin. Subjects were assigned to response groups on the basis of progress notes from their medical charts which were written by physicians and social workers. Prior to stimulant treatment, their parents were rated on a series of nine parenting style scales. Interjudge

reliability was acceptable in assigning children to response groups in rating their parents. The results, however, did not provide sufficient evidence to conclude that there is a relationship between parenting styles and response to stimulants.

Schleifer et al. (1975), as part of their study which has been described previously, rated the mothers of their hyperactive subjects on a number of dimensions during a psychiatric interview prior to medication. The results demonstrated that the mothers of responders tended to be more frustrated and more likely to use physical punishment than those of non-responders. In reviewing this study, Barkley (1976) suggested that its results were inconsistent with those earlier investigations which concluded that a hyperactive child is more likely to respond favorably to stimulant medication when his parents are competent, good managers, and able to maintain a positive relationship with their children. His suggestion, however, must be questioned. The frustration of these mothers may simply indicate a deep concern over the welfare of their children, and their use of physical punishment may represent a desire to supply their children with external controls, a variable that Loney et al. (1975) considered to be a sign of a "good manager". In any case, there is no reason to assume that a frustrated mother who uses physical punishment is incompetent, a poor manager, or incapable of maintaining a positive relationship with her

child.

The Problem

Although it would appear that a number of familial variables have some utility in predicting the hyperactive child's response to stimulant medication, hypotheses offered to explain this phenomenon have not been adequate or satisfying. Familial variables, in a sense, form a very special and unique class of predictors. Other classes, including psychophysiological, neurological, cognitive/academic, and rating scale predictors all tend to involve a consideration of either the child himself, or of his productions, albeit with varying degrees of directness. Familial predictors, on the other hand, entail a consideration not of the child himself, but of his social milieu. This raises questions as to the mechanisms involved in how it is that the response of the child's body to stimulant medication is influenced by attitudes and qualities of his parents. By what means do these "exogenous phenomena" (parental qualities) come to influence this "endogenous phenomenon" (response to medication) to the extent that the former can be used to predict the latter? As was previously stated, researchers in this field have not offered

adequate hypotheses to explain this relationship.

One possible explanation, however, might use the child's personality as an intervening variable, for it is a well established and accepted fact that parental competence and child-rearing attitudes have considerable impact on the formation of a child's personality (Schaeffer & Bell, 1958). Thus various parental qualities and attitudes may influence a hyperactive child's personality, which may in turn influence such endogenous phenomena as his autonomic arousal level in such a way as to play a role in his reaction to stimulant medication. The problem of directionality, however, need not be addressed. Perhaps various endogenous characteristics of the child determine his response to stimulants and also influence his personality which may in turn alter his parents in some way. In either case, this hypothesis tends to account for the relationship between the child's response to medication and various qualities of his parents. In order to support it, however, it would be necessary to demonstrate that there are distinct personality differences between hyperactive responders and non-responders to stimulant medication.

Despite the enormous amount of research that has been devoted towards hyperactive children in recent years, incongruously little attention has been paid to their personality characteristics. Those studies which have attempted to examine their personalities

have tended to reiterate that they score high on the definitive and obvious characteristics of distractability and impulsivity (e.g., Lambert & Windmiller, 1977). Others have followed them into their teens and have described them as being at greater risk of becoming involved in certain behavior patterns such as more frequent alcohol consumption than matched non-hyperactives (Blouin, Bornsein, & Trites, 1978) and a higher incidence of juvenile delinquency (Mendelson, Johnson, & Stewart, 1971; Morrison & Stewart, 1971; Weiss, Minde, Werry, Douglas, & Nemeth, 1971; Soloman, 1972).

Efforts to delineate personality differences between hyperactive stimulant responders and non-responders, on the other hand, have been both less frequent and less satisfying. The best of those which have been attempted was perhaps that conducted by Hoffman et al. (1974) and has already been described. The authors reported that "variable" responders, prior to treatment, were more aggressive, impulsive, and perfectionistic than "consistent" responders according to Conners parent ratings. A very obvious limitation of this study, however, is that its authors were not, in fact, examining differences between responding and non-responding groups. All of their subjects were responders but differed with regard to the quality of their responses.

Zahn et al. (1975), as previously stated, concluded that

prior to medication, the members of their non-responding group had higher anxiety and acting out scores than responders as rated by a psychiatrist. The rating scales that they employed, however, were neither named nor described, thus it is not possible to assess the value of these results.

Conrad and Insel (1967) reviewed the medical charts of their hyperactive subjects, and on the basis of information found there, classified each as having "primary emotional pathology" or not. Their results suggested that responders tended not to have such pathology, whereas their non-responders did. It is felt that this study sheds some light on personality differences between stimulant response groups, albeit rather vague.

Rapoport et al. (1971) compared their response groups' pre-treatment scores on the Child's Manifest Anxiety Scale and Rapoport et al. (1974) compared their response groups on a pre- treatment self-concept scale. In neither study were significant differences reported.

It must be reiterated that these attempts to delineate personality differences between stimulant response groups have not been satisfying. With all due respect to the investigators involved, however, it must be noted that it was not their intention to examine this issue in any detail, for in each of these studies only rather narrow or vague personality measures were employed.

The study described in the present paper, however, does represent an attempt to examine this issue in detail. Pre-treatment personality characteristic measures of responders and non-responders to stimulant medication will be compared and contrasted in the hope of delineating fundamental differences between the two groups. This study, in a sense, represents a survey with an exploratory basis, to the extent that the two groups will be compared on a broad range of personality characteristics, without stating a priori which are expected to distinguish the two from each other. Similar comparisons will also be made between responders and non-responders to behavior modification. Of all the psychotherapeutic techniques which have been considered, behavior therapy appears to be the most successful (Ross & Ross, 1976; Safer & Allen, 1976). Just as in the case of stimulant medication, some hyperactive children appear to respond well to this form of treatment and others do not. Unfortunately, this issue has received little attention in the literature, which has prompted Mash and Dolby (1979) to suggest that in the future, should any distinctions between responders and non-responders to stimulant medication be discovered, attempts should be made to determine if these distinctions also hold true for responders and non-responders to behavior therapy. To that end then, personality variables which differentiate between stimulant response groups in this investigation will be

applied to known responders and non-responders to behavior therapy in order to see if they can indeed distinguish them from each other.

Methodology

Subjects

Subjects consisted of 125 boys who had been referred to the Neuropsychology Laboratory of the Royal Ottawa Hospital for an assessment. Each was subsequently diagnosed as being hyperactive by a senior psychologist on the basis of results from an extensive psychometric battery (which included motor, sensory, language; intelligence, and personality tests), a detailed history, school record information, physicians' referral letters, and parent and teacher questionaires. To be included in the study, a child must have displayed clinically significant levels of hyperactivity, as well as having scored above 1.5 or more on both the Conners' parent and teacher rating scales of hyperactivity. Those subjects who showed evidence of gross psychopathology or neurological disease (other than "minimal brain dysfunction") or who had full scale Wechsler IQs below 80 were not included in the present investigation.

One hundred and seven of these boys were put on a program of stimulant medication in a manner which will be described. To ensure that the prescribed medication was actually taken, weekly "rations" of it were given to the parents in dated envelopes

which, when emptied, were returned to the laboratory during the parents' weekly visit. In addition to this weekly visit, a research assistant phoned the families once a week to ensure that the medication was being taken and that everything was running smoothly. The result was that no parent at any time returned unused pills. Three of the subjects were withdrawn from the program when their parents had second thoughts about this mode of treatment. Later in the program, two subjects appeared to be having some adverse reaction to medication and their treatment was therefore terminated, leaving a total of 102 boys who received Ritalin throughout the entire length of the project. They ranged in age from 7 years, 0 months to 12 years, 11 months (mean age = 113 months, standard deviation = 20 months) and had a mean Wechsler full scale IQ of 98.9 (standard deviation = 10.6).

Prior to the beginning of the Ritalin project, 24 of the original 125 hyperactive subjects were randomly invited to participate in a program of behavior management. Due to the extensive time commitment required, the parents of six of the subjects declined the invitation, leaving 18 who actually did participate. The six who declined were included in the stimulant medication program. The behavior management subjects themselves ranged in age from 7 years, 4 months to 12 years, 9 months (mean age = 109 months, standard deviation = 21 months) and had a mean IQ of 104.4 (standard deviation = 14.2). The parents

of all subjects gave consent that any data which were collected could be used for research purposes and all data were codified prior to analysis in such a way as to safeguard and guarantee the confidentiality of the subjects' identities.

Apparatus

The standard materials associated with the Continuous Performance Test (CPT), the Reaction Time Test (RTT), the Matching Familiar Figures Test (MFF), the Conners Parent Symptom Questionnaire (PSQ), the Conners Teacher Rating Scale (TRS), the Vineland Social Maturity Scale, the Children's Personality Questionnaire (CPQ), and the Early School Personality Questionnaire (ESPQ) were employed. These standardized instruments are generally recognized as being valuable research tools and as such have been considered and described frequently in the literature. For the sake of clarity, however, concise descriptions will be provided.

The CPT in sensitive to brief lapses in vigilance (Sykes, Douglas, Weiss, & Minde, 1971). Subjects were required to respond to an experimenter-paced stimulus array presented on a television monitor by correctly identifying a pre-determined signal stimulus from irrelevant stimuli. In this case a series of letters was flashed on the screen and each time the letter "X" was immediately preceded by the letter "A", the subject was

expected to respond by pushing a button. Two error scores were used: omissions (the number of times a subject neglected to respond to a presented A-X combination) and commissions (the number of times a subject responded to an erroneous combination).

In the RTT (Cohen & Douglas, 1972) an auditory stimulus (a tone) marked the onset of either a four or eight second preparatory interval at the end of which a reaction signal (a light) placed before the subject was activated. Simultaneous with the appearance of the reaction signal, a Standard Electric Clock Timer started and ran until the subject removed his finger from the response button. Each subject participated in nine blocks of fifteen trials to yield two measures: his mean reaction time and the standard deviation of his reaction times (in that hyperactive children are characterized by more variable scores than normals).

In the MFF (Kagan, 1965) subjects were presented with a booklet on each page of which was printed one standard drawing and six comparison drawings. One of the comparisons was actually identical to the standard, and to avoid error, the subject had to identify it correctly. His score was his total number of errors.

The Vineland Social Maturity Scale (Doll, 1953; 1965) is, in fact, a detailed structure for an intensive interview with the subject's mother, geared at assessing his capacity for looking after himself and participating in those activities which will lead to his ultimate independence as an adult. A series of 117 items, each

describing some behavior (e.g., buttons his own coat) are arranged in order of increasing difficulty and the total number of those behaviors which the subject exhibits is translated into a social age by means of provided tables. That figure is multiplied by 100 and divided by his chronological age to yield his social quotient (SQ).

The PSQ (Conners, 1970b) required a parent (in this investigation the mother) of each subject to assess the extent to which given behaviors are present in her son's repertoire of behaviors. She therefore classified each in a list of items (such as "Fails to finish what he starts") into one of the following categories: not present at all, just a little, pretty much, and very much present. The items load onto eight factors and the PSQ thus yields scores for each child on the following scales: conduct problem, anxiety, impulsive-hyperactive, learning problem, psychosomatic, perfectionism, antisocial, and muscular tension. Should a mother, for example, have reported that all 21 items which compose the anxiety scale were very much present in her son's repertoire of behavior, his PSQ anxiety scale would have been 100%.

The TRS (Conners, 1970a) is a similar instrument which, with parental consent, was filled out by the subject's teacher. It yields scores on the scales of conduct, inattentive-passive, tension-anxiety, and hyperactivity.

The ESPQ (Coan & Cattell, 1970) consists of 80 items which load onto 13 personality factors. The items are in fact forced-choice questions (such as Do you prefer a: to climb trees or b: to look at pictures in books). The subjects' responses provide raw scores for the 13 personality factors and these are translated, by means of provided tables, into standard or "sten" scores which range from one to ten. Unlike many other personality tests, low scores on the ESPQ do not indicate an absence of a trait, for its scales are, in fact, bipolar. Thus the more extreme a score, or the more it deviates from the expected sten score range of five or six, be that deviation positive or negative, the more a subject is said to be imbued with a given trait.

The factors are refered to by single letters, being known as Factors A,B,C,D,E,F,G,H,I,J,N,O, and Q respectively. Low scorers on Factor A are described as being reserved, detached, and critical, whereas high scorers are said to be warmhearted, outgoing, and participating. Low scorers on Factor B are considered to be dull and concrete-thinking, and high scorers bright and abstract-thinking. Low scorers on Factor C are affected by feelings and easily upset, and high scorers are emotionally stable, calm, and mature. Low scorers on Factor D are said to be undemonstrative and deliberate; high scorers are described as being

excitable and impatient. Low scorers on Factor E are obedient, mild, and accomodating,whereas high scorers are assertive, competitive, and stubborn. Low scorers on Factor F are sober and prudent; high scorers are enthusiastic and happy-go-lucky. Low scorers on Factor G tend to disregard rules and be expedient, but high scorers are said to be conscientious and rule-bound. Low scorers on Factor H are shy, timid, and threat-sensitive; high scorers are venturesome and spontaneous. Low scorers on Factor I are tough-minded, self-reliant, and realistic; high scorers are tender-minded, dependent, and sensitive. Low scorers on Factor J are vigorous and given to action; high scorers are circumspect and internally restrained. Low scorers on Factor N are forthright, natural, and sentimental; high scorers are astute and shrewd. Low scorers on Factor O are self-assured, placid and secure; high scorers are apprehensive, insecure and troubled. Low scorers on Factor Q are relaxed and tranquil; high scorers are tense and frustrated.

Whereas the ESPQ was administered to subjects below the age of nine years, the CPQ (Porter & Cattell, 1975), a more senior form of that test, was given to subjects above that age. Its items are more numerous, their verbal sophistication greater, and a subject reads them to himself (unless assistance is required). Its items nevertheless load onto the same personality factors as do those of the ESPQ, thus data from the two tests are readily comparable.

Procedure

One hundred and two boys who had been diagnosed as being hyperactive were administered a battery of tests which included the ESPQ or CPQ (depending on the child's age), the MFF, the CPT, and the RTT. Testing was conducted by a team of psychotechnicians who rescored each other's tests at a later date to ensure accuracy and precision. The teacher of each subject filled out a TRS and the mother of each filled out a PSQ. The latter was also interviewed to determine her son's Vineland social quotient.

With parental consent and under the supervision of a qualified physician, all 102 subjects were put on a program of stimulant medication. They were given 0.5 milligrams of Ritalin per kilogram of their body weights each day in two doses: at breakfast and at lunch. A double-blind crossover strategy was used, involving three treatment periods each of three weeks duration according to two orders: Ritalin-placebo-Ritalin and placebo-Ritalin-placebo. The MFF, CPT, and RTT were readministered to all subjects immediately following each of these three week periods and their mothers were also asked to fill out additional PSQs at those times.

The five measures of attention (i.e., the CPT omission, CPT commission, the RTT mean, RTT standard deviation, and MFF scores)

and the PSQ hyperactivity scale ~~was~~ were used as criterion variables. Specifically, those subjects whose post-Ritalin measures of attention had dropped below their respective baseline levels were considered to be more attentive, less hyperactive, and thus responsive to medication. Those subjects whose post-Ritalin PSQ hyperactivity scales had dropped by at least ten percent from baseline levels were also considered as less hyperactive and thus responsive to medication. The remaining subjects, that is, those whose criterion scores remained unchanged or even rose above baseline levels were classified as being non-responders.

In that six different criterion measures were used, numerous formal definitions of response to medication were possible. For example, one might arbitrarily state that a responder will be defined as a subject who improves on four of the six criterion measures following medication. Another definition such as improvement on five of the six criteria, however, might be equally valid and to ignore it would be to forfeit potentially valuable information. For this reason then, response to medication was defined in a variety of ways in the present investigation and each of these definitions forms the basis for its own separate study.

Nine different definitions of positive response were employed. The first six considered each criterion measure individually. Thus, in each, responders improved on one given measure whereas

non-responders did not. In the seventh study, classification in the responding group was contingent upon post-Ritalin improvement on four of the five measures of attention. This definition was chosen because the PSQ hyperactivity scale is somewhat incongruent with the remaining criterion measures of attention; thus for the sake of homogeneity it was deemed profitable to exclude it in one study. In the eighth study, classification in the responding group was contingent upon improvement on four of the six criterion measures, and on five of the six in the ninth study. It was not practical to conduct a study defining response as improvement on all six criteria, for only three of the 102 subjects actually improved on all six measures.

In each of these studies, the ability of 26 pre-treatment personality measures to predict response to medication was explored. The 26 personality measures include: the 13 ESPQ/CPQ factors, the 8 PSQ scales, the 4 TRS scales, and the social quotient.

Eighteen boys who were diagnosed as being hyperactive in the same fashion as the 102 treated with stimulant medication and were subjected to the same battery of psychological tests were put on a program of behavior management. The technique of contracting was employed (Cantrell, Cantrell, Huddleston, & Woodridge, 1969). Parents were asked to choose one of their hyperactive son's behaviors which they considered to be particularly

maladaptive, and for one week kept a careful frequency count of the number of times it occurred. That figure was divided by seven for a daily average baseline.

In the next stage of the program, a female research assistant visited the family and drew up a written contract specifying the target behavior and the rewards to be given to the subject for refraining from it with all parties present. The following is an example of a typical contract:

> For every hour that Joey walks instead of runs (from room to room or up and down stairs) he will be given one point. At the end of the day, if he has earned five points, he will be allowed to stay up 30 minutes past his bed time. If he earns 25 points in any given week, he will be taken swimming.

Both the subject and his parents signed the document and a frequency count of the target behavior was made at the end of each hour of every day for nine weeks, in the child's presence. The daily mean frequency of the target behavior during the ninth week was compared with the daily mean baseline frequency for each subject. Those subjects whose target behaviors had decreased by at least 75% during the program were classified as responders to behavior management and those who did not meet this criterion were considered to be non-responders.

It was not possible to subject the pre-treatment personality measures derived from this program to the same statistical analyses as were those generated by the stimulant medication program because of the limited number of subjects involved. The discriminant functions based on personality characteristics which significantly predicted response to Ritalin, however, were applied to the data of this program in order to determine if they could successfully predict response to behavior management.

Results

Study 1. When response to medication was defined as a decrease in the CPT omission score after receiving Ritalin, 58 subjects were classifed as responders and 44 as non-responders. The responders had a mean age of 9 years, 6 months (standard deviation = 22 months) and a mean Wechsler full scale IQ of 98.4 (standard deviation = 11.6). Non-responders had a mean age of 9 years, 3 months (standard deviation = 18 months) and a mean IQ of 99.2 (standard deviation = 8.9). The mean criterion scores for both groups are reported in Table 1. In those cases in which a subject received two Ritalin or two placebo treatments, the means of the relevant criterion scores are reported.

Insert Table 1 about here

Direct discriminant analysis was carried out using the

26 pre-treatment personality measures to distinguish responders from non-responders. The resulting discriminant function is reported in Table 2 but is not significant to the .05 level (Wilks' Lambda = 0.81). This function nevertheless successfully predicts the response group membership of 63 (or 61.76%) of the subjects.

Insert Table 2 about here

Stepwise discriminant analysis was also carried out to determine if the number of variables in the direct function could be reduced without appreciably altering the "hit rate", or number of subjects whose response group memberships were correctly predicted. The resulting function is reported in Table 3 and is significant to the .05 level (Wilks' Lambda < 0.90). It successfully predicts the response group membership of 67 (or 66.34%) of the subjects but none of its components are univariately significant to the .05 level (with 1 and 100 degrees of freedom).

Insert Table 3 about here

The differences between the pre- and post-treatment CPT omission scores were calculated and the improvement scores were then used as the dependent variable in a multiple correlation with the 26 personality measures. The multiple correlation was 0.40 which suggests that 16% of the variation in CPT omission

improvement scores is explained by the personality measures, but is not significant to the .05 level.

Study 2. When response to medication was defined as a decrease in CPT commissions after having received Ritalin, 63 subjects were classified as responders and 39 as non-responders. The responders had a mean age of 9 years, 5 months (standard deviation = 21 months) and a mean IQ of 98.0 (standard deviation = 10.7). Non-responders had a mean age of 9 years, 4 months (standard deviation = 19 months) and a mean IQ of 99.9 (standard deviation = 10.1). The mean criterion scores for both groups are reported in Table 4.

Insert Table 4 about here

The direct discriminant function using the 26 personality measures is reported in Table 5 but is not significant to the .05 level (Wilks' Lambda = 0.82). It nevertheless successfully predicts the medication responses of 69 (or 67.65%) of the subjects.

Insert Table 5 about here

Stepwise discriminant analysis was once again carried out to see if the number of variables in the direct function could be reduced without altering the hit rate appreciably. The resulting function is reported in Table 6 and is significant to the .05 level (Wilks' Lambda = 0.89). It successfully predicts

the medication responses of 67 (or 66.34% of the subjects, but none of its components are univariately significant to the .05 level (with 1 and 100 degrees of freedom).

Insert Table 6 about here

The multiple correlation between the CPT commission improvement scores and the personality measures was 0.49 which suggests that 24% of the variation in the former is explained by the latter, but is not significant to the .05 level.

Study 3. When response to medication was defined as a decrease in the RTT mean after having received Ritalin, 65 subjects were classified as responders and 37 as non-responders. The responders had a mean age of 9 years, 5 months (standard deviation = 20.8 months) and a mean IQ of 99.4 (standard deviation = 11.0). The non-responders had a mean age of 9 years, 3 months (standard deviation = 19 months) and a mean IQ of 98.4 (standard deviation = 10.6). The mean criterion scores for both groups are reported in Table 7.

Insert Table 7 about here

The direct discriminant function using the 26 personality measures is reported in Table 8 but is not significant to the .05 level (Wilks' Lambda = 0.79). It nevertheless successfully predicts the medication responses of 72 (or 70.59%) of the

subjects.

Insert Table 8 about here

The stepwise discriminant function is reported in Table 9 and is significant to the .05 level (Wilks' Lambda = 0.80). It successfully predicts the medication responses of 70 (or 68.62%) of the subjects. One of its components, the TRS Inattentive scale, is univariately significant to the .05 level (with 1 and 100 degrees of freedom) which suggests that prior to treatment, subjects who would later resond positively to Ritalin were more inattentive that those who would later be classified as non-responders.

Insert Table 9 about here

The multiple correlation between the RTT mean improvement scores and the 26 personality measures was 0.40 which suggests that 16% of the variation in the former is explained by the latter, but is not significant to the .05 level.

Study 4. When response to medication was defined as a decrease in the RTT standard deviation after having received Ritalin, 67 subjects were classifed as responders and 35 as non-responders. The responders had a mean age of 9 years, 5 months (standard deviation = 19 months) and a mean IQ of 98.3 (standard deviation = 10.1). Non-responders had a mean age

of 9 years, 3 months (standard deviation = 22 months) and a mean IQ of 100.6 (standard deviation = 11.6). The mean criterion scores for both groups are reported in Table 10.

Insert Table 10 about here

The direct discriminant function using the 26 personality measures is reported in Table 11 but is not significant to the .05 level (but is significant to the .06 level) with Wilks' Lambda being equal to 0.65. It nevertheless successfully predicts the medication responses of 79 (or 77.45%) of the subjects.

Insert Table 11 about here

The stepwise discriminant function is reported in Table 12 and is significant to the .001 level (Wilks' Lambda = 0.73). It successfully predicts the medication responses of 75 (or 73.53%) of the subjects. Two of its components are univariately significant: the TRS Inattentive scale to the .05 level and Factor A to the .01 level (both with 1 and 100 degrees of freedom). This suggests that prior to medication, subjects who would later be classified as non-responders were more attentive, reserved, detached, and critical than those who would respond positively to Ritalin.

Insert Table 12 about here

The multiple correlation between the RTT standard deviation improvement scores and the 26 personality measures was 0.54 which suggests that 29% of the variation in the former is explained by the latter, but is not significant to the .05 level.

Study 5. When response to medication was defined as a decrease in the MFF score after having received Ritalin, 70 subjects were classified as responders and 32 as non-responders. The responders had a mean age of 9 years, 6 months (standard deviation = 21 months) and a mean IQ of 97.9 (standard deviation = 9.5). The non-responders had a mean age of 9 years, 1 month (standard deviation = 19 months) and a mean IQ of 101.2 (standard deviation = 12.6). The mean criterion scores for both groups are reported in Table 13.

Insert Table 13 about here

The direct discriminant function using the 26 personality measures is reported in Table 14 but is not significant to the .05 level (Wilks' Lambda = 0.76). It nevertheless successfully predicts the medication responses of 72 (or 70.59%) of the subjects.

Insert Table 14 about here

The stepwise discriminant function is reported in Table 15 and is significant to the .05 level (Wilks' Lambda = 0.79). It successfully predicts the medication responses of 70 (or 68.63%)

of the subjects. One of its components, the PSQ Antisocial scale, is significant to the .05 level (with 1 and 100 degrees of freedom) which suggests that prior to medication subjects who would later respond positively to medication were less antisocial than those who would be classified as non-responders.

Insert Table 15 about here

The multiple correlation between MFF improvement scores and the 26 personality measures was 0.56 which suggests that 31% of the variation in the former is explained by the latter, but is not significant to the .05 level.

Study 6. When response to medication was defined as a decrease by 10% or more on the PSQ Hyperactivity scale after having received Ritalin, 53 subjects were classified as responders and 49 as non-responders. The responders had a mean age of 9 years, 3 months (standard deviation = 19 months) and a mean IQ of 99.1 (standard deviation = 9.4). The non-responders had a mean age of 9 years, 6 months (standard deviation = 21 months) and a mean IQ of 99.2 (standard deviation = 12.1). The mean criterion scores for the two groups are reported in Table 16.

Insert Table 16 about here

The direct discriminant function using the 26 personality measures is reported in Table 17 but is not significant to the

.05 level (Wilks' Lambda = 0.80). It nevertheless successfully predicts the medication responses of 71 (or 69.61%) of the subjects.

Insert Table 17 about here

The stepwise discriminant function is reported in Table 18 and is significant to the .01 level (Wilks' Lambda = 0.81). It successfully predicts the medication responses of 71 (or 69.61%) of the subjects. Two of its components are univariately significant to the .05 level: the Social Quotient and Factor F (both with 1 and 100 degrees of freedom) which suggests that prior to medication, subjects who would later respond to Ritalin were less-mature and less enthusiastic by nature than were those who would be classified as non-responders.

Insert Table 18 about here

The multiple correlation between the PSQ Hyperactivity improvement scores and the 26 personality measures was 0.41 which suggests that 17% of the variation in the former is explained by the latter, but is not significant to the .05 level.

Study 7. When response to medication was defined as improvement on four of the five measures of attention (i.e., CPT omission, CPT commission, RTT mean, RTT standard deviation, and MFF scores) after having received Ritalin, 52 subjects were classified as responders and 50 as non-responders. The responders

had a mean age of 9 years, 6 months (standard deviation = 21 months) and a mean IQ of 98.0 (standard deviation = 10.7). The non-responders had a mean age of 9 years, 3 months (standard deviation = 19 months) and a mean IQ of 99.9 (standard deviation = 10.6). The mean criterion scores for both groups are reported in Table 19.

Insert Table 19 about here

The direct discriminant function using the 26 personality measures is reported in Table 20 but is not significant to the .05 level (Wilks' Lambda = 0.77). It nevertheless successfully predicts the medication responses of 69 (or 67.65%) of the subjects.

Insert Table 20 about here

The stepwise discriminant function is reported in Table 21 and is significant to the .05 level (Wilks' Lambda = 0.83). It successfully predicts the medication responses of 69 (or 67.65%) of the subjects. Two of its components are significant to the .05 level: the PSQ Antisocial and TRS Inattentive scales (both with 1 and 100 degrees of freedom) which suggests that prior to medication subjects who would later respond positively to Ritalin were less antisocial but more inattentive than those who would be classified as non-responders.

Insert Table 21 about here

It is not possible to determine the amount of variation in the four out of five improvement scores explained by the predictors for this would require precise knowledge of which of the five are involved. By design, however, which of the five used varies from subject to subject. It is nevertheless possible to determine the canonical correlation between all five measures of attention and the 26 personality measures. That correlation was in fact 0.63 which suggests that 40% of the variation in the measures of attention is explained by the personality measures. This correlation is not, however, significant to the .05 level.

Study 8. When response to medication was defined as improvement on four of the six criteria after having received Ritalin, 57 subjects were classified as responders and 45 as non-responders. The responders had a mean age of 9 years, 5 months (standard deviation = 21 months) and a mean IQ of 97.2 (standard deviation = 9.3). The non-responders had a mean age of 9 years, 4 months (standard deviation = 19 months) and a mean IQ of 101.1 (standard deviation = 11.9). The mean criterion scores for both groups are reported in Table 22.

Insert Table 22 about here

The direct discriminant function using the 26 personality measures is reported in Table 23 but is not significant to the .05 level (Wilks' Lambda = 0.78). It nevertheless successfully predicts the medication responses of 74 (or 72.55%) of the subjects.

Insert Table 23 about here

The stepwise discriminant function is reported in Table 24, but is not significant to the .05 level (Wilks' Lambda = 0.89) nor are any of its components univariately significant to the .05 level (with 1 and 100 degrees of freedom). It nevertheless correctly predicts the medication responses of 66 (or 64.71%) of the subjects.

Insert Table 24 about here

Study 9. When response to medication was defined as improvement on five of the six criteria after having received Ritalin, 35 subjects were classified as responders and 67 as non-responders. The responders had a mean age of 8 years, 4 months (standard deviation = 19 months) and a mean IQ of 97.1 (standard deviation = 9.8). The non-responders had a mean age of 9 years, 5 months (standard deviation = 21 months) and a mean IQ of 99.9 (standard deviation = 11.0). The mean criteria scores for both groups are reported in Table 25.

The direct discriminant function using the 26 personality

Insert Table 25 about here

measures is reported in Table 26 but is not significant to the .05 level (Wilks' Lambda = 0.81). It nevertheless successfully predicts the medication responses of 71 (or 69.61%) of the subjects.

Insert Table 26 about here

The stepwise discriminant function is reported in Table 27 and is significant to the .01 level (Wilks' Lambda = 0.83). It successfully predicts the medication responses of 69 (or 67.65%) of all subjects but none of its components are univariately significant to the .05 level (with 1 and 100 degrees of freedom).

Insert Table 27 about here

The canonical correlation between all six criterion improvement scores and the 26 measures of the personality was 0.63. This suggests that 40% of the variation in the former may be explained by the latter, but the correlation is not significant to the .05 level.

Study 10. A quick glance at the descriptive criterion data reported in Tables 1, 4, 7, 10, 13, 16, 19, 22, and 25 suggests that among responders, there seems to a general tendency for post-placebo scores to be lower than baseline scores and

for post-Ritalin scores to be still lower. This suggests that although treatment with Ritalin may be more effective than treatment with placebo, the latter is not without benefits. The nine different definitions of response which were employed in this investigation are reported in Table 28 along with the numbers and percentages of subjects who fulfilled the requirements of those definitions after having received Ritalin and placebo treatments. The number of responders to the placebo treatment appears to be rather high, in most cases above 50%. This tends to raise certain fundamental questions about the nature of the present investigation, particularly about the manner in which

Insert Table 28 about here

subjects were classified as responders and non-responders. Classification was dichotomous; it was dependent upon whether a subject improved on a given criterion or whether he did not. Only the fact of improvement was considered, not the extent of improvement. Thus subjects may have differed in the extents of their responses to Ritalin and placebo, as is suggested in the previous tables of descriptive data, but this is not reflected in the numbers who respond to each as is reported in Table 28. Thus in most cases the high percentages of subjects who responded to the placebo treatment may be artifacts of the

manner in which they were classified. There are, however, notable exceptions. When response was defined as improvement on a number of criteria as opposed to a single criterion, some acknowledgement of the extent or quality of improvement was considered. To earn the distinction of being considered a responder by the definition employed in Study 9, for example, a subject had to demonstrate a clear pattern of improvement; he had to show improvement on five of the six criterion measures. This definition is strict and only 35 subjects could fulfill its requirements. One is rather confident, however, that these 35 did, in fact, respond positively to Ritalin, more so than the 70 subjects who were considered responders in Study 5 merely because they improved on the sole criterion measure of their MFF scores.

The same is true of placebo scores. In defining placebo response as improvement on five of the six criteria, only 15 of the 102 subjects were considered responders. Due to the strict definition used, however, one is confident that these 15 did, in fact, respond positively to placebo treatment and that this figure is not spuriously high. For this reason then, these 15 subjects were studied in more detail.

The 15 responders to placebo treatment had a mean age of 9 years, 11 months (standard deviation = 20 months) and had a mean IQ of 96.8 (standard deviation = 9.4). The corresponding

87 non-responders to placebo treatment had a mean age of 9 years, 3 months (standard deviation = 20 months) and a mean IQ of 99.3 (standard deviation = 10.9). The mean criterion scores for both groups are reported in Table 29.

Insert Table 29 about here

Due to the fact that there were so few responders to placebo, it was not possible to carry out discriminant analysis using the 26 personality measures all at one time. Thus two sets of discriminant analyses were conducted; the first involved the 13 ESPQ/CPQ factors and the resulting direct discriminant function is reported in Table 30. It is not significant to the .05 level (Wilks' Lambda = 0.88). It nevertheless successfully predicts the placebo responses of 72 (or 70.59%) of the subjects.

Insert Table 30 about here

The corresponding stepwise discriminant function is reported in Table 31, and it is not significant to the .05 level (Wilks' Lambda = 0.90) nor are any of its components (with 1 and 100 degrees of freedom). It nevertheless correctly predicts the placebo responses of 73 (or 71.57%) of the subjects.

Insert Table 31 about here

The second set of discriminant analyses considered the

social quotient, the eight PSQ scales, and the four TRS scales. The resulting direct discriminant function is reported in Table 32 but is not significant to the .05 level (Wilks' Lambda = 0.94). It nevertheless successfully predicts the placebo responses of 67 (or 65.69%) of the subjects.

Insert Table 32 about here

The corresponding stepwise discriminant function is reported in Table 33 and is not significant to the .05 level (Wilks' Lambda = 0.94) nor are any of its components univariately significant to the .05 level (with 1 and 100 degrees of freedom). It nevertheless successfully predicts the placebo responses of 68 (or 66.67%) of the subjects.

Insert Table 33 about here

Study 11. The 26 personality measues of the subjects in the behavioral management study were plugged into those discriminant functions which were significant to the .05 level in the stimulant medication program. This was done in an attempt to determine if personality differences found in one program could be generalized to another. None of the direct discriminant functions reported in Studies 1 through 9 were significant to the .05 level, nor was the stepwise discriminant function reported in Study 8 (which defined response as improvement on four

of the six criteria). The numbers of behavior management subjects whose response group memberships were correctly identified by each of the remaining significant stepwise discriminant

Insert Table 34 about here

functions are reported in Table 34. None, however, distinguished between responders and non-responders to behavior management significantly ($\alpha = .05$, two-tailed test).

Discussion

The stated goal of the present investigation was to determine whether or not hyperactive responders and non-responders to stimulant medication differ with regard to personality characteristics, and if they do, to delineate the nature of those differences. Beyond presenting descriptive data, four statistical strategies were employed. The first involved the formation of discriminant functions on the basis of direct discriminant analysis to distinguish between responders and non-responders in Studies 1 through 9. The second involved attempts to reduce the number of variables in those functions without decreasing their hit rates appreciably by forming discriminant functions on the basis of stepwise discriminant analysis. The third attempted to delineate the nature of personality differences between response groups by subjecting those variables which were significant enough to

be included in the stepwise discriminant functions to univariate analysis. The fourth involved determining the correlation between the 26 predictor variables and whichever criteria were employed in the definitions of response which served as the bases for Studies 1 through 9.

The first strategy, that of forming discriminant functions by means of direct discriminant analyses did not yield statistically significant results. The hit rates of the nine direct discriminant functions ranged from 62% to 77%. Thus, solely on the basis of pre-treatment personality measures, they could successfully predict the response to medication of from 62 to 77% of the subjects. It would seem, however, that these hit rates are not significantly better than chance, for none of the functions were significant to the .05 level. The use of this strategy therefore did not provide sufficient evidence to conclude that response groups as defined in this investigation differ with regard to personality characteristics.

The second statistical strategy, that of forming discriminant functions on the basis of stepwise discriminant analyses, yielded considerably more significant results. It must be noted that these functions essentially represent more efficient or "streamlined" forms of their corresponding direct discriminant function counterparts. Had one of the direct discriminant functions

functions, for example, been significant, it might have offered some degree of clinical utility in identifying hyperactive children who would profit from treatment with Ritalin. That function, however, would have contained an unwieldy 26 variables, making its use somewhat inconvenient to the clinician. Stepwise discriminant analysis, however, might have offered an alternative function which would have eliminated those of the 26 variables which had little discriminatory power. This might have reduced the variables to a more manageable number, while not reducing the function's hit rate appreciably. This, in fact, seemed to happen in the present investigation. The stepwise discriminant functions indeed contained considerably fewer that 26 variables (at the most 9 in Study 3) and the hit rates of the direct and stepwise functions were approximately equivalent. Where as none of the direct discriminant functions were statistically significant, all of the stepwise functions were significant, except that which was described in Study 8. This raises an apparent paradox. If a function cannot significantly differentiate between responders and non-responders to Ritalin, how then can a "stream-lined" version of that same function do so? The answer must be that it does so by chance. By placing a heavy emphasis on those of the 26 predictors which distingished between response groups by chance this function achieves a

high significance level. On the basis of this explanation, one would predict that the significant stepwise functions could not stand the test of cross-validation; that is, they could not significantly differentiate similar subjects on the basis of such measures.

The third major statistical strategy involved univariate analyses. It was hoped that direct discriminant analyses would establish the fact of personality differences between response groups, that stepwise discriminant analyses would eliminate those personality variables that had limited discriminatory powers, and that the remainder would be subjected to univariate analyses. This strategy was adpoted because the obvious alternative, that is, carrying out univariate analyses on all 26 predictors in each study was fundamentally unsound. If one had chosen that alternative and set α at .05, then one would expect to have at least one variable significant in each study merely by chance. In univariately testing only those predictors which were contained in the stepwise functions, however, this possibility was reduced. Unfortunately, the direct discriminant functions were not significant, thus univariate analyses were not conducted with the knowledge that responders and non-responders do in fact differ with regard to personality characteristics. In effect then, 61 univariate analyses were conducted in Studies 1 through 9, and only eight

were statistically significant (seven to the .05 level and one to the .01 level). The fact that so small a percentage was significant raises the serious possibility that these variables differed by chance. Bearing this reservation in mind then, it should be noted that in four of these nine studies, no univariate comparisons were significant. In three of the remaining five, responders and non-responders differed significantly with regard to their TRS Inattentive scores. If one is prepared to accept the definitions of response employed in Studies 3, 4, and 7 as being valid, it would thus seem that prior to medication, hyperactive children who will respond positively to Ritalin are more inattentive that those who will not, or are at least perceived as such by their teachers. The question as to whether or not the definitions employed in those studies were in fact appropriate will be considered shortly.

The fact that eight of the nine stepwise discriminant functions were significant and yet only five of the nine contained variables which were univariately significant raises an apparent incongruity which must be addressed. Specifically in Studies 1, 2, and 9, the discriminant functions were significant and yet their individual components were not. This suggests that those components combined to form new variables that were more effective in distinguishing responders from non-responders.

The fourth statistical strategy involved determining the correlations between the predictors and various criterion variables employed. These correlations ranged from 0.40 (in Studies 1 and 3) up to 0.63 (in Studies 7 and 9). Thus in Studies 7 and 9 it would appear that 40% of the variation in the criterion variables employed was explained by the predictors. These figures appear to be rather high; however none are significant to the .05 level. One is thus reluctant to attach importance to them, for they might very well have occurred by chance.

The presumed relationship between the qualities of parents and the hyperactive child's reaction to medication has been ill-defined. It was hoped that the present investigation would suggest that responders and non-responders differ with regard to personality characteristics and that the child's personality might thus be offered as a possible intervening variable between these exogenous phenomena (parental qualities) and endogenous phenomena (his reaction to medication) in a manner which was suggested earlier. Such personality differences, however, were not demonstrated. Future research in this area might explore the possibility that personality characteristics do, in fact, play the intermediary role suggested but that the characteristics that do so were not those examined in the present investigation. Thus measures of different personality characteristics might

be used. Alternatively, other explanations as to how parental qualities are related to drug response might be explored.

In most studies in the field of predicting the response of hyperactive children to stimulant medication, absolute criterion scores have not been used. Instead the strategy of using relative thresholds, that is, comparing each subject's post-treatment scores with their appropriate baseline scores to assess improvement has been employed. The present investigation has conformed to that practice. This investigation deviates from common practice, however, in that it has employed multiple definitions of response.

One of the most obvious benefits that this use of multiple definitions of response has offered has been to demonstrate the importance of painstakingly reporting one's definition of response. In most studies, for example, only one definition is used and the subjects are classified as responders and non-responders on the basis of it and differences between the two groups are then examined and reported. In the present investigation, however, the same 102 subjects were divided into response groups on the basis of nine different definitions of response and the resulting contrasts between response groups varied considerably from definition to definition. The variables

which made up the ensuing nine stepwise discriminant functions, for example, varied dramatically. It is therefore clear that even if the subjects remain constant, minor alterations in the definition of response can have profound effects on what appear to be the differences between the response groups. Because of this fact, it is vital that one's definition of response to medication be clearly stated. In studies such as those of Conners (1972), Weiss et al. (1971), and Weiss et al. (1968), the definitions of response were not stated, thus one cannot assess the value of their results. This detracts from the quality of those studies.

Despite the lessons to be learned from employing multiple definitions of response, the question still arises as to which of the nine is, in fact, the soundest. It would clearly be inappropriate to decide that a particular definition is the most well-grounded on the basis of the resulting discriminant function's ability to differentiate between responders and non-responders. The definition used in Study 4, for example, resulted in that direct discriminant function which predicted response with the greatest accuracy. Response was defined as a decrease in RTT standard deviation after having received Ritalin. Its direct discriminant function was significant to the .06 level and correctly predicted

the responses of 77% of the subjects. Such numerical results, however, speak only for the power of the predictors given this particular definition of response, not for the power of the definition itself.

As was stated in the results section of Study 10, when a subject improves on a number of measures of his hyperactivity, one is more confident in classifying him as improved than if he were to improve on just one such measure. For example, only 35 subjects were able to meet the high standards of Study 9 which required improvement on five of the six criteria for a child to be considered as a responder. One is more confident, however, that these 35 did in fact improve than did the 70 who were considered responders in Study 5 merely because they improved on the single criterion of their MFF score.

It must be noted that the assumption that improvement on many measures is more valid than improvement on only one measure is, at this point, merely speculative. It is suggested, however, that the testing of this assumption is a matter worthy of future research. One strategy that such research might adapt would be to conduct follow-up studies to see if hyperactive children who were considered improved because of improvement on multiple criterion measures tend to remain improved more so that those who were considered as improved solely on the basis

of a single measure.

Yet another issue which must be addressed concerns placebos. The study of the general effectiveness of either Ritalin or placebos was considered to be beyond the parameters of the present investigation in that its stated goal was to explore personality differences between responders and non-responders to stimulant medication. For this reason then, no attempts were made to establish whether or not there was a placebo effect by statistical means. By comparing post-placebo criterion scores to their respective baselines, however, it was fairly easy to establish which of the 102 subjects responded positively to placebos under each of the nine different definitions of response. As was reported in the results section of Study 10, those 15 subjects who responded positively to placebo under what is believed to be this investigation's soundest definition of response (improvement on five of the six criteria) were compared with the 87 who did not. Those differences which existed between the two groups were not statistically significant. Although the groups may differ significantly on a number of dimensions, they do not differ significantly on any of the 26 personality measures used in this investigation. Attempts to determine just how responders and non-responders to placebo do differ would be an appropriate topic for future research and might have far reaching clinical applications.

If one could identify a hyperactive child who is likely to respond positively to placebo treatment, for example, he might be so treated and thereby possibly avoid some of the deleterious side effects often associated with stimulant medication.

Comment must also be made on the results of Study 11 which considered those 18 subjects who were treated with behavior management. The limited number of subjects clearly restricted the statistical possibilities in this study, but in following the advice of Mash and Dolby (1979), significant distinctions between response groups in the stimulant medication program were applied to those in the behavioral management program, to see if they held true.

When response to treatment was defined as a 75% or greater reduction in the subject's target behavior, none of the discriminant functions which significantly differentiated responders from non-responders in the stimulant medication program could do so in the behavior management program. This does not suggest that responders and non-responders to behavior management do not differ, nor even does it suggest that they do not differ with regard to personality characteristics. What it does suggest, however, is that there is insufficient evidence to conclude that they differ with regard to the 26 personality characteristics examined in this study in the same way as do responders and

non-responders to Ritalin. It therefore appears that response group differences in the stimulant medication program might be specific to that mode of treatment.

It would be profitable, in concluding, to consider the results of the present investigation as a whole and perhaps to make a few pertinent general comments. It is clear that hard, statistically significant evidence has not been offered to suggest a relationship between personality characteristics and response to stimulant medication among hyperactive boys. Much of the evidence, however, is almost significant, which renders one quite reluctant to rule out the possibility that such a relationship may still, in fact, exist. The multiple and canonical correlations between personality characteristics and criterion variables in Studies 1 through 9, for example, were not significant, but were all positive and all relatively high (up to 0.63). Thus, at the risk of being speculative, it is suggested that the present results clearly do not prove a relationship between personality and drug response, but they are sufficiently encouraging so as to suggest that future research in this area is in order. Perhaps if more subjects were used or if different personality measures were employed, the true nature of the hypothesized relationship between personality and drug response would de demonstrated. It might also be profitable to alter the present investigation's

experimental design in future research. As was stated earlier, response groups were essentially dichotomous; either a given subject responded to treatment or he did not. A problem inherent in such a design is that one inevitably makes comparisons of some subjects who in fact differ very little in their responses. The subjects whose change in criterion measures following treatment just barely qualifies him for classification in the responding group may, in effect, differ very little from one who does not quite qualify for membership in that group and is therefore classified as a non-responder. To include them in groups that do differ significantly might tend to minimize the apparent differences between the two groups. One solution might be to consider only the extremes. Responders in such a design might be subjects who improve dramatically as a result of treatment and non-responders might be those who decline dramatically. Subjects in between the extremes would not be considered. Such a design might result in the discovery of clear and consistent differences between the two groups. Alternatively, one might include the subjects that fall between the two extremes and form other groups, that is, rather than a dichotomous response/non-response situation, groups might consist of very poor responders, poor responders, unchanged subjects, good responders, and very good responders. It is clear that the prediction of the response

of hyperactive children to treatment is fertile ground for research. Many theoretical questions remain unanswered and the clinical implications of such research are profound.

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Table 1

Mean Criterion scores for Ritalin Response Groups as Determined by CPT Omission Improvement

Criterion	Baseline[a]	Post Ritalin[a]	Post Placebo[a]
CPT Omissions			
Responders	3.6 (4.2)	1.5 (2.3)	2.4 (3.6)
Non-responders	1.4 (1.8)	2.9 (2.9)	2.3 (2.2)
CPT Commissions			
Responders	2.6 (3.8)	1.2 (1.9)	1.1 (1.4)
Non-responders	3.0 (3.6)	2.6 (3.3)	2.0 (2.9)
RTT Mean			
Responders	1.0 (0.3)	0.9 (0.3)	1.0 (0.3)
Non-responders	1.0 (0.2)	1.0 (0.3)	1.0 (0.3)
RTT Standard Deviation			
Responders	0.3 (0.2)	0.3 (0.1)	0.3 (0.2)
Non-responders	0.3 (0.2)	0.3 (0.1)	0.3 (0.3)
MFF Mean			
Responders	12.6 (6.3)	9.5 (6.1)	10.1 (6.2)
Non-responders	14.2 (6.8)	11.6 (7.8)	11.6 (6.9)
Conners Hyperactivity			
Responders	45.4% (20.1)	33.9% (18.6)	35.2% (19.2)
Non-responders	47.8% (24.0)	33.1% (23.8)	34.7% (23.2)

[a] Numbers in parentheses indicate standard deviations

Table 2

Direct Discriminant Function for Ritalin Response Groups as Determined by CPT Omission Improvement

Predictor	Unstandardized Discriminant Coefficient	Predictor	Unstandardized Discriminant Coefficient
Social Quotient	0.00	Factor A	0.14
PSQ Conduct	-0.01	Factor B	0.12
PSQ Anxiety	0.05	Factor C	-0.08
PSQ Impulsive	0.00	Factor D	-0.05
PSQ Learning Prob	-0.13	Factor E	-0.21
PSQ Psychosomatic	0.27	Factor F	0.19
PSQ Perfectionism	-0.14	Factor G	0.17
PSQ Antisocial	0.36	Factor H	-0.11
PSQ Muscular Tens	-0.08	Factor I	0.09
TRS Conduct	-0.03	Factor J	0.09
TRS Passive	-0.08	Factor N	0.17
TRS Tension	-0.17	Factor O	0.00
TRS Hyperactive	0.06	Factor Q	0.08
		Constant	-1.64

Table 3

Discriminant Function for Ritalin Response Groups as Determined by CPT Omission Improvement

Predictor	Unstandardized Discriminant Coefficient	Responding Group's Mean[a]	Non-responding Group's Mean[a]	F
PSQ Psychosomatic	1.96	16.7% (16.0%)	13.3% (15.3%)	3.6
TRS Passive	-0.55	55.0% (18.9%)	58.3% (18.9%)	2.2
TRS Tension	-1.05	23.3% (15.3%)	26.7% (17.3%)	2.1
Factor A	0.28	4.9 (1.6)	4.6 (1.7)	3.1
Constant	-0.20			

[a] Numbers in parentheses indicate standard deviations

Table 4

Mean Criterion Scores for Ritalin Response Groups as Determined by CPT Commission Improvement

Criterion	Baseline[a]	Post Ritalin[a]	Post Placebo[a]
CPT Omissions			
Responders	3.1 (3.9)	2.2 (2.6)	2.3 (2.8)
Non-responders	1.8 (2.6)	2.1 (2.8)	2.4 (3.5)
CPT Commissions			
Responders	3.4 (4.2)	1.0 (1.8)	1.4 (2.5)
Non-responders	1.6 (2.1)	3.1 (3.3)	1.5 (1.6)
RTT Mean			
Responders	1.0 (0.3)	0.9 (0.3)	0.9 (0.3)
Non-responders	1.1 (0.3)	1.0 (0.3)	1.0 (0.4)
RTT Standard Deviation			
Responders	0.3 (0.2)	0.2 (0.1)	0.3 (0.2)
Non-responders	0.4 (0.2)	0.3 (0.2)	0.3 (0.4)
MFF Mean			
Responders	13.5 (6.7)	10.3 (6.5)	10.2 (6.2)
Non-responders	13.0 (6.3)	10.5 (7.6)	11.6 (7.0)
Conners Hyperactivity			
Responders	45.8% (20.4%)	34.8%(20.5%)	34.9% (20.1%)
Non-responders	47.5% (24.2%)	34.9% (21.8%)	35.1% (22.4%)

[a] Numbers in parentheses indicate standard deviations.

Table 5

Direct Discriminant Function for Ritalin Response Groups as Determined by CPT Commission Improvement

Predictor	Unstandardized Discriminant Coefficient	Predictor	Unstandardized Discriminant Coefficient
Social Quotient	0.00	Factor A	-0.03
PSQ Conduct	-0.12	Factor B	-0.10
PSQ Anxiety	-0.12	Factor C	0.13
PSQ Impulsive	0.00	Factor D	-0.12
PSQ Learning Prob.	0.24	Factor E	0.04
PSQ Psychosomatic	0.15	Factor F	0.02
PSQ Perfectionism	0.18	Factor G	0.13
PSQ Antisocial	-0.31	Factor H	-0.15
PSQ Muscular Tens	0.02	Factor I	0.03
TRS Conduct	0.04	Factor J	-0.06
TRS Passive	-0.07	Factor N	-0.22
TRS Tension	-0.04	Factor O	-0.16
TRS Hyperative	-0.10	Factor Q	0.34
		Constant	2.67

Table 6

Discriminant Function for Ritalin Response Groups as Determined by CPT Commission Improvement

Predictor	Unstandardized Discriminant Coefficient	Responding Group's Mean[a]	Non-responding Group's Mean[a]	F
PSQ Conduct	0.65	30.8% (23.8%)	39.6% (24.1%)	3.2
TRS Hyperactive	0.65	61.8% (22.1%)	69.0% (20.9%)	2.6
Factor G	-0.33	4.7 (1.4)	4.3 (2.4)	1.3
Factor Q	-0.40	6.1 (1.8)	5.7 (1.9)	1.0
Constant	1.58			

[a] Numbers in parentheses indicate standard deviations

Table 7

Mean Criterion Scores for Ritalin Response Groups as Determined by RTT Mean Improvement

Criterion	Baseline[a]	Post Ritalin[a]	Post Placebo[a]
CPT Omissions			
Responders	2.6 (3.2)	1.8 (2.0)	2.0 (2.5)
Non-responders	2.6 (4.2)	2.8 (3.5)	2.9 (3.9)
CPT Commissions			
Responders	2.8 (4.1)	1.5 (2.0)	1.7 (2.5)
Non-responders	2.6 (2.8)	2.4 (3.6)	1.0 (1.3)
RTT Mean			
Responders	1.0 (0.3)	0.9 (0.3)	0.9 (0.3)
Non-responders	1.0 (0.2)	1.1 (0.3)	1.0 (0.4)
RTT Standard Deviation			
Responders	0.3 (0.2)	0.2 (0.1)	0.3 (0.2)
Non-responders	0.3 (0.2)	0.3 (0.2)	0.3 (0.4)
MFF Mean			
Responders	13.8 (6.6)	10.4 (7.6)	10.5 (6.6)
Non-responders	12.6 (6.2)	10.5 (5.6)	11.3 (6.4)
Conners Hyperactivity			
Responders	47.3% (24.3%)	34.7% (21.9%)	34.4% (23.1%)
Non-responders	43.5% (16.9%0	34.0% (19.6%)	34.7% (17.0%)

[a] Numbers in parentheses indicate standard deviations

Table 8

Direct Discriminant Function for Ritalin Response Groups as Determined by RTT Mean Improvement

Predictor	Unstandardized Discriminant Coefficient	Predictor	Unstandardized Discriminant Coefficient
Social Quotient	0.02	Factor A	0.30
PSQ Conduct	0.06	Factor B	0.16
PSQ Anxiety	-0.05	Factor C	-0.21
PSQ Impulsive	0.01	Factor D	-0.19
PSQ Learning Prob	-0.01	Factor E	-0.24
PSQ Psychosomatic	-0.05	Factor F	0.01
PSQ Perfectionism	0.05	Factor G	-0.05
PSQ Antisocial	0.01	Factor H	0.10
PSQ Muscular Tens	0.00	Factor I	-0.14
TRS Conduct	-0.06	Factor J	0.12
TRS Passive	0.19	Factor N	0.15
TRS Tension	0.06	Factor O	0.00
TRS Hyperactive	0.01	Factor Q	0.12
		Constant	-4.91

Table 9

Discriminant Function for Ritalin Response Groups as Determined by Improvement on RTT Mean

Predictor	Unstandardized Discriminant Coefficient	Responding Group's Mean[a]	Non-responding Group's Mean[a]	F
PSQ Conduct	0.36	36.0% (25.3%)	31.0% (22.3%)	1.0
PSQ Learning Prob	-1.10	31.3% (17.8%)	32.1% (22.2%)	0.4
TRS Conduct	-0.20	25.4% (18.9%)	28.1% (26.3%)	0.3
TRS Inattentive	1.20	61.2% (18.4%)	52.7% (18.9%)	4.8[b]
TRS Hyperactive	0.47	65.6% (21.3%)	61.0% (23.7%)	1.9
Factor A	0.39	4.8 (1.7)	4.1 (1.8)	3.3
Factor C	-0.28	4.9 (1.7)	4.9 (1.5)	0.0
Factor D	-0.14	6.0 (2.1)	6.3 (2.1)	0.7
Factor I	-0.18	5.5 (1.8)	5.8 (2.0)	0.6
Constant	-1.21			

[a] Numbers in parentheses indicate standard deviations

[b] Significant to the .05 level

Table 10

Mean Criterion Scores for Ritalin Response Groups as Determined by RTT Standard Deviation Improvement

Criterion	Baseline[a]	Post Ritalin[a]	Post Placebo[a]
CPT Omissions			
Responders	2.4 (3.8)	2.1 (2.8)	2.4 (3.5)
Non-responders	3.1 (3.1)	2.3 (2.5)	2.1 (2.0)
CPT Commissions			
Responders	2.8 (4.2)	1.8 (2.6)	1.5 (2.5)
Non-responders	2.5 (2.6)	1.8 (2.9)	1.4 (1.5)
RTT Mean			
Responders	1.0 (0.3)	0.9 (0.3)	1.0 (0.3)
Non-responders	0.9 (0.2)	1.0 (0.3)	0.9 (0.2)
RTT Standard Deviation			
Responders	0.4 (0.2)	0.2 (0.1)	0.3 (0.3)
Non-responders	0.2 (0.2)	0.3 (0.2)	0.3 (0.1)
MFF Mean			
Responders	13.6 (6.6)	10.5 (7.8)	10.5 (6.9)
Non-responders	12.9 (6.3)	10.2 (4.8)	11.3 (5.7)
Conners Hyperactivity			
Responders	46.3% (23.1%)	34.4% (22.5%)	33.7% (21.8%)
Non-responders	45.3% (19.8%)	34.5% (18.0%)	36.1% (19.7%)

[a] Numbers in parentheses indicate standard deviations

Table 11

Direct Discriminant Function for Ritalin Response Groups as Determined by RTT Standard Deviation Improvement

Predictor	Unstandardized Discriminant Coefficient	Predictor	Unstandardized Discriminant Coefficient
Social Quotient	0.01	Factor A	0.35
PSQ Conduct	0.02	Factor B	-0.01
PSQ Anxiety	0.03	Factor C	-0.33
PSQ Impulsive	0.02	Factor D	-0.02
PSQ Learning Prob	0.01	Factor E	-0.04
PSQ Psychosomatic	0.00	Factor F	0.04
PSQ Perfectionism	-0.08	Factor G	0.11
PSQ Antisocial	0.19	Factor H	0.19
PSQ Muscular Tens	-0.22	Factor I	0.04
TRS Conduct	-0.01	Factor J	0.12
TRS Passive	0.11	Factor N	0.07
TRS Tension	0.05	Factor O	-0.01
TRS Hyperactive	0.01	Factor Q	0.24
		Constant	-6.07

Table 12

Discriminant Function for Ritalin Response Groups as Determined by Improvement on RTT Standard Deviation

Predictor	Unstandardized Discriminant Coefficient	Responding Group's Mean[a]	Non-responding Group's Mean[a]	F
PSQ Impulsive	-0.24	46.1% (22.1%)	42.2% (18.9%)	0.8
PSQ Muscular Tens.	1.18	11.3% (15.5%)	18.2% (19.3%)	3.7
TRS Inattentive	-1.00	62.0% (17.7%)	50.5% (19.2%)	8.8[b]
Factor A	-0.34	4.8 (1.7)	3.9 (1.6)	6.2[c]
Factor C	0.29	4.8 (1.7)	4.9 (1.5)	0.1
Factor G	-0.14	4.7 (2.0)	4.2 (1.6)	1.2
Factor H	-0.19	5.2 (1.8)	4.5 (2.1)	2.2
Factor N	-0.16	6.1 (1.7)	5.8 (2.2)	0.4
Constant	4.90			

[a] Numbers in parentheses indicate standard deviations

[b] Significant to the .01 level

[c] Significant to the .05 level

Table 13

Mean Criterion Scores for Ritalin Response Groups as Determined by MFF Score Improvement

Criterion	Baseline[a]	Post Ritalin[a]	Post Placebo[a]
CPT Omissions			
Responders	2.8 (3.6)	2.1 (2.3)	2.3 (3.0)
Non-responders	2.1 (2.8)	2.2 (3.2)	2.2 (3.3)
CPT Commissions			
Responders	2.4 (3.2)	1.4 (1.8)	1.5 (2.5)
Non-responders	3.4 (4.5)	2.6 (3.9)	1.3 (1.4)
RTT Mean			
Responders	1.0 (0.3)	0.9 (0.2)	0.9 (0.3)
Non-Responders	1.0 (0.3)	1.0 (0.3)	1.0 (0.4)
RTT Standard Deviation			
Responders	0.3 (0.2)	0.2 (0.1)	0.3 (0.2)
Non-responders	0.3 (0.3)	0.3 (0.2)	0.3 (0.3)
MFF Mean			
Responders	14.5 (6.2)	8.6 (5.9)	10.5 (6.0)
Non-responders	10.5 (6.5)	14.1 (7.5)	10.9 (7.7)
Conners Hyperactivity			
Responders	45.6% (22.5%)	33.1% (20.9%)	33.6% (21.9%)
Non-responders	47.3% (21.0%)	37.7% (21.0%)	37.2% (18.9%)

[a] Numbers in parentheses indicate standard deviations

Table 14

Direct Discriminant Function for Ritalin Response Groups as Determined by MFF Score Improvement

Predictor	Unstandardized Discriminant Coefficient	Predictor	Unstandardized Discriminant Coefficient
Social Quotient	0.00	Factor A	0.20
PSQ Conduct	-0.08	Factor B	0.13
PSQ Anxiety	0.05	Factor C	0.08
PSQ Impulsive	0.00	Factor D	0.07
PSQ Learning Prob	0.12	Factor E	0.07
PSQ Psychosomatic	-0.07	Factor F	-0.01
PSQ Perfectionism	0.01	Factor G	0.20
PSQ Antisocial	0.26	Factor H	-0.16
PSQ Muscular Tens	0.18	Factor I	0.10
TRS Conduct	0.01	Factor J	-0.30
TRS Passive	0.07	Factor N	-0.05
TRS Tension	-0.12	Factor O	-0.07
TRS Hyperactive	-0.02	Factor Q	0.13
		Constant	-2.03

Table 15

Discriminant Function for Ritalin Response Groups as Determined by MFF Score Improvement

Predictor	Unstandardized Discriminant Coefficient	Responding Group's Mean[a]	Non-responding Group's Mean[a]	F
PSQ Anxiety	-0.41	21.1% (15.6%)	24.4% (17.5%)	1.0
PSQ Psychosomatic	1.17	13.9% (14.2%)	12.9% (17.2%)	0.1
PSQ Antisocial	-3.45	2.5% (5.8%)	6.8% (11.3%)	6.4[b]
PSQ Muscular Tens.	-1.51	12.4% (16.0%)	16.7% (18.9%)	1.4
TRS Inattentive	-0.37	58.0% (16.8%)	58.6% (22.7%)	0.0
TRS Tension	0.91	27.8% (18.1%)	23.2% (16.3%)	1.5
Factor B	-0.14	4.3 (1.9)	4.7 (1.8)	1.0
Factor D	-0.26	5.8 (2.1)	6.6 (2.0)	3.5
Factor G	-0.25	4.4 (1.9)	4.8 (1.7)	1.1
Factor J	0.19	6.1 (2.0)	5.4 (2.0)	2.4
Constant	2.84			

[a] Numbers in parentheses indicate standard deviations

[b] Significant to the .05 level

Table 16

Mean Criterion Scores for Ritalin Response Groups as Determined by Conners Parent Hyperactivity Scale Improvement

Criterion	Baseline[a]	Post Ritalin[a]	Post Placebo[a]
CPT Omissions			
Responders	2.6 (3.4)	2.1 (2.5)	2.6 (3.8)
Non-responders	2.8 (3.8)	2.2 (3.0)	2.0 (2.0)
CPT Commissions			
Responders	2.8 (3.9)	1.9 (2.8)	1.4 (1.6)
Non-responders	2.3 (2.7)	1.6 (2.7)	1.2 (1.3)
RTT Mean			
Responders	1.0 (0.3)	1.0 (0.3)	1.0 (0.3)
Non-responders	1.0 (0.3)	0.9 (0.3)	0.9 (0.4)
RTT Standard Deviation			
Responders	0.3 (0.2)	0.3 (0.1)	0.3 (0.2)
Non-responders	0.3 (0.3)	0.3 (0.1)	0.3 (0.3)
MFF Mean			
Responders	12.5 (6.1)	10.4 (7.5)	11.1 (6.9)
Non-responders	13.6 (6.9)	10.2 (6.1)	10.1 (6.3)
Conners Hyperactivity			
Responders	52.0% (20.1%)	30.3% (19.3%)	35.4% (22.2%)
Non-responders	39.1% (21.5%)	40.2% (22.5%)	33.8% (19.9%)

[a] Numbers in parentheses indicate standard deviations

Table 17

Direct Discriminant Function for Ritalin Response Groups as Determined by Conners Parent Hyperactivity Scale Improvement

Predictor	Unstandardized Discriminant Coefficient	Predictor	Unstandardized Discriminant Coefficient
Social Quotient	0.02	Factor A	-0.21
PSQ Conduct	-0.05	Factor B	-0.12
PSQ Anxiety	0.02	Factor C	0.10
PSQ Impulsive	-0.02	Factor D	-0.12
PSQ Learning Prob	-0.02	Factor E	0.12
PSQ Psychosomatic	-0.07	Factor F	0.11
PSQ Perfectionism	0.06	Factor G	-0.07
PSQ Antisocial	0.19	Factor H	0.03
PSQ Muscular Tens	0.01	Factor I	-0.18
TRS Conduct	-0.01	Factor J	-0.02
TRS Passive	0.07	Factor N	0.03
TRS Tension	-0.01	Factor O	-0.03
TRS Hyperactive	-0.10	Factor Q	-0.21
		Constant	1.67

Table 18

Discriminant Function for Ritalin Response Groups as Determined by Improvement on the PSQ Hyperactivity Scale

Predictor	Unstandardized Discriminant Coefficient	Responding Group's Mean[a]	Non-responding Group's Mean[a]	F
Social Quotient	-0.02	91.0 (18.8)	99.0 (11.8)	6.2[b]
PSQ Conduct	0.26	37.8% (26.1%)	29.2% (21.2%)	3.2
TRS Hyperactivity	0.44	67.6% (21.6%)	61.0% (22.8%)	2.3
Factor A	0.17	4.7 (2.0)	4.4 (1.5)	0.5
Factor E	-0.22	5.2 (1.6)	5.6 (1.5)	1.5
Factor F	-0.22	4.7 (2.0)	5.7 (2.1)	4.5[b]
Factor Q	0.27	6.3 (1.9)	5.7 (1.7)	2.6
Constant	0.71			

[a] Numbers in parentheses indicate standard deviations

[b] Significant to the .05 level

Table 19

Mean Criterion Scores for Ritalin Response Groups as Determined by Improvement on Four out of Five Measures of Attention

Criterion	Baseline[a]	Post Ritalin[a]	Post Placebo[a]
CPT Omissions			
Responders	3.3 (4.4)	1.7 (2.3)	2.0 (2.6)
Non-responders	1.9 (2.2)	2.6 (2.9)	2.6 (3.4)
CPT Commissions			
Responders	3.0 (4.5)	1.2 (2.1)	1.4 (2.7)
Non-responders	2.4 (2.6)	2.3 (3.1)	1.4 (1.5)
RTT Mean			
Responders	1.0 (0.3)	0.9 (0.3)	0.9 (0.3)
Non-responders	1.0 (0.2)	1.0 (0.3)	1.0 (0.3)
RTT Standard Deviation			
Responders	0.3 (0.2)	0.2 (0.1)	0.3 (0.2)
Non-responders	0.3 (0.2)	0.3 (0.2)	0.3 (0.4)
MFF Mean			
Responders	13.7 (6.9)	9.4 (7.4)	9.7 (6.7)
Non-responders	12.7 (6.2)	11.3 (6.3)	11.6 (6.2)
Conners Hyperactivity			
Responders	45.9% (21.5%)	32.5% (18.3%)	32.7% (20.4%)
Non-responders	40.4% (22.6%)	36.8% (23.2%)	36.8% (21.5%)

[a] Numbers in parentheses indicate standard deviations

Table 20

Direct Discriminant Function for Ritalin Response Groups as Determined by Improvement on Four of the Five Measures of Attention

Predictor	Unstandardized Discriminant Coefficient	Predictor	Unstandardized Discriminant Coefficient
Social Quotient	0.00	Factor A	0.17
PSQ Conduct	0.03	Factor B	-0.09
PSQ Anxiety	-0.02	Factor C	-0.21
PSQ Impulsive	0.03	Factor D	0.06
PSQ Learning Prob	0.06	Factor E	0.04
PSQ Psychosomatic	0.02	Factor F	-0.01
PSQ Perfectionism	0.05	Factor G	0.02
PSQ Antisocial	-0.51	Factor H	0.25
PSQ Muscular Tens	-0.18	Factor I	0.07
TRS Conduct	-0.01	Factor J	0.14
TRS Passive	0.04	Factor N	-0.05
TRS Tension	0.16	Factor O	-0.16
TRS Hyperactive	0.03	Factor Q	0.15
		Constant	-3.65

Table 21

Discriminant Function for Ritalin Response Groups as Determined by Improvement on Four out of Five Measures of Attention

Predictor	Unstandardized Discriminant Coefficient	Responding Group's Mean[a]	Non-responding Group's Mean[a]	F
PSQ Antisocial	5.44	2.1% (4.3%)	5.8% (10.5%0	5.6[b]
TRS Inattentive	-0.75	62.1% (18.2%)	54.1% (18.7%)	4.8[b]
TRS Tension	-0.74	28.5% (19.0%)	24.1% (16.0%)	1.5
Factor A	-0.25	4.7 (1.9)	4.4 (1.5)	1.0
Factor B	0.17	4.2 (1.8)	4.6 (2.0)	1.2
Factor H	-0.15	5.2 (1.9)	4.8 (2.0)	0.8
Factor Q	-0.22	6.1 (1.7)	5.9 (1.9)	0.4
Constant	3.98			

[a] Numbers in parentheses indicate standard deviations

[b] Significant to the .05 level

Table 22

Mean Criterion Scores for Ritalin Response Groups as Determined by Improvement on at Least Four out of Six Criteria

Criterion	Baseline[a]	Post Ritalin[a]	Post Placebo[a]
CPT Omissions			
Responders	3.0 (3.3)	1.8 (2.3)	2.7 (3.7)
Non-responders	2.1 (3.8)	2,5 (3.2)	1.8 (2.0)
CPT Commissions			
Responders	3.0 (4.2)	1.1(1.9)	1.5 (2.6)
Non-responders	2.4 (2.9)	2.6 (3.3)	1.3 (1.5)
RTT Mean			
Responders	1.0 (0.3)	0.9 (0.3)	1.0 (0.3)
Non-responders	1.0 (0.3)	1.0 (0.3)	1.0 (0.3)
RTT Standard Deviation			
Responders	0.3 (0.2)	0.2 (0.1)	0.3 (0.3)
Non-responders	0.3 (0.2)	0.3 (0.2)	0.3 (0.3)
MFF Mean			
Responders	14.0 (6.7)	9.7 (7.5)	10.2 (6.6)
Non-responders	12.2 (6.3)	11.0 (6.1)	11.2 (6.4)
Conners Hyperactivity			
Responders	46.6% (20.8%)	31.7% (18.2%)	34.0% (21.6%)
Non-responders	45.5% (23.5%)	38.3% (23.6%)	35.6% (20.3%)

[a] Numbers in parentheses indicate standard deviations

Table 23

Direct Discriminant Function for Ritalin Response Groups as Determined by Improvement on at Least four of the Six Criteria

Predictor	Unstandardized Discriminant Coefficients	Predictor	Unstandardized Discriminant Coefficients
Social Quotient	-0.01	Factor A	0.41
PSQ Conduct	0.09	Factor B	-0.25
PSQ Anxiety	-0.02	Factor C	-0.33
PSQ Impulsive	-0.04	Factor D	-0.05
PSQ Learning Prob	-0.11	Factor E	0.22
PSQ Psychosomatic	-0.05	Factor F	-0.01
PSQ Perfectionism	-0.05	Factor G	-0.06
PSQ Antisocial	-0.27	Factor H	0.07
PSQ Muscular Tens	-0.02	Factor I	-0.04
TRS Conduct	-0.01	Factor J	0.17
TRS Passive	0.03	Factor N	-0.24
TRS Tension	0.19	Factor O	0.00
TRS Hyperactive	-0.03	Factor Q	0.09
		Constant	1.33

Table 24

Discriminant Function for Ritalin Response Groups as Determined by Improvement on at Least Four out of Six Criteria

Predictor	Unstandardized Discriminant Coefficient	Responding Group's Mean[a]	Non-responding Group's Mean[a]	F
PSQ Antisocial	-3.68	3.1% (6.2%)	5.0% (10.1%)	1.4
TRS Tension	1.79	28.8% (18.1%)	23.2% (16.7%)	2.5
Factor A	0.29	4.7 (1.9)	4.4 (1.5)	0.0
Factor B	-0.26	4.2 (1.8)	4.7 (2.0)	0.9
Factor C	-0.36	4.8 (1.8)	5.0 (1.4)	2.1
Factor O	-0.20	6.2 (2.2)	6.3 (1.4)	0.2
Constant	2.01			

[a] Numbers in parentheses indicate standard deviations

Table 25

Mean Criterion Scores for Ritalin Response Groups as Determined by Improvement on Five out of Six Criteria

Criterion	Baseline[a]	Post Ritalin[a]	Post Placebo[a]
CPT Omissions			
Responders	3.4 (3.7)	1.6 (2.0)	2.5 (2.9)
Non-responders	2.2 (3.4)	2.4 (2.9)	2.2 (3.1)
CPT Commissions			
Responders	2.6 (4.0)	1.3 (2.2)	1.3 (1.6)
Non-responders	2.8 (3.5)	2.0 (2.9)	1.5 (2.5)
RTT Mean			
Responders	1.1 (0.4)	0.9 (0.3)	1.0 (0.3)
Non-responders	1.0 (0.2)	0.9 (0.3)	1.0 (0.3)
RTT Standard Deviation			
Responders	0.4 (0.2)	0.2 (0.1)	0.3 (0.1)
Non-responders	0.3 (0.2)	0.3 (0.2)	0.3 (0.3)
MFF Mean			
Responders	13.7 (6.4)	9.5 (7.2)	10.8 (7.0)
Non-responders	13.0 (6.7)	10.8 (6.8)	10.5 (6.3)
Conners Hyperactivity			
Responders	51.2% (22.3%)	32.2% (20.0%)	34.0% (21.7%)
Non-responders	43.5% (21.5%)	35.9% (21.4%)	35.1% (20.7%)

[a] Numbers in parentheses indicate standard deviations

Table 26

Direct Discriminant Function for Ritalin Response Groups as Determined by Improvement on at Least Five of the Six Criteria

Predictor	Unstandardized Discriminant Coefficients	Predictor	Unstandardized Discriminant Coefficients
Social Quotient	0.01	Factor A	-0.34
PSQ Conduct	-0.07	Factor B	0.00
PSQ Anxiety	0.06	Factor C	0.10
PSQ Impulsive	-0.03	Factor D	0.05
PSQ Learning Prob	0.04	Factor E	-0.08
PSQ Psychosomatic	-0.12	Factor F	-0.17
PSQ Perfectionism	0.08	Factor G	0.05
PSQ Antisocial	0.63	Factor H	-0.02
PSQ Muscular Tens	-0.07	Factor I	-0.16
TRS Conduct	0.01	Factor J	0.00
TRS Passive	-0.09	Factor N	-0.07
TRS Tension	-0.03	Factor O	-0.04
TRS Hyperactive	-0.01	Factor Q	-0.20
		Constant	4.87

Table 27

Discriminant Function for Ritalin Response Groups as Determined by Improvement on Five out of Six Criteria

Predictor	Unstandardized Discriminant Coefficient	Responding Group's Mean[a]	Non-responding Group's Mean[a]	F
PSQ Psychosomatic	-1.97	17.4% (17.2%)	11.8% (13.8%)	3.1
PSQ Perfectionism	1.65	15.2% (16.6%)	21.4% (26.0%)	1.6
PSQ Antisocial	4.22	2.0% (4.2%)	4.8% (9.4%)	2.7
PSQ Muscular Tens.	1.66	10.1% (12,5%)	15.6% (18.6%)	2.3
Factor A	-0.29	5.0 (2.1)	4.4 (1.5)	2.8
Factor Q	-0.24	6.2 (1.4)	5.9 (2.0)	0.5
Constant	2.55			

[a] Numbers in parentheses indicate standard deviations

Table 28

Numbers of Subjects Responding to Ritalin and Placebo

Criterion Measure	Responders to Ritalin	Responders to Placebo
Improvement on CPT Omissions	58 (57%)	39 (38%)
Improvement on CPT Commissions	63 (62%)	54 (53%)
Improvement on RTT Mean Score	65 (64%)	56 (55%)
Improvement on RTT Standard Deviation	67 (66%)	59 (58%)
Improvement on MFF Score	70 (69%)	56 (55%)
At Least 10% Improvement on PSQ Hyperactivity Scale	53 (52%)	50 (49%)
Responders on 4/5 Measures of Attention	52 (51%)	25 (25%)
Responders on 4/6 Criteria	57 (56%)	42 (41%)
Responders on 5/6 Criteria	35 (34%)	15 (15%)

Table 29

Mean Criterion Scores for Placebo Response Groups

as Determined by Improvement on Five out of Six Criteria

Criterion	Baseline[a]	Post Ritalin[a]	Post Placebo[a]
CPT Omissions			
Responders	2.9 (1.8)	1.3 (1.6)	1.0 (1.3)
Non-responders	2.6 (3.7)	2.3 (2.8)	2.5 (3.2)
CPT Commissions			
Responders	1.7 (1.4)	0.9 (1.0)	0.6 (0.6)
Non-responders	2.9 (3.9)	1.9 (2.8)	1.6 (2.3)
RTT Mean			
Responders	0.9 (0.2)	0.9 (0.2)	0.8 (0.2)
Non-responders	1.0 (0.3)	0.9 (0.3)	1.0 (0.3)
RTT Standard Deviation			
Responders	0.3 (0.2)	0.2 (0.1)	0.2 (0.1)
Non-responders	0.3 (0.2)	0.3 (0.2)	0.3 (0.3)
MFF Mean			
Responders	12.1 (6.6)	9.1 (5.0)	7.1 (4.9)
Non-responders	13.4 (6.6)	10.6 (7.2)	11.2 (6.6)
Conners Hyperactivity			
Responders	45.9% (19.0%)	31.3% (18.4%)	25.9% (17.0%)
Non-responders	46.2% (22.5%)	35.2% (21.3%)	37.2% (21.3%)

[a] Numbers in parentheses indicate standard deviations

Table 30

Direct Discriminant Function Using ESPQ/CPQ Data for Placebo Response Groups as Determined by Improvement on Five of the Six Criteria

Predictor	Unstandardized Discriminant Coefficient
Factor A	0.09
Factor B	0.01
Factor C	-0.22
Factor D	-0.35
Factor E	-0.23
Factor F	0.34
Factor G	-0.06
Factor H	-0.33
Factor I	0.13
Factor J	0.20
Factor N	-0.07
Factor O	-0.06
Factor Q	0.17
Constant	2.00

Table 31

Discriminant Function Using ESPQ/CPQ Data for Placebo Response Groups as Determined by Improvement on Five out of Six Criteria

Predictor	Unstandardized Discriminant Coefficient	Responding Group's Mean[a]	Non-responding Group's Mean[a]	F
Factor D	-0.35	6.7 (2.3)	5.9 (2.1)	1.5
Factor E	-0.35	5.7 (1.6)	5.3 (1.6)	0.7
Factor F	0.31	4.8 (2.1)	5.2 (2.1)	0.5
Factor H	-0.39	5.4 (1.6)	4.9 (2.0)	0.7
Factor J	0.24	5.1 (2.2)	6.0 (1.9)	2.3
Constant	2.56			

[a] Numbers in parentheses indicate standard deviations

Table 32

Discriminant Function Using SQ,PSQ, and TRS Data for Placebo Response Groups as Determined by Improvement on Five out of Six Criteria

Predictor	Unstandardized Discriminant Coefficient	Responding Group's Mean[a]	Non-responding Group's Mean[a]	F
Social Quotient	-0.04	89.5 (28.2)	95.8 (13.0)	2.0
PSQ Anxiety	0.74	26.7% (17.5%)	21.5% (16.0%)	1.3
PSQ Learning Prob	-2.03	28.3% (12.9%)	32.0% (20.0%)	0.5
PSQ Psychosomatic	1.27	18.7% (22.1%)	12.7% (13.6%)	2.0
Constant	3.73			

[a] Numbers in parentheses indicate standard deviations

Table 33

Direct Discriminant Function Using SQ, PSQ, and TRS Data for Placebo Response Groups as Determined by Improvement on Five of the Six Criteria

Predictor	Unstandardized Discriminant Coefficient
Social Quotient	0.00
PSQ Conduct	0.12
PSQ Anxiety	-0.16
PSQ Impulsive	0.05
PSQ Learning Prob	0.26
PSQ Psychosomatic	-0.20
PSQ Perfectionism	0.12
PSQ Antisocial	-0.48
PSQ Muscular Tens	-0.03
TRS Conduct	0.03
TRS Passive	0.00
TRS Tension	-0.12
TRS Hyperactive	-0.06
Constant	0.57

Table 34

Significant Discriminant Functions Applied to Known Responders and Non-responders to Behavior Management

Discriminant Function	Number of Subjects Correctly Identified [a]	t
Based on CPT Omissions	7 (38.9%)	-0.94
Based on CPT Comissions	9 (50.0%)	0.0
Based on RTT Mean	10 (55.6%)	0.46
Based on RTT Standard Deviation	7 (39.9%)	-0.94
Based on MFF Scores	7 (39.9%)	-0.94
Based on PSQ Hyperactivity Scale	9 (50.0%)	0.0
Based on 4/5 Measures of Attention	12 (66.7%)	1.46
Based on 5/6 Criteria	9 (50.0%)	0.0

[a] N = 18 in each case