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DIAGNOSIS OF TWIN ZYGOSITY BY MEANS OF  
DISCRIMINANT ANALYSIS OF PERSONALITY TEST ITEMS

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## ABSTRACT

The increasing attention being paid at the present time to the genetic bases of human behavior necessitates an updating of techniques in the twin study method which has been the best available and most sophisticated method of investigating relative contributions of heredity and environment. One such improvement would be an investigation of the usefulness of personality inventory items in aiding zygosity determination. The present study has the following aims: (1) derive statistically through multiple discriminant analysis a set of personality inventory items, taken from the MMPI and CPI, which could predict zygosity with some degree of accuracy; (2) derive a set of items or predictors which would discriminate between MZ and DZ within-pair differences; (3) investigate which items are related to MZness and DZness, per se; (4) investigate childhood experiential factors as reflected by these factors in distinguishing between MZs and DZs, i.e., differences in parental treatment of MZs vs. DZs; and (5) check the relationship of social desirability and item ambiguity with the discriminatory power of these items.

The sample of twins consisted of 80 MZ pairs and 66 DZ pairs. Sets of 60 best items from each of the two inventories used, MMPI and CPI, were selected using stepwise multiple discriminant analysis. This was done using

both raw scores as well as within-pair difference scores. Difference score items resulted in the greatest degree of accuracy with 99% (CPI) and 98% (MMPI) accuracy in predicting within-pair differences. The set of 60 MMPI-Raw Score items resulted in 92% accuracy in predicting MZness and DZness while the CPI-Raw Score items resulted in 89% accuracy.

Investigation of social desirability and item ambiguity and their relationship to the discriminatory power of the inventory items revealed no significant differences between the sets of best predictors and random sets of items for both raw score and difference score items.

With respect to items related to MZness and DZness, per se, the items making up the dimension labelled "Paranoia" seem to characterize MZs more so than DZs. Furthermore, MZs appear to answer "true" more often than do DZs to items concerning Conventionality, Super-ego Strength, and Conduct Problems or Psychopathic Deviate. On the other hand, DZs more often than MZs respond "true" to items making up the factors of Ego Strength and Self-confidence.

On items making up the factors of Psychopathic Deviate or Conduct Problems, MZs were more similar than DZs; also, though to a lesser extent, MZs were more similar than DZs on items reflecting Persistence, Achievement, and Social Confidence.

An analysis of any significant differences between MZs and DZs with respect to childhood experiential factors indicated that DZs believed more often than did MZs that they were allowed their own way as a child. On the other hand, MZs responded more often than did DZs that their home life was always happy; that their parents objected to the friends they kept or the people they went around with. The within-pair differences for DZs were greater on three items reflecting childhood experiences; that they had their own way as a child; that their home life was always happy; and that they were able to go to their parents with their problems.

Suggestions were made with respect to further investigation of the four sets of 60 items with plans for a study with the purpose of cross-validating the power of discrimination of these items as well as of contributing information concerning other aspects of the twin study method. In general, the present study offers the following contributions: (1) through multiple discriminant analysis sets of personality inventory items can be derived which predict zygosity per se or within-pair differences with considerable accuracy which is an aid to the twin study method; (2) the study reveals that MZs as a group respond differently from DZs as a group; and (3) the study suggests that social desirability and item ambiguity does not appear to be related to discriminating between MZs and DZs or in predicting within-pair differences.

## TABLE OF CONTENTS

ABSTRACT . . . . .	iii
LIST OF TABLES . . . . .	vii
CHAPTER I      INTRODUCTION . . . . .	1
CHAPTER II     METHOD . . . . .	24
CHAPTER III    RESULTS. . . . .	29
CHAPTER IV     DISCUSSION . . . . .	112
APPENDICES . . . . .	123
REFERENCES . . . . .	176

## LIST OF TABLES

Table

1	Proportion of Pairs Agreeing on a Particular Item of the MMPI and CPI. . . . .	30
2a	List of Top 60 Predictors Using MMPI-Raw Scores. . . . .	35
2b	Means and Standard Deviations for MZs and DZs using MMPI Raw Score items . . . . .	39
2c	List of MMPI-Raw Score items with significant F-values . . . . .	42
3	Classification matrix using MMPI-Raw Scores Predictors. . . . .	43
4a	List of Top 60 Predictors using CPI-Raw Scores . . . . .	45
4b	Means and Standard Deviations for MZs and DZs using CPI-Raw Score items. . . . .	49
4c	List of CPI-Raw Score Items with Significant F-values . . . . .	52
5	Classification Matrix using CPI-Raw Score Predictors . . . . .	53
6a	List of Top 60 Predictors using MMPI-Difference Scores. . . . .	55
6b	Means and Standard Deviations for MZs and DZs using MMPI-Difference Score Items. . . . .	59
6c	List of MMPI-Difference Score Items with Significant F-values . . . . .	62
7	Classification matrix using MMPI-Difference Score Predictors . . . . .	64
8a	List of Top 60 Predictors using CPI-Difference Scores . . . . .	65
8b	Means and Standard Deviations for CPI-Difference Score Items . . . . .	69

8c	List of CPI-Difference Score Items with Significant F-values. . . . .	72
9	Classification Matrix Using CPI-Difference Score Predictors . . . . .	73
10	Varimax Factors for MMPI-Raw Score Items. . . . .	76
11	Varimax Factors for CPI-Raw Score Items . . . . .	79
12	Varimax Factors for MMPI-Difference Score Items . . . . .	82
13	Varimax Factors for CPI-Difference Score Items . . . . .	88
14	List of MMPI-Raw Score Items Which Load Highest on Each Factor. . . . .	94
15	List of CPI-Raw Score Items Which Load Highest on Each Factor. . . . .	97
16	List of MMPI-Difference Score Items Which Load Highest on Each Factor . . . . .	100
17	List of CPI-Difference Score Items Which Load Highest on Each Factor . . . . .	104
18	Table of means, standard deviations for MMPI and CPI, raw scores and difference scores, using both the best 60 predictors and a randomly selected set of 60 predictors and respective t-values with respect to Social Desirability scale values and item ambiguity . . . . .	109
19	Non-parametric t-tests (Lubin's t) for classification matrices using MMPI-Raw Score, CPI-Raw Score; MMPI Difference Score; and CPI-Difference Score Predictors . . . . .	111

## CHAPTER I

### INTRODUCTION

With the growing interest in investigating genetic bases of behavior, the use of the twin study method has become more frequent, as indicated by the literature on human behavior genetics (Vandenberg, 1966; 1968; Manosevitz, Lindzey, & Thiessen, 1969; McClearn, 1970). As a consequence, the method has been under greater scrutiny, and improvements to facilitate its application are being suggested, such as better statistical analyses of twin data (Cattell, 1968; Jinks and Fulker, 1970) or more efficient and accurate methods of zygosity determination (Smith and Penrose, 1955; Nichols and Bilbro, 1966).

The effects of genes on behavior generally have been assessed by the following methods. In animal studies the utilization of both selective breeding techniques, where animals that exhibit a particular attribute are selected for mating, and inbred strains, where relatives are mated with each other, are the most commonly used and most powerful methods. Selective breeding has been used in animal studies such as Tryon's (1940), who bred maze-dull and maze-bright rats. McClearn (1970) notes the use of selective breeding for high activity and emotionality in rats, geotaxis and phototaxis in the *Drosophila*. Inbreeding of animals has resulted in strain differences,

for example, in alcohol preference and in aggression in mice (McClearn, 1970). These techniques, however, cannot be applied to human research for obvious reasons.

The study of genetic bases of human behavior generally involves the use of (a) pedigree studies ("family tree" studies); (b) comparisons of relatives; (c) studies of adopted children; (d) observations of early neonatal differences; and (e) twin studies.

Pedigree studies essentially involve tracing the family lines of various individuals. The greater frequency of high mental ability occurring among relatives as compared with others was noted as far back as 1865 by Galton (1865; 1869) who further found that this similarity among relatives was even more obvious, the closer the relationship. Studies of royal families (Woods, 1906; Gun, 1930) were similar to Galton's family study. The problem which these studies have been confronted with is that parentage cannot always be established with a high degree of accuracy.

One of the better known pedigree studies is that conducted by Dugdale (1877), which was followed-up by Estabrook (1916), concerning a group of six sisters from whom stemmed generations of criminals, mentally retarded, and generally sociopathic individuals. The family, given the alias "Jukes," was followed for over 130 years.

Another well-known family study (Goddard, 1912) was concerned with two separate lines of descendants from a

single individual, "Martin Kallikak," and two women. The branch of his family which descended from a feeble-minded girl produced a number of individuals similar to the "Jukes." The other branch of the family stemmed from Kallikak's wife who apparently produced generations of normals. More recently, Reed and Reed (1965) investigated over 200 mentally retarded probands and over 80,000 relatives. Their general conclusions appear to support the major role of heredity in influencing mental retardation. The studies of these families, like family studies in general, are problematic in that often accurate assessment of family members is difficult, considering that they may number in the thousands. Furthermore, question may arise concerning the paternity of various individuals. Also, it becomes very difficult to separate the effects of heredity from the effects of being raised in a deprived environment.

Investigation of correlations among relatives is a technique which is somewhat related to pedigree studies. Many studies have found correlations near .50 for parent-child and sibling relationships (Jones, 1928; Roberts, 1941) for measures of IQ and physical traits. More recently Erlenmeyer-Kimling and Jarvik (1963) summarized 52 studies concerned with correlations on IQ tests among siblings; between parent and child; between foster-parent and child; among unrelated children raised together; as well as with within-pair twin comparisons. Median correlations

for parent-child comparisons was .49; median correlations among siblings was .49. Median correlation for sibs reared apart was .39; while that of foster-parent and child was .20. For unrelated persons reared together, the median correlation was .23. The general conclusion of the review of these studies appeared to emphasize the role of heredity in influencing IQ, although the effects of environment is also undeniable, though not quite as important. One of the major problems with investigating correlations among relatives is that it is assumed that random mating has occurred. With respect to variables such as IQ, there exists evidence to the contrary (Conrad and Jones, 1940; Willoughby, 1928) that there is a significant correlation between husband and wife (between .20 and .65). Other problems are discussed by McClearn (1963).

The study of adopted children provides another means of investigating the influence of heredity and environment. These studies generally involve looking at the degree of similarity between the child and his biological mother or siblings as compared with the child and his foster mother or parent. The Chicago Study (Freeman, Holzinger, and Mitchell, 1928) involved several groups of adopted children. The general findings emphasized environment as the greater contributor to measures of IQ. One group was assessed prior to and after several years of adoption and increases in average IQ were noted. Another

sample involved siblings who had been adopted by different families; the between-sibling correlation was in the neighborhood of .30. Similarly the correlation between the adopted child and unrelated sibs in the foster home was .34 while correlations among unrelated children adopted into the same home was .37.

Burks' (1928) Stanford Study concluded, contrary to the Chicago Study, that with respect to IQ, heredity was somewhat more important than environment. The correlations found between foster parent and adopted child were much lower than between parent and true child. Similar to these results were those obtained by Leahy (1935). In this study, adopted child-foster parent correlations approached .22 while the correlation between the adopted child and his biological parent exceeded .50. Skodak and Skeels (1949) found that there was a significant correlation between adopted child and true parent. However, the mean IQ for the biological mother was significantly lower than that of the child. Honzik (1957) explored the variable of mother's educational level and found that the correlation between adopted children and biological mother's educational level was as high as the correlation between the true child and the biological mother's educational level. The correlation between the adopted child and the foster mother's educational level was found to be low.

Susceptibility to schizophrenia has been studied by Heston (1966) who compared 47 adopted children whose

biological mothers were all classified as being schizophrenic with a control group of normals who were also adopted at an early age. Five of the 47 were later classified "schizophrenic," with approximately one-half of them having an excess of "psycho-social disability." The control exhibited no abnormalities. Similarly, Rosenthal, Wender, Kety, Schlusinger, Welner, and Ostergard (1968) found that children of schizophrenic parents reared in foster homes exhibited greater schizoid behaviors than controls. Kety, Rosenthal, Wender, and Schlusinger (1968) studied a group of schizoid adopted children and found significantly higher frequencies of similar behaviors in their biological parents as compared with their foster parents.

With studies of adopted children, the effects of environment are often difficult to separate from that of heredity. One reason for this is that many adoption agencies attempt to match the foster parent with the true parent on such variables as race, IQ if known, educational level, etc. and as such there may be a significant correlation between the environments of these two homes. Furthermore, in looking at measures of IQ, etc. of children prior to and after adoption, it should be noted that the environment prior to adoption may be especially stressful, adding to the unreliability of the measure. Also, measures of mother's IQ are often taken just prior to or just after

delivery of the child, when the child is to be given up for adoption, which is again a stressful situation.

Observations of early neonatal differences which continue to exist in later years have also provided another approach in investigating genetic determinants of behavior, although the effects of intra-uterine environment are obviously confounded with genetic influence. Early differences have been found in the amount of smiling (Washburn, 1929); crying (Aldrich, Sung & Knop, 1945); motor behavior-activity level (Fries and Woolf, 1953); and sensitivity of stimulation and vigor of response (Chess, Thomas, Birch, and Hertzog, 1960).

Perhaps the best available technique for assessing the relative contributions of heredity and environment is the twin study method.

Basically the rationale for the twin method is that since monozygotic (MZ) twins are identical in genotype, i.e., that there is no intra-pair genetic variation ( $\text{Var}_{\text{MZ}} = \text{Var}_{\text{ENV}_{\text{MZ}}}$ ), while for dizygotic (DZ) twins any phenotypic variation is due to both genetic and environmental factors ( $\text{Var}_{\text{DZ}} = \text{Var}_{\text{HER}_{\text{DZ}}} + \text{Var}_{\text{ENV}_{\text{DZ}}}$ ), then the comparison of MZs and DZs offer some measure of the genetic contribution to a particular phenotype such as various facets of intelligence or various personality traits.

Comparisons of MZ with DZ twins is one way of utilizing twins while the comparison of MZs alone is another way of attacking the problem of determining the relative influence of genetic and environmental factors. Differences found between MZ twins reared together and MZ twins reared apart could be attributed to environmental effects since, in general, only environmental differences separate the two groups of MZ twins.

The term "environment" is used in its broadest sense, i.e., to include intra-uterine, perinatal, and postnatal influences. The use of MZ and DZ twins drawn from the same population offers an indication of the importance of genetic factors in affecting behavior with the assumption that the environments of both types of twins are approximately identical, as probably is the case (Scarr, 1968). On the other hand, the comparison of MZ twins reared together with those reared apart attempts to evaluate the effects of environment on behavior.

In analyzing any MZ-DZ differences one may test whether the intra-class correlation for MZs is significantly larger than for DZs. Furthermore, an H (heredity) index may be calculated where  $H = \frac{\text{Var}_{DZ} - \text{Var}_{MZ}}{\text{Var}_{DZ}} = \frac{r_{MZ} - r_{DZ}}{1 - r_{DZ}}$ .

H is usually interpreted as being the percent of intra-family variance due to heredity for a given twin population.

The comparisons of twins were considered as far back as 1875 by Galton who recognized differences in MZ and DZ twins, (Galton, 1883), although the zygosity of twins was not clearly established. Thorndike's (1905) contribution concerning the measurement of twins was the first significant study after Galton's. However, Thorndike did not consider twins as existing in two categories but rather hypothesized that all twins were of the same type but differing in resemblance. The results of his study indicated that within-pair twin similarity was greater than for siblings; also evidence indicated that older twins were less similar than younger ones.

Merriman (1924) also made comparisons of twins on measures of IQ and found within-pair correlations from ages 10-16 not to be greater than ages 5-9. Furthermore, Merriman hypothesized, contrary to Thorndike, that there were in actuality two types of twins, fraternal and "duplicates," the latter arising from a single egg. In like-sexed twins (including both fraternal and duplicates) within-pair correlations on IQ were approximately .90; for unlike-sexed twins, .50. Lauterbach (1925), Wingfield (1928), and Tallman (1928) all presented further evidence in support of Merriman's study. In the latter two studies attempts were made to separate, among the like-sexed twins, the fraternal from the identicals. In these early studies judgments of physical similarity were used as the method of zygosity determination.

One of the early most extensive studies to assess the evidence for the inheritance of IQ and achievement was that done by Newman, Freeman, and Holzinger (1937). They obtained intra-pair correlations for MZ twins reared together, reared apart, and DZ twins reared together, with zygosity determined by within-pair resemblance or similarity. They found that identical genetic makeup, in addition to similar environment (as in MZs reared together) resulted in greater similarity in IQ, while dissimilar environments (in MZs reared apart) resulted in lower correlations, although the role of heredity in influencing IQ was clearcut. In achievement behavior the intra-pair correlations for MZs reared apart was even lower than that of DZs reared together (about .51 for MZs reared apart as compared with .88 for DZs reared together), indicating a greater environmental influence on measures of achievement.

Burt (1958; 1966) also compared MZ twins reared together with those reared apart to investigate genetic effects on IQ. In addition to MZ twins, he obtained groups of DZs reared together, siblings reared together and siblings reared apart, and unrelated children reared together. The intra-pair correlations for MZs reared apart is not significantly different from that of MZs reared together, and in general the findings indicated that IQ is influenced more by genetic factors than by environmental ones. On the other hand, measures of

achievement support the view of greater environmental effects on achievement.

Vandenberg (1966) notes a number of criticisms which have been lodged against the use of twins and attempts to refute each argument. Comparisons of MZ and DZ twins can offer indications of the hereditary components in a particular variable but, some argue, the twin method cannot offer specific genetic hypotheses, such as the role of dominance or sex linkage in a trait. Vandenberg, however, stresses the point that the twin study method is nevertheless an economical initial step in the forming of specific hypotheses, i.e., the method provides a means of ranking the items according to their degree of heritability.

A further criticism of the twin method attacks the assumption of equal environmental contribution for both kinds of twins, that the environmental contribution to within-pair variance is the same for MZ as for DZ twins, i.e.,  $\text{Var}_{\text{ENV}_{\text{MZ}}} = \text{Var}_{\text{ENV}_{\text{DZ}}}$ . In support of this argument is a study by Smith (1965) who assessed the personal and social characteristics of 90 pairs of MZ twins and 74 pairs of DZ twins such as information on work, school, sports, and leisure activities; sleep, dress, study habits, and food preferences. He found a greater intra-pair similarity among MZs than among DZs with respect to habits, activities, parental treatment, personal preference, and self images.

Furthermore, he found that, on the average, DZs come from a lower social economic class than MZs, a finding consistent with Lilienfeld and Pasamanick (1955) who analyzed variations in twinning in different socioeconomic groups. Scheinfeld (1965) suggests several variables related to twinning rate. While rate of MZ twinning occurs fairly consistently across maternal age groups and number of previous childbirths, DZ twinning is greatly affected by these factors with a peak frequency of occurrence for mothers in the 35-40 age ranges with more than five children. A mother's race is also related to rate of twinning with Blacks exhibiting highest rate, Oriental lowest, whites in between. Variations among racial groups in DZ twinning are very large while occurrence of MZ twinning is fairly consistent across groups.

On the other hand, Johnson (1963) reanalyzed data on MZs raised apart at various ages. He found that the average MZ difference in IQs of MZs separated late (after one year of age) was smaller than those separated early (before one year of age). Similar findings were reported by Vandenberg and Johnson (1968) using a sample of twins from Denmark.

Scarr (1968) approached the question of equality of environmental influences by comparing misclassified MZs and DZs with properly classified MZs and DZs on the assumption that if the environmental variable of parental belief concerning zygosity has a differential effect on

MZs and DZs, i.e., that parents treat those pairs that they believe to be MZ more alike than those that they believe to be DZ, then misclassified MZs should resemble DZs more closely than they resemble properly classified MZs. If the environmental variable was not crucial then MZs should resemble each other more closely than DZs, whether misclassified or not. In fact, misclassified MZs were found to be more similar to properly classified MZs than to DZs while DZs believed to be MZ pairs more closely resembled properly classified DZs, thus supporting the contention that actual zygosity is more important than parental belief and treatment of twins, although parental belief concerning zygosity (and hence, presumably, parental treatment) did have some effect on the degree of similarity between twins. The assumption of similarity in environmental contributions in the twin study method is supported by her study.

Another criticism which has sometimes been raised of the twin method is that only within-family variance, not between-family variance is investigated. Vandenberg, however, argues that the ranking of heritability of different attributes, an important result of the twin study method, is not affected by this criticism as long as the proportion of within-family variance that is the environmental variance is essentially the same as the proportion

of total variance that is the within-family variance. A fuller explanation is presented by Vandenberg (1966).

In spite of these points which have been raised in questioning the twin study method, one cannot avoid the obvious conclusion that this approach still remains at present the most powerful and economical single approach in the area of human behavior genetics.

The twin study method has been used in assessing not only the heritability of intelligence, but also of psychopathology, and of personality traits. The studies investigating the role of heredity in schizophrenia (Gottesman and Shields, 1966; Shields, 1967; Rosenthal, 1963) have in general found MZs more concordant than DZs.

Recent advances have been made in developing appropriate statistical techniques to extract as much information as possible from the twin study method. Cattell's (1955; 1960) Multiple Abstract Variance Analysis and the biometrical genetic methods of statistical analysis (Jinks and Fulker, 1970) attempt to provide some index of the degree of contribution of heredity to individual differences regarding a given characteristic. For example, Hundleby, Pawlik, and Cattell (1964) estimate that, overall, personality is two-thirds determined by environment, one-third by heredity. The variable with the largest hereditary influence is Neuroticism (Ego-Weakness) which they estimate to be approximately 40-45% determined by heredity. The

biometrical genetic approach, on the other hand, estimates Neuroticism to be approximately 54% set by hereditary influences. Using this method of estimating degree of relative contributions, Social Introversion-Extraversion has been found to be about 67% hereditary, with a significant genetic-environmental interaction, i.e., Introversion is more modifiable than Extraversion by within-family environment.

Vandenberg (1967) has reviewed most of the twin studies dealing with self-report or inventory measures of personality. One of the earliest comparisons of MZ and DZ twins on personality variables was done by Carter (1935) using the Bernreuter Personality Inventory. F tests of the H indices indicated Self-sufficiency, Dominance, and Self-confidence to be significant at the .01 level; Neuroticism at the .05 level.

Using the Thurstone Temperament Scale, Vandenberg (1962) found Active and Vigorous significant at the .01 level; Impulsive and Sociability significant at the .05 level. Three studies (Cattell, Blewett, & Beloff, 1955; Vandenberg, 1962; and Gottesman, 1963) used the High School Personality Questionnaire and found Surgent Excitement, Neuroticism, and Energetic Conformity significant at the .01 level. Adventurous cyclothymia and Will Control were significant at the .05 level.

Vandenberg, Stafford, Brown and Gresham (1966) used the Myers-Briggs Type Scale and found Introversion significantly influenced by heredity at the .05 level of confidence. They further administered the Comrey Personality Inventory and the variables Achievement Need and Shyness were found to be significant at the .01 level, with Compulsion and Religious attitudes significant at the .05 level.

Sandra Scarr (1968) administered the Adjective Check List and the Fels Behavior List and found Need for Affiliation, Friendliness, Social Apprehension, and Likeableness significant at the .01 level, Counseling Readiness at the .05 level.

The Minnesota Multiphasic Personality Inventory has been administered in a number of studies (Gottesman, 1963; 1966; Reznikoff and Honeyman, 1967). The combined results of these three studies have shown Social Introversion, Depression, Psychasthenia to be significantly influenced by heredity at the .01 level of confidence; Psychopathic deviate and Schizophrenia at the .05 level.

Vandenberg's review appears to indicate a hereditary component in Sociability, Extraversion-Introversion, Neuroticism, Dominance, Emotionality, Activity, and Impulsiveness. More recent studies such as one by Owen and Sines (1970) indicate significant heritability of measures

of Inhibition, Social Introversion-Extraversion, Other-person orientation, Activity, and Aggression.

A basic premise of the twin study method is that the zygosity of twins is known. The method of zygosity determination utilized in early studies was that of ascertaining a similarity index or measure of resemblance. The studies by Galton, Merriman, Newman, Freeman, and Holzinger, and others utilized judgments on the degree of similarity in physical variables such as height, eye color, etc. The major weakness of this method is that there is some degree of confounding of the variable(s), such as IQ, which are to be measured with respect to heritability by this criterion of similarity for judging zygosity. Since greater within-pair similarity is necessary in order for a pair to be classified as MZ, it is likely that there is greater similarity on the variables to be measured and assessed as to their heritability.

Blood tests to determine blood types provide a large step in the direction of more accurate determination of zygosity (Smith and Penrose, 1955). Juel-Nielsen, Nielsen, & Hauge (1958) demonstrated that 98% of all DZs can be shown to be properly classified by the ten most common serological systems. While blood types of twins themselves may be assessed, blood types of parents may also be ascertained to add further information as to zygosity (Sutton, Clark, and Schull, 1955). Fingerprints also have been

evaluated as a further aid to zygosity determination (Smith and Penrose, 1955). The problem that arises with blood typing and tests of fingerprints is that of time and expense of conducting these tests, in addition to the possible resistance on the part of twins to participating in studies requiring blood tests.

In answer to these problems of zygosity determination Nichols and Bilbro (1966) developed a questionnaire concerning physical similarity. The physical similarity index which they derived from the questionnaire had a high degree of accuracy, when cross-validated against blood typing. One study (Nichols, 1965) found the index to have a 93% accuracy as compared with blood tests conducted on the twins. Of the 1239 sets of twins, however, 70 sets could not be diagnosed by the index.

It appears that no investigator has attempted to formulate a short simple personality questionnaire derived analytically to aid in zygosity determination. The single study which is perhaps most similar to the present study in its emphasis on questionnaire items is that done by Loehlin (1965). He focused on the items of the Thurstone Temperament Scale and the Cattell Junior Personality Quiz, and subjectively formed a total of 35 clusters of items drawn from these two inventories. The clusters were then ranked with respect to size of genetic variance (DZ-MZ difference) and the 15 clusters with the largest DZ-MZ

differences were factor analyzed, independently of the 14 clusters with the smallest DZ-MZ differences. The 15 clusters with the largest genetic variance include: (1) likes to take things slow; (2) quick thinking; (3) optimistic; (4) socially outgoing; (5) socially dominant; (6) likes physical work; (7) likes to work with tools; (8) good social adjustment; (9) gets angry, frightened, upset; (10) has own opinions; (11) intellectual interests; (12) adventurous, self-confident; (13) controls his impulses; (14) gets going easily; and (15) impatient, impulsive.

The fourteen low-heredity clusters include the following: (1) good memory for recent events; (2) enjoys group activities; (3) likes racing, boxing, betting; (4) vigorous, active; (5) enjoys team sports; (6) seeks social stimulation; (7) impulsive, outgoing; (8) likes school and teacher; (9) shy; (10) good behavior; (11) feels restricted by adults and rules; (12) gets along well with parents; (13) nervous, suspicious, jumpy; and (14) considers self fortunate.

The present study is an attempt to derive statistically, in contrast to the subjective method used by Loehlin, through stepwise multiple discriminant analysis, a set of items taken from the Minnesota Multiphasic Personality Inventory (MMPI) and the California Psychological Inventory (CPI) which would be able to predict zygosity without the necessity of blood tests.

Discriminant analysis, developed by Fisher (1938), is a method devised to obtain the optimal linear combination of predictors or independent variables which would best discriminate between two or more groups, i.e., maximize the between-group variance relative to the within-group variance. The technique is suited to the situation involving prediction of some qualitative classification, such as groups labeled MZ and DZ, by some quantitative set of predictors. Multiple regression analysis, which involves the use of quantitative variables, is similar to discriminant analysis in the two-group case where the criterion is not a quantitative variable but a dichotomous variable denoting group membership. Stepwise multiple discriminant analysis involves the determination of the best sequence of predictors or independent variables. At each step that variable is selected which contributes most to the accurate classification of cases into various groups, i.e., the variable which discriminates best, given the variables that have already been added to the discriminating set at a certain step. At each step the coefficients of the function for each group are calculated for the set of predictors already entered and F-ratios are computed to test for significant differences between the groups. Furthermore, F-ratios for each variable added at each step are calculated. This tests the equivalence over all groups

of the conditional distribution of the variable given the variables already entered.

The variable to be included at each step is judged along the following equivalent criteria: (1) the size of its F-value; (2) the size of the variable's multiple correlation with the groups when the effects of the other variables already added to the set are partialled out; or (3) the size of decrease in the ratio of within- to total variance. The variable which best meets these criteria is then selected to be added at a particular step. When none of these criteria are met beyond some level of significance (e.g.,  $F = .01$ ) no variables are added.

A further aim of the present study was to investigate what items in these two tests (CPI and MMPI) were relevant to MZ-ness and DZ-ness, per se; also of interest was an analysis of whether within-pair differences could be attributed to MZs or to DZs. Factor analysis of the items was done in determining what factors emerge for the MZs as opposed to the DZs. Of equal importance is the question of whether childhood experiential factors differ for MZs and DZs. In addition, the present study also attempted to check the relationship of Social Desirability (Edwards, 1957) and item ambiguity of the MMPI and the Social Desirability of the CPI to the discriminant power of the items. It was hypothesized that those items which would discriminate best between MZs and DZs or between MZ

and DZ within-pair differences would be those items which are highest in ambiguity. That is, for those items which the Social Desirability is not readily discernible, the selection of the True or False response would be more dependent on the effect of the genes than items whose responses were very much influenced by the common environment of all subjects, MZ or DZ.

Gottesman's Harvard Study (1965) was the source of the MMPI and CPI information on twins. The twins were obtained from grades 9-12 in 20 school systems in the Greater Boston area, as well as from members of Twins Clubs and from Catholic parochial school students in the area. A final sample of 79 MZ pairs and 68 DZ pairs were used, with zygosity determined by blood typing, except in obvious cases of dizygosity. Each of them was administered the CPI and MMPI.

For the 18 CPI scales intra-class correlations for MZs were all significant at or beyond the .01 level, while for the DZs nine were significant at the .01 level; five at the .05 level. H values for the total sample of twins indicated that the following scales had greater than 30% of the within-family variance attributable to heredity: Dominance, Sociability, Social Presence, Self Acceptance, Socialization; Good Impression, and Psychological Mindedness. The factors which can be derived from the CPI scales (Nichols and Schnell, 1963) indicate that the

Extraversion-Introversion or Person Orientation Factor, comprised of Dominance, Sociability, Social Presence, and Self Acceptance, is highly determined by genetic factors. This scale correlates  $-.66$  with the Social Introversion Scale of the MMPI.

Of the ten major scales of the MMPI, administered to a final sample of 82 MZ pairs and 68 DZ pairs, five scales were found to have significant hereditary contribution: Depression, Psychopathic Deviate, Paranoia, Schizophrenia, and Social Introversion.

The present study utilized the MMPI and CPI data gathered on these twins and analyses were concentrated on the item-level rather than on the scale-level that was the concern of Gottesman.

In summary, then, the present study has the following aims: (1) derive statistically through multiple discriminant analysis a set of personality inventory items, from the MMPI and CPI, which could predict zygosity with some degree of accuracy; (2) derive a set of items or predictors which would predict MZ and DZ within-pair differences; (3) determine which items or sets of items are related to MZness and DZness, per se; (4) investigate childhood experiential factors as reflected by these items in discriminating MZs and DZs, i.e., differences in parental treatment of MZs vs. DZs; and (5) check the relationship of social desirability and item ambiguity with the discriminatory power of the items.

## CHAPTER II

### METHOD

Ss. The twins were taken from Gottesman's (1965; 1966) sample from the greater Boston Area.\* The total number of usable twins were 80 MZ pairs and 66 DZ pairs. The discrepancy in number of pairs used as compared with Gottesman's studies is due to errors in Xeroxing of CPI and MMPI answers sheets which necessitated deletions of Ss. Further details of the sample may be obtained from Gottesman (1965; 1966).

Procedure. All twins had been administered both the MMPI and CPI. Missing responses on either test were randomly coded as being either true or false.

The statistical analyses of the responses were as follows: First, proportion of cases having agreeing or similar responses on a particular item was computed for MZs and DZs separately. Differences between MZs and DZs with respect to these proportions were found for each item. Items with the largest differences were used as an indication of which items were most closely related to MZ-DZ differences. Intraclass correlations for MZs

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\*The data were provided to the writer through the generosity of Dr. Gottesman.

and DZs for each item were not utilized in the study since, on a number of the items, there was no variation within-pairs or between pairs within a particular group.

The next step in the analyses of the responses for the MMPI and CPI involves the use of multiple discriminant analysis. The computer program BMD07M (Dixon, 1968) was used for this purpose. The 566 items of the MMPI and the 480 items of the CPI were divided into subsets of 60 items each; for each subset the program determined the sequence of items which best predicted or categorized twins with respect to zygosity. The top 20 predictors in each of the 10 subsets in the MMPI were then grouped into four subsets of 60 items each. Finally the top 15 non-overlapping items of each of the four subsets were included in the final analysis to determine the sequence of best predictors. A similar method of analysis was followed for the 480 CPI items. However, the top 15 predictors were selected from the first eight subsets of 60 items, resulting in two subsets of 60 items each. These were again analyzed and the top 30 predictors from each run were combined for the final set of 60 predictors and again analyzed to determine the sequence of items according to power of predictability of zygosity.

A similar procedure was followed for the next phase of analysis which involved the use of within-pair differences. Absolute differences (  $|T_1 - T_2|$  ) were computed

for each pair of twins for each item, resulting in half the number of scores as for the previous analyses, i.e., instead of having scores for each twin, difference scores were used for each set of twins. Again the top 60 items of the MMPI and the top 60 items of the CPI were derived using the procedure described above. This particular procedure was used first, because of the limitation of the discriminant analysis program (BMD07M) to 80 independent variables or predictors, and second, because the number of cases for DZ twins was 66 pairs.

The procedure of using empirical groups as criteria for selecting personality items for a test, which is what the present study does, is not a new technique, but rather is a well-established technique in personality assessment. The development of the MMPI itself was based on a comparison of empirical groups. Hase and Goldberg (1967) compared various methods of developing measures of personality, e.g., measures based on a formal theory, measures based on some intuitive notion of what should be included in the test, and measures based on its ability to discriminate between empirically formed groups, and found all these measures to be comparable with respect to reliability and validity indices.

Each of the four sets of 60 items: two sets of MMPI items (raw scores and within-pair difference scores) and two sets of CPI items (raw scores and within-pair difference

scores) were factor analyzed by the common factor analysis method and rotated orthogonally by the Varimax method.

For the MMPI, for both the raw scores and difference scores, t tests were done comparing the top 60 predictors with an additional set of randomly selected 60 items not in the set of the top 60 items to test for differences in mean Social Desirability value as well as for item ambiguity, as measured by the standard deviation of Social Desirability values. These standard deviations were obtained from Messick and Jackson's study (1961).

Since measures of item ambiguity were not available for CPI items, t tests were done on only the Social Desirability Scale values to check for any mean differences between the set of top 60 predictors as compared with a randomly selected set of 60 items not included in the set of best predictors.

Accuracy of classification using the top 60 predictors, in each case (MMPI raw scores and difference scores; CPI raw scores and difference scores) was assessed by the non-parametric t test for the difference between 2 percentages developed by Lubin (1950) for discriminant analysis. This test of significance is derived as follows:

$$t = \frac{(o - e) \sqrt{N}}{\sqrt{e(N - e)}},$$

where  $o$  = the number of persons observed to be correctly classified;  $e$  = the theoretical number of correct classifications expected by chance, and  $N$  = the total number of cases.

## CHAPTER III

### RESULTS

A list of the 566 items in the MMPI is contained in Appendix I. Appendix II contains the 480 items of the CPI.

Table 1 contains the proportion of pairs agreeing on a particular item on the MMPI and CPI, for both MZs and DZs. Differences between proportions for each item can be calculated from these. The MMPI items with the largest MZ-DZ differences (difference  $\geq .175$ ) with respect to proportion of agreeing responses are as follows: Items 6, 30, 86, 117, 129, 131, 208, 217, 221, 248, 278, 296, 324, 328, 406, 451, 560, 561, 563.

The following are the CPI items with the largest MZ-DZ differences in proportion of agreeing responses: Items 24, 45, 48, 52, 54, 74, 85, 102, 115, 170, 177, 226, 228, 242, 245, 252, 270, 282, 293, 371, 378, 400, 408, 448, 460, 468, and 476.

#### Raw scores for all individuals

The set of 60 best predictors selected from the MMPI items, using stepwise multiple discriminant analysis, is presented in Table 2a.

Table 3 presents the classification matrix indicating the number of properly classified MZs and DZs, using the set of 60 predictors from the MMPI. A total of 269 cases

Table 1

Proportion of Pairs Agreeing on a Particular Item of the MMPI and CPI<sup>a</sup>

MMPI items

MZ

.837	.837	.650	.825	.575	.712	.675	.787	.837	.925	.737	.700	.813	.950	.587	.950	.912
.825	.762	.850	.612	.712	.938	.825	.675	.688	.900	.675	.938	.938	.912	.787	.625	.950
.912	.525	.862	.787	.625	.637	.688	.962	.825	.962	.725	.612	.850	.837	.987	.862	.862
.775	.938	.887	.700	.925	.675	.737	.587	.925	.875	.612	.762	.662	.912	.875	.575	.688
.750	.700	.737	.875	.737	.762	.962	.900	.837	.700	.575	.662	.737	.662	.962	.525	.850
.750	.887	.950	.662	.912	.725	.800	.600	.650	.925	.662	.650	.725	.725	.487	.675	.563
.837	.900	.675	.737	.850	.862	.587	.825	.625	.625	.950	.938	.625	.700	.650	.837	.662
.737	.950	.912	.962	.612	.887	.737	.575	.688	.662	.725	.675	.787	.813	.625	.625	.575
.862	.700	.737	.762	.600	.637	.612	.750	.650	.787	.600	.625	.900	.787	.950	.688	.950
.875	.563	.800	.712	.775	.787	.600	.887	.587	.650	.737	.625	.750	.762	.887	.825	.737
.675	.625	.813	.800	.887	.762	.975	.925	.813	.650	.737	.875	.688	.925	.938	.800	.712
.587	.900	.800	.688	.837	.813	.912	.725	.925	.962	.625	.650	.925	.650	.925	.725	.912
.912	.762	.850	.812	.975	.962	.962	.662	.938	.625	.925	.912	.688	.925	.850	.975	.787
.587	.762	.675	.775	.625	.750	.537	.675	.487	.662	.762	.625	.600	.762	.825	.700	.750
.750	.875	.650	.675	.712	.563	.700	.975	.672	.587	.762	.650	.825	.900	.712	.650	.712
.925	.650	.962	.688	.787	.875	.612	.775	.612	.900	.688	.688	.625	.825	.688	.650	.912
.937	.662	.950	.962	.688	.675	.800	.737	.637	.637	.700	.688	.887	.825	.550	.962	.662
.813	.962	.662	.925	.787	.600	.725	.650	.625	.600	.700	.837	.862	.612	.700	.775	.787
.737	.625	.800	.862	.737	.850	.637	.612	.925	.662	.612	.725	.712	.750	.600	.662	.612
.787	.787	.688	.625	.762	.662	.762	.925	.725	.887	.750	.750	.612	.762	.787	.912	.550
.825	.787	.625	.563	.637	.662	.762	.563	.750	.837	.950	.762	.600	.850	.813	.712	.625
.662	.625	1.000	.600	.650	.800	.850	.800	.837	.675	.487	.662	.762	.537	.525	.775	.675
.688	.750	.762	.700	.587	.700	.750	.688	.650	.625	.787	.762	.712	.737	.688	.625	.837
.912	.925	.612	.675	.637	.625	.600	.537	.550	.787	.600	.813	.550	.900	.712	.662	.625
.675	.650	.725	.675	.737	.600	.637	.675	.675	.662	.975	.825	.837	.837	.688	.800	.637

\*Read items from left to right across table.

Table 1 (continued) Proportion of Pairs Agreeing on a Particular Item  
of the MMPI and CPI

MZ

.625	.675	.662	.650	.762	.637	.700	.875	.787	.688	.650	.688	.650	.625	.737	.637	.637
.575	.662	.762	.637	.625	.650	.775	.750	.813	.688	.637	.737	.612	.750	.813	.813	.800
.712	.600	.837	.787	.725	.525	.762	.688	.575	.725	.737	.862	.650	.737	.775	.575	.825
.625	.575	.787	.637	.612	.662	.800	.637	.737	.813	.737	.737	.550	.950	.700	.688	.612
.762	.637	.625	.862	.625	.637	.575	.625	.688	.512	.563	.637	.712	.637	.900	.637	.775
.775	.887	.587	.725	.862	.700	.925	.550	.938	.650	.600	.725	.637	.787	.612	.975	.737
.625	.825	.600	.612	.688	.662	.650	.925	.612	.825	.787	.700	.850	.850	.813	.912	.725
.688	.662	.875	.737	.662	.750	.587	.712	.737	.712	.750	.800	.800	.625	.725	.650	.787
.700	.825	.537	.813	.750												

DZ

.712	.833	.591	.758	.576	.439	.697	.712	.909	.909	.667	.591	.803	.955	.545	.864	.894
.667	.621	.939	.636	.652	.939	.667	.667	.561	.879	.667	.955	.742	.879	.636	.621	.894
.879	.576	.879	.727	.545	.742	.576	.939	.833	.909	.667	.621	.833	.864	.939	.864	.864
.621	.939	.879	.727	.955	.545	.758	.530	.955	.909	.636	.803	.485	.939	.788	.606	.697
.818	.727	.712	.970	.591	.697	.939	.833	.697	.606	.652	.606	.773	.742	.955	.667	.909
.561	.879	.848	.636	.833	.727	.788	.576	.606	.939	.561	.758	.742	.576	.500	.561	.561
.773	.894	.682	.818	.727	.833	.606	.879	.652	.773	.985	.818	.727	.697	.455	.833	.576
.591	.955	.788	.939	.606	.970	.621	.530	.652	.455	.788	.500	.682	.894	.652	.667	.561
.758	.652	.697	.636	.515	.667	.591	.697	.712	.773	.636	.545	.773	.818	.970	.545	.970
.833	.455	.773	.667	.621	.803	.636	.939	.636	.652	.621	.621	.591	.697	.909	.894	.667
.576	.500	.758	.682	.864	.758	.939	.879	.712	.591	.742	.924	.682	.894	.864	.818	.788
.530	.879	.712	.545	.909	.727	.879	.848	.924	.924	.561	.727	.894	.591	.909	.652	.758
.894	.682	.833	.591	.848	.894	.955	.636	.848	.515	.864	.864	.500	.909	.773	.970	.591
.545	.773	.773	.758	.561	.788	.515	.576	.667	.621	.697	.652	.364	.727	.803	.621	.606
.576	.833	.500	.697	.818	.636	.773	.970	.697	.409	.879	.652	.803	.909	.652	.606	.636
.879	.727	.924	.606	.697	.727	.576	.788	.636	.848	.606	.576	.576	.939	.636	.591	.909
.909	.712	.939	.864	.652	.485	.864	.697	.682	.591	.697	.712	.864	.909	.500	.939	.606

Table 1 (continued) Proportion of Pairs Agreeing on a Particular Item  
of the MMPI and CPI

DZ

.788	1.000	.545	.939	.758	.606	.470	.545	.591	.576	.652	.788	.848	.515	.652	.682	.727
.576	.606	.712	.894	.682	.864	.591	.667	.879	.500	.576	.712	.606	.621	.530	.697	.652
.606	.697	.636	.667	.591	.621	.833	.894	.712	.742	.803	.636	.500	.682	.712	.909	.530
.788	.818	.530	.530	.697	.621	.879	.530	.742	.879	.939	.652	.636	.879	.833	.606	.606
.652	.606	.955	.515	.561	.848	.894	.803	.788	.621	.485	.561	.652	.606	.561	.818	.606
.697	.758	.682	.667	.621	.591	.606	.606	.500	.530	.682	.652	.788	.697	.530	.545	.712
.924	.894	.606	.682	.606	.591	.652	.424	.424	.818	.606	.652	.606	.924	.455	.591	.606
.530	.576	.788	.682	.742	.591	.545	.561	.530	.576	.894	.818	.682	.773	.591	.697	.561
.545	.682	.667	.606	.742	.667	.561	.803	.894	.652	.652	.652	.621	.576	.773	.621	.470
.591	.515	.818	.636	.561	.712	.697	.727	.636	.697	.591	.727	.515	.742	.727	.682	.697
.742	.455	.818	.833	.788	.530	.818	.576	.606	.636	.712	.924	.561	.803	.727	.561	.788
.621	.530	.636	.576	.682	.667	.848	.727	.636	.758	.682	.682	.606	.788	.652	.606	.561
.682	.545	.621	.848	.545	.576	.545	.576	.788	.485	.515	.561	.606	.561	.864	.591	.742
.682	.803	.652	.773	.909	.667	.894	.682	.939	.697	.606	.667	.727	.682	.652	.879	.758
.561	.697	.652	.697	.758	.712	.591	.864	.500	.742	.848	.652	.833	.788	.773	.803	.636
.545	.636	.894	.667	.652	.667	.545	.667	.818	.682	.652	.712	.712	.591	.606	.439	.515
.576	.636	.455	.909	.621												

Table 1 (continued) Proportion of Pairs Agreeing on a Particular Item of the MMPI and CPI

MZ	CPI items															
.813	.962	.688	.637	.700	.813	.725	.600	.962	.875	.537	.688	.637	.662	.700	.837	.925
.575	.825	.625	.750	.775	.612	.737	.550	.712	.775	.725	.688	.725	.712	.600	.700	.762
.725	.938	.575	.587	.712	.612	.650	.625	.650	.625	.825	.700	.712	.700	.725	.775	.750
.737	.662	.787	.688	.637	.550	.600	.575	.587	.837	.600	.600	.962	.787	.938	.800	.650
.712	.600	.575	.887	.637	.662	.725	.625	.775	.600	.837	.925	.587	.850	.688	.712	.662
.600	.787	.850	.825	.887	.612	.475	.900	.813	.612	.712	.587	.487	.675	.612	.625	.637
.737	.662	.700	.550	.750	.600	.750	.675	.662	.563	.813	.662	.737	.875	.587	.875	.587
.737	.762	.662	.563	.637	.637	.688	.762	.512	.850	.587	.850	.775	.563	.525	.700	.750
.625	.762	.575	.537	.587	.725	.750	.612	.563	.862	.650	.637	.563	.700	.637	.725	.725
.700	.662	.850	.737	.775	.675	.800	.575	.825	.900	.662	.500	.587	.675	.775	.675	.650
.837	.688	.537	.587	.675	.650	.750	.700	.637	.762	.637	.637	.662	.675	.525	.662	.600
.600	.850	.625	.675	.587	.700	.637	.500	.787	.962	.688	.762	.612	.637	.575	.587	.612
.675	.625	.700	.675	.600	.750	.587	.850	.700	.813	.862	.625	.800	.800	.612	.787	.912
.650	.637	.612	.662	.650	.650	.737	.537	.875	.575	.662	.675	.700	.600	.637	.688	.712
.675	.800	.612	.662	.612	.625	.837	.637	.637	.550	.800	.575	.612	.712	.637	.813	.612
.600	.675	.700	.850	.725	.875	.737	.712	.712	.700	.537	.737	.712	.725	.688	.725	.650
.650	.850	.612	.550	.775	.612	.675	.887	.725	.675	.650	.550	.675	.637	.688	.938	.750
.862	.762	.650	.650	.688	.487	.650	.650	.600	.862	.637	.662	.675	.637	.787	.825	.862
.875	.938	.762	.612	.912	.925	.625	.662	.750	.938	.912	.625	.662	.662	.862	.813	.912
.962	.662	.837	.850	.563	.637	.938	.625	.912	.862	.637	.575	.625	.950	.887	.900	.662
.700	.813	.912	.587	.775	.600	.550	.800	.938	.875	.625	.825	.850	.525	.637	.637	.675
.612	.625	.862	.750	.650	.575	.575	.850	.900	.637	.862	.662	.600	.887	.712	.675	.887
.637	.612	.563	.862	.662	.675	.887	.750	.612	.938	.712	.500	.575	.700	.662	.875	.688
.688	.925	.587	.750	.650	.525	.912	.712	.650	.925	.938	.762	.612	.762	.850	.862	.688
.600	.850	.912	.637	.712	.887	.750	.712	.862	.737	.813	.737	.787	.725	.900	.650	.600
.900	.750	.688	.712	.750	.775	.750	.700	.900	.737	.725	.925	.825	.737	.912	.625	.725
.762	.737	.912	.800	.875	.725	.925	.662	.637	.675	.750	.950	.950	.675	.900	.600	.813
.712	.675	.575	.612	.775	.637	.700	.637	.712	.563	.675	.512	.625	.612	.688	.850	.912
.712	.625	.762	.737													

Table 1 (continued) Proportion of Pairs Agreeing on a Particular Item  
of the MMPI and CPI

	CPI items																
DZ	.727	.955	.682	.545	.712	.682	.591	.530	.970	.773	.667	.667	.576	.697	.727	.803	.803
	.636	.788	.636	.727	.758	.682	.561	.561	.561	.727	.803	.561	.652	.636	.545	.697	.803
	.606	.909	.500	.591	.742	.606	.500	.667	.712	.545	.591	.697	.636	.439	.682	.818	.727
	.545	.591	.606	.697	.545	.485	.561	.545	.515	.788	.606	.500	.939	.682	.758	.758	.667
	.742	.606	.485	.727	.727	.455	.818	.621	.742	.530	.833	.894	.515	.788	.621	.652	.470
	.455	.606	.758	.818	.924	.591	.530	.909	.788	.591	.712	.591	.530	.667	.621	.606	.439
	.697	.636	.606	.530	.667	.576	.742	.591	.606	.667	.758	.606	.455	.803	.591	.864	.470
	.727	.606	.545	.561	.545	.561	.667	.758	.591	.773	.561	.803	.621	.606	.545	.606	.742
	.485	.803	.667	.591	.621	.667	.652	.591	.621	.773	.697	.576	.470	.561	.636	.788	.591
	.621	.515	.894	.727	.833	.530	.667	.530	.803	.803	.742	.455	.606	.591	.621	.576	.470
	.682	.545	.530	.485	.652	.576	.530	.697	.636	.742	.606	.636	.652	.667	.515	.530	.576
	.561	.879	.727	.727	.682	.803	.545	.545	.758	.848	.652	.682	.576	.742	.621	.561	.712
	.621	.545	.636	.682	.545	.727	.530	.833	.727	.894	.894	.606	.697	.697	.500	.742	.803
	.682	.545	.636	.561	.424	.500	.576	.500	.742	.591	.606	.758	.727	.682	.621	.636	.697
	.667	.742	.636	.409	.576	.591	.652	.515	.576	.530	.742	.545	.652	.530	.667	.833	.682
	.561	.636	.652	.803	.667	.909	.667	.591	.742	.712	.621	.621	.636	.667	.500	.742	.561
	.652	.758	.515	.530	.758	.697	.621	.864	.727	.500	.697	.652	.621	.636	.727	.939	.652
	.848	.818	.606	.439	.667	.455	.667	.697	.606	.803	.667	.652	.515	.500	.712	.879	.848
	.924	.939	.697	.591	.909	.955	.652	.530	.712	.894	.773	.697	.621	.576	.848	.864	.864
	.970	.636	.833	.803	.530	.515	.970	.455	.970	.939	.576	.606	.576	.909	.939	.848	.712
	.545	.833	.879	.682	.864	.636	.515	.727	.894	.894	.606	.879	.697	.545	.652	.591	.530
	.576	.667	.970	.667	.636	.576	.667	.818	.864	.636	.848	.667	.621	.712	.682	.606	.879
	.545	.515	.500	.667	.606	.576	.864	.121	.545	.864	.727	.561	.636	.606	.576	.818	.545
	.621	.879	.485	.652	.530	.500	.818	.576	.470	.909	.848	.621	.500	.636	.742	.803	.470
	.621	.848	.939	.682	.636	.939	.773	.652	.864	.697	.667	.621	.818	.697	.848	.591	.576
	.727	.848	.667	.591	.652	.788	.667	.833	.773	.742	.652	.939	.864	.667	.879	.621	.697
	.636	.727	.879	.803	.818	.530	.894	.606	.727	.576	.803	.833	.909	.515	.848	.500	.833
	.500	.667	.727	.455	.712	.652	.591	.821	.530	.591	.636	.606	.652	.545	.621	.803	.652
	.636	.591	.682	.667													

Table 2a

## List of Top 60 Predictors Using MMPI-Raw Scores

Sequence No.	Item No.	
1	561	I very much like horseback riding.
2	137	I believe that my home life is as pleasant as that of most I know.
3	533	I am not bothered by a great deal of belching of gas from my stomach.
4	58	Everything is turning out just like the prophets of the Bible said it would.
5	284	I am sure I'm being talked about.
6	447	I am often inclined to go out of my way to win a point with someone who has opposed me.
7	526	The future seems hopeless to me.
8	243	I have few or no pains.
9	490	I read the Bible several times a week.
10	129	Often I can't understand why I've been so cross and grouchy.
11	195	I don't like everyone I know.
12	419	I played hooky from school often as a youngster.
13	224	My parents often objected to the kind of people I went around with.
14	278	I have often felt that strangers were looking at me critically.
15	19	When I take a new job I like to be tipped on who needs to be gotten next to.
16	30	At times I feel like swearing.

Table 2a (continued) List of Top 60 Predictors

Sequence No.	Item No.	
17	347	I have no enemies who really wish to harm me.
18	299	I think I feel more intensely than most people do.
19	114	Often I feel as if there were a tight band about my head.
20	444	I do not try to correct people who express an ignorant belief.
21	387	I have had no difficulty starting or holding my urine.
22	285	Once in a while I laugh at a dirty joke.
23	348	I tend to be on my guard with people who are somewhat more friendly than I had expected.
24	165	I like to know some important people because it makes me feel important.
25	564	I am not easily angered.
26	3	I wake up fresh and rested most mornings.
27	300	There never was a time in my life when I liked to play with dolls.
28	125	I have a great deal of stomach trouble.
29	491	I have no patience with people who believe there is only one true religion.
30	238	I have periods of such great restlessness that I cannot sit long in a chair.
31	49	It would be better if almost all laws were thrown away.
32	543	Several times a week I feel as if something dreadful is about to occur.

Table 2a (continued) List of Top 60 Predictors

Sequence No.	Item No.	
33	479	The only miracles I know of are simply tricks that people play on one another.
34	112	I frequently find it necessary to stand up for what I think is right.
35	328	I find it hard to keep my mind on a task or job.
36	553	I am afraid of being alone in a wide-open place.
37	537	I would like to hunt lions in Africa.
38	73	I am an important person.
39	402	I often must sleep over a matter before I decide what to do.
40	95	I go to church almost every week.
41	492	I dread the thought of an earthquake.
42	343	I usually have to stop and think before I act even in trifling matters.
43	82	I am easily downed in an argument.
44	482	My plans have frequently seemed so full of difficulties that I have had to give them up.
45	59	I have often had to take orders from someone who did not know as much as I did.
46	158	I cry easily.
47	548	I never attend a sexy show if I can avoid it.
48	77	I enjoy reading love stories.
49	474	I have to urinate no more often than others.
50	253	I can be friendly with people who do things which I consider wrong.

Table 2a (continued) List of Top 60 Predictors

Sequence No.	Item No.	
51	294	I have never been in trouble with the law.
52	324	I have never been in love with anyone.
53	276	I enjoy children.
54	498	It is always a good thing to be frank.
55	306	I get all the sympathy I should.
56	221	I like science
57	513	I think Lincoln was greater than Washington.
58	450	I very seldom have spells of the blues.
59	36	I seldom worry about my health.
60	185	My hearing is apparently as good as that of most people.

Table 2b

Means and Standard Deviations for MZs and DZs  
using MMPI Raw Score items

		Means		
Items	Orig #	MZ	DZ	Grand means
1	3	.48750	.37121	.43493
2	19	.38125	.31061	.34932
3	30	.95625	.84091	.90411
4	36	.42500	.57576	.49315
5	49	.00625	.03030	.01712
6	58	.19375	.31818	.25000
7	59	.54375	.62879	.58219
8	73	.18125	.29545	.23288
9	77	.58125	.45455	.52397
10	82	.20625	.14394	.17808
11	95	.73750	.62121	.68493
12	112	.70000	.79545	.74315
13	114	.04375	.09091	.06507
14	125	.05625	.01515	.03767
15	129	.60625	.43939	.53082
16	137	.91875	.78788	.85959
17	158	.23750	.32576	.27740
18	165	.61250	.75000	.67466
19	185	.96875	.90152	.93836
20	195	.77500	.87879	.82192
21	221	.65625	.56818	.61644
22	224	.30000	.17424	.24315
23	238	.41250	.33333	.37671
24	243	.84375	.89394	.86644
25	253	.71875	.64394	.68493
26	276	.98125	.91667	.95205
27	278	.40000	.50000	.44521
28	284	.29375	.17424	.23973
29	285	.93125	.87121	.90411
30	294	.79375	.84848	.81849
31	299	.30000	.37879	.33562
32	300	.31250	.44697	.37329
33	306	.86875	.81818	.84589
34	324	.21875	.33333	.27055
35	328	.19375	.28030	.23288
36	343	.43750	.53788	.48288
37	347	.85625	.92424	.88699
38	348	.50625	.40152	.45890
39	387	.25625	.15152	.20890
40	402	.36250	.33333	.34932
41	419	.01250	.05303	.03082

Table 2b (continued) Means and Standard Deviations for  
MZs and DZs

Items	Orig #	MZ	DZ	Grand Means
42	444	.28125	.36364	.31849
43	447	.51250	.64394	.57192
44	450	.83750	.74242	.79452
45	474	.76250	.86364	.80822
46	479	.85625	.74242	.80479
47	482	.31875	.22727	.27740
48	490	.05000	.12121	.08219
49	491	.16250	.23485	.19521
50	492	.60625	.48485	.55137
51	498	.58750	.46970	.53425
52	513	.48125	.65909	.56164
53	526	.01250	.07576	.04110
54	533	.66875	.81061	.73288
55	537	.27500	.18939	.23630
56	543	.04375	.11364	.07534
57	548	.68125	.57576	.63356
58	553	.16875	.12121	.14726
59	561	.65625	.45455	.56507
60	564	.51875	.42424	.47603

## Standard Deviations

Items	Orig #	MZ	DZ
1	3	.50141	.48496
2	19	.48721	.46450
3	30	.20518	.36715
4	36	.49589	.49611
5	49	.07906	.17207
6	58	.39647	.46754
7	59	.49964	.48497
8	73	.38643	.45798
9	77	.49490	.49982
10	82	.40588	.35236
11	95	.44137	.48693
12	112	.45969	.40490
13	114	.20518	.28857
14	125	.23113	.12262
15	129	.49011	.49820
16	137	.27408	.41037
17	158	.42688	.47044
18	165	.48870	.43466
19	185	.17454	.29910
20	195	.41889	.32762
21	221	.47645	.49721

Table 2b (continued) Means and Standard Deviations for  
MZs and DZs

Items	Orig #	MZ	DZ
22	224	.45969	.38076
23	238	.49383	.47320
24	243	.36423	.30909
25	253	.45102	.48065
26	276	.13607	.27744
27	278	.49143	.50190
28	284	.45690	.38076
29	285	.25382	.33624
30	294	.40588	.35991
31	299	.45969	.48693
32	300	.46496	.49907
33	306	.33873	.38716
34	324	.41469	.47320
35	328	.39647	.45085
36	343	.49763	.50046
37	347	.35193	.26562
38	348	.50153	.49207
39	387	.43793	.35991
40	402	.48223	.47320
41	419	.11145	.22495
42	444	.45102	.48287
43	447	.50141	.48065
44	450	.37006	.43896
45	474	.42688	.34448
46	479	.35193	.43896
47	482	.46745	.42066
48	490	.21863	.32762
49	491	.37006	.42551
50	492	.49011	.50167
51	498	.49383	.50098
52	513	.50121	.47582
53	526	.11145	.26562
54	533	.47214	.39331
55	537	.44791	.39331
56	543	.20518	.31858
57	548	.46745	.49611
58	553	.37570	.32762
59	561	.47644	.49982
60	564	.50121	.49611

Table 2c

List of MMPI-Raw Score items with significant F-values

Step No.	Item	F-value	df	p
1	561	12.4001	1,290	.001
2	137	11.4110	1,289	.001
3	533	8.6188	1,288	.01
4	58	8.0884	1,287	.01
5	284	8.8945	1,286	.01
6	447	9.3326	1,285	.01
7	526	8.1449	1,284	.01
8	243	8.7690	1,283	.01
9	290	9.0906	1,282	.01
10	129	7.3960	1,281	.01
11	195	8.0688	1,280	.01
12	419	7.5787	1,279	.01
13	229	7.1232	1,278	.01
14	278	6.9971	1,277	.01
15	19	7.3162	1,276	.01
16	30	6.0171	1,275	.05
17	347	4.9787	1,274	.05
18	299	4.5495	1,273	.05
19	114	4.5617	1,272	.05
20	444	4.6963	1,271	.05
21	387	4.7808	1,270	.05
22	285	5.7176	1,269	.05
23	348	4.6089	1,268	.05
24	165	4.2964	1,267	.05
25	564	4.8398	1,266	.05
26	3	5.6824	1,265	.05
27	300	6.8739	1,264	.05
28	125	5.514	1,263	.05
29	491	5.0137	1,262	.05
30	238	4.8177	1,261	.05
31	49	4.3914	1,260	.05

For all 60 variables  $F = 5.94366$  ( $df=60,231$ ;  $p < .001$ )

Table 3  
Classification matrix using MMPI-Raw scores predictors

Group	No. of cases classified into groups:	
	MZ	DZ
MZ	146	14
DZ	9	123

92% accuracy

were properly classified, with 146 of the 180 MZs being classified as MZs and 123 of the 132 DZs being classified as DZs. Nine of the DZs were misclassified as MZs and 14 of the MZs were misclassified as DZs.

Table 4a contains the set of 60 best predictors selected from the CPI.

The classification matrix for this set of 60 predictors is presented in Table 5. The predictors classified 146 MZs correctly and 114 DZs correctly. Eighteen of the DZs were misclassified as MZs; fourteen of the MZs were misclassified as DZs.

The means and standard deviations of each of the 60 items were computed for the MZs and DZs separately. These are presented in Tables 2b and 4b for the MMPI-Raw Score and CPI-Raw Score items, respectively.

For the MMPI-Raw Score items, mean response for MZs is higher on approximately half the items (32 of 60 items) including the following items with the largest differences in means between MZs and DZs: 3, 77, 129, 137, 224, 479, 498, and 561. On the following items, DZs have a higher average response: 58, 73, 165, 300, 324, 447, 513. Since the response "true" is coded as being a "1" and a "false" is coded as being a "0," a higher mean value indicates a greater frequency of "true" responses.

The average response for the CPI-Raw Score items is higher for MZs on 35 of 60 items including the following

Table 4a

## List of Top 60 Predictors using CPI-Raw Scores

Sequence No.	Item No.	
1	197	Once in a while I laugh at a dirty joke
2	476	I had my own way as a child
3	152	I read at least 10 books a year
4	168	My home life was always happy
5	66	Sometimes I feel like swearing
6	305	I often wish people would be more definite about things
7	262	There have been a few times when I have been very mean to another person
8	174	I never make judgments about people until I am sure of the facts
9	442	The trouble with many people is that they don't take things seriously enough
10	74	It's very hard for me to tell anyone about myself
11	388	When I am cornered I tell that portion of the truth which is not likely to hurt me
12	164	My parents have often disapproved of my friends
13	332	I would be perfectly happy without a friend
14	72	I used to keep a diary
15	316	My parents wanted me "to make good" in the world
16	191	I can remember "playing sick" to get out of something
17	100	I prefer a shower to a bathtub

Table 4a (continued) List of Top 60 Predictors using  
CPI-Raw Scores

Sequence No.	Item No.	
18	424	The one to whom I was most attached and whom I most admired as a child was a woman (mother, sister, aunt or other woman)
19	183	Sometimes I feel as if I must injure either myself or someone else
20	450	I get sort of annoyed with writers who go out of their way to use strange and unusual words
21	65	I think I would like the work of a clerk in a large department store
22	398	Life usually hands me a pretty raw deal
23	386	I know who is responsible for most of my troubles
24	184	I have had more than my share to worry about
25	353	No one seems to understand me
26	48	Most people would tell a lie if they could gain by it
27	146	I would like to wear expensive clothes
28	61	I liked school
29	46	I think I would like the work of a school teacher
30	49	When someone does me a wrong I feel I should pay him back if I can, just for the principle of the thing
31	451	I set a high standard for myself--and I feel others should do the same
32	111	When in a group of people I have trouble thinking of the right things to talk about

Table 4a (continued) List of Top 60 Predictors using  
CPI-Raw Scores

Sequence No.	Item No.	
33	135	I wake up fresh and rested most mornings
34	4	A person needs to "show off" a little now and then
35	171	I think I could do better than most of the present politicians if I were in office
36	339	I have been in trouble one or more times because of my sex behavior
37	129	I think I would like to drive a racing car
38	260	I always try to do at least a little better than what is expected of me
39	418	I am embarrassed with people I do not know well
40	23	In most ways the poor man is better off than the rich man
41	31	I doubt whether I would make a good leader
42	283	I like to read about science
43	434	My skin seems to be unusually sensitive to touch
44	462	Even though I am sure I am in the right, I usually give in because it is foolish to cause trouble
45	348	I usually try to do what is expected of me and avoid criticism
46	50	I seem about as capable and smart as most others
47	179	When I work on a committee, I like to take charge
48	38	It is hard for me to start a conversation with strangers

Table 4a (continued) List of Top 60 Predictors using  
CPI-Raw Scores

Sequence No.	Item No.	
49	212	I have never been in trouble with the law
50	291	I think I would like to belong to a motorcycle club
51	313	I hardly ever feel pain in the back of the neck
52	267	I am a better talker than a listener
53	317	I often think about how I look and what impression I am making on others
54	302	I have often gone against my parents' wishes
55	367	My home life was always very pleasant
56	278	If I get too much change in a store, I always get it back
57	221	People have a real duty to take care of their aged parents even if it means making some pretty big sacrifices
58	295	I would be willing to give money myself in order to right a wrong, even though I was not mixed up in it in the first place
59	263	Lawbreakers are almost always caught and punished
60	431	As a youngster in school I used to give the teachers lots of trouble

Table 4b

Means and Standard Deviations for MZs and DZs  
using CPI-Raw Score items

Items	Orig #	MZ	DZ	Grand means
1	4	.68125	.59091	.64041
2	23	.51875	.38636	.45890
3	31	.28125	.37879	.32534
4	38	.45625	.56818	.50685
5	46	.47500	.53030	.50000
6	48	.71250	.55303	.64041
7	49	.25000	.37121	.30479
8	50	.87500	.83333	.85616
9	61	.86875	.80303	.83904
10	65	.15625	.20455	.17808
11	66	.95625	.84848	.90753
12	72	.36875	.22727	.30479
13	74	.39375	.51515	.44863
14	100	.54375	.38636	.47260
15	111	.44375	.40909	.42808
16	129	.32500	.21970	.27740
17	135	.41250	.28788	.35616
18	146	.78125	.68939	.73973
19	152	.63750	.81818	.71918
20	164	.35625	.23485	.30137
21	168	.72500	.58333	.66096
22	171	.10625	.18939	.14384
23	174	.50625	.34848	.43493
24	179	.33125	.40909	.36644
25	183	.18125	.21970	.19863
26	184	.32500	.21212	.27397
27	191	.58750	.62121	.60274
28	197	.98125	.84848	.92123
29	212	.80000	.87121	.83219
30	221	.94375	.85606	.90411
31	260	.81250	.72727	.77397
32	262	.84375	.71212	.78425
33	263	.79375	.65909	.73288
34	267	.20625	.28030	.23973
35	278	.60625	.54545	.57877
36	283	.24375	.13636	.19521
37	291	.24375	.13636	.19521
38	295	.39375	.51515	.44863
39	302	.43750	.37879	.41096
40	305	.83750	.92424	.87671
41	313	.68750	.79545	.73630
42	316	.96875	.93182	.95205
43	317	.95625	.85606	.91096

Table 4b (continued) Means and Standard Deviations for MZs and DZs using CPI-Raw Score items

Items	Orig #	MZ	DZ	Grand means
44	332	.04375	.01515	.03082
45	339	.05000	.07576	.06164
46	348	.78750	.81818	.80137
47	353	.13750	.22727	.17808
48	367	.65625	.57576	.61986
49	386	.43750	.37121	.40753
50	388	.55000	.62121	.58219
51	398	.05625	.12121	.08562
52	418	.26875	.34848	.30479
53	424	.63750	.53788	.59247
54	431	.16250	.13636	.15068
55	434	.05000	.11364	.07877
56	442	.81250	.69697	.76027
57	450	.46875	.37879	.42808
58	451	.59375	.69697	.64041
59	462	.33750	.16667	.26027
60	476	.04375	.18939	.10959

## Standard Deviations

Items	Orig #	MZ	DZ
1	4	.46745	.49353
2	23	.50121	.48877
3	31	.45102	.48693
4	38	.49964	.49721
5	46	.50094	.50098
6	48	.45401	.49907
7	49	.43437	.48496
8	50	.33176	.37410
9	61	.33873	.39922
10	65	.36423	.40490
11	66	.20518	.35992
12	72	.48398	.42066
13	74	.49011	.50167
14	100	.49964	.48877
15	111	.49838	.49353
16	129	.46984	.41561
17	135	.49383	.45450
18	146	.41469	.46450
19	152	.48223	.38716
20	164	.48039	.42552
21	168	.44791	.49488
22	171	.30912	.39331
23	174	.50153	.47830

Table 4b (continued) Means and Standard Deviations for  
MZs and DZs using CPI-Raw Score items

Items	Orig #	MZ	DZ
24	179	.47213	.49353
25	183	.38643	.41561
26	184	.46984	.41036
27	191	.49383	.48693
28	197	.13607	.35992
29	212	.40125	.33624
30	221	.23113	.35236
31	260	.39153	.44705
32	262	.36423	.45450
33	263	.40588	.47582
34	267	.40588	.45085
35	278	.49011	.49982
36	283	.49905	.50167
37	291	.43069	.34448
38	295	.49011	.50167
39	302	.49763	.48693
40	305	.37006	.26562
41	313	.46496	.40490
42	316	.17454	.25302
43	317	.20518	.35236
44	332	.20518	.12262
45	339	.21863	.26562
46	348	.41036	.38716
47	353	.34545	.42066
48	367	.47644	.49611
49	386	.49763	.48497
50	388	.49905	.48693
51	398	.23113	.32762
52	418	.44470	.47830
53	424	.48223	.50046
54	431	.37006	.34448
55	434	.21863	.31858
56	442	.39153	.46131
57	450	.50058	.48693
58	451	.49267	.46131
59	462	.47434	.37410
60	476	.20518	.39331

Table 4c

## List of CPI-Raw Score Items with Significant F-values

Step No.	Item	F-value	df	p
1	197	18.5664	1,290	.001
2	476	18.4193	1,289	.001
3	152	9.1692	1,288	.01
4	168	9.6964	1,287	.01
5	66	9.4071	1,286	.01
6	305	7.6232	1,285	.01
7	262	9.4354	1,284	.01
8	174	8.1764	1,283	.01
9	442	7.5829	1,282	.01
10	74	7.3139	1,281	.01
11	388	6.6327	1,280	.05
12	164	6.6007	1,279	.05
13	332	6.4996	1,278	.05
14	72	5.7589	1,277	.05
15	316	4.5246	1,276	.05
16	191	4.7073	1,275	.05
17	100	5.3232	1,274	.05
18	424	3.8643	1,273	.05
20	450	3.9541	1,271	.05
22	398	5.1452	1,269	.05
23	386	4.8128	1,268	.05
24	184	4.2421	1,267	.05
25	353	4.1049	1,266	.05
26	48	4.4915	1,265	.05
33	135	3.8873	1,258	.05

For all 60 variables  $F = 5.4947$  ( $df=60,231$  ;  $p < .001$ )

Table 5  
Classification Matrix using CPI-Raw Score predictors

No. of cases classified into groups:

	MZ	DZ
Group		
MZ	146	14
DZ	18	114

89% accuracy

with the largest differences in means between MZs and DZs: items 23, 48, 72, 100, 135, 168, 174, 197, 262, and 462. The DZs have higher average responses (more "true" responses) on the following items: 49, 74, 152, 295.

Tables 2c and 4c present for each of the two sets of items (MMPI-Raw Score and CPI-Raw Score) the sequence of items in the order of their discriminatory power, along with their F-ratios. Furthermore, for each set of 60 items F-tests were computed for all variables in the set indicating whether it is possible to discriminate between group means on the basis of all these items.

F-ratios were significant for 31 of the 60 items in the MMPI-Raw Score set, with two significant at the .001 level, 13 significant at the .01 level, and 16 at the .05 level of confidence. The F-ratios for testing differences between the two groups using all 60 predictors was significant at the .001 level (df=60, 231).

A total of 25 F-ratios were significant for the CPI-Raw Score items with two items significant at the .001 level, eight at the .01 level and 15 at the .05 level of confidence. The F-ratios for testing the difference between the two groups using all 60 predictors was significant at the .001 level of confidence (df=60, 231).

#### Scores using within-pair differences

The set of 60 MMPI items which best predict MZ-DZ differences in zygosity is presented in Table 6a. The

Table 6a

## List of top 60 predictors using MMP I-Difference Scores

Sequence No.	Item No.	
1	561	I very much like horseback riding
2	209	I believe my sins are unpardonable
3	406	I have sometimes stayed away from another person because I feared doing or saying something that I might regret afterwards
4	296	I have periods in which I feel unusually cheerful without any special reason
5	129	Often I can't understand why I have been so cross and grouchy
6	208	I like to flirt
7	261	If I were an artist I would like to draw flowers
8	217	I frequently find myself worrying about something
9	230	I hardly ever notice my heart pounding and I am seldom short of breath
10	4	I think I would like the work of a librarian
11	52	I prefer to pass by school friends or people I know but have not seen for a long time, unless they speak to me first
12	30	At times I feel like swearing
13	114	Often I feel as if there were a tight band about my head
14	484	I have one or more faults which are so big that it seems better to accept them and try to control them rather than to try to get rid of them
15	234	I get mad easily and then get over it soon

Table 6a (continued) List of top 60 predictors using  
MMP I-Difference Scores

Sequence No.	Item No.	
16	288	I am troubled by attacks of nausea and vomiting
17	161	The top of my head sometimes feels tender
18	20	My sex life is satisfactory
19	195	I do not like everyone I know
20	513	I think Lincoln was greater than Washington
21	490	I read in the Bible several times a week
22	149	I used to keep a diary
23	529	I would like to wear expensive clothes
24	458	The man who had most to do with me when I was a child (such as my father, step-father, etc.) was very strict with me
25	224	My parents have often objected to the kind of people I went around with
26	82	I am easily downed in an argument
27	266	Once a week or oftener I become very excited
28	171	It makes me uncomfortable to put on a stunt at a party even when others are doing the same sort of things
29	112	I frequently find it necessary to stand up for what I think is right
30	324	I have never been in love with anyone
31	278	I have often felt that strangers were looking at me critically
32	471	In school my marks in deportment were quite regularly bad

Table 6a (continued) List of top 60 predictors using  
MMP I-Difference Scores

Sequence No.	Item No.	
33	122	I seem about as capable and smart as most others around me
34	333	No one seems to understand me
35	74	I have often wished I were a girl. (Or if you are a girl) I have never been sorry that I am a girl
36	6	I like to read newspaper articles on crime
37	294	I have never been in trouble with the law
38	518	I have often felt guilty because I have pretended to feel more sorry about something than I really was
39	347	I have no enemies who really wish to harm me
40	342	I forget right away what people say to me
41	72	I am troubled by discomfort in the pit of my stomach every few days or oftener
42	451	When someone says silly or ignorant things about something I know about, I try to set him right
43	526	The future seems hopeless to me
44	560	I am greatly bothered by forgetting where I put things
45	404	People have often misunderstood my intentions when I was trying to put them right and be helpful
46	307	I refuse to play some games because I am not good at them
47	448	I am bothered by people outside, on street-cars, in stores, etc., watching me

Table 6a (continued) List of top 60 predictors using  
MMP I-Difference Scores

Sequence No.	Item No.	
48	564	I am not easily angered
49	562	The one to whom I was most attached and whom I most admired as a child was a woman (mother, sister, aunt, or other woman)
50	536	It makes me angry to have people hurry me
51	24	No one seems to understand me
52	316	I think nearly anyone would tell a lie to keep out of trouble
53	461	I wish I could get over worrying about things I have said that may have injured other people's feelings
54	41	I have had periods of days, weeks, or months when I couldn't take care of things because I couldn't "get going"
55	403	It is great to be living in these times when so much is going on
56	34	I have a cough most of the time
57	399	I am apt to pass up something I want to do when others feel that it isn't worth doing
58	469	Lightning is one of my fears
59	444	I do not try to correct people who express an ignorant belief
60	291	At one or more times in my life I felt that someone was making me do things by hypnotizing me

Table 6b

Means and Standard Deviations for MZs and DZs  
using MMPI-Difference Score Items

Items	Orig #	Means		Grand means
		MZ	DZ	
1	4	.17500	.24242	.20548
2	6	.28750	.56061	.41056
3	20	.15000	.06061	.10955
4	24	.17500	.33333	.24658
5	30	.06250	.25758	.15068
6	34	.05000	.10606	.07534
7	41	.31250	.42424	.36301
8	52	.22500	.37879	.29452
9	72	.12500	.03030	.08219
10	74	.23750	.30303	.26712
11	82	.33750	.25758	.30137
12	113	.05000	.01515	.03425
13	114	.06250	.18182	.11644
14	122	.08750	.21212	.14384
15	129	.33750	.54545	.43151
16	149	.10000	.22727	.15753
17	161	.11250	.06061	.08904
18	171	.32500	.42424	.36986
19	195	.27500	.15152	.21918
20	208	.18750	.40909	.28767
21	209	.02500	.15152	.08219
22	217	.31250	.50000	.39726
23	224	.32500	.22727	.28082
24	230	.51250	.33333	.43151
25	234	.40000	.63636	.50685
26	261	.12500	.27273	.19178
27	266	.31250	.39394	.34932
28	278	.32500	.51515	.41096
29	288	.03750	.06061	.04795
30	291	.03750	.0	.02055
31	294	.21250	.24242	.22603
32	296	.27500	.53030	.39041
33	307	.26250	.42424	.33562
34	316	.33750	.50000	.41096
35	324	.21250	.39394	.29452
36	333	.11250	.25758	.17808
37	342	.21250	.18182	.19863
38	347	.23750	.12121	.18493
39	399	.46250	.57576	.51370
40	403	.18750	.34848	.26027
41	404	.45000	.39394	.42466
42	406	.28750	.54545	.40411

Table 6b (continued) Means and Standard Deviations  
for MZs and DZs using MMPI-Difference Score Items

Items	Orig #	MZ	DZ	Grand means
43	444	.33750	.48485	.40411
44	448	.35000	.28788	.32192
45	451	.18750	.36364	.26712
46	458	.18750	.31818	.24658
47	461	.40000	.54545	.46575
48	469	.27500	.36364	.31507
49	471	.13750	.07576	.10959
50	484	.36250	.27273	.32192
51	490	.05000	.21212	.12329
52	513	.41250	.34848	.38356
53	518	.45000	.31818	.39041
54	526	.02500	.12121	.06849
55	529	.17500	.30303	.23288
56	536	.38750	.50000	.43836
57	560	.35000	.56061	.44521
58	561	.21250	.48485	.33562
59	562	.30000	.42424	.35616
60	564	.46250	.54545	.50000

Standard Deviations

Items	Orig #	MZ	DZ
1	4	.38236	.43183
2	6	.45545	.50012
3	20	.35932	.24043
4	24	.38236	.47502
5	30	.24359	.44065
6	34	.21932	.31027
7	41	.46644	.49801
8	52	.42022	.48880
9	72	.33281	.17273
10	74	.42824	.46309
11	82	.47584	.44065
12	113	.21932	.12309
13	114	.24359	.38865
14	122	.28435	.41194
15	129	.47584	.50174
16	149	.30189	.42228
17	161	.31797	.24043
18	171	.47133	.49801
19	195	.44933	.36130
20	208	.39277	.49543
21	209	.15711	.36130
22	217	.46644	.50383

Table 6b (continued) Means and Standard Deviations for  
MZs and DZs using MMPI-Difference Score Items

Items	Orig #	MZ	DZ
23	224	.47133	.42228
24	230	.50300	.47502
25	234	.49299	.48473
26	261	.33280	.44877
27	266	.46644	.49237
28	278	.47133	.50360
29	288	.19118	.24043
30	291	.19118	.0
31	294	.41166	.43183
32	296	.44933	.50290
33	307	.44277	.49801
34	316	.47584	.50383
35	324	.41166	.49237
36	333	.31797	.44065
37	342	.41166	.38865
38	347	.42824	.32887
39	399	.50174	.49801
40	403	.39277	.48014
41	404	.50063	.39237
42	406	.45545	.50174
43	444	.47584	.50360
44	448	.47998	.45624
45	451	.39277	.48473
46	458	.39277	.46934
47	461	.49299	.50174
48	469	.44933	.48473
49	471	.34655	.26664
50	484	.48375	.44877
51	490	.21932	.41194
52	513	.49539	.48014
53	518	.50063	.46934
54	526	.15711	.32887
55	529	.38236	.46309
56	536	.49025	.50383
57	560	.47998	.50012
58	561	.41166	.50360
59	562	.46115	.49801
60	564	.50174	.50174

Table 6c

List of MMPII-Difference Score Items with Significant F-values

Step No.	Item	F-value	df	p
1	561	12.9307	1,144	.001
2	209	10.0257	1,143	.001
3	406	11.9997	1,142	.001
4	296	12.5889	1,141	.001
5	129	9.0985	1,140	.01
6	208	7.1388	1,139	.01
7	261	9.2540	1,138	.01
8	217	7.7113	1,137	.01
9	230	7.9382	1,136	.01
10	4	5.3647	1,137	.05
11	52	7.2705	1,134	.01
12	30	9.1871	1,133	.01
13	114	6.3583	1,132	.05
14	484	6.2366	1,131	.05
15	234	7.0826	1,130	.01
16	288	7.3748	1,129	.01
17	161	5.9429	1,128	.05
18	20	5.9676	1,127	.05
19	195	4.8386	1,126	.05
20	513	4.1550	1,125	.05
21	490	5.873	1,124	.05
22	149	4.0747	1,123	.05
23	529	4.0825	1,122	.05
26	82	4.1025	1,119	.05
33	122	4.7582	1,112	.05
36	6	4.6555	1,109	.05

For all 60 variables F-value = 8.14610

(df=60,85; p &lt; .001)

classification matrix associated with this set of predictors is given in Table 7. A total of 144 out of 146 cases was properly classified, with 78 of the 80 MZ pairs correctly classified as MZs and all 66 DZs correctly classified. Two MZ pairs were classified as DZs.

Table 8a contains the 60 CPI items which are the best predictors of MZ-DZ differences in zygoty. The classification matrix for this set of predictors is given in Table 9. A total of 145 cases were properly classified with all 80 MZ sets classified as MZs and 65 DZ sets classified as DZs. Only one DZ pair was misclassified as being MZ.

The average values on the MMPI-Difference Score and CPI-Difference score items presented in Tables 6b and 8b, respectively, are smaller for the MZs than DZs for most items. This is understandable since the means indicate average within-pair differences for a particular group, MZ or DZ, and it is expected that within a particular pair, MZs are more similar to each other or agree with each other more than do DZs. Of the 17 MMPI items on which MZs agree less than DZs, the following are included which exhibited the greatest difference in means between MZs and DZs: items 20, 195, 224, 347, and 518. The MMPI-Difference Score items on which DZs responded less similarly than MZs include the following which showed the greatest difference in means between MZs and DZs: items 6, 24, 30, 129, 208, 217, 234, 278, 296, 260, and 261.

Table 7

Classification matrix using MMPI-Difference Score Predictors

		No. of cases classified into:	
		MZ	DZ
Group	MZ	78	2
	DZ	0	66

98% accuracy

Table 8a

## List of top 60 predictors using CPI-Difference Scores

Sequence No.	Item No.	
1	476	I had my own way as a child
2	66	Sometimes I feel like swearing
3	242	I am a good mixer
4	45	As a child I used to be able to go to my parents with my problems
5	408	I always see to it that my work is carefully planned and organized
6	48	Most people would tell a lie if they could gain by it
7	72	I used to keep a diary
8	168	My home life was always happy
9	43	It's no use worrying my head about public affairs; I can't do anything about them anyhow
10	87	I like adventure stories better than romantic stories
11	331	I often start things I never finish
12	303	We should cut down on our use of oil, if necessary, so that there will be plenty left for the people fifty or a hundred years from now
13	245	Most of the time I feel happy
14	11	People can pretty easily change me even though I thought that my mind was already made up on a subject
15	282	A large number of people are guilty of bad sexual conduct
16	284	It is hard for me to act natural when I am with new people

Table 8a (continued) List of top 60 predictors using  
CPI-Difference Scores

Sequence No.	Item No.	
17	360	It is impossible for an honest man to get ahead in the world
18	401	Most young people get too much education
19	456	I have more trouble concentrating than others seem to have
20	85	I don't like to undertake any project unless I have a pretty good idea as to how it will turn out
21	159	I feel nervous if I have to meet a lot of people
22	112	I set a high standard for myself and I feel others should do the same
23	262	There have been a few times when I have been very mean to another person
24	54	I find it hard to keep my mind on a task or job
25	468	I like to eat my meals quickly and not spend a lot of time at the table visiting and talking
26	61	I liked school
27	102	I like to be the center of attention
28	39	I must admit that I enjoy playing practical jokes on people
29	293	Every now and then I get into a bad mood, and no one can do anything to please me
30	329	It is hard for me to sympathize with someone who is always doubting and unsure about things
31	452	I dislike to have to talk in front of a group of people
32	238	Sometimes I just can't seem to get going

Table 8a (continued) List of top 60 predictors using  
CPI-Difference Scores

Sequence No.	Item No.	
33	79	I am afraid of deep water
34	432	I am not afraid of picking up a disease or germs from doorknobs
35	460	A strong person doesn't show his emotions and feelings
36	339	I have been in trouble one or more times because of my sex behavior
37	477	I get tired more easily than other people seem to
38	316	My parents wanted me to "make good" in the world
39	382	Success is a matter of will power
40	305	I often wish people would be more definite about things
41	317	I often think about how I look and what impression I am making upon others
42	74	It is very hard for me to tell anyone about myself
43	194	I like to keep people guessing what I'm going to do next
44	204	I like to plan a home study schedule and follow it
45	330	Everything tastes the same
46	32	I tend to be on my guard with people who are somewhat more friendly than I had expected
47	65	I think I would like the work of a clerk in a large department store
48	378	I doubt if anyone is really happy

Table 8a (continued) List of top 60 predictors using  
CPI-Difference Scores

Sequence No.	Item No.	
49	426	There have been times when I have been very angry
50	75	We ought to worry about our own country and let the rest of the world take care of itself
51	230	I would rather be a steady and dependable worker than a brilliant but unstable one
52	170	I often act on the spur of the moment without stopping to think
53	434	My skin seems to be unusually sensitive to touch
54	371	I would rather be a steady and dependable worker than a brilliant but unstable one
55	221	People have a real duty to take care of their aged parents, even if it means making some pretty big sacrifices
56	132	I fall in and out of love rather easily
57	260	I always try to do at least a little better than what is expected of me
58	391	I am quite a fast reader
59	206	I have often found people jealous of my good ideas, just because they had not thought of them first
60	163	I like parties and socials

Table 8b

## Means and Standard Deviations for CPI-Difference Score Items

Item	Orig #	Means		Grand Means
		MZ	DZ	
1	11	.46250	.33333	.40411
2	32	.40000	.45455	.42466
3	39	.28750	.25758	.27397
4	43	.35000	.28788	.32192
5	45	.17500	.40909	.28082
6	48	.30000	.56061	.41781
7	54	.21250	.39394	.29452
8	61	.16250	.21212	.18493
9	65	.21250	.31818	.26027
10	66	.06250	.24242	.14384
11	72	.11250	.27273	.18493
12	74	.33750	.54545	.43151
13	75	.27500	.18182	.23288
14	79	.16250	.16667	.16438
15	85	.33750	.53030	.42466
16	87	.21250	.39394	.29452
17	102	.36250	.56061	.45205
18	112	.43750	.33333	.39041
19	132	.22500	.37879	.29452
20	159	.32500	.46970	.39041
21	163	.10000	.19697	.14384
22	168	.22500	.37879	.29452
23	170	.35000	.53030	.43151
24	194	.36250	.45455	.40411
25	204	.38750	.28788	.34247
26	206	.37500	.45455	.41096
27	221	.08750	.19697	.13699
28	230	.12500	.25758	.18493
29	238	.28750	.30303	.29452
30	242	.33750	.59091	.45205
31	245	.16250	.34848	.24658
32	260	.27500	.33333	.30137
33	262	.26250	.33333	.29452
34	282	.32500	.50000	.40411
35	284	.45000	.34848	.40411
36	293	.35000	.56061	.44521
37	303	.36250	.50000	.42466
38	305	.17500	.12121	.15068
39	316	.06250	.10606	.08219
40	317	.08750	.22727	.15068
41	329	.36250	.48485	.41781
42	330	.06250	.03030	.04795
43	331	.37500	.54545	.45205

Table 8b (continued) Means and Standard Deviations for  
CPI-Difference Score Items

Item	Orig #	MZ	DZ	Grand Means
44	339	.10000	.15152	.12329
45	360	.13750	.03030	.08904
46	371	.11250	.28788	.19178
47	378	.13750	.33333	.22603
48	382	.25000	.37879	.30822
49	391	.31250	.45455	.37671
50	401	.38750	.50000	.43836
51	408	.31250	.53030	.41096
52	426	.10000	.27273	.17808
53	432	.25000	.33333	.28767
54	434	.10000	.22727	.15753
55	452	.32500	.42424	.36986
56	456	.32500	.48485	.39726
57	460	.28750	.50000	.38356
58	468	.28750	.46970	.36986
59	476	.08750	.34848	.20548
60	477	.28750	.36364	.32192

## Standard Deviations

Item	Orig #	MZ	DZ
1	11	.50174	.47502
2	32	.49299	.50174
3	39	.45545	.44065
4	43	.47998	.45624
5	45	.38236	.49543
6	48	.46115	.50012
7	54	.41166	.49237
8	61	.37124	.41194
9	65	.41166	.46934
10	66	.24359	.43183
11	72	.31797	.44877
12	74	.47584	.50174
13	75	.44933	.38865
14	79	.37124	.37553
15	85	.47584	.50290
16	87	.41166	.49237
17	102	.48375	.50012
18	112	.49921	.47502
19	132	.42022	.48880
20	159	.47133	.50290
21	163	.30189	.40076
22	168	.42022	.48880
23	170	.47998	.50290

Table 8b (continued) Means and Standard Deviations for  
CPI-Difference Score Items

Item	Orig #	MZ	DZ
24	194	.48375	.50174
25	204	.49025	.45624
26	206	.48718	.50174
27	221	.28435	.40076
28	230	.33280	.44065
29	238	.45545	.46309
30	242	.47584	.49543
31	245	.37124	.48014
32	260	.44933	.47502
33	262	.44277	.47502
34	282	.47133	.50383
35	284	.50063	.48014
36	293	.47998	.50012
37	303	.48375	.50383
38	305	.38236	.32887
39	316	.24359	.31027
40	317	.28435	.42228
41	329	.48375	.50360
42	330	.24359	.17273
43	331	.48718	.50174
44	339	.30189	.36130
45	360	.34655	.17273
46	371	.31797	.45624
47	378	.34655	.47502
48	382	.43574	.48880
49	391	.46644	.50174
50	401	.49025	.50383
51	408	.46644	.50290
52	426	.30189	.44877
53	432	.43574	.47502
54	434	.30189	.42228
55	452	.47133	.49801
56	456	.47133	.50360
57	460	.45545	.50383
58	468	.45545	.50290
59	476	.28435	.48014
60	477	.45545	.48473

Table 8c

List of CPI-Difference Score Items with Significant F-values

Step No.	Item	F-value	df	p
1	476	16.5967	1,144	.001
2	66	13.2931	1,143	.001
3	242	13.3337	1,142	.001
4	45	10.3784	1,141	.01
5	408	8.8307	1,140	.01
6	48	6.0684	1,139	.05
7	72	6.3867	1,138	.05
8	168	6.5909	1,137	.05
9	43	5.6191	1,136	.05
10	87	6.2677	1,135	.05
11	331	5.9583	1,134	.05
12	303	5.8509	1,133	.05
13	245	4.9441	1,132	.05
14	11	6.4014	1,141	.05
15	282	5.2126	1,130	.05
16	284	5.0143	1,129	.05
17	360	4.4909	1,128	.05
18	401	5.3632	1,127	.05
19	456	3.9060	1,126	.05
20	85	4.0714	1,125	.05
21	159	4.1883	1,124	.05
22	112	5.6140	1,123	.05
23	262	4.3289	1,122	.05
24	54	3.2788	1,121	.05

For all 60 variables,  $F = 6.5192$  ( $df = 60,85$ ;  $p < .001$ )

Table 9

## Classification Matrix Using CPI-Difference Score Predictors

No. of cases classified into:

	MZ	DZ
Group		
MZ	80	0
DZ	1	65

99% accuracy

The nine CPI-Difference Score items on which MZs are less similar than DZs are the following: items 11, 39, 43, 75, 112, 204, 284, 305, and 330. Of the items on which the DZs are less similar than MZs the following items are included which showed greatest difference in means between MZs and DZs: items 45, 48, 74, 85, 102, 242, 292, 378, and 408.

Tables 6c and 8c, respectively, present for the MMPI-Difference Score and CPI-Difference Score items the sequence of items in the order of their importance along with their F-ratios and the F-value for all 60 items included in the set.

F-ratios for 26 of the MMPI-Difference Score items were significant with four items significant at the .001 level of confidence, nine at the .01 level, and 13 at the .05 level. The f-value for testing differences between groups using all 60 variables was significant at the .001 level of confidence ( $df=60, 85$ ).

A total of 24 F-ratios were significant on the CPI-Difference Score items with three items significant at the .001 level, two at the .01 level, and 19 significant at the .05 level of confidence. The F-ratio for testing differences between groups using all 60 items was significant at the .001 level of confidence ( $df=60, 85$ ).

The Varimax solutions for each of the four sets of 60 predictors (MMPI-Raw Score items and CPI-Raw Score items,

both of which deal with MZness and DZness per se; and MMPI-Difference Score items and CPI-Difference Score items which have to do with within-pair differences for MZs and DZs) are presented in Tables 10-13 respectively. Tables 14-17 present a listing of the items with the highest loadings on each factor for MMPI-Raw Score, CPI-Raw Score, MMPI-Difference Score, and CPI-Difference Score factors, respectively. Of the seven MMPI-Raw Score factors extracted, Suspiciousness or Paranoia, Sensitivity or Tendermindedness, Hypochondriasis, Ego Strength and Conventionality are the most clearcut. The other factors appear to be somewhat undefined. The CPI-Raw Score factors include the factors of Conduct Problem or Psychopathic Deviate, Introversiion-Extraversiion, Shyness or Self-confidence, and Super-ego Strength.

Of the 13 MMPI-Difference Score Factors the following interpretable factors were found: Sensitivity, Psychopathic Deviate or Conduct problems, and Lethargy. The CPI-Difference Score factors include the factors of Persistence, Need for Structure, Psychopathic Deviate, Achievement, and Social Confidence.

T-ratios comparing the top 60 MMPI predictors with a randomly selected set of 60 items with respect to (1) social desirability and (2) item ambiguity are presented in Table 18. Similar tests for MMPI-Difference scores are also presented. Furthermore, a t-test comparing the 60 CPI-Raw

Table 10

## Varimax Factors for MMPI-Raw Score Items

N = 160 MZs and 132 DZs

Factor Number		1	2	3	4	5	6	7
Sum Squares Over Variables		2.457	2.050	1.898	1.551	1.511	1.313	1.307
Variable No.	Communality							
1	.229	-.378	-.106	.193	.165	-.080	.042	.042
2	.258	.402	-.214	.037	-.153	-.092	.121	.045
3	.158	.141	.067	.010	-.057	.348	-.096	-.018
4	.177	-.070	.098	-.065	-.335	-.029	-.110	.181
5	.150	-.037	-.009	-.246	.097	-.053	.275	-.009
6	.149	.237	.015	.157	.165	-.195	.043	.022
7	.255	.162	-.012	.046	-.001	.161	.100	.436
8	.237	-.052	.091	.317	-.107	-.060	.105	.315
9	.474	-.007	.608	-.001	.113	.274	.113	-.056
10	.176	.299	.060	-.124	-.069	.220	.114	-.031
11	.290	.078	.019	-.013	.524	-.014	.006	.087
12	.276	.064	-.121	-.084	.027	.063	.014	.496
13	.147	.049	.142	-.307	-.075	.138	.032	.064
14	.127	-.097	.014	-.286	.017	.141	-.027	.120
15	.210	.342	.180	-.058	.021	.216	-.055	.083
16	.263	-.028	-.013	.495	.078	.036	-.083	.051
17	.368	.248	.547	-.063	-.019	-.013	-.039	.036
18	.163	.371	.088	.089	.001	.060	-.065	.045
19	.337	-.067	-.004	.557	.001	.141	.049	.008
20	.110	.139	.096	-.048	-.138	.102	-.186	.123
21	.200	-.068	-.295	-.026	.086	-.055	-.306	.059

Table 10 (continued) Varimax Factors for MMPI-Raw Score Items

Factor Number		1	2	3	4	5	6	7
Sum Squares Over Variables		2.457	2.050	1.898	1.551	1.511	1.313	1.307
Variable No.	Communality							
22	.282	.322	-.101	-.157	.236	.275	-.070	.087
23	.195	.324	-.005	-.267	.016	.084	.030	.099
24	.197	.030	-.190	.343	-.112	.135	-.080	-.075
25	.170	.031	-.111	.156	-.151	.316	-.081	-.057
26	.268	-.048	.159	.281	.370	.135	-.075	.023
27	.264	.432	.159	-.124	-.046	.072	.131	.110
28	.216	.397	-.098	-.013	.019	.015	.213	.049
29	.116	.032	.037	-.048	-.060	.288	-.064	.144
30	.261	-.030	.407	.282	-.048	-.006	-.090	.066
31	.135	.159	-.131	.050	-.112	-.060	.043	.269
32	.341	.026	-.541	.018	-.139	-.053	-.130	.092
33	.088	-.054	.069	.258	-.004	.116	.011	-.014
34	.192	-.024	-.076	-.097	.072	-.318	-.254	-.075
35	.208	.289	-.027	-.200	-.232	.131	.046	-.105
36	.170	.321	.017	-.117	.164	-.045	.052	.147
37	.235	.015	.280	.076	-.153	.079	.320	.133
38	.189	.368	-.029	.119	.070	-.142	.099	.059
39	.083	.039	-.048	.064	-.265	-.013	.042	.054
40	.147	.230	.036	.025	-.139	.089	.204	.154
41	.162	.199	-.066	-.279	-.175	.063	-.056	-.050
42	.117	.120	.015	-.035	.016	-.036	.315	.019
43	.194	.177	-.070	-.057	-.064	.110	-.083	.363
44	.111	.135	.045	.089	.039	.274	.078	.008
45	.154	-.031	.227	.004	-.168	-.063	-.044	.259
46	.208	-.229	-.058	.153	.077	.317	.055	.138
47	.247	-.174	.073	-.087	.014	.326	.216	.226
48	.202	.102	.044	.138	.042	-.047	.384	.139

Table 10 (continued) Varimax Factors for MMPI-Raw Score Items

Factor Number		1	2	3	4	5	6	7
Sum Squares Over Variables		2.457	2.050	1.898	1.551	1.511	1.313	1.307
Variable No.	Communality							
49	.115	-.060	-.053	-.146	-.038	-.130	.150	.214
50	.212	.270	.204	.120	.258	-.045	.025	-.118
51	.132	-.018	-.236	.062	.032	.093	.231	.098
52	.134	-.037	.009	.048	-.327	-.010	-.101	.113
53	.141	.187	-.014	-.292	-.014	-.130	-.060	-.011
54	.101	-.031	.031	.167	-.056	-.095	-.164	.180
55	.267	.024	-.482	.043	-.080	.116	-.038	.106
56	.224	.145	.115	-.085	-.187	.041	.382	.001
57	.234	-.031	.037	.071	.465	-.087	-.056	-.025
58	.199	.324	.042	-.029	.041	-.069	.272	-.106
59	.216	-.018	-.088	.046	.123	.424	-.052	-.090
60	.205	.422	-.058	-.104	.084	.061	.012	.042

Table 11  
 Varimax Factors for CPI-Raw Score Items  
 N = 160 MZs and 132 DZs

Factor Number		1	2	3	4	5	6	7
Sum of Squares over Variables		2.193	2.035	1.571	1.389	2.336	1.498	1.374
Variable No.	Communality							
1	.125	.194	-.092	-.047	-.061	.086	-.085	-.242
2	.062	-.159	.000	-.182	.000	-.034	.017	.048
3	.266	-.224	.385	-.110	-.066	.211	-.076	.018
4	.449	.026	.643	.122	-.003	-.009	.021	.143
5	.129	.055	-.017	-.074	.209	-.205	-.098	-.157
6	.136	.129	.093	-.189	.115	.139	-.021	.205
7	.182	.227	.110	.038	-.029	.207	-.042	.266
8	.129	.225	-.086	.058	.104	-.222	.089	.008
9	.129	.040	-.115	.063	.153	-.214	-.079	-.187
10	.108	.039	.013	-.315	-.011	-.079	.009	-.032
11	.157	.095	.033	-.215	.144	.230	-.144	-.079
12	.233	-.169	-.107	-.119	.007	.048	.029	-.419
13	.184	-.008	.396	.001	.090	.117	.069	.014
14	.223	.229	.018	-.066	-.001	.011	-.094	.396
15	.367	.003	.584	.061	.007	.138	-.007	.060
16	.515	.699	.051	-.043	.002	.056	.053	.129
17	.081	-.010	-.084	.014	-.015	-.258	.080	-.005
18	.244	-.159	-.135	-.193	.146	.230	.085	-.286
19	.255	.088	-.090	.351	.136	-.170	-.031	-.259
20	.275	.134	-.022	-.036	.068	.500	-.027	-.006

Table 11 (continued) Varimax Factors for CPI-Raw Score Items

Factor Number		1	2	3	4	5	6	7
Sum of Squares over Variables		2.193	2.035	1.571	1.389	2.336	1.498	1.374
Variable No.	Communality							
21	.587	.043	-.054	-.138	.035	-.258	.700	-.080
22	.185	.399	.068	.089	.019	.024	.105	.037
23	.206	.039	-.123	-.274	.080	-.178	-.029	.274
24	.189	.191	-.274	.212	.085	.034	.133	-.077
25	.136	.215	.082	.037	-.113	.261	.016	.020
26	.240	-.035	-.004	.013	.183	.245	-.070	.374
27	.175	.083	-.051	-.147	.003	.357	-.047	-.119
28	.147	.172	-.039	-.254	.107	.190	-.062	.001
29	.274	-.373	.032	.038	.069	-.137	.283	-.170
30	.179	.011	-.052	-.111	.392	.003	-.036	-.094
31	.183	-.122	-.180	.011	.256	-.167	.136	.156
32	.170	.035	.040	-.009	.302	.268	.055	-.027
33	.155	-.083	.057	-.360	.117	.002	.002	-.042
34	.204	.066	-.327	.156	.054	.200	.142	-.073
35	.178	-.367	-.054	.023	.071	-.118	.121	-.079
36	.185	.165	.089	.272	.217	-.120	-.118	.009
37	.310	.531	-.029	-.060	.049	.131	-.006	-.061
38	.088	-.186	.011	.217	.037	.001	-.031	.059
39	.272	.229	.039	-.019	-.053	.455	-.078	.034
40	.195	-.065	-.049	-.021	.280	.198	.236	.118
41	.061	-.063	-.203	.035	-.026	-.072	.052	.078
42	.163	.005	.104	.017	.387	-.025	.031	.026
43	.211	-.110	.049	-.405	.121	.049	.003	-.125
44	.059	.205	-.005	.066	-.086	.039	-.028	.052

Table 11 (continued) Varimax Factors for CPI-Raw Score Items

Factor Number		1	2	3	4	5	6	7
Sum of Squares over Variables		2.193	2.035	1.571	1.389	2.336	1.498	1.374
Variable No.	Communality							
45	.076	.119	-.049	.069	-.045	.153	.097	.139
46	.198	-.151	.134	-.080	.366	-.079	.000	.103
47	.275	.028	.100	.166	.023	.485	-.019	.023
48	.559	-.014	-.073	-.048	.045	-.160	.723	-.039
49	.079	.127	.126	-.006	-.026	.205	-.069	.003
50	.208	.051	.196	-.243	.035	.313	.092	.026
51	.179	.047	.114	.098	-.034	.350	-.052	.167
52	.383	.090	.585	-.037	.082	.064	.046	.136
53	.207	-.205	.006	-.224	-.244	.086	.152	-.158
54	.270	.355	-.100	.156	.065	.195	-.056	.254
55	.119	.149	.119	.219	.160	.079	-.048	-.001
56	.230	-.082	.022	-.073	.408	.093	.178	.104
57	.099	.101	.201	-.190	.067	.024	-.052	-.070
58	.186	-.020	-.043	.135	.282	-.275	-.021	-.101
59	.218	-.073	.152	.317	.080	.157	.100	.218
60	.109	-.033	.123	.187	.083	.130	.180	-.035

Table 12

## Varimax Factors for MMPI-Difference Score Items

N = 80 MZs and 66 DZs

Factor Number:	1	2	3	4	5	6	7	8	9	10	
Sum of Squares Over Variables	2.048	2.035	1.619	1.479	1.627	1.445	1.295	1.365	1.491	1.365	
Var. No.	Communality										
1	.364	-.033	-.170	.225	-.071	.412	.040	-.198	.049	-.093	-.001
2	.370	.022	-.011	-.111	-.303	-.241	.085	.034	-.024	-.192	-.156
3	.283	.008	.067	-.039	.333	.162	-.144	.032	.104	-.243	.147
4	.496	.672	.013	.034	.011	-.104	.035	.020	.087	-.122	-.017
5	.243	.122	-.089	-.136	-.119	-.130	.236	.060	-.131	-.005	.030
6	.330	.002	-.059	-.190	-.118	.264	.072	.061	-.115	.069	.176
7	.524	.068	.112	.175	-.131	-.231	.028	.094	.165	.073	.498
8	.267	.151	.340	-.044	.077	-.042	-.164	.132	.139	-.076	.070
9	.380	-.049	.013	-.051	-.007	.582	-.067	-.042	.082	-.050	.013
10	.324	-.009	-.118	.234	-.172	.245	-.172	.169	.007	.215	.101
11	.296	.127	-.014	-.106	-.061	-.186	-.160	.200	-.165	-.039	.090
12	.188	-.115	-.096	.170	-.184	-.069	-.151	.024	-.049	.173	.007
13	.383	.227	-.215	-.042	-.097	-.005	-.214	.037	-.148	-.424	.137
14	.361	.444	.055	-.072	-.253	.006	.157	-.147	.192	-.010	-.036
15	.382	.086	.256	.504	.012	-.091	.024	.067	.027	.050	.055
16	.181	.097	.080	.354	.024	-.061	.066	-.028	-.110	.064	.023
17	.344	.179	.393	.236	-.165	-.069	-.117	-.090	-.111	.028	.033
18	.189	.023	.001	-.034	.052	-.045	-.034	.403	.041	.015	.063
19	.237	-.268	.153	.060	-.097	-.112	.062	-.043	-.002	-.270	-.103
20	.310	-.091	.204	.014	.086	.067	.090	.395	.155	-.128	.049
21	.431	-.024	.094	-.258	-.275	.116	.487	.008	.046	-.108	.054

Table 12 (continued) Varimax Factors for MMPI-Difference Score Items

Factor Number:	1	2	3	4	5	6	7	8	9	10	
Sum of Squares Over Variables	2.048	2.035	1.619	1.479	1.627	1.445	1.295	1.365	1.491	1.365	
Var No.	Communality										
22	.266	.152	-.065	.151	.115	-.295	.051	-.153	-.104	-.199	.113
23	.229	.037	.009	-.004	.422	-.026	.074	-.012	-.024	-.040	.030
24	.328	.053	.043	-.081	-.112	.145	.029	-.266	.040	.055	.320
25	.341	-.000	.072	.009	.002	-.263	.320	.256	-.056	.078	.151
26	.395	.156	-.364	.051	.195	-.024	-.073	-.074	.153	-.283	.019
27	.333	.064	-.299	.017	-.202	-.250	.121	-.170	.152	-.052	.072
28	.347	-.001	.063	-.085	-.057	-.108	.118	-.071	-.015	-.069	.060
29	.278	.039	.249	-.143	-.081	.138	.025	-.019	-.150	.063	.271
30	.332	.167	.178	-.128	.124	-.137	-.035	-.370	-.022	.161	.227
31	.491	.009	.670	.034	.031	-.090	-.030	-.003	-.112	-.009	.012
32	.458	.198	-.035	.146	.018	.026	-.075	.036	-.015	.059	.024
33	.184	.104	-.033	-.061	.030	-.086	.082	.071	-.014	-.363	-.089
34	.320	.278	-.013	.079	-.180	-.028	.078	.343	-.185	.089	-.174
35	.329	-.034	.360	.239	.252	.047	-.033	.138	.119	-.037	.080
36	.648	.740	.152	-.018	.035	-.078	-.077	.040	-.159	-.108	.115
37	.499	.402	.039	.010	.023	.235	.283	-.163	-.105	-.164	-.086
38	.277	.039	.139	.037	-.242	-.269	.025	-.181	-.278	-.073	.052
39	.213	.045	-.098	.071	.085	-.063	.421	.003	-.004	.047	.023
40	.345	.197	.235	.213	-.210	-.128	.228	.050	.026	-.279	.013

Table 12 (continued) Varimax Factors for MMPI-Difference Score Items

Factor Number:	1	2	3	4	5	6	7	9	9	10	
Sum of Squares Over Variables	2.048	2.035	1.619	1.479	1.627	1.445	1.295	1.365	1.491	1.365	
Var. No.	Communality										
41	.345	.020	-.006	.250	.061	-.202	-.038	-.107	.347	.113	.238
42	.439	.194	-.036	-.066	-.190	-.058	-.306	.120	.239	-.058	-.124
43	.377	.126	-.011	.098	-.502	.097	-.031	.010	.210	-.069	.101
44	.458	.071	-.143	.012	.057	-.002	.033	.087	-.038	-.070	.014
45	.267	.092	-.089	-.060	-.089	-.096	.111	.104	.428	-.024	-.042
46	.274	.023	.019	.100	.109	.025	.201	-.026	-.365	-.133	-.059
47	.265	.143	.043	-.399	.082	-.092	.171	.085	-.031	.037	.115
48	.446	.059	-.280	.175	.020	-.190	.087	.014	-.393	.185	-.013
49	.443	.126	.497	-.024	-.026	.007	.170	-.218	.041	.003	-.159
50	.200	.075	.029	-.198	-.048	-.068	.026	.059	-.316	.013	.131
51	.288	-.047	-.009	.045	.072	.057	.016	.107	-.047	-.070	-.036
52	.195	-.003	.030	-.031	-.273	.101	-.007	-.106	-.157	-.196	.026
53	.386	.130	.105	.051	.066	-.176	-.085	-.036	-.056	.253	-.209
54	.307	.150	-.095	.151	.107	.242	.118	.032	.016	-.383	.021
55	.332	-.078	.172	-.068	-.094	-.081	-.212	-.022	.037	-.439	.018
56	.348	-.008	-.060	-.058	.078	.022	.081	.042	-.071	-.033	.559
57	.361	.021	-.004	.078	.006	-.159	.335	-.034	-.037	-.081	.231
58	.442	.074	-.213	.098	-.021	-.126	.007	.322	-.079	-.075	.237
59	.322	.098	.109	-.474	.049	-.068	-.048	-.082	-.014	.018	.096
60	.140	-.013	.008	.207	.020	-.012	.23	.081	.130	-.103	.086

Table 12 (continued) Varimax Factors for MMPI-Difference Score Items

Factor Number:	11	12	13
Sum of Squares Over Variables	1.407	1.313	1.644
Var. No.	Communality		
1	.364	-.150	.177
2	.370	.184	.051
3	.283	-.126	.013
4	.496	-.042	.067
5	.243	.292	.083
6	.330	.105	-.017
7	.524	-.233	.073
8	.267	-.173	.106
9	.380	.029	-.139
10	.324	.051	.183
11	.296	-.332	.122
12	.188	-.080	.177
13	.383	.055	-.060
14	.361	.013	.020
15	.382	.177	.042
16	.181	.011	.108
17	.344	-.059	-.091
18	.189	-.049	-.085
19	.237	.037	-.142
20	.310	-.028	.126
21	.431	-.037	.065
22	.266	.091	.135
23	.228	-.111	-.039
24	.328	-.110	.102
25	.341	-.022	.029

Table 12 (continued) Varimax Factors for MMPI-Difference Score Items

Factor Number	11	12	13
Sum of Squares Over Variables	1.407	1.313	1.644

Var. No.    Communality

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26	.395	.074	-.120	.249
27	.333	-.147	-.079	.185
28	.347	-.155	.506	.116
29	.278	.117	-.230	-.028
30	.332	.005	-.077	.014
31	.491	.056	-.111	-.054
32	.458	.186	.579	-.123
33	.184	-.070	-.038	.051
34	.320	.047	.033	-.058
35	.329	-.095	-.001	.159
36	.648	.004	.057	-.092
37	.499	-.275	-.103	.206
38	.277	.016	-.062	-.027
39	.213	.069	.022	-.014
40	.345	.102	-.021	.037
41	.345	-.023	.160	.094
42	.439	.111	.117	.382
43	.377	-.088	-.118	.092
44	.458	-.642	.026	-.029
45	.267	-.048	.126	-.054
46	.274	-.049	.228	-.031
47	.265	-.035	-.036	.119
48	.446	-.138	.218	.185
49	.443	.146	.206	.109

Table 12 (continued) Varimax Factors for MMPI-Difference Score Items

Factor Number	11	12	13
Sum of Squares Over Variables	1.407	1.313	1.644

Var. No.    Communality

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50	.200	-.027	.082	.136
51	.288	.036	-.019	.504
52	.195	-.098	.146	.050
53	.386	-.162	.063	.413
54	.307	-.056	.119	-.057
55	.332	-.045	.168	.082
56	.348	.081	.040	.009
57	.361	-.082	.015	.384
58	.442	.426	-.004	.111
59	.322	.123	.172	-.076
60	.140	-.120	.155	.031

Table 13

## Varimax Factors for CPI-Difference Score Items

N = 80 MZs and 66 DZs

Factor Number		1	2	3	4	5	6	7
Sum Squares Over Variables		1.994	1.463	1.724	1.226	1.393	1.403	1.441
Var. No.	Communality							
1	.498	.147	.050	-.388	.241	.151	-.242	-.052
2	.424	-.042	.099	-.388	.033	-.105	-.023	.109
3	.313	-.009	-.015	.063	-.199	-.209	-.027	-.303
4	.297	.053	-.051	-.091	.007	.344	-.189	-.195
5	.330	.117	.002	.128	.016	.046	.009	.153
6	.302	-.040	-.000	.437	-.148	.039	-.222	.060
7	.506	-.158	-.260	.002	-.125	.007	-.192	-.105
8	.432	.042	-.081	-.097	.138	-.132	.188	-.169
9	.407	.088	.035	-.123	-.274	-.240	.046	.070
10	.212	-.021	.036	.240	-.004	-.056	.046	-.088
11	.353	-.190	-.244	.009	.110	-.002	.258	.024
12	.300	-.099	.228	.167	.048	.044	.017	-.080
13	.306	.095	-.289	-.050	-.087	.031	.051	-.187
14	.418	.015	.193	.292	.016	.101	.104	-.154
15	.242	.119	.041	.174	-.218	-.055	-.013	-.154
16	.180	.082	.028	.041	-.081	.069	-.012	-.002
17	.274	.123	-.104	.098	.011	.195	.297	-.052
18	.199	.021	-.008	-.005	-.340	.024	-.031	.006
19	.276	.008	-.422	.074	-.065	-.026	-.067	.023
20	.381	-.026	-.023	-.196	-.200	.198	-.313	-.018

Table 13 (continued) Varimax Factors for CPI-Difference Score Items

Factor Number		1	2	3	4	5	6	7
Sum Squares Over Variables		1.994	1.463	1.724	1.226	1.393	1.403	1.441
Var. No.	Communality							
21	.395	.216	-.023	.081	-.107	.104	.044	.129
22	.340	.191	.075	-.040	.160	.045	-.431	.026
23	.327	.038	.142	.518	-.021	.119	.096	.023
24	.428	.020	-.625	-.083	.075	.061	.024	.018
25	.184	-.032	-.239	.134	.022	.041	-.079	-.108
26	.295	-.065	.013	-.085	-.178	.083	-.218	.003
27	.193	.036	-.008	.025	-.187	.308	.026	.080
28	.473	.650	-.083	-.024	-.020	.035	.061	-.003
29	.346	.171	.014	.134	-.099	.168	-.021	.035
30	.396	.103	-.120	-.078	-.087	-.036	-.211	.108
31	.337	.138	-.021	.028	-.012	-.088	-.201	-.016
32	.318	-.024	-.077	-.024	-.520	-.055	.058	-.128
33	.461	.089	.170	.009	.104	.094	.011	.615
34	.296	.063	-.047	-.208	-.095	-.150	-.033	-.122
35	.347	.008	-.166	.049	-.084	.004	-.484	-.138
36	.210	.055	-.142	.045	-.027	.029	.126	.343
37	.271	.312	-.089	.052	.030	.084	.019	.206
38	.346	.342	.282	.057	.079	-.117	.012	-.118
39	.442	.317	.039	-.005	-.101	.208	.287	.007
40	.423	.421	.055	.267	.160	-.210	-.212	-.048
41	.245	-.092	-.091	.039	.050	-.197	.020	.034
42	.316	.191	.069	-.073	.067	-.096	.001	-.005
43	.222	-.054	-.022	-.041	.039	.037	.048	-.340
44	.401	-.244	-.004	.015	.007	-.063	-.181	.100

Table 13 (continued) Varimax Factors for CPI-Difference Score Items

Factor Number		1	2	3	4	5	6	7
Sum Squares Over Variables		1.994	1.463	1.724	1.226	1.393	1.403	1.441
Var. No.	Communality							
45	.202	-.128	.073	-.035	.041	-.059	-.008	.092
46	.562	.672	.003	-.047	-.038	-.071	-.092	.088
47	.371	.148	.017	.038	.095	.013	.101	-.044
48	.238	.091	.037	.036	.001	.024	.020	.061
49	.245	-.088	.108	-.027	.031	-.125	.118	-.107
50	.357	-.241	-.073	-.099	-.006	-.145	.035	.443
51	.284	-.025	-.096	.193	-.073	.405	.003	-.004
52	.323	.007	-.239	.336	-.014	-.155	-.056	.295
53	.359	-.021	.263	.189	-.454	.076	-.102	.092
54	.303	.116	-.248	.359	.151	-.120	.040	-.093
55	.126	.089	-.060	.003	-.058	.089	.028	-.047
56	.285	-.161	-.139	.024	-.001	.113	.014	-.010
57	.272	-.107	.038	.247	.039	.066	-.309	-.017
58	.193	.090	-.114	.226	.081	-.080	-.028	.074
59	.315	.008	.016	.076	.063	-.021	.052	-.008
60	.407	.077	-.041	.033	-.137	-.601	.005	-.031

Table 13 (continued) Varimax Factors for CPI-Difference Score Items

Factor Number		8	9	10	11	12	13
Sum Squares Over Variables		1.519	1.631	1.398	1.257	1.691	1.366
Var. No.	Communality						
1	.498	.016	.395	.139	.033	-.051	-.038
2	.424	-.002	.021	-.424	-.078	-.128	-.187
3	.313	.267	.042	-.102	.180	-.054	.116
4	.297	.049	.102	-.029	-.078	.115	.241
5	.330	.096	.341	-.257	.097	.044	.268
6	.302	.059	-.020	.021	.091	-.046	.135
7	.506	.541	.081	-.200	.037	-.081	-.045
8	.432	.111	.247	.423	-.010	-.138	.207
9	.407	-.091	.422	.037	-.169	.102	-.126
10	.212	-.023	.220	.058	.158	.011	-.250
11	.353	.099	-.011	-.123	-.004	.090	.381
12	.300	.050	.065	-.198	-.001	-.382	.084
13	.306	.037	.093	.231	-.299	.079	-.077
14	.418	.465	.055	.149	.095	-.015	-.026
15	.242	.109	-.116	-.079	-.277	-.083	.081
16	.180	-.069	.024	.043	-.033	-.080	.380
17	.274	-.006	.069	-.281	-.043	-.050	.147
18	.199	-.013	-.274	.021	.014	-.065	-.032
19	.276	-.126	.094	-.130	.059	-.079	-.177
20	.381	-.132	-.061	.035	.074	-.322	.177
21	.395	-.259	.040	.027	.119	-.460	.076
22	.340	.123	.194	-.051	-.031	.152	.046
23	.327	.075	.033	-.021	.049	-.035	-.039

Table 13 (continued) Varimax Factors for CPI-Difference Score Items

Factor Number	8	9	10	11	12	13
Sum Squares Over Variables	1.519	1.631	1.398	1.257	1.691	1.366

Var No.    Communalities

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24	.428	.071	.011	.078	.061	-.053	.042
25	.184	-.122	.031	.235	-.099	.047	.072
26	.295	-.025	.193	-.114	-.344	-.112	-.125
27	.193	-.001	.163	.027	-.040	-.136	.080
28	.473	-.087	.059	-.061	-.056	-.131	.053
29	.346	-.115	-.068	.063	.473	-.067	.097
30	.396	.165	.051	-.062	-.058	-.508	.063
31	.337	.001	.482	-.041	.061	-.133	.115
32	.318	.019	.066	-.087	-.056	.035	.043
33	.461	-.095	-.121	.023	.036	.005	.013
34	.296	-.117	.279	-.195	.229	-.116	-.056
35	.347	.122	-.015	.041	-.042	.016	-.195
36	.210	.074	.191	-.032	.060	-.037	.044
37	.271	.192	.010	.137	.161	.065	-.161
38	.346	-.087	-.198	-.039	.248	-.048	.018
39	.442	.223	-.216	-.178	.165	.217	.045
40	.423	-.093	-.096	-.067	-.104	-.016	.144
41	.245	.007	.048	-.091	.408	.036	-.078
42	.316	.475	-.034	.025	-.154	-.053	-.041
43	.222	-.035	-.026	-.073	-.067	-.291	-.014
44	.401	.417	-.136	.129	-.190	-.203	-.091
45	.202	.069	-.092	.374	-.089	-.049	.046
46	.562	.105	.096	-.075	-.022	-.229	.088
47	.371	.109	.090	-.008	-.122	-.521	-.142
48	.238	-.101	-.005	.010	.089	.053	.449
49	.245	.101	.024	.047	.051	-.202	.356

Table 13 (continued) Varimax Factors for CPI-Difference Score Items

Factor Number	8	9	10	11	12	13
Sum Squares Over Variables	1.519	1.631	1.398	1.257	1.691	1.366

Var. No.    Communalities

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50	.357	-.137	.034	-.163	-.038	-.136	.004
51	.284	-.048	-.054	-.013	-.046	-.246	.006
52	.323	-.008	-.102	-.066	-.036	.096	.116
53	.359	-.010	.086	.105	.028	-.060	-.019
54	.303	-.151	-.015	-.100	.053	-.091	-.084
55	.126	.072	-.003	.117	.080	-.265	.072
56	.285	.002	.446	.031	-.138	-.058	-.062
57	.272	-.076	.251	-.137	-.042	-.081	.001
58	.193	-.147	.103	-.124	-.212	-.040	-.089
59	.315	.086	-.023	-.426	-.184	-.062	.272
60	.407	.054	.087	.070	-.018	.003	.044

Table 14

List of MMPI-Raw Score Items Which Load Highest on Each Factor  
(N=160 MZs; 132 DZs, top 60 predictors, 7-factor solution)

Factor	Item No.		
I		PARANOIA OR SUSPICIOUSNESS	
	278	I have often felt that strangers were looking at me critically	
	564	I am not easily angered	
	19	When I take a new job I like to be tipped on who should be gotten next to	
	* 3	I wake up fresh and rested most mornings	
	284	I am sure I am being talked about	
	165	I like to know some important people because it makes me feel important	
	348	I tend to be on guard with people who are more friendly than I expected	
	129	Often I can't understand why I've been so cross and grouchy	
	238	I have periods of such great restlessness that I cannot sit long in a chair	
	224	My parents have often objected to the kind of people I went around with	
	553	I am afraid of being alone in a wide open place	
	II		SENSITIVITY (TENDERMINDEDNESS)
		77	I enjoy reading love stories
158		I cry easily	
* 300		There was never a time in my life when I liked to play with dolls	
* 537	I would like to hunt lions in Africa		
294	I have never been in trouble with the law		

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\* indicates negative direction of weighting

Table 14 (continued) List of MMPI-Raw Score Items

Factor	Item No		
III		HYPOCHONDRIASIS	
	185	My hearing is apparently as good as that of most people	
	137	My home life is as pleasant as most I know	
	243	I have few or no pains	
	73	I am an important person	
*	114	Often I feel as if there were a tight band around my head.	
IV		CONVENTIONALITY	
	95	I go to church almost every week	
	548	I never attend a sexy show if I can avoid it	
	*	36	I seldom worry about my health
*	513	I think Lincoln was greater than Washington	
V	561	I very much like horseback riding	
	30	At times I feel like swearing	
	482	My plans have frequently seemed so full of difficulties that I have had to give them up	
	479	The only miracles I know of are simply tricks that people play on one another	
	*	324	I have never been in love with anyone
		253	I can be friendly with people who do things I consider wrong
	VI	490	I read in the Bible several times a week
543		Several times a week I feel as if something dreadful is about to occur	
*		347	I have no enemies who really wish me harm

Table 14 (continued) List of MMPI-Raw Score Items

Factor	Item No.	
	444	I do not try to correct people who express an ignorant belief
*	221	I like science
	553	I am afraid of being alone in a wide open place
	49	It would be better if almost all laws were thrown away
*	324	I have never been in love with anyone
	498	It is always a good thing to be frank
	482	My plans have frequently seemed so full of difficulties that I have had to give them up
	284	I am sure I am being talked about
	402	I often must sleep over a matter before I decide what to do.
VII	112	I frequently find it necessary to stand up for what I think is right
	59	I have often had to take orders from someone who did not know as much as I did
	447	I am often inclined to go out of my way to win a point with someone who has opposed me
	43	I am an important person

Table 15

List of CPI-Raw Score Items which load Highest on each Factor  
(N=160 MZs; 132 DZs top 60 predictors, 7-factor solution)

Factor	Item No.	
I		CONDUCT PROBLEM (PSYCHOPATHIC DEVIATE)
	129	I would like to drive a race car
	291	I think I would like to belong to a motorcycle club
	171	I think I could do better than most of the present politicians if I were in office
	*	212 I have never been in trouble with the law
	*	278 If I get too much change in a store I always take it back
		431 As a youngster in school I used to give the teachers lots of trouble
II		INTROVERSION - EXTRAVERSION
	38	It is hard for me to start a conversation with strangers
	418	I am embarrassed with people I do not know well
	111	When in a group of people I have trouble thinking of the right things to talk about
		74 It is very hard for me to tell anyone about myself
		31 I doubt whether I would make a good leader
*	267 I am a better talker than a listener	
III		SHYNESS OR LACK OF SELF CONFIDENCE
	*	317 I often think about how I look and what impression I am making on others
	*	263 Lawbreakers are almost always caught and punished
	152	I read at least 10 books a year

Table 15 (continued) List of CPI-Raw Score Items

Factor	Item No.	
*	65	I think I would like the work of a clerk in a large department store
*	462	Even though I am sure I am in the right, I usually give in because it is foolish to cause trouble
IV	SUPER EGO STRENGTH	
	442	The trouble with many people is that they don't take things seriously
	316	My parents wanted me to "make good" in the world
	221	People have a real duty to take care of their aged parents, even if it means making some pretty big sacrifices
	348	I usually try to do what is expected of me and to avoid criticism
	262	There have been a few times when I have been very mean to another person
V		
	164	My parents have often disapproved of my friends
	353	No one seems to understand me
	302	I have often gone against my parents' wishes
	191	I can remember "playing sick" to get out of something
	398	Life usually hands me a pretty raw deal
	388	When I am cornered I tell that portion of the truth which is not likely to hurt me
VI		
	168	My home life was always happy
	367	My home life was always very pleasant

Table 15 (continued) List of CPI-Raw Score Items

Factor	Item No.	
	212	I have never been in trouble with the law
	305	I often wish people would be more definite about things
VII	72	I used to keep a diary
	100	I prefer a shower to a bathtub
	184	I have had more than my share of things to worry about

Table 16

List of MMPI-Difference Score Items Which Load  
Highest on Each Factor

(N=80 MZs; 66 DZs top 60 predictors, 13 factor solution)

Factor	Item No.	
I	333	No one seems to understand me
	24	No one seems to understand me
	122	I seem about as capable and smart as most others
	342	I forget right away what most people say to me
II		PSYCHOPATHIC DEVIATE OR CONDUCT PROBLEM
	294	I have never been in trouble with the law
	471	In school my marks in deportment were quite regularly bad
	161	The top of my head sometimes feels tender
	* 261	If I were an artist I would like to draw flowers
	324	I have never been in love with anyone
	52	I prefer to pass by school friends, or people I know but have not seen for a long time unless they speak to me first
III		SENSITIVITY
	129	Often I can't understand why I have been so cross and grouchy
	* 562	The one to whom I was most attached and whom I most admired as a child was a woman (Mother, Sister, Aunt, or other Woman)
	* 461	I wish I could get over worrying about things I have said that may have injured others' feelings
	149	I used to keep a diary

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\* indicates negative loading

Table 16 (continued) List of MMPI-Difference Score Items

Factor	Item No.	
IV		
*	444	I do not try to correct people who express an ignorant belief
	224	My parents have often objected to the kind of people I went around with
	20	My sex life is satisfactory
*	6	I like to read newspaper articles on crime
V		
	72	I am troubled by discomfort in the pit of my stomach every few days or oftener
	4	I think I would like the work of a librarian
VI		
	209	I believe my sins are unpardonable
	399	I am apt to pass up something I want to do when others feel it isn't worth doing
	560	I am greatly bothered by forgetting where I put things
	234	I get mad easily and then get over it soon
VII		
	171	It makes me uncomfortable to put on a stunt at a party even when others are doing the same sort of things
	208	I like to flirt
*	291	At one or more times in my life I felt that someone was making me do things by hypnotizing me
	316	I think nearly anyone would tell a lie to keep out of trouble
	561	I very much like horseback riding

Table 16 (continued) List of MMPI-Difference Score Items

Factor	Item No.	
VIII	451	When someone says silly or ignorant things about something I know about, I try to set him right
*	469	Lightning is one of my fears
*	458	The man who had most to do with me when I was a child (such as father, stepfather, etc.) was very strict with me
	404	People have often misunderstood my intentions when I was trying to put them right and be helpful
*	484	I have one or more faults which are so big that it seems better to accept them and try to control them rather than to try to get rid of them
IX		
*	114	Often I feel as if there were a tight band about my head
*	529	I would like to wear expensive clothes
*	526	The future seems hopeless to me
	307	I refuse to play some games because I am not good at them
X		
	LETHARGY	
	536	It makes me angry to have people hurry me
	41	I have had periods of days, weeks, or months when I couldn't take care of things because I couldn't "get going"
	230	I hardly ever notice my heart pounding and I am seldom short of breath
XI		
*	448	I am bothered by people outside, on street-cars, in stores, etc., watching me

Table 16 (continued) List of MMPI-Difference Score Items

Factor	Item No.	
	561	I very much like horseback riding
*	82	I am easily downed in an argument
XII	296	I have periods in which I feel unusually cheerful without any special reason
	278	I have often felt that strangers were looking at me critically
*	288	I am troubled by attacks of nausea and vomiting
	458	The man who had most to do with me when I was a child (such as my father, stepfather, etc.) was very strict with me
	469	Lightning is one of my fears
	471	In school my marks in deportment were quite regularly bad
XIII	490	I read in the Bible several times a week
	518	I have often felt guilty because I have pretended to feel more sorry about something than I really was
	560	I am greatly bothered by forgetting where I put things
	406	I have sometimes stayed away from another person because I feared doing or saying something that I might regret afterwards
	34	I have a cough most of the time
	6	I like to read newspaper articles on crime

Table 17

List of CPI-Difference Score Items Which Load  
Highest on Each Factor

(N=80 MZs; 66 DZs Top 60 predictors, 13-factor solution)

Factor	Item No.	
I		PERSISTENCE
	371	I would rather be a steady and dependable worker than a brilliant but unstable one
	230	I would rather be a steady and dependable worker than a brilliant but unstable one
	317	I often think about how I look and what impression I am making upon others
	305	I often wish people would be more definite about things
	316	My parents wanted me to "make good" in this world
	303	We should cut down on our use of oil, if necessary, so that there will be plenty left for people fifty or a hundred years from now
II		NEED FOR STRUCTURE
*	194	I like to keep people guessing what I'm going to do next
*	132	I fall in and out of love rather easily
*	75	We ought to worry about our own country and let the rest of the world take care of itself
	305	I often wish people would be more definite about things
*	54	I find it hard to keep my mind on a task or job
	432	I am not afraid of picking up a disease or germs from doorknobs

Table 17 (continued) List of CPI-Difference Score Items

Factor	Item No.	
*	72	I used to keep a diary
*	434	My skin seems to be unusually sensitive to touch
*	424	There have been times when I have been very angry
*	204	I like to plan a home study schedule and then follow it
	74	It is very hard for me to tell anyone about myself
III		PSYCHOPATHIC DEVIATE OR CONDUCT PROBLEM
	170	I often act on the spur of the moment without stopping to think
	48	Most people would tell a lie if they could gain by it
*	11	People can pretty easily change me even though I thought that my mind was already made up on a subject
*	32	I tend to be on my guard with people who are somewhat more friendly than I had expected
	434	My skin seems to be unusually sensitive to touch
	426	There have been times when I have been very angry
IV		ACHIEVEMENT
*	260	I always try to do at least a little better than what is expected of me
*	432	I am not afraid of picking up a disease or germs from doorknobs
*	112	I set a high standard for myself and I feel others should do the same

---

\* indicates negative loading

Table 17 (continued) List of CPI-Difference Score Items

Factor	Item No.	
V		
* 477		I get tired more easily than other people seem to
	408	I always see to it that my work is carefully planned and organized
	43	It's no use worrying my head about public affairs; I can't do anything about them anyhow
	221	People have a real duty to take care of aged parents, even if it means making some pretty big sacrifices
VI		
* 284		It is hard for me to act natural when I am with new people
* 168		My home life was always happy
* 159		I feel nervous if I have to meet a lot of people
* 460		A strong person doesn't show his emotions and feelings
VII		
	262	There have been a few times when I have been very mean to another person
	401	Most young people get too much education
	293	Every now and then I get into a bad mood, and no one can do anything to please me
* 331		I often start things and never finish
* 39		I must admit I enjoy playing practical jokes on people

---

\* indicates negative loading

Table 17 (continued) List of CPI-Difference Score Items

Factor	Item No.	
VIII	54	I find it hard to keep my mind on a task or job
	330	Everything tastes the same
	339	I have been in trouble one or more times because of my sex behavior
	79	I am afraid of deep water
IX	456	I have more trouble concentrating than others seem to have
	245	Most of the time I feel happy
	65	I think I would like the work of a clerk in a large department store
	11	People can pretty easily change me even though I thought that my mind was already made up on a subject
	45	As a child I used to be able to go to my parents with my problems
X	* 476	I had my own way as a child
	* 32	I tend to be on my guard with people who are somewhat more friendly than I had expected
	61	I liked school
	360	It is impossible for an honest man to get ahead in the world
XI	238	Sometimes I just can't seem to get going
	329	It is hard for me to sympathize with someone who is always doubting and unsure about things

---

\* indicates negative loading

Table 17 (continued) List of CPI-Difference Score Items

Factor	Item No.	
	* 206	I have often found people jealous of my good ideas, just because they had not thought of them first
	* 75	We ought to worry about our own country and let the rest of the world take care of it-self
	* 85	I don't like to undertake any project unless I have a pretty good idea as to how it will turn out
XII		SOCIAL CONFIDENCE
	* 378	I doubt if anyone is really happy
	* 242	I am a good mixer
	* 163	I like parties and socials
	* 74	It is very hard for me to tell anyone about myself
	* 159	I feel nervous if I have to meet a lot of people
XIII		
	382	Success is a matter of will power
	72	I used to keep a diary
	87	I like adventure stories better than romantic stories
	391	I am quite a fast reader

---

\*indicates negative loading

Table 18

Table of means, Standard deviations for MMPI and CPI, raw scores and difference scores, using both the best 60 predictors and a randomly selected set of 60 predictors and respective t-values with respect to Social Desirability scale values and item ambiguity

	Raw Scores				Difference Scores	
	<u>MMPI</u>		<u>CPI</u>	<u>MMPI</u>		<u>CPI</u>
	SD value	Item Amb.	SD value	SD value	Item Amb.	SD value
Top	$\bar{X}=4.946$	$\bar{X}=1.563$	$\bar{X}=5.010$	$\bar{X}=4.533$	$\bar{X}=1.472$	$\bar{X}=4.806$
60	S=1.473	S= .326	S=1.743	S=1.429	S= .338	S=1.665
Random	$\bar{X}=4.719$	$\bar{X}=1.563$	$\bar{X}=4.636$	$\bar{X}=4.460$	$\bar{X}=1.488$	$\bar{X}=4.830$
60	S=1.611	S=.3018	S=1.585	S=1.600	S= .294	S=1.540
	t=.8049	t=.0029	t=1.2273	t=2634	t=.2908	t=.0813

Score items with a randomly selected set of 60 items on social desirability is included. A similar value is presented for CPI-Difference Score items. None of the t-values are significant.

Non-parametric t-tests are presented in Table 19 for each of the four classification matrices. T-values for all four matrices were significant at beyond the .001 level. For the MMPI-Raw Score predictors,  $t = 14.14$  ( $p < .001$ ). Although the accuracy of prediction using the CPI-Raw Score predictors was not as high as the MMPI-Raw Score predictors,  $t = 13.19$  ( $p < .001$ ).

The classification of MZ and DZ sets using difference scores resulted in fewer errors than using raw scores. For the MMPI-Difference Scores predictors,  $t = 12.08$  ( $p < .001$ ), while for the CPI-Difference Score predictors  $t = 11.70$  ( $p < .001$ ).

Table 19

Non-parametric t-tests (Lubin's t) for classification matrices using  
MMPI-Raw Score, CPI-Raw Score; MMPI-Difference Score; and CPI Difference  
Score Predictors

	MMPI-RS	CPI-RAW Score	MMPI-Differ. Score	CPI-Differ Score
t	14.14	13.19	12.08	11.70
N	292	292	146	146
p	.001	.001	.001	.001

## CHAPTER IV

### DISCUSSION

The MZ-DZ differences in the proportion of pairs with agreeing or similar responses to a particular item indicate that twelve of the 19 MMPI items on which MZ-DZ differences equal or exceed .175 are included in the set of 60 best predictors as found by multiple discriminant analysis. Seventeen of the 27 CPI items with largest MZ-DZ differences were found to be included in the set of 60 best predictors. There does, therefore, seem to be some overlapping of items found by simply comparing MZs and DZs with respect to proportion of similar responses and those found by multiple discriminant analysis. The method of looking at within pair agreement is similar to that used by Loehlin. The results of this particular technique will not be pursued since multiple discriminant analysis, which utilizes information concerning covariation among the variables or items, provides a more precise and accurate method of selecting items which best discriminate between groups. Using this method 60 items have been obtained from both the MMPI and CPI which predict a zygosity, or MZness and DZness with a high level of accuracy.

Sets of 60 items also have been obtained using multiple discriminant analysis which predict to MZ within-pair differences and DZ-within-pair differences. The set of

60 predictors for the CPI-Raw Scores is least accurate in the number of correctly classified cases--89% accuracy. The CPI-Difference Score items, on the other hand, are the most accurate with over 99% accuracy of classification. The MMPI-Difference Score items are also very accurate in classification with 98% accuracy, while the MMPI-Raw Score items are somewhat less accurate with 92% accuracy. The difference score items, then, are more accurate in determining whether a case represents an MZ within-pair difference rather than a DZ within-pair difference; the raw score items are less accurate in predicting MZness and DZness.

Lubin's t test for testing the hypothesis that the number of correctly classified cases is not significantly different from the number correctly classified on the basis of a random assignment to categories was applied to all four classification matrices and all t ratios were significant at well beyond the .001 level of confidence. All four sets of items resulted in significantly better classification of cases than if classification had been done on a random basis. However, the difference scores items (for both the CPI and MMPI) appear to be better discriminators in classifying MZ and DZ differences. These two sets of items should perhaps be the tests used in predicting zygosity.

On both sets of raw score items (MMPI and CPI) more MZs than DZs responded "true" on slightly more than half of the items. On the difference score items there was greater within-pair similarity for MZs than for DZs, which is to be expected, since MZs are more similar to each other genetically than are DZs.

The discriminatory power of the top 15 predictors of each of the four sets of items was investigated, with the following results. For the MMPI-Raw Score items, the top 15 items correctly classified 124 MZs out of a total of 160 and 99 DZs out of a total of 132. These 15 items resulted in 76% accuracy in prediction. Similarly, the top 15 predictors from the CPI-Raw Score items classified 77% of the MZs and DZs correctly, i.e., 129 out of 160 MZs and 98 out of 132 DZs. The 15 best items taken from the MMPI-Difference Score items correctly classified 87% of the sample of within-pair differences: 68 of 80 MZ pairs and 59 of 66 DZ pairs. Eighty-four percent of the pairs of within-pair differences were properly predicted by the top 15 CPI-Difference Score items. Sixty-nine of 80 MZ pairs and 54 out of 66 DZ pairs were correctly classified. Although none of these four sets of 15 items reach the level of accuracy in predicting zygosity that blood tests do, it is possible that any one of these sets of 15 items may be combined with Nichols and Bilbro's questionnaire

form a fairly simple test which may demonstrate a level of accuracy equalling that of blood tests.

Factor analysis of MMPI-Raw Score items. Factor I appears to be predominantly a factor of Paranoia, most of the variables of which are responded to as being "true" more often by MZs than by DZs. The factors of Sensitivity or Tendermindedness and Hypochondriasis are comprised of items which are not more frequently answered as being "true" by either MZs or DZs. The items making up the factor of Conventionality are answered as being "true" more often by MZs than by DZs. In other words MZs appear to be more conventional or see themselves as being more conventional than DZs. On the other hand, DZs most often reply "true" to items which make up the factor of Ego Strength.

Factor analysis of CPI-Raw Score items. Most of the items making up the factors of Conduct Problem or Psychopathic Deviate and Superego Strength are answered "true" more frequently by MZs than DZs. However, approximately half the items of the factor of Introversion-Extraversion is answered "true" more often by MZs. The factor of Self-Confidence is composed of items most of which are answered "true" more often by DZs.

Factor analysis of MMPI-Difference Score items. The responses to items which constitute the factor of Psychopathic Deviate or Conduct Problems are more similar for MZs than DZs, i.e., the within-pair differences for DZs are larger than for MZs. On the factors of Sensitivity and Lethargy the MZs and DZs did not differ with respect to within-pair differences.

Factor analysis of CPI-Difference Scores. The factors of Persistence, Need for Structure, Psychopathic Deviate, Achievement, and Social Confidence are composed of items for most of which there are greater within pair DZ differences than there are for MZ differences.

The factors reflecting Sociability (Introversion-Extraversion), Self Confidence, Psychopathic Deviate, and Sensitivity-Shyness appear in most of the four sets of items. These factors are somewhat similar to some of the clusters derived by Loehlin (1965); for example, the clusters: Socially outgoing; socially dominant; good social adjustment; self-confident. The factors found in the present study, however, have been derived analytically as opposed to Loehlin's less analytic method of cluster determination.

The mean Social Desirability Scale Value for the 60 best MMPI-Raw Score items is 4.946 while the mean SD value for a separate set of 60 items randomly selected from the other MMPI items is 4.719. The differences between these

two means was not significant. The mean SD scale value for the top MMPI-Difference Score items is 4.53 as compared with the mean of 4.46 for a random sample of 60 items. This difference is again not significant. There are then no differences in SD scale values between the best predictors and a random selection of items on the MMPI, using both Raw score and Difference scores.

The item ambiguity of the MMPI items (both Raw and Difference Scores), as measured by the standard deviations of responses to the Social Desirability of an item, was not significantly different for the best 60 items as compared with a random selection of 60 items. The average standard deviation for the top MMPI-Raw Score items is 1.563; the average standard deviation for a random selection of items is 1.5636. The average standard deviation of the top MMPI-Difference Score items is 1.472, while for a random selection of items the mean is 1.488. The lack of any significant differences in item ambiguity is contrary to the proposed hypothesis that the set of items which best predict classification in MZs and DZs have greater item ambiguity, i.e., larger standard deviations than the rest of the items.

The best CPI items (both Raw Score and Difference Score) items do not differ with respect to SD scale as compared with a random selection of CPI items. The average SD value for the best CPI-Raw Score items is 5.01; the mean scale value for a random selection of

items is 4.636, which indicates no significant difference. The average SD value for the best CPI-Difference Score items is 4.806; for a random selection of items, the mean is 4.85, again indicating no significant difference.

Thus neither the SD scale value nor the ambiguity of an item is related to the predictive value of an item with respect to zygosity or MZ or DZ within-pair differences.

Four items out of a total of nine Raw Score predictors (two from the MMPI-Raw Score items and seven from the CPI-Raw Score items) concerning childhood experiences (especially with respect to parental treatment of the twins) showed significant differences between MZs and DZs. DZ twins indicated significantly more often than did MZs that they had their own way as a child ( $t=3.85$ ,  $p < .001$ ). On the other hand, MZs responded more often that their home life was always happy ( $t=2.54$ ,  $p < .01$ ); that their parents often disapproved of their friends ( $t=2.29$ ,  $p < .01$ ); and similarly, that their parents objected to the kind of people that they went around with ( $t=2.57$ ,  $p < .01$ ).

A total of seven items from the difference score predictors (three from the CPI and four from the MMPI Difference Score items) reflected parent-child experiences. On three of these items MZs differed significantly from DZs in their within-pair differences. There was significantly greater within-pair differences for DZs than for

MZs on all three items: "I had my own way as a child" ( $t=3.89$ ,  $p < .001$ ); "My home life was always happy" ( $t=2.02$ ,  $p < .01$ ); and "As a child I used to be able to go to my parents with my problems" ( $t=3.14$ ,  $p < .01$ ). There was, in other words, greater within-pair disagreement among DZs than among MZs on these items. This might suggest that in fact with respect to parental treatment of the children in such areas as being available as a counselor or creating a pleasant home life or granting autonomy to the child, MZ twins are treated more similarly than are DZs. Or perhaps the perceptions of MZ pairs concerning these items are more concordant with each other than those of DZ pairs.

Taking both Raw Score items and Difference Score items which reflect significant differences, it might be generally suggested that with respect to parent-child experience, MZs responded more often than did DZs that they had a happy home life, while DZ pairs expressed greater disagreement with each other than did MZ pairs in responding to this item. MZs also indicated that there appeared to be parental disapproval of friends or acquaintances. DZs in general responded that they had their own way as a child although there was significantly less within-pair similarity for DZs than MZs. DZs also exhibited greater dissimilarity with respect to whether they were able to go to their parents with their problems.

From these childhood experiential items drawn from the four sets of 60 predictor items the suggestion might be offered that MZs, although they viewed their home life as a happy one, were subject to greater restraints than DZs were. On the other hand, DZs, it might be suggested, were granted a bit more autonomy. This analysis seems to be somewhat in agreement with the results of the factor analysis in which it appears that MZs are more conventional than DZs and that they have experienced greater conduct problems than DZs. DZs responded "true" more often to the items on the Self-Confidence and Ego Strength factors which appears concordant with parental granting of autonomy.

The major problem with the present study is that the analyses have not been cross-validated. The sets of 60 items from the CPI and MMPI should be further administered to another sample of twins in order to validate the power of discrimination between MZ and DZ twins. Such a project for cross-validation is being proposed at the present time as part of a larger study for which the initial step of obtaining a list of twins born between 1948-1965 has been completed with the aid of Dr. M. P. Mi (Department of Genetics, University of Hawaii). The purposes of the proposed study are as follows: (1) provide a means of checking, against the results of blood tests, the four sets of personality inventory items which discriminated best between MZs and DZs, per se, as well as between MZ

and DZ within-pair differences; (2) assess the heritability indices (H) of various personality traits as measured by both questionnaires and ratings which would provide some means of cross-method validation of the H values; (3) add further information to S. Scarr's study concerning differences in parental treatment of MZ versus DZ twins; (4) investigate each of the above with a longitudinal view, i.e., conduct the investigation over a period of time, staggering the age groups from which the twins are drawn (cross-sequential method); and (5) given a large enough sample, attempt to study racial differences in heritability of personality. The study will utilize a number of different groups of twins varying with respect to zygosity, sex, whether correctly classified by parents or not and whether reared together or not.

The twin population in Hawaii is especially fertile ground for finding the MZs reared apart because of the hanai system of allowing friends and relatives to raise one's child. This proposed study, then, will serve not only as a means of validating the sets of predictors, but as a further exploration of the heritability of personality characteristics as well as an investigation of other aspects of the twin method, which is closely tied into the aims of the present study.

The important contributions of this study are, to the writer, threefold. First, the study reveals that

MZness-DZness, per se, is a sufficiently powerful life circumstance to cause MZs, as a group, to respond significantly differently from DZs, as a group, on a substantial number of items. Second, one can, through multiple discriminant analysis, obtain sets of items from both the MMPI and the CPI than lead to zygosity determination of the same level of success as does blood grouping, demonstrating clearly the value of multiple discriminant analysis in human behavior genetics research. The determination of sets of items which result in a high degree of accuracy in predicting zygosity or whether within-pair differences are attributed to MZs or DZs, may aid in making the twin study method a more efficient and less time-consuming and costly method. With cross validation and proper revisions these items may be a significant contribution to the twin method. Third, one would expect, from the position of such persons as Edwards, that items of varying levels of social desirability and item ambiguity should differ in their discriminative power. This is not so; the data support Scott (1964) and Rorer (1965) in their suggestion that the role of social desirability and item ambiguity in determining the discriminative power of given items on a personality scale probably is rather trivial.

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