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Application of Gray's theory of personality to the DSM-III-R personality disorders: Multivariate and behavioral findings

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APPLICATION OF GRAY'S THEORY OF PERSONALITY TO THE DSM-III-R PERSONALITY DISORDERS: MULTIVARIATE AND BEHAVIORAL FINDINGS

by

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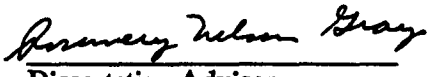

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Recent years have witnessed a rapid growth of published reports on the descriptive features associated with the personality disorders. Despite growing recognition of the existence and clinical relevance of these disorders, there has been relatively little systematic experimental research performed, perhaps because of an absence of a testable, guiding theoretical framework. In the recognition that descriptive studies without the benefit of a guiding theoretical framework can only provide limited understanding, this study examined the applicability of Jeffrey Gray's structural and behavioral theory of personality to a subset of the DSM-III-R personality disorders.

Two independent samples, a normative and a research sample, were employed in this study to test some of the basic assumptions of Gray's theory. The normative sample consisted of 477 college undergraduates. This sample's primary roles in this study included the evaluation of some of the structural assumptions of Gray's model as well as the provision of a context for understanding the smaller research sample. The research sample, self-selected based on individual perceptions of oneself as being anxious or impulsive, was composed of 77 persons who responded to advertisements in local periodicals. This sample's principle roles in this research included: (a) the further evaluation of some of the structural assumptions of Gray's theory, (b) the evaluation of Gray's behavioral predictions arising from his structural model, and (c) the evaluation of the applicability of a subset of the DSM-III-R personality disorders, specifically the "anxious-fearful" and "erratic-dramatic" disorders, to Gray's structural and behavioral theory.

Multivariate findings from both the normative and research sample provided converging support for many of the basic assumptions underlying Gray's structural model

of personality. Additional analyses based on the research sample strongly suggested that this structural model is a viable model for understanding relations among the anxious-fearful and erratic-dramatic personality disorders of DSM-III-R. Behavioral findings from the research sample, however, did not support Gray's theory of individual differences in behavior arising from his structural model, thus calling into question the applicability of this aspect of Gray's theory to the DSM-III-R personality disorders.

CHAPTER I

INTRODUCTION

With the introduction of the Diagnostic and Statistical Manual of Mental Disorders-Third Edition (DSM-III, American Psychiatric Association, 1980) came formal recognition of the existence and clinical relevance of personality disorders. Since this time, there has been a rapid growth of published reports delineating the descriptive features associated with these disorders. However, relatively little systematic experimental research has been undertaken, perhaps because of the dearth of testable theoretical conceptualizations. Most of the theorizing within the area of personality disorders has been advanced by clinicians and researchers who have psychoanalytic or psychodynamic orientations (e.g., Kernberg, 1975; Masterson, 1976). These formulations have generated little empirical study, however, possibly because predictions cannot readily be operationalized or directly observed. Millon's (1981) biosocial theory, despite its current popularity, has largely escaped empirical evaluation, perhaps because of the highly eclectic nature of the theory. Recently, Beck, Freeman and Associates (1990) have advanced a cognitive theory of personality disorders. Because of the recency of this theory, few, if any, studies have examined its principal tenets.

For an area of inquiry to advance, systematic evaluation of assumptions and predictions must be performed. To date, there is no theory of personality disorders which has generated large numbers of research reports which evaluate the appropriateness of the theory to an understanding of personality disorders. Descriptive studies without the benefit of a guiding theoretical framework to facilitate the evaluation and integration of

assumptions and observations can only provide a limited understanding of an object of study.

The primary purpose of this study was to establish a common theoretical and empirical basis for conceptualizing eight of the eleven personality personality disorders subsumed under an atheoretical and minimally empirically validated classification scheme (i.e, the DSM system). As such, this study extended considerably beyond the simple descriptive studies which permeate the published literature on personality disorders. Rather, it was anticipated that results from this study would suggest a guiding theoretical framework to facilitate the evaluation and integration of assumptions and observations related to the anxious-fearful and erratic-dramatic personality disorders of DSM-III-R. To accomplish this goal, this study included an evaluation of the extent to which these personality disorders can be fit into a well-researched and empirically validated structure of personality . This evaluation was made by performing a number of multivariate analyses designed to identify the relationships that these personality disorders share with other constructs of theoretical interest. Theoretical assumptions stemming from this structural model of personality were then tested. Specifically, this study investigated the relationship between dominant personality style and behavior change under varying reinforcement contingencies. This research was novel in that it was the first to examine the influence of reward and punishment on behavior among persons who have a variety of diagnosed personality disorders. Guiding all stages of this research was the theorizing of Jeffrey Gray, whose modification of Hans Eysenck's theory of personality has attracted considerable interest in recent years and has received broad empirical support.

Before outlining the specifics of this investigation, Eysenck's two-dimensional model of personality is discussed, followed by a discussion of Gray's modification of this

theory. These sections are followed with a discussion of the personality disorders, and how such disorders may relate to Gray's model.

Eysenck's Two-Dimensional Models of Personality

Overview of Models

Eysenck's 1957 theory of personality: An antecedent theoretical framework to the 1967 theory: Eysenck's early theorizing which eventually gave rise to his 1967 theory had as its theoretical foundations the theorizing of Jung, Pavlov, Hull, and Yerkes and Dodson (Eysenck, 1957). Drawing from predictions from these theories and from empirical findings reported in the literature, Eysenck (1957, p. 114) advanced two postulates for integrating findings from learning theory and personality research: (a) the postulate of individual differences, and (b) the typological postulate. The individual differences postulate suggested that the relative balance of two psychophysiological constructs, excitatory and inhibitory processes, were instrumental in accounting for differences in behavior among persons. The typological postulate specified the nature of the relationship between differences in the balance of excitation and inhibition processes by specifying predominant personality type (i.e., introversion and extraversion). When combined, these two postulates suggested that introverts' excitatory potentials are generated quickly and are relatively strong, whereas reactive inhibitions are developed slowly and weakly, and once developed, dissipate quickly. The neurotic predisposition for introverts was hypothesized as being dysthymia which, in Eysenck's terminology, is analogous to the constructs of anxiety and reactive depression. For extraverts, the combination of the two postulates suggested that excitatory potentials are generated slowly and are relatively weak, whereas reactive inhibitions are developed quickly and are strong, and once developed, dissipate

slowly. The neurotic predispositions for extraverts according to Eysenck are hysteria and psychopathy.

Eysenck (1957, p. 115) went on to hypothesize individual differences in learning between introverts and extraverts based on these differences in excitation and inhibition processes. Specifically, Eysenck suggested that introverts should form conditioned responses quickly and strongly, whereas extraverts should form conditioned responses slowly and weakly. Eysenck further suggested that neuroticism (which, in his model, is analogous to emotionality, and not limited to the construct of anxiety) should have no correlation with conditionability. Thus, there should, according to this model, be no differences in conditionability between neurotic introverts and normal introverts nor differences in conditionability between neurotic extraverts and normal extraverts (Eysenck, 1957, p. 115).

Eysenck's 1967 arousal theory. Whereas Eysenck's 1957 theory was one of differences in inhibition and excitation, his 1967 theory was primarily concerned with differences in cortical arousal, and the effects that differences in arousal have on conditionability. The concept of arousal as described in this theory is a unitary one; that is, arousal is viewed as a unidimensional construct.

As applied to personality, Eysenck (1967) suggested that introverts are, in general, more cortically aroused than extraverts. Furthermore, Eysenck (1967) equated degree of baseline arousal with conditionability, such that conditioning is enhanced by higher levels of arousal in most instances. Introverts, because of their higher cortical arousal, were hypothesized to form conditioned responses with greater ease compared to extraverts. The superiority in conditionability for introverts was hypothesized to be invariant across different types of response consequation (i.e., punishment and reward) (Eysenck & M. W. Eysenck, 1985).

Neuroticism, like in the 1957 theory, was hypothesized to have little influence on conditioning. Rather, Eysenck (1967) conceptualized neuroticism as a motivational variable (pp. 131-132) that is associated with the level of autonomic (as opposed to cortical) arousal (pp. 231-242). The critical brain structures thought to underlie neuroticism were the limbic system and hypothalamus. Eysenck (1967) further hypothesized that the autonomic and cortical arousal systems were partially independent of one another. The relative independence of these two systems was thought to break down when the person becomes extremely emotional. That is, Eysenck (1967) postulated that autonomic activation (neuroticism or emotionality) can increase cortical arousal. However, Eysenck maintained that elevations in cortical arousal are only infrequently the result of autonomic activation, and that such differences in levels of cortical arousal are due primarily to stable individual differences (i.e., introversion-extraversion). As related to learning, Eysenck (1967) speculated that high neuroticism can interfere with learning as it impairs attention and "the higher nervous process", but that such interference is relatively rare as one is only infrequently highly emotionally aroused, and as such, neuroticism was thought to have little effect on conditionability in general.

One implication from Eysenck's arousal theory is that introverts, relative to extraverts, are more likely to show greater fear conditioning because of their stronger autonomic reactivity to a greater variety of stimuli, and as a consequence, are more inclined to develop fears and phobias (Eysenck, 1969a). Extraverts, conversely, are less likely to develop fear conditioning, and are consequently more likely to demonstrate impulsive, self-gratifying, and psychopathic behavior (Eysenck, 1969a). Thus, we see in the 1967 theory as well as in the 1957 theory a tendency for introverts to be neurotically predisposed to experience dysthymia (anxiety and reactive depression) and extraverts to experience hysteria and psychopathy.

Summary of models. In both the 1957 and 1967 theories, emphasis was placed on two causal, but uncorrelated, dimensions of personality: introversion-extraversion and neuroticism-stability. In both of these theories, greater emphasis was placed on the introversion-extraversion dimension for explaining differences in learning. In the 1957 theory, this difference was accounted for by unspecified central processes responsible for the excitation or inhibition of cortical functioning, with introverts hypothesized to have quicker and stronger excitatory potentials, whereas extraverts were hypothesized to have quicker and stronger inhibitory potentials. In the 1967 theory, it was hypothesized that the underlying physical substrate responsible for individual differences in personality (i.e., introversion and extraversion) was ascending reticular activating system (ARAS) arousal (Eysenck, 1967), with introverts hypothesized as being more aroused generally than extraverts, and thus, more conditionable.

Difficulties with Eysenck's (1967) Theory

Four frequently reported findings present some difficulties for Eysenck's (1967) model of personality: (a) problems in the definition of extraversion, (b) diurnal variations in arousal among introverts and extraverts, (c) differential conditionability in response to different types of response consequation among introverts and extraverts (or among those that are anxious and impulsive), and (d) findings which suggest that anxiety and impulsivity, and not introversion-extraversion, are better predictors of conditionability. As the last two sets of findings are relevant for Gray's extension of Eysenck's (1967) theory, they are elaborated in the context of the discussion of Gray's theory.

Problems in the definition of extraversion. Research from a variety of sources has suggested that extraversion has a "dual-nature"; that is, it is comprised of two subfactors, sociability and impulsivity (Carrigan, 1960; S. B. G. Eysenck & Eysenck, 1969; Guilford,

1977; Rocklin & Revelle, 1979). These subfactors have been found to correlate modestly to moderately with the various Eysenck personality inventories and questionnaires (generally between .20 and .48) (S. B. G. Eysenck & Eysenck, 1969, 1977; Zuber & Ekehammar, 1988). Others, such as Guilford (1977) and Schalling and Åsberg (1985), however, have argued that impulsiveness and sociability are largely independent dimensions. In support of this contention, S. B. G. Eysenck and Eysenck (1977), for example, reported that impulsiveness, narrowly defined, correlated .18 and .08 with sociability. Schalling and Åsberg (1985) reported that they have consistently found impulsivity and sociability to load on different orthogonal factors. These latter findings would suggest that extraversion, conceived by Eysenck as an internally consistent construct, is composed of two essentially non-correlated components. As will be evident in the discussion below, each of these components regarded by Eysenck as defining extraversion appear to have different relations with a variety of independent variables, providing some empirical validation for distinguishing these as two separate constructs.

Diurnal variations in arousal among introverts and extraverts. Revelle, Humphreys, Simon, and Gilliland (1980) investigated the effects that time of day, caffeine, and subfactors of introversion-extraversion had on performance on cognitive tasks (verbal intelligence tests). When the subscales of extraversion were examined in relation to caffeine and performance, it was observed that, in general, low impulsives' performances were impaired when administered caffeine in the morning (ostensibly due to the combination of high morning arousal plus caffeine leading to overarousal), whereas high impulsives' performance was helped (ostensibly due to the caffeine's effects on their low basal arousal in the morning). Conversely, in the evening, low impulsives' performance was helped when caffeine was ingested (ostensibly due to the caffeine's effects on their low basal arousal in the evening), whereas the performance of high impulsives was

impaired (ostensibly due to overarousal resulting from the combination of high basal arousal in the evening and caffeine consumption). The effects of sociability on performance in relation to the ingestion of caffeine and time of day were unreliable.

These findings suggest that the interaction between introversion-extraversion, caffeine, and time of day is primarily due to the subfactor of impulsivity rather than sociability, and that introverts are not consistently more aroused than extraverts. Rather, Revelle et al.'s (1980) data suggested that the relationship between arousal and extraversion vacillates across the day, an observation which contrasts the views expressed by Eysenck (1967). Caution must be taken in the interpretation of findings from this study, however, as level of arousal was not measured directly, but inferred from the reaction to caffeine consumption.

Zuber and Ekehammar (1988) investigated the relationship between the two subfactors of extraversion, time of day, and performance on visual perception tasks. Results indicated that in the morning, subjects high in impulsivity (who were hypothesized to be under-aroused) preferred viewing shapes with stimulating colors compared to those low in impulsivity (who were hypothesized to be over-aroused), a finding which is supportive of Eysenck's (1967) theory. In the evening, however, this pattern was reversed, with low impulsives preferring stimulating colors compared to those high in impulsivity, a finding congruent with those reported by Revelle et al. (1980). The interactive effects for sociability and time of day were not significant.

M. W. Eysenck and Folkard (1980) reported previously unpublished data obtained from 69 students who recorded their oral temperature at three hour intervals across a 24-hour period. Oral temperature was viewed as an index of arousal. Their data indicate that introverts tended to have higher temperatures than extraverts in the morning and early afternoon, but that extraverts tend to have higher temperatures, relative to introverts, in the

evening (see also Blake, 1967, for similar findings). When the subfactors of extraversion were considered, it was observed that those high in impulsivity had higher temperatures in the evening than that of low impulsives, with this difference appearing larger than that observed between introverts and extraverts in the evening. When the sociability component was considered, it was observed that those high in sociability had higher temperatures in the morning, and lower in the evening, a pattern which is opposite of that observed for extraverts and impulsives. M. W. Eysenck and Folkard (1980) interpreted these findings as generally supportive of Revelle et al.'s (1980) hypothesis that differences in diurnal rhythms between introverts and extraverts are largely due to the impulsivity component of extraversion.

Summary. Taken together, the studies reviewed above suggest: (a) that level of arousal is not consistently higher for introverts compared to extraverts, a finding which is inconsistent with Eysenck's (1967) theory which postulates that the arousal level of the introvert is chronically higher than that of the extravert, (b) impulsivity and sociability, thought by Eysenck to be the two subfactors which define extraversion, may be separate constructs which respond differently to a variety of independent variables, and (c) that impulsivity may be the causal determinant of individual differences in performance observed between introverts and extraverts, a finding which would lend indirect support to Gray's model of personality. In the following sections, an overview of Gray's model is presented, as well as empirical data both supportive and critical of his model.

Gray's Model of Personality

Overview of Theoretical Model

Gray (1970, 1972, 1973, 1981, 1987a, 1987b; Gray, Owen, Davis, & Tsaltas, 1983) has proposed an modification of Eysenck's theory, one which emphasizes the dimensions of anxiety and impulsivity rather than introversion-extraversion as causal determinants of differences in conditionability. Discussion of Gray's model begins with a detailed account of his 1970 theory, followed by a discussion of his subsequent modifications of this theory.

Gray's 1970 theory. Gray (1970) proposed several modifications of Eysenck's (1967) model of personality. In contrast to Eysenck's (1957, 1967) proposition that introverts are superior in conditionability than extraverts under all types of contingencies, Gray (1970) proposed that introverts are more susceptible to contingencies of punishment and frustrative nonreward (or the non-occurrence of an expected reward, where the contingent termination or omission of a stimulus results in a decrease in the probability of a response, and eventually leading to extinction), and that extraverts are more susceptible to contingencies of reward relative to introverts. In support of these views, Gray (1970) reviewed findings on conditionability and anxiety (to be reviewed later) and on the behavioral effects of drugs, specifically the effect of amytal (a barbiturate and CNS depressant) on learning under different reinforcement contingencies in animal studies. Gray's (1970) review suggested that this drug reduces the effects of punishment and frustrative nonreward on behavior, ostensibly because it reduces arousal, while having no effect on reward learning. Gray goes on to conclude from his review that the function of amytal on behavior is to reduce the sensitivity of an endogeneous punishment mechanism, later termed the Behavioral Inhibition System (BIS; Gray, 1981). As to the underlying

physiological origins of this system (and, hence, of introversion), Gray (1970), in addition to hypothesizing ascending reticular activation system (ARAS) involvement, also implicated an inhibitory system regulated by the orbital frontal cortex, the medial septal area, and the hippocampus.

As will be recalled, Eysenck (1957, 1967) de-emphasized the role that neuroticism (emotionality) may play in learning. He further conceived of neuroticism as a drive or as a motivational variable (Eysenck, 1957, p. 115; Eysenck, 1967, p. 132, pp. 182-183). Gray (1970, 1973), in contrast, conceptualized neuroticism principally as emotional reactivity to various forms of external stimuli. In an extension of this assumption, Gray suggested that level of neuroticism (or emotionality) is an index of susceptibility to the effects of both reward and punishment. As one moves from stability to high neuroticism along stability-neuroticism dimension, one becomes increasingly more sensitive to contingencies of both reward and punishment. There is also an interaction, however, between personality type (introversion-extraversion) and susceptibility to reward or punishment, such that introverts relative to extraverts tend to be more susceptible to punishment, whereas extraverts are more susceptible to reward. Thus, introversion is linked to an increasing susceptibility to the effects of punishment and extraversion to an increasing susceptibility to reward, with neuroticism associated with increasing sensitivity to both reward and punishment.

Gray (1970) suggested that the relationship between susceptibility to punishment, introversion-extraversion, and neuroticism can be be illustrated by a diagonal dimension running through the introversion-neurotic quadrant (high anxiety) at a 45° and through the extraverted-stability quadrant (low anxiety) (Figure 1; this figure and all subsequent figures are in Appendix A). It is this dimension which describes the level of anxiety as well as sensitivity to punishment. This placement of this dimension is consistent with Eysenck's

(1965, p. 167) proposition that anxiety is a combination of neuroticism and introversion, and is consistent with findings from factor analytic studies (see, for example, Eysenck, 1969b, p. 37, 39, 46; Eysenck & Rachman, 1965, pp. 21-22).

Thus, those high in anxiety are most susceptible to the effects of punishment whereas those low in anxiety would be the least susceptible. It should be noted, however, that in a footnote, Gray (1970, p. 263) suggested that the angle is probably somewhat greater than 45° given the higher correlations observed between neuroticism and manifest anxiety as measured by Taylor's scale than between introversion and manifest anxiety (see also M. W. Eysenck, 1982, and Kelly & Martin, 1969). Some researchers (e.g., Lykken, 1957), however, have suggested that the Taylor Manifest Anxiety Scale is actually a better measure of neuroticism than of anxiety, an observation which would suggest that this scale would show a stronger association with neuroticism than introversion in Eysenck's two-dimensional space.

In summary, Gray proposed the following in his 1970 theory of personality: (a) in terms of arousability, introverts are high whereas extraverts are low, (b) there are no general differences in the conditionability of introverts and extraverts (i.e., that one group is not superior in conditionability across all types of contingencies), (c) level of neuroticism is a determinant of susceptibility to the effects of both reward and punishment, (d) introverts are highly susceptible to the effects of punishment whereas extraverts are relatively low in susceptibility, (e) extraverts are highly susceptible to the effects of reward whereas introverts are relatively low in susceptibility, (f) in terms of fear conditioning, introverts will be superior to extraverts, (g) the neurotic predisposition for introverts is dysthymia whereas for extraverts it is psychopathic behavior, and (h) the dimension of anxiety, which runs from the introverted-neurotic quadrant through the extraverted-stability

quadrant at a 45° angle, is the best determinant for susceptibility to the effects of punishment and frustrative nonreward.

Subsequent modifications to Gray's 1970 theory. Since 1970, Gray has modified his theory somewhat, with perhaps the most important addition being the introduction of the dimension of impulsivity into his system. A useful delineation of the differences between Gray's 1970 theory and his subsequent reformulations is presented in Gray (1981).

Gray (1973) proposed a second causal dimension of behavior orthogonal to that of anxiety, labeled impulsivity, which extends at a 45° angle through the extravert-neurotic quadrant (high impulsivity) through the introvert-stability quadrant (low impulsivity). Whereas Gray (1970, 1973) postulated the activity of the orbitalfrontal—septo-hippocampal "stop system" as the physiological basis for anxiety (and hence, introversion), he speculated that medial forebrain bundle activity (or "approach system", later termed the Behavioral Activation System, or BAS; Fowles, 1980; Gray, 1987a) underlay the dimension of impulsivity (and hence, extraversion). Since 1973, Gray (1981, 1987a) has expressed some uncertainity about the physiological substrates which underlie the BAS, and in Gray (1987b, p. 330), has suggested that the important regulating structures may be ascending dopaminergic fibers and the dorsal and ventral striatum. He has also expanded his conceptualization of the mechanisms which may underlie impulsive behavior by positing that either a strong BAS or a weak BIS could mediate impulsive actions (Gray et al., 1983), although there is suggestive evidence which indicate that it is unlikely that a weak BIS alone is responsible for impulsive action (Derryberry, 1987; Nichols & Newman, 1986). Fowles (1987) has further suggested that persons with a strong BAS may also be susceptible to transient periods of heightened (state) anxiety as the impulsivity

characteristic of such persons makes them more readily inclined to approach cues which are associated with threats of punishment or frustrative nonreward.

In speculating about sensitivity to the effects of particular contingencies, Gray (1973) proposed that as one's level of impulsivity increases, one becomes increasingly more susceptible to the effects of reward and relieving nonpunishment (or the non-occurrence of an anticipated punishment, where the termination or omission of a stimulus results in an increase in the probability of a response). Those lowest on this dimension (i.e., the stable introvert) would the the least susceptible to the effects of reward and nonpunishment. The function of the BAS, which is associated with the dimension of impulsivity, then, would be to activate behavior in situations where cues associated with reward are present. Conversely, the function of the BIS, which is associated with the dimension of anxiety, is to inhibit behavior in situations where cues associated with punishment are present. A pictorial summary of Gray's theory is illustrated in Figure 1.

The extent to which the dimension of impulsivity occupies the position in Eysenckian two-dimensional space in the manner described by Gray remains theoretically and empirically controversial. Gray (1981) noted that impulsivity tends to correlate positively with neuroticism, whereas sociability (another extraversion subfactor) tends to correlate negatively with neuroticism. S. B. G. Eysenck and Eysenck (1977), for example, reported that sociability correlated -.17 and -.11 with neuroticism. Impulsiveness, narrowly defined, however, was found to correlate between .38 and .18 with neuroticism on the Eysenck Personality Questionnaire (EPQ) (Corulla, 1987; S. B. G. Eysenck & Eysenck, 1977, 1978; S. B. G. Eysenck, Pearson, Easting, & Allsopp,1985). These findings would suggest that the impulsivity dimension belongs in the neurotic extravert quadrant, and sociability in the stable extravert quadrant. Correlations between impulsivity and extraversion, however, suggest that impulsivity may fall closer to the

extraversion dimension than the neuroticism dimension. S. B. G. Eysenck et al. (1985) reported correlations of .39 and .22 between impulsivity and extraversion, S. B. G. Eysenck and Eysenck (1978) reported correlations of .39 between these two constructs, with Corulla (1987) reporting the correlations between these measures as .46 and .30. Somewhat lower correlations were reported by Eysenck and Eysenck (1977), who found that extraversion correlated .28 and .18 with impulsiveness, narrowly defined. Barratt (1971) and Bachorowski and Newman (1985), using the Barratt Impulsiveness Scale to index level of impulsiveness, found impulsivity to correlate .60 and .65, respectively, with extraversion. The range of correlations between impulsiveness and extraversion (from .18 to .65) appears to vary as a function of the questionnaire measure used, and lends credence to the notion that there is not much agreement as to the features that define the construct of impulsiveness across personality assessors (Eysenck, 1987b).

Although some of the correlational data suggest that impulsivity may be closer to the extraversion dimension than the neuroticism dimension, factor analytic studies suggest that the impulsivity dimension may not deviate too much from the 45° angle proposed by Gray. Factor analytic studies reported in Eysenck (1969b) and Eysenck and Rachman (1965) indicated that within Eysenck's two-dimensional space, psychopaths tend to fall along the 45° angle between neuroticism and extraversion. Impulsivity has long been considered a defining feature of psychopaths (Doren, 1987), and as such, has been included as a criterion for the diagnosis of antisocial personality disorder in DSM-III-R (American Psychiatric Association, 1987). In one notable factor analytic study of the MMPI, Kassebaum, Couch, and Slater (1959) suggested a dimension which bisects their primary dimensions of extraversion-introversion and ego-weakness--ego-strength, which runs through the extraversion and ego-weakness (i.e., combined anxiety and neuroticism)

quadrants down through the introversion and ego-strength (i.e., stability) quadrants at a 45° angle. These reseachers labeled this dimension impulsivity-intellectual control.

In sum, it would appear that there is sufficient evidence to justify the placement of the impulsivity dimension in Eysenckian two-dimensional space as suggested by Gray, although it is possible that the impulsiveness dimension may be slightly less than the 45° angle proposed, and similarly, the anxiety dimension may be slightly steeper than 45°. Fluctuations in the placement of these dimensions can be expected. As Eysenck (1987b; Eysenck & M. W. Eysenck, 1985, p. 31) notes, the exact relations between constructs can substantially vary by the addition or deletion of specific items which define a construct. Eysenck (1987b), for example, notes that the worry component of anxiety tends to be more strongly associated with introversion, and somatic anxiety more strongly associated with extraversion. The relative balance of items assessing these two components of anxiety would directly affect the placement of an anxiety dimension. Thus, the exact location of the anxiety and impulsivity dimensions within Eysenck's two-dimensional space can be expected to vary across different measurement instruments which emphasize different aspects of these constructs as well as different subject groups.

Empirical Evaluation of Gray's Model

Anxiety and conditionability. Both Eysenck and Gray would concur that those who are anxious would condition better than those low in anxiety, at least under some circumstances. Explanations for why these two groups may differ in conditionability differ between the two theorists, however. Eysenck would propose that those who are anxious tend to be introverted, and that it is the introversion dimension which accounts for most of the variablility between those high and low on anxiety in conditionability. Gray, however, would postulate that it is the anxiety dimension, not the introversion dimension, which

accounts for most of the variability in differences in conditionability. Thus, the evidence presented below suggesting that highly anxious individuals are better at conditioning under relatively threatening conditions is generally compatible with predictions made by both Eysenck's and Gray's theories. As will be evident, however, these finding appear to be generally more supportive of Gray's theory than Eysenck's.

Spence (1964) reviewed studies conducted mostly at the University of Iowa which explored the relationship between levels of anxiety and eyelid conditioning under relatively threatening conditions. In 21 of 25 studies, those high in trait anxiety were found to be superior in conditioning compared to those low in anxiety, with this difference being statistically signficant in 65% of the studies reviewed. Furthermore, Spence (1966) suggested that those studies which did not show the expected findings may not have been emotionally arousing (i.e., threatening) enough. He went on to speculate that in addition to an elevated level of trait anxiety, situationally produced anxiety may further facilitate conditioning. Ominsky and Kimble (1966) provide some support for this contention.

It should be noted that in the bulk of the Iowa studies, subjects were selected based on their scores on the Taylor Manifest Anxity Scale (TMAS) , a measure which, as a previous discussion has suggested, is perhaps a better measure of neuroticism than anxiety, and shares larger correlations with neuroticism than introversion (Eysenck, 1987b; Eysenck & M. W. Eysenck, 1985). Furthermore, the observation that 65% of the studies comparing those high and low in anxiety resulted in significant differences in conditionability (Spence, 1964) is somewhat higher than the percentage of studies which showed differences in conditionability between introverts and extraverts. Eysenck (1965) concluded from his review that only 55% of these studies showed superior eyeblink conditioning for introverts under conditions thought to be optimum (i.e., partial as opposed to continuous reinforcement). When eyeblink conditioning studies were collapsed across

rate of reinforcement, however, this percentage dropped to 44% (Eysenck, 1965). Subsequent research by Eysenck and Levey (1972) indicated that reinforcement schedule (partial vs. continuous) had no effect on conditioning among introverts and extraverts. Thus the differentiation of studies into those with different reinforcement schedules appears not to be valid for determining the relationship between introversion-extraversion and conditioning.

Finally, the observation that the emotional arousability inherent in the conditioning environment facilitates conditioning (Spence, 1964; Ominsky & Kimble, 1965) suggests that neuroticism (emotionality) plays a role in conditioning, a variable which Eysenck (1957, 1967) suggested should have either no effect or a detrimental effect. One conclusion that one might draw from all of the above observations is that anxiety or neuroticism, and not introversion-extraversion as suggested by Eysenck, is the primary determinant of conditionability, at least under relatively threatening conditions. This conclusion would be more compatible with the theorizing of Gray than of Eysenck.

Impulsivity and conditioning. Eysenck and Levey (1972) reported findings related to introversion-extraversion and conditioning. Two findings from their research are relevant here: (a) that introverts are superior to extraverts in eyeblink conditioning only under some circumstances, and (b) that the impulsivity component of extraversion and not sociability is primarily responsible for the differences observed in conditionability. Using Eysenck's excitation-inhibition model as a theoretical framework, Eysenck and Levey (1972) proposed that introverts would condition best under conditions of partial (as opposed to continuous) reinforcement, weak (as opposed to strong) unconditioned stimuli (as indexed by air puff pressure to the eye), and short (as opposed to long) interval between CS and UCS presentations. Results indicated that the predictions for the intensity of the UCS and the CS-UCS interval held true; that is, introverts conditioned better than

extraverts under conditions of weak UCS and short CS-UCS interval. Perhaps more importantly, however, introverts and extraverts did not differ in conditionability under conditions of partial and continuous reinforcement, when the UCS was strong, and when the CS-UCS interval was long. Furthermore, extraverts were observed to be superior in conditionabilty under the strong UCS condition. When data were collapsed across the combined conditions that were presumed to be the worst for the conditioning of introverts (i.e., strong UCS, long CS-UCS interval, and continuous reinforcement), the correlation between introversion and conditionability was -.31. Although Eysenck and Levey (1972) did not predict that introverts would condition better than extraverts under these conditions, their findings do suggest that introverts are not uniformly better at conditioning than extraverts under all conditions.

Perhaps even somewhat more damaging for Eysenck's (1967) theory, the impulsivity component of extraversion was found to largely account for differences in conditionability, with those high in impulsivity generally the poorest at conditioning under optimal conditions for the conditioning of introverts. The sociability component had no effect on conditionability. The main implication that can be drawn from this finding is that impulsivity, rather than extraversion proper, is responsible for differences in conditioning between introverts and extraverts.

Barratt (1971) differentiated subject groups according to their levels of anxiety and impulsivity, and assessed conditionability using an eyeblink conditioning paradigm. A main effect for conditionability was found for level of impulsiveness, with low impulsive (LI) subjects evidenced significantly more conditioned responses across trials than those high in impulsiveness (HI). Conditionability was not found to vary significantly across those low (LA) and high (HA) in anxiety. When subjects were further subgrouped along

both of the dimensions of anxiety and impulsiveness, LIHA subjects were found to make significantly more conditioned responses than did HILA subjects.

Frcka and Martin (1987) also investigated the role that impulsivity has on conditionability, specifically eyelid conditioning. Among their findings, Frcka and Martin (1987) reported that level of impulsiveness was related to the trial number in which the first conditioned response occurred, with those highest in impulsivity tending to show this response later when compared to those low in impulsivity. Contrary to predictions, however, linear trend analyses did not show a main effect for differences in conditioning between those high and low on impulsiveness over trials.

Relationship of introversion-extraversion to learning under different reinforcement contingencies. McCord and Wakefield (1981) examined the relationship between introversion-extraversion to arithmetic achievement under varying conditions of teacher-administered reinforcement and punishment. The ratio of teacher-presented rewards and punishments as administered during a daily 45-minute arithmetic period was first determined for five separate classrooms, with classes subsequently rank ordered on this dimension. Once these ratios were established, 101 fourth and fifth grade students were administed the Junior Eysenck Personality Questionnaire (JEPQ) and an arithmetic pretest. An arithmetic posttest was then administed after 40 school days. After taking into account arithmetic pretest scores, as well as JEPQ lie scale scores and the arithemetic scores from the Comprehensive Test of Basic Skills (given earlier in the school year), regression analyses were performed using the arithmetic posttest scores as the predictor. Results indicated that there was a significant interaction between introversion-extraversion and teacher adminstered reward-punishment. The overall pattern suggested that the achievement of extraverts was greatest in classrooms where teacher-administered reward predominated. As the ratio of reward to punishment decreased, however, the superiority in

achievement of the extravert decreased, and that of the introvert increased. It should be noted, however, that in all of the classrooms, the rate of teachers administered rewards was found to be greater or equal to that of punishments, with this ratio observed to range between 10.19:1 to 1.01:1, with the median ratio being 4.11:1.

Seunath (1975) investigated the relation between introversion-extraversion and type of reinforcement (reward versus punishment) on learning on a pursuit rotor task. A two-way ANOVA revealed a significant personality (introversion-extraversion) by reinforcement (reward versus punishment) interaction. Post hoc comparisons revealed that extraverts performed significantly better under reward conditions, whereas introverts tended to do better under punishment conditions, with the latter finding just failing to achieve conventional statistical significance.

In two verbal operant conditioning studies, Gupta (Gupta, 1976; Gupta & Nagpal, 1978) investigated the relation between the dimensions of introversion-extraversion and impulsivity-sociability on learning during a Taffel-type task. Findings from both of these studies lend support to Gray's theory. In Gupta (1976), where all subjects were male, it was observed that under conditions of punishment, introverts evidenced greater conditioning, and this relationship was not dependent on the gender of the experimenter. Conversely, it was observed that extraverts evidenced greater conditioning under conditions of reward, but only when the experimenter was a female. When the experimenter was a male, introverts showed greater conditioning under conditions of reward. In Gupta and Nagpal (1978), the effects of impulsivity and sociability on conditionability were examined in a verbal operant conditioning task, with the type of reinforcement (reward versus punishment) varied across conditions. Results indicated that those high on impulsivity (but not sociability) conditioned better under rewarding

conditions. Conversely, low scorers on both the impulsivity and sociability scales were found to condition most readily under conditions of punishment.

Two experiments reported in Boddy, Carver, and Rowley (1986) lend further support to Gray's model. In their first experiment, subjects performed a computer task where they were instructed to find an unobservable target on the screen by moving a cursor. Depending on condition assignment, subjects received either positive (e.g, "good", "excellent") or negative (e.g., "terrible", "very bad") feedback on the computer screen in response to their distance from the target. Results from this study indicated a significant interaction between personality type and reinforcement type. Introverts who received punishment performed significantly better than either rewarded introverts or punished extraverts. Conversely, rewarded extraverts performed significantly better than punished extraverts, but not rewarded introverts. The nature of the interaction further suggested that introverts and extraverts were most greatly differentiated on learning under conditions of punishment than of reward.

In their second experiment, Boddy et al. (1986) examined the relation between reinforcement type (reward versus punishment) and personality type on a number calculation task. Once again, a significant interaction between personality type and reinforcement type was obtained. Extraverts who received reward had significantly higher scores than punished extraverts or rewarded introverts. Conversely, punished introverts received significantly higher scores than rewarded introverts or punished extraverts. The nature of the interaction further suggested that introverts and extraverts were about equally differentiated under conditions of both reward and punishment.

Kantorowitz (1978) explored the relationship between personality type and the conditioning of penile tumescence and detumescence in response to the presentation of slides of nude females. Based on Eysenck's research on the relationship between sexual

activities and introversion-extraversion, Kantorowitz hypothesized that penile tumescence conditioning would be inhibited by anxiety, inhibition, worry, and guilt. Because introversion has been shown to be associated with anxiety and sexual inhibition, it was hypothesized that persons high on this personality dimension should show greater detumescence conditioning and less tumescence conditioning. Conversely, Kantorowitz suggested that hedonism, absence of guilt and anxiety, and sexual disinhibition would be more strongly associated with the extraverted character type. As a consequence, it was hypothesized that extraverts would show greater tumescence conditioning and less detumescence conditioning.

Procedurally, subjects in this study were asked to masturbate, and to signal by depressing a foot switch two minutes before ejaculation. Upon making this signal, a slide (CS+) of a nude female was presented. Once ejaculation occurred, the CS+ slide was removed, and another slide (CS-) of a nude female was presented. The CS- slide was presented for the same length of of time as the CS+ slide. Each subject went through this procedure on eight separate occasions.

Scores on the Eysenck Personality Inventory extraversion scale were correlated with the magnitude of CS+ and CS- conditioning. Results indicated that extraversion positively correlated ($\underline{r}$ = . 88) with CS+ conditioning, indicating that extraversion was associated with larger increases in the amplitude of CS+ responding over trials. Conversely, extraversion negatively correlated (-.76) with CS- conditioning, indicating that introversion was associated with larger decreases in the amplitude of CS- responding over trials. In his discussion of his findings in relation to Gray's theory, Kantorowitz (1978) speculated that the pre-orgasmic (tumescence) phase is largely appetitive or rewarding, whereas the detumescence phase is functionally similar to Gray's notion of non-reward. If

tumescence and detumescence are conceptualized in this manner, his findings lend direct support to Gray's conditioning model.

Relationship of introversion-extraversion and impulsivity-anxiety to performance under different reinforcement contingencies. Derryberry (1987) investigated the relationship between introversion-extraversion on a reaction time task under conditions of varying antecedent stimuli (positive or negative signals) and response consequation (positive or negative). In both of the experiments reviewed, subjects played a game on a computer, where the task was to receive as many points as possible. At the beginning of each trial, one of three signal types was presented: (a) an incentive warning signal, which indicated to the subject that points can be earned if their response on the task is faster than average, (b) a punishment warning signal, which indicated to the subject that points would be lost if the their response was slower than average, and (c) a neutral warning signal, which indicated to the subject that points could neither be gained nor lost based on response speed. Following the warning signal, a target was presented in either the right or left visual field. The subject's task was to respond by depressing a key once the target was observed, or not to respond if no target was presented. Once the subject made a response, a feedback signal was presented, which indicated whether or not the response was faster (positive feedback) or slower (negative feedback) than average.

In Experiment 1, no significant interactions between type of antecedent stimuli and personality type on responding were observed. This insignificant interaction is inconsistent with Gray's theory, which would have predicted that extraverts would have been quicker under positive incentive conditions, and introverts quicker under punishment conditions. However, it was observed that extraverts responded faster on trials following negative feedback than positive feedback, with introverts found to respond slower on trials following negative feedback than positive feedback. These observations are consistent

with findings from other studies (Newman & Kosson, 1985; Nichols & Newman, 1986; Patterson, Kosson, & Newman, 1987). Three possible explanations can account for this robust pattern of findings (Derryberry, 1987; Nichols & Newman, 1986). First, as a result of receiving a punishment signal following responding, introverts may become more behaviorally inhibited (i.e., have an overactive BIS), and consequently respond slower to subsequent signals for reward. Conversely, extraverts may become more activated relative to introverts following punishment while responding for reward (i.e., have an overactive BAS), and thus appear to be disinhibited. A third alternative would be that introverts become inhibited (via BIS activation) and extraverts become disinhibited (via BAS activation) when reward signals are presented following trials where behavior was punished. Both Derryberry (1987) and Nichols and Newman (1986) suggest that the paradoxical effect of extraverts responding quicker following punishment is more indicative of BAS activation among extraverts. Slower responding among introverts on trials following negative feedback could also be indicative of BIS activation in introverts following punishment or frustrative non-reward (which is more consistent with Gray's theory). Thus, it seems that the third alternative may be the most likely, although further exploration is warranted.

As with Experiment 1, three independent variables were manipulated in Derryberry's (1987) second experiment (personality type: introversion vs. extraversion; value of antecedent stimuli: signal of reward vs. punishment; outcome of previous trial: reward vs. punishment), with reaction time serving as the dependent variable. An ANOVA revealed a significant three-way interaction. On trials following negative feedback only, introverts were found to be more responsive to signals of punishment and extraverts more responsive to signals of reward.

A series of studies in Newman's laboratory suggest that extraverts and psychopaths (who are presumed to be extraverted or disinhibited) are more inclined, relative to introverts and controls, to make more passive avoidance errors, or the failure to withhold a response previously associated with punishment while responding for reward. In one such study, Newman, Widom, and Nathan (1985) found in two experiments that extraverted college students, relative to introverts, were unable to avoid punishment (i.e., the loss of money) when avoidance of punishment required the inhibition of a previously rewarded response (see also Patterson et al., 1987, and Newman, Patterson, & Kosson, 1987, for similar findings). In another experiment reported in this paper, Newman et al. (1985) compared the performance of primary psychopaths (defined in this study by elevated Pd scale scores on the MMPI plus a low score on the Welsh Anxiety scale) and secondary psychopaths (defined by elevated Pd scale scores and high score on the Welsh Anxiety scale). Results from this comparison indicated that primary psychopaths made significantly more passive avoidance errors than secondary psychopaths. Newman and Kosson (1986) also found that psychopaths (undifferentiated) made more passive avoidance errors than non-psychopath controls.

Newman's (Newman & Kosson, 1986; Newman et al., 1985) findings are largely consistent with the theorizing of Gray (see Gray, 1987a, for his discussion of these experiments). According to Gray's model, extraverted students would be more sensitive to signals of reward relative to signals of punishment. Newman et al. (1985) observed that extraverts, relative to introverts, tended not to learn from punishment experiences, but only when they were responding for reward. BIS activation in introverts to signals of punishment and non-reward would account for their response inhibition, whereas BAS activation among extraverts in response to signals of reward would result in responding that was relatively uninfluenced by punishment signals. The differences in performance

between primary and secondary psychopaths in Newman et al. (1985) are also consist with Gray's theorizing. Primary psychopaths would fall within the stable-extravert quadrant, and thus would be insensitive to the effects of punishment and moderately sensitive to the effects of reward. Because of their elevated levels of anxiety, secondary psychopaths would fall within the neurotic-extravert quadrant, and thus highly sensitive to reward and moderately sensitive to the effects of punishment. The observation that primary psychopaths would make more passive avoidance errors (the inability to withhold a previously punished reponse when responding for reward) than secondary psychopaths would be expected according to Gray's model, as secondary psychopaths are moderately sensitive to signals of punishment, whereas primary psychopaths are largely insensitive to such cues.

Bachorowski and Newman (1990) asked college undergraduates to trace circles under one of two between subjects' conditions: a goal condition (presumed to stimulate approach behavior) and a no-goal condition (which was designed to facilitate behavioral uncertainity). It was hypothesized that the addition of salient behavioral goals would promote BAS activation among extraverts, whereas the absence of goals (and thus, uncertainity) would lead to BIS activation among introverts, with these relationships being mediated by one's position on the neuroticism dimension.

A within subjects factor was the nature of the instructions given to subjects prior to tracing. For a given trial, a subject was told to either simply trace the circle (neutral tracing condition) or to trace the circle as slowly as possible (inhibition instructions). The order of presentation of this within subjects factor appeared not to be counterbalanced across conditions, with the neutral condition appearing to always precede the inhibition condition. As to possible performance differences under varying instructions, a previous study by Bachorowski and Newman (1985) showed that impulsives, relative to nonimpulsives,

were faster in their tracings under inhibition instructions but not under neutral tracing instructions.

A signficant two-way interaction was observed, with impulsives (as defined by E+N+) in the goal condition under instructions of inhibition found to trace faster than nonimpulsives (E-N-). In contrast, under the no-goal condition with inhibition instructions, anxious subjects (E-N+) traced the circle faster than non-anxious (E+N-) subjects. Bachorowski and Newman (1990) discussed their findings as being supportive of Gray's theory. They suggested that impulsives' faster tracing speed under inhibition conditions was indicative of BAS activation in response to the presence of a behavioral goal. The faster tracing speed of introverts under inhibition and non-goal conditions, on the other hand, was interpreted as being indicative of BIS activation. Although their rational deviates somewhat from Gray's primary emphasis on differing sensitivities to signals of reward and punishment, their findings do seem to support what might be considered to be a logical extension of Gray's model.

Summary

Overall, there seems to be considerable support for Gray's extension of Eysenck's model. Gray's notion that neither introverts nor extraverts are superior in conditionability, in general, has received considerable empirical support. Rather, Gray has suggested that conditionability is dependent on the interaction of personality type (introversion-extraversion) with level of neuroticism (neurotic-stable) and cues present in the environment which exert influence on behavior (reward vs. punishment). There are also suggestions from the published research, consistent with Gray's theorizing, that the dimensions of anxiety and impulsivity, in contrast to the dimensions of introversion-

extraversion as suggested by Eysenck, may be the dimensions which better predict performance and conditioning differences under varying reinforcement contingencies.

Extensions of Gray's theory have been proposed, such as those suggested by Newman. Citing his laboratory's research as examples, Newman (1987) suggests that extraverts, by responding faster following punishment or failing to withhold a response that typically leads to punishment (i.e., passive avoidance failure), evidence a general tendency toward disinhibition. Conversely, introverts, who slow down following punishment, are thought to be more reflective, and thus better able to learn from their experiences with punishmnent. Newman's formulation is not inconsistent with the theorizing of Gray (see Gray, 1987a), although Newman's theory does place greater emphasis on the role of reflectivity, response perseveration, and passive avoidance failure in accounting for performance differences whereas Gray's theory principally emphasizes differing sensitivities to signals of reward and punishment. The advantages of Newman's theory over that of Gray have not been well-delineated nor demonstrated in the literature, however. Consequently, the research described in this proposal places greater emphasis on the theorizing present in Gray's model.

Personality Disorder Clusters of the Diagnostic and Statistical Manuals of Mental Disorders

Unlike the theoretical models of personality presented above, the Diagnostic and Statistical Manual of Mental Disorders (DSM) system is an atheortical classification scheme. With the introduction of the third edition of the DSM (DSM-III; American Psychiatric Association, 1980) and its subsequent revision (DSM-III-R; American Psychiatric Association, 1987) came formal recognition that personality disorders are

differentiable from other psychological disorders. The 11 personality disorders described in this classification scheme, coded on Axis II of this system, were divided into three symptomatological clusters: the odd-eccentric cluster (paranoid, schizoid, and schizotypal personality disorders), the anxious-fearful cluster (dependent, avoidant, passive-aggressive, and compulsive personality disorders), and the erratic-dramatic cluster (histrionic, narcissistic, borderline, and antisocial personality disorders). Some theorists, such as Millon (1981, p. 63), have argued strenuously against grouping the personality disorders in this manner. As is apparent below, however, the clustering scheme proposed in the DSM system appears to have a fair degree of validity attached to it.

Factor analytic studies. Kass, Skodol, Charles, Spitzer, and Williams (1985) examined the factor structure of DSM-III personality disorder traits. Psychiatric residents and clinical psychology interns made 4-point scaled ratings of the degree to which each of the 11 personality disorder were present for 609 new admissions to an outpatient training facility at a large medical center. Ratings ranged from "none or very few traits" (assigned a value of 1) to "meets DSM-III criteria" (assigned a value of 4). The intercorrelations of these ratings were derived, and subsequently submitted to a factor analysis. The factor analysis procedure yielded four factors with eigenvalues greater than 1.0, accounting for 59% of the variability in ratings. Overall, the factor structure of the scaled ratings lent support to the validity of the DSM-III clusters. Personality disorders which loaded highest on Factor 1 were paranoid, schizoid, and schizotypal, with their loadings on this factor being .58, .50 and .66, respectively. Factor 2 was defined primarily by those personality disorders which comprise the anxious-fearful cluster, with avoidant, dependent, and passive-aggressive personality disorders loading .59, .79, and .37, respectively, on this factor. The erratic-dramatic personality disorders were found to load the highest on Factor 3, with histrionic, narcissistic, antisocial, and borderline disorders loading .45, .78, .28

and .48, respectively, on this factor. The only personality disorder which had a moderate positive loading on Factor 4 was compulsive personality disorder, which had a loading of .43.

The factor structure obtained by Kass et al. (1985) was essentially replicated by Hyler and Lyons (1988). In their study, Hyler and Lyons (1985) asked psychiatrists to rate the extent to which each of the 11 of the DSM-III personality disorders were present for two of their patients, with the restriction that these ratings be made for one patient who had a significant personality disturbance and for another who did not. Ratings were made according to the guidelines set forth in the Personality Diagnostic Questionnaire (PDQ), and ranged from 0 ("no traits") to 3 ("meets DSM-III criteria"). Psychiatrists who participated in this study rated a total of 358 patients. These ratings were correlated and then factor analyzed, with the resultant analysis yielding four orthogonal factors with eigenvalues greater than 1.0. The schizotypal, schizoid, and paranoid disorders loaded on Factor 1, with their loadings being .77, .76, and .54, respectively. Narcissistic, histrionic, antisocial, and borderline personality disorders loaded .80, .71, .61, and .56, repectively, on Factor 2. On Factor 3, dependent, passive-aggressive, and avoidant personality disorders loaded .86, .60, and .58, respectively. Like Kass et al. (1985), Hyler and Lyons (1988) found that the only personality disorder to load on Factor 4 was compulsive personality disorder, which had a loading of .87.

In a study by Hyler, Lyons, Reider, Young, Williams, and Spitzer (1990), 552 patients selected by their psychiatrist filled out the PDQ. About half of these subjects were described as having a significant personality disturbance by their psychiatrists, whereas the remainder were described as having no significant personality pathology. In addition to the item responses obtained from the clients themselves, their treating psychiatrists also rated the degree to which each of the 11 personality disorders were present for the client, with

these ratings ranging from 0 ("no traits") to 3 ("meets DSM-III criteria"). The 137 items of the PDQ for the 552 patients were factor analyzed. Two decision rules were employed for deciding if a factor should be retained: (a) an eigenvalue greater than 1.0, and (b) the presence of at least three items with factor loadings greater than .40 per factor. Using these decision rules, Hyler et al. (1990) found 11 factors which accounted for 39% of the variation in responses to the PDQ. Some of these factors were primarily based on traits associated with a specific personality disorder whereas others contained a mix of traits from several of the personality disorders. A somewhat clearer pattern emerged when standardized regression coefficients from clinicans' ratings of their patients were correlated with factor scores. In this analysis, the values of the regression coefficients were determined by regressing the clinicians' ratings (dependent variable) on the 11 factors (predictor variables), with separate regression analyses performed for each personality disorder. Results indicated that seven of the 11 factors correlated positively and significantly with only one of the DSM-III clusters, providing some support for the validity of the DSM-III personality disorder clusters. One problem with this study, however, is found in the ratio of number of subjects to the number of PDQ items factor analyzed. This ratio is 4.03:1, which is quite a bit lower than the 10:1 ratio suggested by factor analysts such as Nunnally (1978, pp. 275-276). Consequently, the obtained factor solution may be quite unreliable, and would be expected to change across studies utilizing similar sample sizes.

Livesley (Livesley & Jackson, 1986, Livesley, Jackson & Schroeder, 1989) investigated the factorial structure of behavioral criteria associated with each of the 11 personality disorders. Livesley's work differs from the studies described above in that Livesley: (a) used college students, university and hospital employees, and members of the general public rather than patient samples, and (b) used behavioral items believed to be

associated with specific personality disorders rather than DSM-III criteria (see Livesley, 1986, for a description of the procedure for arriving at these behavioral criteria) . Livesely and Jackson (1986) asked 115 college undergraduates to rate the extent to which they manifested each of 436 behaviors thought to be associated with each of the 11 personality disorders. Ratings on each item were made along a six-point scale. An 11 x 11 intercorrelation matrix of the personality disorders was first computed. It was observed that generally each of the intercorrelations were significant and positive, with the exception of compulsive personality disorder, which tended to have small and insignificant correlations with the other personality disorders. The correlation matrix was then submitted to a factor analysis, with the decision rule for factor retention being an eigenvalue greater than 1.0. Three factors were retained. Factor 1 was labeled "interpersonal and cognitive dysfunction", with the personality disorders loading highest on this factor being avoidant, passive-aggressive, schizoid, and paranoid, which had loadings of .92, .80, .75, and .74, respectively. Factor 2, labeled "impulsivity and deviant socialization", was primarily composed of histrionic, narcisssistic, and antisocial personality disorders, which, respectively, had loadings of .88, .74, and .73. The only high factor loading obtained for Factor 3 was compulsive personality disorder. Individual items from the questionnaire were also factor analyzed, and using a scree test for retaining factors, 13 factors were identified, which accounted for 42.8% of the variance. Although Livesley and Jackson cite an unpublished paper as suggesting that their sample size would yield stable factor loadings, the ratio of subjects to items (3.79:1 in this study) is quite small. Furthermore, given the population sampled from (i.e., college students), it is unlikely that items which assess significant pathology would likely to be endorsed with sufficient frequency in this presumably normal sample. Consequently, one would expect that in a patient sample, the resultant factor structure would be considerably different from the one obtained in this

study. Similar criticisms apply to research conducted by Livesley et al. (1989), who identified 15 oblique factors based on responses from 274 nonclinical subjects to 100 items (scales).

Multidimensional scaling and cluster analytic studies. Widiger, Trull, Hurt, Clarkin and Frances (1987) conducted interviews with 84 inpatients with a personality disorder diagnosis. During these interviews, the degree of presence of the diagnostic features of the 11 personality disorders was assessed. The number of features associated with each of the personality disorders varied in number between 4 (for passive-aggressive and schizoid) to 16 (for paranoid). Ratings for symptom presence/absence were rated along a nine-point scale, with ratings between 0 and 4 indicating that the symptom was below clinical threshold and 5 to 9 indicating that the symptom was present to a clinically significant degree. Once these ratings were made, the number of symptoms present for each disorder was correlated across subjects. After a constant of 1.0 was subtracted from the coefficients and the resulting absolute values determined, a multidimensional scaling analysis was performed. The results of this analysis suggested a three-dimensional solution, with these dimensions labeled "social involvement", "assertiveness", and "anxious rumination". On the dimension of social involvement, schizoid and paranoid disorders were located at one polar end of this continuum, and dependent, avoidant, borderline, and histrionic at the other end. On the assertiveness dimension, narcissistic and histrionic disorders were found at one end of the continuum, and schizoid, avoidant, passive-aggressive, and dependent at the other. The final dimension was interpreted as having as one of its ends anxious rumination and the other end as behavioral acting out. Personality disorders at the anxious end of this continuum were schizotypal, compulsive, paranoid, and avoidant, with antisocial, passive-aggressive, schizoid, and borderline personality disorders at the behavioral acting out end of the continuum. When one considers the personality disorders

found at the ends of this third dimension, however, it would appear that their fit to these labels is somewhat poor, suggesting that this dimension is poorly defined. Overall, the dimensional model of personality disorders suggested by the research of Widiger et al. (1987) does not correspond to the personality disorder clusters proposed in the DSM system.

Morey (1988) asked clinicians to provide ratings on one or two of their clients who had been diagnosed as having a personality disorder. For each client, the clinician checked each of 166 diagnostic features used to describe the 11 personality disorders contained in DSM-III and DSM-III-R as to their presence or absence. To analyze the clustering of personality disorder features, two cluster analytic algorithms were initially employed, average linkage and complete linkage. Subsequent data analyses suggested that of these two algorithms, the average linkage technique was the most reliable, and it is the results of this technique which are presented. The first set of findings pertain to the classification of personality disorder features. Overall, features associated with specific personality disorders were found to cluster together using the average linkage approach. Exceptions are noted with features corresponding to narcissistic and antisocial disorders, as well as schizotypal and schizoid disorders. These two personality disorder pairs appeared to be poorly differentiated in this analysis. In the case of the narcissistic-antisocial pairing, Morey (1988) proposed that the labels "aggressive" and "psychopathic" be used to in place of antisocial and narcissistic.

The second set of findings pertain to the clustering of the specific personality disorders. Contrary to the format of DSM which suggests three distinct personality clusters, Morey's (1988) findings suggested two broad classes of personality disorders, which were labeled "anxious rumination" and "behavioral acting out" (see also Widiger et al., 1987, above). Comprising the cluster of anxious rumination were dependent,

avoidant, schizotypal, schizoid, and obsessive-compulsive personality disorder. The behavioral acting out cluster consisted of histrionic, borderline, aggressive, psychopathic, passive-aggressive, and paranoid personality disorders. With the exception of passive-aggressive personality disorder and the disorders from the odd-eccentric cluster (paranoid, schizotypal, and schizoid), the personality disorders fell into the clusters suggested by DSM. It should be noted that these four personality disorders were among the five least frequently observed personality disorders in Morey's (1988) sample (with antisocial being the fifth). Consequently, their failure to cluster as suggested by the DSM system may, in part, be an artifact of their relatively low frequency in this study.

Summary. Overall, there appears to be moderate empirical support for the validity of the DSM personality disorder clustering scheme. The greatest support comes from factor analytic studies which examined the factor structure of the personality disorder categories (Hyler & Lyons, 1988; Kass et al., 1988), although such findings have not been consistently obtained (Livesley & Jackson, 1986), perhaps because of differences in subject selection (i.e., patients versus nonpatients) and other methodological differences. Morey's (1988) cluster analysis of the personality disorders also lends some support to the proposed clusters, although the odd-eccentric cluster was found to be undefined in this study, perhaps because of low frequency of these disorders observed in the sample studied. When individual trait and behavioral items associated with the personality disorders were factor analyzed, however, there appears to be little support for the clustering schema (Hyler et al., 1990; Livesley & Jackson, 1986; Livesley et al., 1989). These latter studies, however, have a number of methodological limitations which raise questions about the generalizability and stability of their findings.

The Relation of the DSM-III-R Personality Disorders to the Models of Gray and Eysenck

To what extent do the DSM personality disorder clusters fit into the models of Eysenck and Gray? To date, there have been no attempts to empirically investigate these relationships (although see Widiger et al., 1987, who attempted to discuss their findings in the context of Eysenck's model). Eysenck (1987a) has speculated that the odd-eccentric personality disorders correspond to his psychoticism factor, the erratic-dramatic personality disorders correspond to his extraversion factor, and the anxious-fearful personality disorders correspond to his neuroticism factor. Given the traits that Eysenck (1987a) ascribed to each of his personality dimensions, however, this conclusion seems unlikely. For example, Eysenck (1987a) associated the traits of aggressive, cold, egocentric, impersonal, impulsive, antisocial, unempathic, creative, and tough-minded to those high on his psychoticism factor. It would seem to this writer that these characteristics are more typical of borderline, antisocial, narcissistic, and histrionic clients than of schizoid, paranoid, and schizotypal clients. This writer would speculate that members of the anxious-fearful cluster would fall within the introverted-neurotic quadrant of Eysenck's two-dimensional model (or on the high anxiety dimension of Gray's theory), and that members of the erratic-dramatic cluster would primarily fall within the extraverted-neurotic quadrant (or on the high impulsivity dimension of Gray's model). These hypothesized relations, the rationales for which are described in the following section, remain speculative until which time they are empirically tested.

Application of Gray's Theory of Personality to the DSM-III-R Personality Disorders: Multivariate and Behavioral Findings

Statement of Purpose

This study examines the applicability of Gray's theory of personality to a subset of the DSM-III-R personality disorders, with the intent of this research being the establishment of a common theoretical and empirical basis for conceptualizing eight of the eleven personality personality disorders subsumed under the atheoretical DSM system. Personality disorders of primary interest are those included in the anxious-fearful (i.e., avoidant, dependent, obsessive-compulsive, and passive-aggressive) and erratic-dramatic (i.e., histrionic, narcisssistic, borderline, and antisocial) clusters. The remaining personality disorders from the odd-eccentric cluster (i.e., paranoid, schizoid, and schizotypal) are not a main feature of this study as Gray's behavioral model of personality makes no reference to the importance of a "psychoticism" dimension to an understanding of individual differences in behavior under varying reinforcement contingencies.

The applicability of Gray's theory to these personality disorders is assessed via two global methods: multivariate analyses of constructs and behavioral analyses of individual differences in behavior during a laboratory task.

Multivariate analysis

The primary question addressed in the multivariate analyses has to do with the degree of correspondence between the dimensions of introversion-extraversion, neuroticism-stability, high anxiety-low anxiety, and high impulsivity-low impulsivity with the DSM-III-R anxious-fearful and erratic-dramatic personality disorders. If strong

associations were to be observed, it would suggest that findings reported in the literature on introversion-extraversion, anxiety and/or impulsivity might be pertinent to these personality disorders.

Introversion-extraversion and neuroticism-stability. To this writer's knowledge, there have been no direct attempts to link empirically the DSM-III-R defined personality disorders to the dimension of introversion and extraversion. Before hypothesizing about how these disorders might relate to this dimension, Eysenck's descriptions of the features of extraversion and introversion are first reviewed. Regarding extraversion, Eysenck and Rachman (1965, p. 19) state:

> The typical extravert is sociable, likes parties, has many friends, needs to have people to talk to, and does not like reading or studying by himself. He craves excitement, takes chances, often sticks his neck out, acts on the spur of the moment, and is generally an impulsive individual. He is fond of practical jokes, always has a ready answer, and generally likes change; he is carefree, easygoing, optimistic, and 'likes to laugh and be merry'. He prefers to keep moving and doing things, tends to be aggressive and lose his temper quickly; altogether his feelings are not kept under tight control, and he is not always a reliable person.

When one considers the above descriptive features of the extravert in light of the symptomatology associated with the erratic-dramatic personality disorders of DSM-III-R (i.e., borderline, antisocial, narcissistic, and histrionic disorders), a fair degree of correspondence seems to be present. Table 1 (this and all subsequent tables are in Appendix B) displays some of the more obvious overlaps between extraversion and erratic-dramatic personality disorder (i.e., borderline, antisocial, narcissistic, histrionic disorders) symptomatology.

Even when there is not a direct correspondence between Eysenck's description of extraversion and erratic-dramatic symptom features, the overall clinical picture of the erratic-dramatic personality disorders appears to be congruent with the spirit of extraversion

as conceptualized by Eysenck. Based on the above comparative analysis, one might hypothesize that the features of the erratic-dramatic personality disorders would positively correlate with extraversion. Furthermore, since a good deal of the erratic-dramatic symptoms are based on maladaptive emotionality, one would further hypothesize that those who have erratic-dramatic personality features would likely fall within the neurotic-extravert quadrant of Eysenck's two-dimensional model.

In contrast to the extravert, Eysenck (Eysenck & Rachman, 1965, p. 19) described the typical introvert as follows:

> The typical introvert is a quiet, retiring sort of person, introspective, fond of books rather than people; he is reserved and distant except to intimate friends. He tends to plan ahead, 'looks before he leaps', and mistrusts the impulse of the moment. He does not like excitement, takes matters of everyday life with proper seriousness, and likes a well-ordered mode of life. He keeps his feelings under close control, seldom behaves in an aggressive manner, and does not lose his temper easily. He is reliable, somewhat pessimistic and places great value on ethical standards.

When one considers the descriptive features of the introvert with DSM-III-R criteria for the anxious-fearful personality disorders (i.e., avoidant, dependent, compulsive, passive-aggressive disorders), a fair degree of correspondence emerges, as illustrated in Table 2.

Many of the remaining features of the anxious-fearful personality disorders are consistent with the spirit of introversion as conceptualized by Eysenck. Consequently, one might hypothesize a positive correlation between features of the anxious-fearful personality disorders and introversion. Furthermore, since many of the diagnostic features of the anxious-fearful personality disorders have an emotional component, it is likely the case that those who predominantly display features of these disorders would fall within Eysenck's neurotic-introvert quadrant.

Impulsivity and anxiety. The above hypotheses on the relations between the DSM-III-R personality disorders, introversion-extraversion, and neuroticism-stability are pertinent to the hypotheses on the relationships between the DSM-III-R personality disorders and anxiety and impulsivity. This is the case as the neurotic introvert is thought to be high in anxiety, and the neurotic extravert high in impulsivity. Furthermore, the labels applied to two of the personality disorder clusters would suggest that anxiety and impulsivity are characteristic features of these disorders. One could reasonably hypothesize that those with predominant "anxious-fearful" personality features would be high on trait anxiety, and that those with predominant "erratic-dramatic" personality features would be high on impulsivity.

Behavioral Analysis

From the review in the preceeding sections, there seems to be a fair amount of evidence suggesting that those high in impulsivity (i.e., neurotic extraverts) are especially sensitive to signals of reward whereas those high in anxiety (i.e., neurotic introverts) are especially sensitive to signals of punishment, as predicted by Gray's theory. A question remains, however, as to what extent Gray's theory might be relevant for a subset of the DSM-III-R personality disorders. The principle question addressed in the behavioral task has to do with whether the various personality disorders can be differentiated in terms of differing sensitivities to various reinforcement contingencies. It has been suggested above that two of the DSM-III-R personality disorder clusters, anxious-fearful and erratic-dramatic, are characterized, respectively, by elevated levels of introversion and anxiety (neurotic introverts) and elevated levels of extraversion and impulsivity (neurotic extraverts). Consequently, it may be the case that these two clusters of personality disorders are differentially sensitive to cues associated with punishment and reward. This

differential sensitivity will be an object of investigation in the experimental portion of this study.

Relationships between anxious-fearful and erratic-dramatic personality disorders and personality disorder traits to learning under varying reinforcement contingencies. It was hypothesized that personality disorder diagnosis (i.e., anxious-fearful versus erratic-dramatic, and related personality disorder traits) would significantly interact with reinforcement type (reward versus punishment versus non-consequation). Based on the theorizing of Gray, it was expected that persons with anxious-fearful personality disorders compared to those with erratic-dramatic personality disorders would: (a) make fewer punished responses across conditioning blocks, and (b) make fewer rewarded responses across conditioning blocks. Conversely, it was hypothesized that persons with erratic-dramatic personality disorders relative to those with anxious-fearful disorders would: (a) make more punished responses across conditioning blocks, and (b) make more rewarded responses across conditioning blocks. For both the anxious-fearful and erratic-dramatic disorders, it was expected that both disorders would by the last conditioning block (Trials 61-80) use pronouns associated with reward most frequently, followed by those which are non-consequated, followed by those that are punished. Within this pattern, however, it was expected that those with erratic-dramatic disorders would make more rewarded responses and punished responses. This trend was also expected in the first two conditioning blocks (i.e., Trials 21-40, 41-60), although the predicted effects may not be as pronounced. Persons with no personality disorder (or few anxious-fearful and erratic-dramatic traits) would perform the poorest on the conditioning task, as they would be expected to be less neurotic, anxious, and impulsive than the other two groups and, consequently, less sensitive to signals for reward and punishment.

No explicit differences were hypothesized as to the the types of individual differences that may be observed between diagnostic groups on the frequency of use of non-consequated responses, as neither Gray's nor Eysenck's theory make definite predictions under such conditions. This writer would speculate, however, that those with anxious-fearful personality disorders would make more of these responses across conditioning blocks than those with erratic-dramatic disorders. This hypothesis is offered for two reasons. The first is purely mathematical. If it is hypothesized that persons with anxious-fearful disorders would make fewer rewarded and punished responses, then it would necessarily be the case that they would have to make more of some other type of response. The only alternative in this study is non-consequated responses. The second reason is of a more conceptual nature. Gray's theorizing would suggest that those who are high in anxiety are best at avoiding punishment (i.e., make fewer punished responses) as they are better able to identify signals associated with punishment. They are, conversely, presumed not to be as good in identifying signals of reward relative to those that are impulsive. Consequently, their predominant mind set in this study may be to avoid punishment at all costs. They may not, however, be as focused on determining how best to avoid punishment (e.g., by responding for reward versus some other alternative, such as making non-consequated responses), at least not immediately. Impulsive individuals, in contrast, are thought to be very sensitive to signals for reward, but less sensitive to other signals. They know what to do "right" in order to obtain reward, but are less sure of what they are doing wrong. Consequently, it is expected that they will require more time to differentiate between signals associated with punishment and non-consequence relative to anxious individuals, and as a result, make more punishment errors relative to anxious persons, thus resulting in proportionately fewer non-consequated responses.

Plan of Study

This study employs two independent samples, a normative and a research sample, in order to evaluate the applicability of Gray's theory to the anxious-fearful and erratic-dramatic disorders of DSM-III-R. The normative sample, composed of a large number of college undergraduates, was used to exmine some of the structural assumptions of Gray's theory, specifically the placement of the dimensions of anxiety and impulsivity within Eysenck's two dimensional model. The normative sample was also used to reference questionnaire data from the research sample. Furthermore, since it was expected that the research sample would generally evidence higher scores on measures of neuroticism, anxiety, and impulsivity, sample statistics from the normative sample was used to reference scores on these measures for the research sample. Referencing of scores was accomplished by "embedding" the research sample within the normative sample through the use of *z*-score transformations, thus providing an index of where a given member of the research sample would be located relative to the mean of the normative sample.

The research sample consisted of persons who responded to advertisements placed in a local community newspaper, community entertainment weeklies, and a campus newspaper. This particular sample was assessed for the presence of personality disorders and personality disorder features, and participated in the laboratory task. Their function was to further evaluate some of the structural assumptions of Gray's model, as well as to determine the relevance of Gray's structural model for eight of the eleven personality disorders. The research sample was also employed to test some of the behavioral predictions which stem from Gray's model.

As is detailed further in this report, the research sample was configured in three different ways: (a) ungrouped (all subjects), (b) grouped according to categorical membership, and (b) grouped based on dimensional relations among constructs. The

ungrouped configuration was employed to evaluate some of the basic assumptions of Gray's theory as applied to the personality disorders and personality disorder traits, as well as to evaluate the impact that the various reinforcement contingencies had on behavior over time. The categorical and dimensional groupings of subjects had similar functions. However, the the assignment of subjects into groups allows for a more detailed examination of structural relations among constructs, and provides a means by which to examine the role that individual differences may play in the production of behavior.

Both categorical and dimensional group configurations were employed as there is currently substantial discussion concerning how best to describe personality pathology. The DSM systems have historically employed a categorical method for determining the presence or absence of disorders. The use of a categorical group configuration is consistent with this legacy. The categorical approach to defining psychopathology has as its roots the principle assumptions of the medical model, where ideal classes are defined in terms of their within group homogeneity and distinct, non-overlapping boundaries between classes. Such an approach is appropriate when the object of classification has a discontinuous distribution, as is the case with many diseases where the individual either evidences the pathogen responsible for the disease or the pathogen is absent.

However, in recent years, there has been growing debate in psychology and psychiatry as to the relative merits of shifting to a dimensional model of psychopathology (e.g., Cantor & Genero, 1986; Frances, 1980; Widiger & Frances, 1985). Such a shift has been proposed in the recognition that psychopathology is not a discrete phenomenon, but is instead characterized by extreme deviations from normality. For example, the experience of anxiety, thought to underlie a number of "anxiety disorders", does not have a discontinuous distribution in the population. Rather, the experience of anxiety evidences an approximate normal distribution. As such, the line between "normal anxiety" and

"anxiety disorders" exists as an arbitrary one, as cases who fall on either side of this line of demarcation are assigned to vastly different categories. Dimensional approaches, as distinguished from categorical approaches, recognize (a) that there are not clearly delimited boundaries between normal and abnormal personality and behavior, and (b) that boundaries between diagnostic categories are not discrete, and are instead "fuzzy" and overlapping. With this approach, each member located within the same area of dimensional space is viewed as an approximation to the typical for that area, but is not viewed as equally typical of near neighbor members. Rather, featural elements are assumed to be imperfectly related to categorical membership. As such, near neighbors in dimensional space may appear more similar than different (at least on the dimension defined); however, there are likely important differences which distinguish neighboring cases (e.g., dimensions other than that on which individuals were defined). A main difficulty of this appproach is that categories are not definitive nor discrete, resulting in problems in communicating or describing any given member. In the recognition of the strengths and weaknesses of categorical and dimensional approaches to classifying cases, as well as the role that tradition plays in current official classification schemes, both methods of subject classification are employed in this study.

CHAPTER II

METHOD

Overview of Subject Groups and Multivariate and Behavioral Methodologies

Normative sample. One unique feature of this study was that it employed a large normative sample as a context for understanding a smaller research sample. The research sample, self-selected based on individual perceptions of oneself as being anxious or impulsive, might be expected to have sample statistics on some measures which differ substantially from that of the general population. For example, a discussion in the preceding chapter suggested that persons who evidence personality disorders from either the anxious-fearful or erratic-dramatic clusters would display greater levels of neuroticism relative to other individuals. As such, the mean score on the dimension of neuroticism for these groups may be larger than those typically reported, perhaps as much as a standard deviation or more. Such sample statistics, consequently, can be misleading when interpreted in isolation. Therefore, in most of the analyses presented in this study, scores on dependent measures for the research sample will be referenced to the distribution of means and standard deviations from the normative sample (z-score transformations), thus providing an index of the location of members in the research sample within the normative sample.

In addition to referencing the research sample, another function of the normative sample was to evaluate some of the structural assumptions of Gray's model, specifically the location of the dimensions of anxiety and impulsivity within Eysenck's two-dimensional space. As will be recalled, the placement of these dimensions provides a direct indication of sensitivity to reward and punishment within Gray's model. This normative

sample, however, was not used to test Gray's behavioral predictions arising from his structural model. Rather, the normative sample was employed in a variety of multivariate analyses to evaluate the structural aspects of his model.

Research sample. The primary function of the research sample was to evaluate the applicability of the anxious-fearful and erratic-dramatic personality disorders to Gray's structural and behavioral model of personality. As such, the research sample was employed in both multivariate and behavioral analyses, whereas the normative sample only appeared in the multivariate analyses. Multivariate analyses involving the research sample were primarily concerned with identifying the dimensions underlying the anxious-fearful and erratic-dramatic personality disorders, and to determine if these underlying dimensions correspond to Gray's primary dimensions, namely, anxiety and impulsivity. Thus, several of the multivariate analyses involving the research sample were designed to provide an index of "goodness of fit" of the personality disorders to Gray's structural model.

The behavioral analyses involving the research sample were geared towards evaluating the applicability of Gray's predictions of individual differences in behavior arising from his structural model to an understanding of differences in behavior observed among persons with different personality disorders. Specifically examined here are differing sensitivities to a variety of reinforcement contingencies across persons with predominant anxious-fearful and erratic-dramatic personality traits and disorders. Findings from the behavioral analyses may shed light on the sources of environmental stimuli that exert their greatest control on persons with different personality disorders.

As is described in greater detail in subsequent sections, the research sample was configured in three different ways depending on the nature of the statisical analysis employed and the type of research question being addressed. These configurations were: (a) ungrouped, which included all subjects from the research sample, (b) categorical

configuration, which is composed of three subject categorical groupings, and (c) dimensional configuration, which included all of the research sample subjects defined in terms of four groups based on personality disorder dimensional scores. The composition of each of these sample configurations are elaborated in a future section of this report.

Normative Sample Subjects

Four-hundred and seventy-seven university undergraduates (176 males, 299 females, 2 failed to indicate gender) participated in this study in exchange for research participation points associated with a course requirement. Data from persons who indicated that they were foreign exchange students were excluded from this sample.

Each subject completed a packet of questionnaires, with individual questionnaires within the packet arranged in a random order. Questionnaires were filled out in a classroom setting, with several persons filling these measures at the same time. These questionnaires, also completed by the research sample, included measures which assess anxiety, impulsivity, introversion-extraversion, and neuroticism-stability. Descriptions of each of these questionnaires are provided below.

Questionnaire Measures

Introversion-extraversion and neuroticism-stability. The dimensions of introversion-extraversion and neuroticism-stability were assessed via the Eysenck Personality Inventory, Form A (EPI; Eysenck & S. B. G. Eysenck, 1968). This 57-item inventory has been widely used to assess the two dimensions of Eysenck's theory. This measure contains 24 items that assess extraversion and 24 items which assess neuroticism, with these items selected based on previous factor analytic research. There are also nine

items which assess response distortion, which collectively have been dubbed the Lie scale (L).

Eysenck and S. B. G. Eysenck (1968) reported means (and standard deviations) for Form A based on 1,003 responses from American college students as 13.1 (4.1) for E, 10.9 (4.7) for N, and 3.8 (1.7) for L. Norms for varied samples from the normal population (total $\underline{n}$ = 1,931) for Form A are 12.1 (4.4) for E and 9.0 (4.8) for N (norms for the L scale are not presented for this sample). The test-retest reliability of the EPI over one year is .82 for E, and .84 for N on Form A. Eysenck and S. B. G. Eysenck (1968) briefly reviewed the extensive validity work done on the EPI, and its predecessor, the Maudsley Personality Inventory (MPI), which includes factor analytic research, and studies on the inventory's construct and concurrent validity.

Some consideration was given to the administration of the more recently published Eysenck Personality Questionnaire (EPQ; Eysenck & S. B. G. Eysenck, 1975) rather than the EPI. This particular measure was rejected for several reasons. First, the EPQ was designed to assess Eysenck's three-dimensional model of personality, which included the dimension psychoticism-impulse control (P) in addition to E and N. Gray's theory, however, is based on Eysenck's two-dimensional theory, which is not easily translatable to the three dimensional model. As Gray (1981) noted, impulsivity in this three-dimensional model loads highest on P and E, and to a lesser extent N. Thus, impulsivity would now be found within the P+, E+, N+ octant, rather than the E+ N+ quadrant. Consequently, it remains entirely unclear as to what dimension may run from the neurotic extravert quadrant to the stable introvert quadrant with the EPQ. Some researchers (e.g., Bachorowski & Newman, 1990) continue to associate the E+ N+ quadrant as assessed by the EPQ with impulsivity, although this conclusion appears unjustified at this time.

Second, the P scale has been severely criticized on conceptual and methodological grounds (Bishop, 1977; Block, 1977a, 1977b; Davis, 1974), leading to a recent revision of the P scale by the Eysencks (S. B. G. Eysenck, Eysenck, & Barrett, 1985). Conceptual concerns revolved around the issue of what the P scale actually assesses, particularly since it does not differentiate psychotics from other groups (Block, 1977a, 1977b; Davis, 1974; Eysenck & S. B. G. Eysenck, 1975). Given the relative lack of validity data on the scale and its questionable psychometric properties, as well as the concerns expressed in the preceding paragraph, it was felt that the EPI would be a better measure to employ in this study.

Anxiety. Anxiety was assessed in two ways. The trait scale of the State-Trait Anxiety Inventory, Form Y-2 (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) is a 20-item measure of "relatively stable individual differences in anxiety-proneness". Anxiety was also assessed with the Social Avoidance and Distress Scale (SADS; Watson & Friend, 1969). Whereas the STAI is purported to be a global measure of trait anxiety, the SADS is thought to be a measure of social anxiety, and thus a more narrowly defined aspect of the anxiety construct. The SADS is a 28-item, true-false scale which assesses the tendency to "avoid being with, talking to, or escaping from others" and "the reported experience of a negative emotion, such as being upset, distressed, tense, or anxious, in social interactions". This scale was included for this study as it seems to assess a number of concerns characteristically reported by persons with anxious-fearful personality disorders.

Spielberger et al. (1983) reported means (and standard deviations) of 38.3 (9.18) and 40.40 (10.15) for males (n = 324) and females (n = 531), respectively, on Form Y-2 of the State-Trait Anxiety Inventory (STAI) based on responses from introductory psychology students at the University of South Florida. Means (and standard deviations)

of 34.89 (9.19) and 34.79 (9.22) were reported for males (n = 1,387) and females (n = 451), respectively, on Form Y-2 based on responses from employees of the Federal Aviation Administration. Alpha reliability coefficients ranged from .90 to .91 across these samples. Test-retest reliability coefficients based on the responses of high school students 60 days between administrations was found to be .68 for males and .65 for females. An earlier edition of the STAI, Form Y (STAI, Form X) has been reportedly used in over 2,000 studies, and has considerable demonstrated validity (Spielberger et al., 1983). Among the validity data, Spielberger et al. (1983) presented correlations between the trait scale of Form X with the impulsivity scale of the Personality Research Form (PRF), which was found to be .35 with clients with vocational problems and .51 with clients with emotional problems (Form X and Form Y have been observed to correlate in excess of .95 with each other; Spielberger et al., 1983). These findings are somewhat divergent from previous studies which suggested that anxiety and impulsivity are orthogonal dimensions (e.g., Barratt, 1959, 1964; Kipnis, 1971).

The Social Avoidance and Distress Scale (SADS; Watson & Friend, 1969), standardized on college undergraduates, was reported to have a mean of 9.11 and a standard deviation of 8.01. Means for males and females, respectively, were 11.20 and 8.24, with males reporting significantly more social avoidance and distress. The mean item-to-total correlation for the SADS was .77, and the alpha reliability coefficient was reported to be .94. Test-retest reliability after one month was .68.

Watson and Friend (1968) conducted two experiments to test the validity of the SADS, both of which resulted in findings consistent with the constructs of social avoidance and distress, and thus providing some support for the scale's validity. Correlational studies were also conducted to assess the scale's convergent and discriminant properties. The SADS scale generally correlated significantly with constructs to which it should have

been conceptually related. Interestingly, Watson and Friend (1968) reported that the SADS scale had an insignficant correlation with the impulsivity scale of the PRF.

For this study, one item of the SADS was unintentionally duplicated while another omitted. Consequently, scores from this questionnaire are based on responses to 27 items rather than 28.

Impulsivity. Impulsivity was also assessed in two ways in the recognition that there is little consensus among researchers as to the defining features of impulsivity construct (Eysenck, 1987b). The Barratt Impulsiveness Scale, Version 10 (BIS-10; Barratt, unpublished mimeo) is a 34-item rating form where the subject is instructed to rate the degree to which a statement describes him or her, ranging from "rarely/never" to "almost always/always". Impulsiveness was also assessed using the 19-item "impulsiveness narrow" subscale of the seventh version of the Impulsiveness Questionnaire (S. B. G. Eysenck et al., 1985). This impulsiveness scale is the latest version of a previously published impulsiveness measure (S. B. G. Eysenck & Eysenck, 1977, 1978; S. B. G. Eysenck & McGurk, 1980).

The Barratt Impulsiveness Scale, Version 10 (BIS-10; Barratt, unpublished mimeo) purports to measure three components of impulsiveness (Barratt, 1985a, 1987): (a) motor impulsiveness, (b) cognitive impulsiveness, and (c) non-planning. Barratt (1987) associates the motor impulsiveness dimension with Eysenck's concept of "impulsiveness narrow", described below. Each of these components was identified via factor analysis (oblique solution), and have been demonstrated to intercorrelate moderately with one another (range: .65 to .80) and highly correlate with the total scale score (range: .87 to .91) (Barratt et al., 1987). Barratt (personal communication, August, 1990) provides normative and reliability data on the BIS-10. In one study consisting of a mixed sample of junior college students, physical plant personnel, and policemen (combined n = 300),

means (and standard deviations) of the impulsiveness substraits were found to be 15.0 (4.2) for motor impulsiveness, 16.3 (5.3) for cognitive impulsiveness, and 17.8 (4.9) for non-planning. Alpha reliabilities for these three subscales in this study were .87, .91, and .86, respectively. In another study of college students (n = 379), means (and standard deviations) of motor impulsiveness, cognitive impulsiveness, and non-planning were found to be 19.6 (5.1), 10.3 (6.1), and 16.8 (5.1), respectively.

The BIS-10 has been either described or used in several research reports (e.g., Barratt, 1985a; Barratt, Pritchard, Faulk & Brandt, 1987; Brown, Kent, Bryant, Gevedon, Campbell, Felthous, Barratt, & Rose, 1989), and has been found to be a valid measure of the impulsiveness construct (e.g., Barratt, 1985a, 1987; Barratt et al., 1987). As with previous versions of the Barratt Impulsivenes Scale (Barratt, 1959, 1965, 1971), the BIS-10 is uncorrelated with trait anxiety (Barratt, 1985a; Barratt et al., 1987).

Means (and standard deviations) of the "impulsiveness narrow" subscale of the seventh version of the Impulsiveness Questionnaire (S. B. G. Eysenck et al., 1985) were reported for two samples. In Sample 1, norms were presented for 559 males and 761 females ranging in ages from early teens to high eighties. There was a definite trend towards decreasing impulsiveness over the age range. Males' mean impulsiveness narrow scores were 6.55 (4.43), with the female mean being 7.48 (4.42). Sample 2 consisted of 383 males (mean age 25) and 206 females (mean age 28). The mean on the impulsiveness narrow scale was 8.76 (4.31) for males and 8.17 (4.44) for females. The reliability (unspecified as to method) of the impulsiveness narrow scale was .84 for males and .83 for females. Validity of this measure is restricted to correlations with other personality measures (S. B. G. Eysenck et al., 1985).

Research Sample Subjects

Subjects for the research sample were initially recruited through newspaper advertisements. These advertisements appeared in a local newspaper, entertainment weeklies, and a campus paper. The content of the advertisement which recruited impulsive individuals roughly paralleled that used by Newman et al. (1985) to recruit disinhibited subjects. A second advertisement, which roughly paralleled that for impulsive individuals, was created to recruit anxious individuals. The content of these advertisements is displayed below.

> ARE YOU ADVENTUROUS OR IMPULSIVE? Doctoral student in psychology is studying carefree persons who lead exciting, impulsive lives. If you are the type of person who is emotional, likes parties, craves excitement, takes chances, and tends to act on the spur of the moment, call Richard Farmer at the UNCG Psychology Clinic at 334-5662. Persons invited to participate in this study will earn at least $20.

> ARE YOU ANXIOUS OR INHIBITED? Doctoral student in psychology is studying conscientious persons who are shy and apprehensive. If you are the type of person who avoids social activities, feels anxious or nervous, tends to trust their judgment rather than their feelings, and has difficulty making decisions, call Richard Farmer at the UNCG Psychology Clinic at 334-5662. Persons invited to participate in this study will earn at least $20.

Persons who responded to these advertisements were informed of the study over the phone. After hearing a general description of the research, and if the subject agreed to participate, he or she was scheduled for an appointment at the UNCG Psychology Department and mailed a packet which contained a cover letter (Appendix C), consent form (Appendix D), and a number of questionnaires. Subjects were asked to complete these questionnaires prior to their appointment time. Subjects were also asked over the phone about their use of psychotropic medication. In the event that subjects reported using such

medication, they were excluded from the study in the recognition that certain drugs can alter one's characteristic response patterns to varying reinforcement contingencies (Gray, 1970, 1987b). A total of eight potential subjects were excluded during pre-screening for this reason, with an additional subject excluded after beginning a pharmacological intervention for panic disorder a few days after this initial screening but prior to participation in the study. Subjects were also excluded if they were younger than 18 years of age or older than 49 in an effort to make the participants in this study more homogeneous on this demographic variable. Although no subjects were excluded because they were younger than 18, a total of six potential subjects were excluded at pre-screening because they were older than 49. Specifics of the composition of the research sample and its configurations are reported in future sections.

Upon arrival for their appointment, subjects were greeted by the principal investigator for this study, and were again informed of the procedures which would be employed during the meeting. This included the administration of a semi-structured clinical interview and participation in a sentence construction task, followed by a debriefing session. A description of the interview as well as the questionnaires mailed to the subject is provided in a following section.

Questionnaire measures and assessment of personality disorders and traits. Prior to participation in the clinical interview and sentence construction task, subjects were mailed a variety of questionnaires to complete at their homes. These included all of the measures completed by the normative sample as well as a questionnaire which assessed personality disorder symptomatology. The latter measure was the Structured Clinical Interview for DSM-III-R Personality Disorders Screen (SCID-II Screen, Version 1.0; Spitzer, Williams, Gibbon, & First, 1990), a 113 item self-report questionnaire which asked the subject to indicate the presence or absence of personality disorder features.

From initial SCID-II Screen responses, the presence of personality disorder features were further assessed by the Structured Clinical Interview for DSM-III-R Personality Disorders (SCID-II, Version 1.0; Spitzer et al., 1990). Spitzer et al. (1990) do not explictly report reliability data on the SCID-II, other than to state that the "kappas for the SCID-II on 226 subjects were similar to the test-retest kappas reported for other personality assessment instruments" (p. 16). The only validity data to which Spitzer et al. (1990) refer regarding the SCID-II is a study done by Skodol, Rosnick, Kellman, Oldham, and Hyler (1988). Following Spitzer's (1983) suggestion of a standard for comparing diagnoses called LEAD ("longitudinal expert evaluation using all data"), Skodol et al. (1988) used the LEAD method to validate SCID-II personality disorder assessments. Subjects for this study were inpatients at a unit for persons with severe personality disorders.

As a part of their comprehensive assessment, LEAD assessors first interviewed all applicants to this unit, and once admitted, observed their behavior over an unspecified period of time. Many individuals ranging from psychiatrists to occupational therapists observed any given client's behavior. These assessors eventually met collectively in order to rate each patient on the degree of presence of each DSM-III-R personality disorder feature, with these ratings made on a four-point scale ranging from "no or very few traits" (assigned a value of 1) to "meets DSM-III-R criteria" (assigned a value of 4). The process which led to consensus judgments on ratings was not delineated in the report. Another groups of assessors administered the SCID-I (for Axis I disorders) and SCID-II (for Axis II disorders). The LEAD assessors were blind to the patients' SCID diagnoses.

Results from this study indicated that most patients had several personality disorder diagnoses. On the average, 4.1 personality disorder diagnoses were made for each patient using the LEAD method, and 4.6 for the SCID-II. Unfortunately, these researchers do not

present kappa coefficients which index the degree of agreement exceeding chance between these two assessment approaches (they do, however, present their raw data and indices of what they term to be "predictive power"). Using their data, however, kappas were computed by the present writer for what appeared to be the two disorders which evidenced the most agreement and disagreement between the two methods. The two disorders where agreement appeared to be best were antisocial and schizotypal, which were computed to have kappa coefficients of .81 and .69, respectively. The disorders which appeared to result in the greatest disagreement were narcissistic and compulsive, which were computed to have kappa coefficients of .07 and .30, respectively. A glance at the remainder of the data suggests that overall agreement between these two methods of assessment was generally low. Agreement between the SCID-II and the Personality Disorder Examination (PDE), another semi-structured clinical interview for assessing personality disorders, was also found to be relatively poor (Skodol, Rosnick, Kellman, Oldham, & Hyler, 1991), although the investigators in this particular study expressed their view that the SCID-II proved to be slightly better than the PDE "for all disorders diagnosed with reasonable accuracy" (p. 60).

Twenty-five percent ($\underline{n}$ = 19) of all subject interviews were recorded for inter-diagnostic reliability purposes. Validity was indirectly assessed via correlations with measures hypothesized to correlate with the personality disorder features (e.g., measures of anxiety, impulsivity, introversion, and extraversion) as well as with personality disorder dimensional scores. A factor analysis was also performed on the intercorrelation matrix of the percent of personality disorder features present for each of the eight disorders from the anxious-fearful and erratic-dramatic clusters as assessed by the SCID-II. Given that similar factor analytic studies reported in the literature (Hyler & Lyons, 1988; Kass et al., 1985) have found good correspondence between the DSM-III-R personality disorder clusters and

the results of factor analyses of the intercorrelation matricies of personality disorder features, this was also expected for the results from the SCID-II assessments from this study.

Experimental task. The experimental task for the research sample was similar to the operant conditioning task employed by Taffel (1955). The purpose of this task was to clarify the association between DSM-III-R personality disorders and learning under varying reinforcement contingencies. Stimuli to which subjects responded were 80 3 x 5 index cards, all of which displayed a verb on the center of the card, with a row of six pronouns (i.e., I, we, she , he, they, and you) typed along the lower left hand corner. Verbs for inclusion in this task were selected if they (a) could be used in conjuction with each of the pronouns, and (b) were frequently appearing words in the written English language (Francis & Kucera, 1982). The six pronouns typed along the lower left-hand corner of the card were randomly arranged across cards.

Once presented with the cards, the subjects' task was to construct a sentence, using any one of the six pronouns as the first word of the sentence in conjunction with the verb typed in the center of the card. Subjects received either reward (i.e., the awarding of money and verbal praise), punishment (i.e., the removal of money and verbal punishment), or neither reward nor punishment (i.e., no response) depending on their response to the stimulus card.

Taffel's (1955) verbal operant conditioning task has been the subject of some debate over the years. Whereas Taffel (1955) has asserted that changes in the rate of behavior during the Taffel task are the result of operant conditioning, others have suggested that changes in the rate of behavior are directly due to awareness of response-consequence relations (e.g., Spielberger & DeNike, 1966; Spielberger, Levin, & Shepard, 1962) or hypotheses about such relations (Dulany, 1961). As a result of the uncertainty surrounding

which mechanisms are responsible for behavior change during the Taffel task, some thought was given to using alternative human operant laboratory procedures which may be unaffected by awareness or hypothesis generation. The idea of using such alternative procedures was rejected, however, as it remains unclear if awareness underlies most or all of the effects observed on operant conditioning tasks (e.g., Bandura, 1977). Furthermore, the exact mechanisms which result in behavior change during the Taffel task are not of a concern of this research. Whether the mechanism responsible for behavior change is conditioning, awareness, or hypothesis testing is irrelevant for Gray's theory. The predictions set forth in this study would be the same for each of these possible mechanisms. Nonetheless, upon the conclusion of the experimental task, subjects were interviewed in order to determine if they had knowledge of response-consequence relations. Those who evidenced awareness of these relations were later compared with those who expressed no awareness in order to determine if knowledge of the behavioral contingencies covaried with behavior change. The interview used to assess knowledge of response-consequence relations was based on a modification of the interview employed by Levin (1961) (a copy of this interview can be found in Appendix E). Data from these interviews may suggest mechanisms which influenced responding during the experimental task. In the text which follows, the term "learning" will be employed to describe that which is expected to occur during the Taffel task, although it is recognized that this explanation of the behavior change observed during this task remains a source of controversy.

Experimental Design

Independent variables. When research sample subject groups were defined using the categorical approach, two independent variables were employed in a 3 (personality

disorder cluster) by 3 (conditioning block) mixed design. The personality disorder cluster ("anxious-fearful" vs. "erratic-dramatic" vs no personality disorder) variable was the between subjects factor, and the conditioning block (Block 2, Block 3, Block 4) variable the within subject factor. When subjects were defined in terms of dimensional groupings, the only difference from that described above were the number of subject groups, of which there were four (subsequently labeled as "STABLE", "Impulsive without Anxiety" [IMP/NO ANX], "Anxious without Impulsivity" [ANX/NO IMP], and NEUROTIC). Methods for defining subject groups according to the categorical and dimensional approaches are described in the Procedures section.

Dependent variable. The main dependent variable was the number of times that subjects used pronouns which were rewarded, punished, and neither rewarded nor punished (i.e., non-consequated) in each of the conditioning blocks. Prior to the subjects' participation in the experiment, two pronouns were identified as rewarded pronouns (e.g., "I" and "we"), two were identified as punished pronouns (e.g., "he" and "she"), and two were identified as non-consequated pronouns (e.g., "you" and "they"). The pronoun pairs which were rewarded, punished, or non-consequated were randomized across subjects.

For each conditioning block (defined as a block of 20 reinforced trials), each subject received three scores: (a) the number of times rewarded words were used (adjusted for baseline use), (b) the number of times punished words were used (adjusted for baseline use), and (c) the number of times non-consequated words were used (adjusted for baseline use). For example, if during baseline, the subject used the two pronouns which were subsequently rewarded 7 times and in the final conditioning block used these words 15 times, the subjects conditioning score for rewarded pronouns in the final conditioning block was +8. These scores yield an index of the degree of conditioning which took place

as a result of exposure to the varying reinforcement contingencies during conditioning trials (Gupta & Nagpal, 1978).

Procedures

Assessment of personality disorders and personality disorder features. The presence of personality disorders and personality disorder features for the research sample was assessed via the Structured Clinical Interview for DSM-III-R Personality Disorders (SCID-II, Version 1.0; Spitzer, Williams, Gibbon, & First, 1990). Subjects first completed the SCID-II Screen at their homes prior to the interview. If the subject indicated that the inquired symptom on the questionnaire was present, that symptom was later assessed in greater detail with the SCID-II interview. Based on subject's responses to interview questions, the interviewer would make ratings based on the degree to which the symptom was present. For any given symptom, a rating of 1 was made if the symptom was absent, 2 if the symptom was present but subthreshold (i.e., present but not to a significant degree), and 3 if the symptom was present to a clinically significant degree. A copy of the SCID-II coding sheet on which these ratings were made is included in Appendix F.

From these data, the interviewer subsequently determined (a) the presence or absence of personality disorders (or diagnostic category) according to the decision rules described by Spitzer et al. (1990), with these judgments used to determine the categorical grouping of subjects, and (b) the proportion of symptoms within each disorder which were present, used to define the dimensional grouping of subjects. Proportions were determined by assigning a value of 1 to a symptom which was fully present, 0.5 to a symptom that was partially present or subthreshold, and 0 to a symptom that was absent. To arrive at percentages (or dimensional scores) for individual personality disorders, values

corresponding to a single disorder were summed and then divided by the total number of possible symptoms present for that disorder. For example, if a given subject were determined to have four of the symptoms of dependent personality disorder fully present, three partially present, and the remaining two absent, that person would receive a dimensional score of .56 for that disorder (i.e., [4(1) + 3(.5) + 2(0)]/9). Similarly, to compute the dimensional score for a given personality disorder cluster, the dimensional scores corresponding to each of the personality disorders within a cluster were summed, and then divided by the number of disorders within that cluster. If, then, a given subject had a dimensional score of .34 on avoidant personality disorder, .50 on dependent personality disorder, .67 on obsessive-compulsive personality disorder, and .17 on passive-aggressive personality disorder, that subject's dimensional score for the anxious-fearful dimension would be .42 (i.e., [.34 + .50 + .67 + .17]/4). Both diagnostic categories and dimensional scores are employed in the analyses which follow in the recognition of the strengths and limitations inherent in each descriptive approach (e.g., Frances, 1980; Widiger & Francis, 1985).

Subject groupings. For analyzing Taffel task data and testing structural relations within Gray's model, subjects were categorized for group membership according to the types of personality disorders or personality disorder traits they exhibited. With the categorical method of classification, subject groups were defined as follows. In the event that at least one personality disorder was diagnosed, subjects were considered for assignment to either the erratic-dramatic or anxious-fearful group based on the relative proportion of personality disorders evident from the three orthogonal personality disorder clusters (those who evidenced no personality disorders were placed within a separate group). Two of the personality disorder clusters, anxious-fearful and erratic-dramatic, each contain four personality disorders. The odd-eccentric cluster, which is comprised of

paranoid, schizotypal, and schizoid disorders, contains three personality disorders. If, for example, a subject had two anxious-fearful disorders, one erratic-dramatic disorder, and one odd-eccentric disorder, that subject, according to the percentage method employed here, would be included in the anxious-fearful group, as the percentage of personality disorders present across the three clusters would be 50%, 25%, and 33%, respectively, as anxious-fearful concerns in this example are predominant when plotted in three dimensional space. With this categorical approach, subjects were excluded from analysis if (a) they only evidenced personality disorders from the odd-eccentric cluster (of which there were 2), (b) had a greater proportion of odd-eccentric disorders relative to the anxious-fearful or erratic-dramatic disorders (of which there were 7), and (c) had equal proportions of anxious-fearful and erratic-dramatic disorders (of which there were 2). As a result of these criteria, there were 20 subjects in the anxious-fearful category, 20 subjects in the erratic-dramatic category, and 26 subjects in the no personality disorder group.

With the dimensional method of classification, all 77 subjects from the research sample were assigned to groups as follows. A factor analysis was first performed on the correlation matrix of dimensional scores for each of the eight personality disorders from the anxious-fearful and erratic-dramatic clusters. Each subject in the research sample, then, contributed eight scores to the analysis, one for each of the personality disorders within the anxious-fearful and erratic-dramatic clusters. Given previous research (e.g., Hyler & Lyons, 1985; Kass et al., 1985), it was anticipated (and subsequently confirmed) that one factor would generally correspond to the anxious-fearful disorders and another would correspond to the erratic-dramatic disorders. Factor scores from this analysis were then split at the medians, resulting in four groups defined in terms of their relative proportions of anxious-fearful and erratic-dramatic disorder symptoms. All subjects in the research sample ($n = 77$), regardless of their category membership, were included in this sample

configuration. The resulting four groups, after an inspection of their defining features, were labeled STABLE (n = 20), impulsive without anxiety (IMP/NO ANX; n = 18), anxious without impulsivity (ANX/NO IMP; n = 19), and NEUROTIC (n = 20).

Experimental task. In all cases, participation in the experimental task followed the administration of the SCID-II diagnostic interview. After a brief period following the interview (about 5 minutes), the subject was introduced to the experimenter for the Taffel task. The experimenter for this task was someone different from the interviewer and was in all instances a female in the recognition that experimenter gender may be a variable moderating performance during this task (Gupta, 1976). The experimenters for this portion of the study, who were graduate and undergraduate college students, were blind to the findings from the diagnostic interview.

The experimental task for this study was a verbal operant conditioning task similar to that employed by Taffel (1955). Eighty 3 x 5 index cards were prepared, all of which contained a verb typewritten in the center of an unlined card, with a row of six pronouns (i.e., I, we, she , he, they, and you) typed along the lower left hand corner. The order of the pronouns was randomized across cards. Once presented with the cards, the subjects' task was to construct a sentence, using any one of the six pronouns as the first word of the sentence. Beginning with the twenty-first card and depending on which pronouns they used in the construction of their sentences, subjects were either rewarded (i.e., the word "good" spoken in a natural tone along with presentation of 10¢ which was placed next to the subject), punished (i.e., the phrase "not good" spoken in a natural tone and the removal of 10¢ from a pile of dimes placed next to the subject), or will be simply be told "next." Pronouns which were rewarded, punished, or not consequated were randomly varied across subjects.

Subjects were instructed in advance that during some trials, they may receive 10¢ from the experimenter for each instance of "correct" responding, and that such a reward will be made immediately after a "correct" response is made. They were further told that they may occasionally lose one dime for each instance of "incorrect" responding, and that a dime would be removed from the pile immediately after an "incorrect" response is made. It was also noted to the subject that on some trials there would be no reaction from the experimenter as to the "correctness" or "incorrectness" of their responses (i.e., dimes would not be awarded nor removed). They were further notified that they would be able to keep whatever dimes remain upon the conclusion of the experimental task. Each subject began the experimental task with 30 dimes. The instructions for this task as read by the experimenter to the subject are contained in Appendix G.

The 80 trials were divided into four blocks of 20. During the first block, the subjects' use of the six pronouns was simply recorded and not reinforced. This was done in order to establish the subjects' baseline level of the use of these words. The next three blocks were conditioning blocks, where the subjects' use of the rewarded words (e.g., "I" or "we") and punished words (e.g., "he" and "she") were consequated with either the presentation of dime of the removal of a dime. Non-consequated words (e.g., "you" and "they") were not reinforced. Pronoun pairs associated with reward, punishment, or behavioral non-consequence were randomized across subjects.

Debriefing. Following the completion of the experiment, subjects were provided with a debriefing form (Appendix H) to read. This form was supplemented with a full verbal explanation of the rationale and hypotheses associated with the study in which they participated. Questions regarding the study were solicited, and once it was determined that no questions remained, subjects were thanked and dismissed.

CHAPTER III

RESULTS

Overview of Organization of Results Section

For purposes of clarity, multivariate and behavioral findings from this study are presented separately for each sample. Discussion of the results begins with a description of questionnaire data and multivariate findings from the normative sample. This subsection is then followed by a presentation of multivariate and behavioral findings for the research sample, with findings from the ungrouped configuration of the research sample presented first, followed by those for the categorical configuration of research sample subjects, and finally the those pertaining to the dimensional configuration of these subjects. Within each configuration of the research sample, descriptive and multivariate findings are presented first, followed by results from the behavioral (i.e., Taffel) task.

Normative Sample

Overview

As previously noted, the normative sample of 477 university undergraduates (176 males, 299 females, 2 failed to indicate gender) was employed to reference data from the research sample as well as to evaluate some of the basic assumptions of Gray's theory, specifically the placement of the dimensions of anxiety and impulsivity within Eysenck's two dimensional space. The latter analysis is novel in that it is the first to evaluate the location of both the dimensions of anxiety and impulsivity within a single, large normative sample.

Descriptive Sample Statistics

Table 3 presents the means and standard deviations of the normative sample for each of the main dependent measures. These include a measure of introversion-extraversion and neuroticism-stability, as well as two measures of anxiety and two measures of impulsivity. The number of subjects for each of these measures varies slightly due to incomplete or unusable responding. Means and standard deviations presented in Table 3 are not greatly deviant from those reported by these measures' authors. Also displayed for illustrative purposes are the sample means and standard deviations for these measures once z-transformations of scores have been performed. Finally, this table presents two composite scores, one for the two anxiety measures and one for the two impulsivity measures. Each of these composite scores was computed by separately summing the z-scores for two scales corresponding to the constructs of anxiety and impulsivity, and then dividing by two. These two composites (ANX and IMP) were computed following an examination of the skewness of the distribution scores for the each of the measures of anxiety and impulsivity, where it was determined that none of these distributions evidenced a substantial skew (i.e., $-1.0 < \text{skew} < +1.0$). These composite scores have features similar to that of z-scores, as means for both of these composites were 0.00 with standard deviations near 1.0 (standard deviations: 0.87 for ANX, 0.94 for IMP). Raw scores for these composites are not presented in Table 3 as such scores would be meaningless given the differences in the range of scores for each measure contributing to the composite.

Table 4 presents the inter-correlations of the z-scores for each of the dependent measures. As expected, the dimension of introversion-extraversion and and neuroticism-stability failed to substantially correlate ($r = -.12$), confirming the orthogonality of these

dimensions. Also as expected, the anxiety measures tended to correlate highly with one another, as did the impulsivity measures. Similarly, anxiety tended to negatively correlate with extraversion and positively with neuroticism, and impulsivity positively correlated with both extraversion and neuroticism. Somewhat unexpectedly, one of the measures of anxiety (the State-Trait Anxiety Inventory, Trait Scale) evidenced moderately low (rs = .30 and .36) correlations with the two impulsivity measures (the other measure of anxiety, the Social Avoidance and Distress scale, was uncorrelated with measures of impulsivity, as expected). One possible explanation for this finding is that this scale may actually be a better measure of neuroticism, as it contains a number of items which appear to tap emotions other than anxiety (e.g., "I am happy", "I feel like a failure", "I feel pleasant").

The Placement of Anxiety and Impulsivity Dimensions within Eysenck's Two Dimensional Model

The purpose of this analysis was to further clarify the placement of the dimensions of anxiety and impulsivity within Eysenck's dimensional model of personality. For this analysis, subjects who represented the upper and lower quartiles on the measures of anxiety and impulsivity were identified. These subject groups were then plotted within the dimensions of introversion-extraversion and neuroticism-stability, with the axes of these dimensions defined in terms of z-scores (Figure 2). Each point within this plot represents about 120 subjects. The results from this analysis generally support Gray's hypothetical placement of anxiety and impulsivity within Eysenck's two dimensional model. The anxiety dimension, as indexed by the line corresponding to the anxiety composite, bisects the introvered-neurotic and extraverted-stable quadrants at approximately 60°, a finding remarkably similar to those reviewed in Gray (1970). The impulsivity dimension, as indexed by the line corresponding to the impulsivity composite, bisects the extraverted-

neurotic and introverted-stable quadrants at approximately 40°, a finding quite similar to that reported in S. B. G. Eysenck and Eysenck (1969). The placement of these dimensions further illustrates the small positive correlations that anxiety and impulsivity composite scores have in this sample, as their positions are not orthogonal (90°) but are instead somewhat less than that (about 80°).

Research Sample: All Subjects

Overview

The research sample consists of persons who responded to newspaper advertisements soliciting persons who viewed themselves as being either anxious and inhibited or impulsive and adventurous. All of these subjects (a) filled out a number of questionnaires, the same ones to which the normative sample responded, (b) completed the SCID-II questionnaire and diagnostic interview, and (c) participated in a verbal operant conditioning task (i.e., the Taffel task). The purpose of this sample was to further evaluate some of the basic assumptions of Gray's theory, as well as to test the applicability of eight of the eleven personality disorders to Gray's model.

Descriptive Sample Statistics

Subject demographics. A total of 77 subjects (35 males, 42 females) comprised the research sample. The mean age for this sample is 25.78 (SD = 8.09).

Questionnaire data. Table 5 presents sample statistics for each of the main dependent measures for the entire research sample. Two types of statistics are presented: (a) means and standard deviations based on untransformed raw scores, and (b) means and standard deviations when raw scores are transformed with reference to the means and

standard deviations from the normative sample. The latter statistics are expressed in terms of standard deviation units, and indicate what the subjects' z-scores on each of the measures would be if they were imbedded within the normative sample. An examination of these values indicate that the means across measures deviate substantially from zero (or from the 50th percentile for the normative sample). Rather, most of these means for the research sample generally correspond to about the 70th percentile based on normative sample statistics. This finding suggests that it would be misleading to interpret the research sample's scores on these measures in isolation. As a consequence, future analyses involving the dependent measures listed in Table 5 will utilize z-score values rather than raw, untransformed scale scores.

Intercorrelations of dependent measures. As with the normative sample, intercorrelations among the dependent measures were computed for the research sample. All subjects were included in this analysis ($n = 77$). Patterns of correlation magnitude are generally quite similar to those reported for the normative sample (Table 6). One difference is found in the magnitude of correlations between impulsivity and neuroticism, which are somewhat lower in the research sample, and are not significantly different from zero. Conversely, the correlations between impulsivity and extraversion are substantially larger in magnitude. The correlations with anxiety and neuroticism are about the same, although the negative correlations between anxiety and extraversion tended to be somewhat larger. Finally, the State-Trait Anxiety Inventory, Trait Scale, evidenced zero order correlations with all impulsivity measures in the research sample, whereas these correlations were moderately low (around .33) in the normative sample. The Social Avoidance and Distress Scale, which had no correlation with measures of impulsivity in the normative sample, evidenced moderately low negative correlations (between -.36 and -.41) with the impulsivity measures in the research sample.

The above findings, taken together, suggest that the axes corresponding to the dimensions of anxiety and impulsivity largely maintained the orientation observed in the normative sample, with slight rotations. Whereas the anxiety and impulsivity dimensions evidenced moderately low positive correlations in the normative sample for the most part, they tended to evidence moderately low negative correlations in the research sample. The impulsivity axis in the research sample is now closer to the extraversion dimension and father away from neuroticism dimension than previously observed in the normative sample. Similarly, the anxiety dimension is somewhat closer to the introversion dimension and father away from the neuroticism dimension, such that it bisects the introverted-neurotic quadrant at approximately a 45° angle. The nature of the position of the axes corresponding to the anxiety and impulsivity dimensions will be further evaluated later in this report through an examination of the location of the subject groups within the two dimensional model.

Reliability of Personality Disorder and Personality Disorder Feature Assessment

Twenty-five percent of all SCID-II interviews (n = 19) were reassessed by a second rater for purposes of establishing inter-rater reliability. The second rater, an advanced graduate student in clinical psychology, rated subjects' responses to interview questions from audiotapes. This rater also made a number of judgments about the subjects' behavior (e.g., odd or impressionistic speech; inappropriate, labile, or constricted affect) during the interview for behaviors which directly pertained to personality disorder symptomatology. Finally, this second rater also made judgments as to the presence or absence of individual personality disorders.

Table 7 presents kappa coefficients which index the degree of agreement between the two raters as to the presence or absence of the personality disorders once the effects of

chance agreement have been statisitically removed. Coefficients are presented for (a) the presence or absence of all disorders, and (b) the presence or absence of individual personality disorders. Table 7 also presents kappa coefficients for ratings of individual personality disorder symptoms. Symptoms were rated as either 1, 2, or 3, depending on if the symptom was judged to be absent, partially present but subthreshold, or present to a clinically significant degree, respectively (see Appendix F for a copy of the form on which ratings were made). Agreement on dimensional scores for individual personality disorders was also assessed via Pearson correlations, where summary dimensional scores obtained by one rater were correlated with those obtained by the other (Table 7).

Overall, reliability was generally quite good to excellent across both interviewers. Across all personality disorders, the kappa value for the presence or absence for all personality disorders was .89. The kappa value for agreement among individual personality disorder symptoms was .65. Finally, the correlation indexing the degree of agreement for summary dimensional scores across all of the personality disorders was .93. There were, however, a couple of disorders which evidenced lower than average reliability, both from the odd-eccentric cluster. The attenuated reliability coefficients for schizoid personality disorder are primarily the result of a restriction in range of manifest symptomatology, and are actually a bit better than they appear. For this particular disorder, (a) both raters agreed across all reliability assessments ($\underline{n}$ = 19) that the disorder was absent, (b) both raters agreed exactly on their individual symptom ratings 73% of the time, and (c) dimensional scores as derived by both raters were exactly the same on 11 of 19 interviews (58%). The relatively poor reliability for schizotypal personality disorder is primarily the result of this disorder having a higher proportion of observational items than other disorders. Of the nine symptoms comprising this disorder, three (33%) are judged by raters after considering the range of the subject's behavior during the interview. Such

items require a greater level of interference from the rater. Furthermore, since reliabilities were done from audiotapes, the second assessor was not exposed to the full range of behavior demonstrated by the subject during the interview, making judgments of observational items more difficult.

The relatively poor reliabilities for the two of the odd-eccentric disorders does not compromise the validity of this study, as these disorders were only utilized in this reseach to exclude subjects from group membership when the categorical grouping method was employed. Additionally, even though these disorders were relatively low in their reliability for this study, the reliability values reported here for these particular disorders are similar to those reported in other published studies for the full range of Axis II disorders (e.g., Mellsop, Varghese, Joshua, & Hicks, 1982; Shea, Glass, Pilkonis, Watkins, & Docherty, 1987; Spitzer, Forman & Nee, 1979). As such, the reliability values for all personality disorders and personality disorder traits assessed in this study substantially exceed those typically reported in the literature.

Frequency of Personality Disorder Diagnoses

Table 8 presents the frequency counts for each of the individual personality disorders present in the entire sample as determined by the principle diagnostic interviewer, an advanced student in clinical psychology. Also displayed are percentages which correspond to the proportion of times that individual personality disorders occurred with reference to the total number of personality disorder diagnoses across subjects (n = 133). The average number of personality disorders diagnosed among those with any personality disorder (n = 51) was 2.61. As Table 8 indicates, all of the personality disorders, with the exception of schizoid, were well represented in this research sample.

Correlations of Personality Disorder Dimensional Scores with Introversion-Extraversion, Neuroticism-Stability, Impulsivity, and Anxiety

Table 9 presents correlations among anxious-fearful and erratic-dramatic personality disorder dimensional scores (i.e., trait scores) with measures of introversion-extraversion (EPI-E), neuroticism-stability (EPI-N) and the composite measures of impulsivity and anxiety (IMP and ANX, respectively). Generally, the table shows that the anxious-fearful dimensional scores tended to moderately or highly correlate with anxiety and neuroticism, have small or zero-order correlations with impulsivity, and show negative correlations with extraversion. Similarly, erratic-dramatic disorders tended to correlate moderately with impulsivity and neuroticism, small correlations with anxiety, and moderate positive correlations with extraversion. Some exceptions are noted, however. Dependent, passive-aggressive, and borderline traits evidenced only small correlations with extraversion. The antisocial trait evidenced a near zero correlation with neuroticism, and the borderline trait had about equal correlations with anxiety and impulsivity ($p > .05$; Fisher's Z transformation comparison). Analyses presented below and in other sections, however, suggest that at the level of personality disorder (as opposed to the trait level), these disorders evidence all of the predicted hypothesized relations among the constructs examined in this section.

Placement of Personality Disorders within Eysenck's Two Dimensional Space

This analysis examined the location of each of the eight individual personality disorders from the anxious-fearful and erratic-dramatic clusters (Figure 3). All subjects who were diagnosed with a personality disorder ($n = 51$ minus 2 who were diagnosed with only odd-eccentric disorders; $n = 49$ total) were included in this figure. As some individuals had more than one personality disorder, the location of two or more points can

be influenced by a single individual. The results presented in Figure 3 indicate that those personality disorders which belong to the anxious-fearful cluster (i.e., avoidant [AVD; n = 13], dependent [DEP; n = 9], obsessive-compulsive [COM; n = 17], and passive-aggressive [PAG; n = 12]) all fell within the neurotic-introvert quadrant, as expected. Similarly, those personality disorders which belong to the erratic-dramatic cluster (i.e., histrionic [HST, n = 11], narcissistic [NAR; n = 17], borderline [BRD, n = 18], and antisocial [ANT; n = 8]) all fell within the extraverted-neurotic quadrant, as expected.

Factor Analysis of Personality Disorder Dimensional Scores

Previous factor analytic work of dimensional personality disorder ratings has supported the validity of the personality disorder clusters (Hyler & Lyons, 1985; Kass et al., 1985). This present study also assumes that the personality disorder clusters are valid, with this assumption perhaps being most evident in the two methods selected for configuring subject groups (categorical and dimensional, as described in future sections). To test this assumption in the context of this research, the dimensional scores for the eight personality disorders comprising the anxious-fearful and erratic-dramatic clusters were submitted to a factor analysis with varimax (orthogonal) rotation. Dimensional scores for all subjects who were interviewed were included (n = 77). Table 10 presents the findings from this analysis.

As indicated in Table 10, two factors were identified with eigenvalues greater than or equal to 1.0. Together, these factors accounted for 67% of the variation in personality disorder dimensional scores. Factor 1 (eigenvalue = 3.55) largely consisted of personality disorders from the erratic-dramatic cluster. Loadings for the four personality disorders from this cluster ranged from .70 (antisocial) to .83 (narcissistic). Factor 2 (eigenvalue = 1.82) was largely defined by personality disorders from the anxious-fearful cluster, with

loadings for the four personality disorders from this cluster ranging between .64 (passive-aggressive) to .85 (avoidant). Figure 4 illustrates a plot of the eight personality disorder traits as referenced to the dimensions corresponding to Factor 1 and Factor 2. These findings provide additional support for the validity of subject groupings for this particular study.

Underlying constructs of the personality disorder factors. Two critical assumptions guiding this research are that the experience of anxiety underlies the anxious-fearful cluster dimension and that the experience of impulsivity underlies the erratic-dramatic cluster dimension. These assumptions were strongly supported in previous analyses. This analysis is different from those mentioned in that it attempts to identify the constructs which describe the two personality disorder factors which emerged from the factor analysis of personality disorder dimensional scores, as previously described.

Factor scores emerging from the factor analysis presented in a previous section were correlated with anxiety and impulsivity measures (Table 11). Factor 1 (largely corresponding to the erratic-dramatic cluster) was found to correlate .68 with the impulsivity composite measure (IMP) and only -.01 with the composite anxiety measure (ANX). Conversely, Factor 2 (largely corresponding to the anxious-fearful cluster) was found to correlate .83 with ANX and only -.25 with IMP. To evaluate the findings further, reference is made to Table 4 where, for the normative sample, correlations between measures purported to assess similar constructs were about the same or smaller than those obtained between the factor scores and the anxiety and impulsivity composite measures. For example, the State-Trait Anxiety Inventory and the Social Avoidance and Distress Scale were found to only correlate .51 with one another. The correlation obtained in the research sample between Factor 2 scores and ANX, in comparison, was significantly larger ($p < .05$; Fisher's Z transformation comparison). Similarly, the Eysenck Impulsiveness Scale

and the Barratt Impulsiveness Scale correlated .76 with one another in the normative sample, a correlation which is no different ($p > .05$; Fisher's Z transformation comparison) than that obtained between Factor 2 scores and IMP with the research sample.

Factor scores were also correlated with introversion-extraversion (EPI-E) and neuroticism-stability scores (EPI-N) (Table 11). Inspection of this table illustrates that these factor scores generally evidenced moderate correlations with these constructs. These correlations are of similar magnitude to those reported between IMP, EPI-E and EPI-N as well as ANX, EPI-E and EPI-N in the normative sample (Table 4). Additional findings, presented in a future section, provide added support to the notion that Factor 1 is primarily corresponds to impulsivity and Factor 2 to anxiety.

Performance on Verbal Conditioning Task

A number of analyses, presented below, were performed in order to determine the impact that the administration of reward and punishment, as well as non-consequation of responses, had on the use of words associated with each of these contingencies across the duration of the verbal conditioning task. The chief aims of the analyses presented below were (a) to evaluate the effectiveness of each of the contingencies in producing behavior change in expected directions, and (b) to determine if awareness of response-consequence relations produced greater behavioral change as compared to occasions when such awareness was not apparent. All subjects from the research sample (ungrouped; $n = 77$) were included in these analyses.

To evaluate the change in behavior as a function of time (i.e., blocks of trials) for each of the three contingencies, a within subjects' ANOVA was performed, with conditioning block (three levels: Block 2, Block 3 and Block 4) serving as the within subjects' factor. Block 1 was not used in this analysis or in subsequent analyses, as this

was the baseline block (described in the method section), where subjects' baseline use of words was assessed before behavioral contingencies became operative. Scores for this block of trials were used to compute the "conditioning score" for each of the subsequent blocks. The reader is referred to the method section for a more detailed description of the rationale and computation of the conditioning score.

When univariate F statistics were found to be significant, post-hoc comparisons using Bonferroni (Dunn) paired t-tests (Toothaker, 1991) were employed for evaluating the significance among differences in means.

Rewarded words. A univariate ANOVA (with Greenhouse-Geisser correction) revealed that the effect for block was highly significant, $F(1,76) = 15.28$, $p < .0001$ (Table 12a). A comparison of means (Table 12b) indicates that the use of rewarded words increased across trial blocks when referenced to their use during the baseline phase (difference score means: Block 2 = 1.99, Block 3 = 2.94, Block 4 = 4.47), indicating that the manipulation had its intended effect. Bonferroni paired t-tests, with the critical alpha level adjusted for the number of comparisons made (number of comparisons = 3; critical alpha = .017), indicated that the difference in means between Block 2 and Block 3 just failed to reach statistical significance ($p = .03$). However, the difference between Blocks 2 and 4 as well as between Blocks 3 and 4 were found to be significantly different (both at $p < .0001$). A pictorial summary of these relations can be found in Figure 5.

Punished words. A similar analysis to that presented above was conducted for the frequency of use of punished words across blocks of 20 trials. A univariate ANOVA (with Greenhouse-Geisser correction) revealed a highly significant effect for block, $F(1,76) = 7.10$, $p < .002$ (Table 13a). As expected, punished words were less frequently used by all subjects across conditioning blocks (mean difference scores: Block 2 = -0.95, Block 3 = -1.69, Block 4 = -2.12) (Table 13b). Bonferroni paired t-tests indicated, with the critical

alpha level adjusted for the number of comparisons made (number of comparisons = 3; critical alpha = .017), indicated that the difference in means between Block 2 and Block 3 reached statistical significance (p = .016), as did the difference between Blocks 2 and 4 (p = .002). The difference between Blocks 3 and 4 failed to reach conventional levels of significance (p = .12). A pictorial summary of these relations can be found in Figure 5.

Non-Consequated words. As with punished words, non-consequated words were also expected to decrease across trial blocks for all subjects. The results from a univariate ANOVA (with Greenhouse-Geisser correction), F (1, 76) = 8.96, p < .0004 (Table 14a) revealed a significant effect for block. Non-consequated words evidenced a decrease in their frequency of use across trial blocks (mean difference scores: Block 2 = -1.04, Block 3 = -1.25, Block 4 = -2.35). Bonferroni paired t-tests (Table 14b), with the critical alpha level adjusted for the number of comparisons made (number of comparisons = 3; critical alpha = .017), indicated that the difference in means between Block 2 and Block 3 failed to reach statistical significance (p = .54). However, the difference between Blocks 2 and 4 (p = .0009) and between Blocks 3 and 4 reached conventional levels of significance (p < .0001). A pictorial summary of these relations can be found in Figure 5.

Effects of awareness on responding. Previous research (Speilberger & DeNike, 1966; Speilberger et al., 1962) has suggested that behavior change observed during verbal operant conditioning tasks is due to awareness of response-consequence relations. After subjects participated in the Taffel task, they were interviewed in order to establish their level of awarenss of such relations (Appendix E). If a subject evidenced any awareness of response-consequence relations of any of the contingencies employed in the experimental task, they were categorized as "aware". Those who were unable to verbalize any of the contingencies were categorized as "unaware".

Of the 77 subjects who participated in the Taffel task, 34 (44%) indicated some awareness of response-consequence relations. An examination of Figures 6, 7 and 8 shows knowledge of such contingencies produced the most dramatic changes in behavior of rewarded, punished, and non-consequated words, respectively. In contrast, those who were categorized as "unaware" showed little, if any, change in behavior over time. One important question explored in future sections is the extent to which subjects from different groups showed varying levels of awareness of response-consequence relations during the operant conditioning task and, similarly, if there was any indication of a group by response type (reward, punish, non-consequence) interaction.

Research Sample: Categorical Group Configuration

Overview

The DSM system utilizes a categorical approach to defining personality disorders. In keeping with this tradition, a categorical approach to defining subjects groups was employed for this portion of the study. Categorization was done at the superordinate, or cluster, level as opposed to categorization at the basic, or individual personality disorder, level. DSM-III and DSM-III-R each recognize that the eleven personality disorders fall into three broad, roughly independent clusters (the anxious-fearful cluster, the erratic-dramatic cluster, and the odd-eccentric cluster).

For this portion of the study, three categorical subject groups (anxious-fearful [AF], erratic-dramatic [ED], no personality disorder [NO PD]) were derived as follows. If a subject failed to receive any personality disorder diagnosis, he or she was assigned to the no personality disorder group. Subjects who were diagnosed with at least one personality

disorder were assigned to group membership (anxious-fearful or erratic-dramatic) if a subject evidenced a greater proportion of personality disorders from one of these clusters than the other. Subjects with personality disorders were excluded from analyses in this section if he or she either (a) evidenced a greater proportion of odd-eccentric disorders than either anxious-fearful or erratic-dramatic disorders, and (b) if the proportions of anxious-fearful and erratic-dramatic disorders present were equal. Eleven subjects of the 77 potential subjects were excluded from analyses presented in this section because of their failure to meet these selection criteria.

Descriptive Sample Statistics

Subject Demographics. A total of 66 subjects (31 males, 35 females) were retained for inclusion in the analyses presented in this section. Of these, 20 were assigned to the anxious-fearful cluster (AF), 20 to the erratic-dramatic cluster (ED), and 26 to the no personality disorder control group (NO PD). The average age for subjects across these three groups was 26.09. A chi-square analysis (Table 15) revealed no significant difference in the distribution of gender among the three subject groups, $\underline{X}^2$ (2) = 2.15, $\underline{p}$ = .34. Similarly, a one-way analysis of variance (ANOVA) (Table 16) indicated no significant differences in age across the three groups, $\underline{F}$ (2, 63) = 1.42, $\underline{p}$ = .25.

Questionnaire data. Table 17 presents means and standard deviations for each of the dependent measures as a function of group membership. Means on these measures are expressed in terms of standard deviation units, as referenced to the normative sample. Tables 18a to 21a display the results from a series of one-way ANOVAs, where differences across groups on these dependent measures were evaluated. As individual measures of anxiety and impulsivity correlate very highly with their corresponding composite measure, only ANOVAs were performed on the composite measures and not for the individual

measures. In the event that an ANOVA was significant, Tukey's Honestly Significant Difference (HSD) post-hoc test was employed to evaluate the significance of differences in means across measures (Tables 18b to 21b).

Results from these analyses indicated that the anxious-fearful group tended to be introverted, the erratic-dramatic group extraverted, and the no personality disorder group neither introverted nor extraverted (i.e., "ambiverted"). Both the anxious-fearful and erratic-dramatic groups were neurotic at about the same level, but significantly more so than the no personality disorder group, who were generally stable. The anxious-fearful group was significantly more anxious than either of the remaining two groups, who had similar levels of anxiety. Finally, the erratic-dramatic group was significantly more impulsive than either of the other two groups, who demonstrated similar levels of impulsivity.

Validity of Personality Disorder Categorical Subject Grouping

One of the inherent problems in the study of personality disorders is the "comorbidity problem", or the often observed finding that if an individual has one personality disorder, he or she likely has several (e.g., Pfohl, Coryell, Zimmerman, & Stangl, 1986; Morey, 1988). For this portion of the study, attempts were made to partially control for this problem by excluding subjects from major analyses who exhibited marked comorbidity across clusters. These exclusionary criteria, described in the method section, were presumed to result in the categorical subject groups being somewhat more pure in their composition. However, there were a number of "impure" cases who evidenced some degree of comorbidity across clusters, thus raising the issue of the validity of the subject grouping scheme employed in this research.

To examine this, two separate ANOVAs were performed using the summary dimensional scores (expressed as proportions of total number of symptoms present) for the

anxious-fearful and erratic-dramatic clusters as dependent variables, and the categorical group variable at three levels (anxious-fearful, erratic-dramatic, no personality disorder) as the independent variable. When the summary dimensional score for the anxious-fearful cluster was employed as the dependent variable, a significant main effect for group was obtained, F (2,63)= 25.94, $p < .0001$ (Table 22a). Tukey HSD multiple comparisons of means (Table 22b) revealed that the anxious-fearful group significantly differed from the erratic-dramatic and no personality disorder groups, which did not differ from each other. Similarly, when summary dimensional scores for the erratic-dramatic cluster were employed as the dependent variable, a significant main effect for group was obtained, F (2,63) = 27.23, $p < .0001$ (Table 23a). Post-hoc comparisons revealed, as expected, that the erratic-dramatic group significantly differed from the anxious-fearful and no personality disorder groups, which did not differ from each other (Table 23b). These results, coupled with those obtained for the dependent measures, strongly support the validity of the categorization method used to define groups in these analyses.

Tests of Principal Assumptions

Placement of categorical diagnostic groups within Eysenck's two dimensional space. This analysis was performed in order to determine the location of subject groups within Eysenck's two dimensional space, and was based on the three categorical subject groupings ($n = 66$), where subjects were classified as belonging to the anxious-fearful, erratic-dramatic, or no personality disorder groups based on their relative proportion of personality disorders across clusters. Subjects who met any of the exclusionary criteria for defining group membership were not included in this analysis ($n = 11$).

Figure 9 displays the location of each of these three groups within the two dimensional model, with the axes of introversion-extraversion and neuroticism-stability

based on z-scores referenced to the normative sample. The point for the anxious-fearful group is based on 20 subjects, with 20 subjects representing the point corresponding to the erratic-dramatic group and 26 subjects representing the no personality disorder group. The anxious-fearful group (AF), as expected, fell within the introverted-neurotic quadrant. Similarly, the erratic-dramatic group (ED) fell within the extraverted-neurotic quadrant. The no personality disorder disorder group (NO PD) was found to be neither introverted nor extraverted (i.e., they were "ambiverts"), and as a group were more stable than neurotic.

The small, negative correlation between anxiety and impulsivity composites for the research sample ($r = -.26$) provide some explanation for the placement of the anxious-fearful (AF) and erratic-dramatic (ED) groups. These two groups are positioned about 130° from one another (as opposed to 90°, as would be expected if the correlation were zero). The AF group is placed at approximately a 30° angle bisecting the introverted-neurotic and extraverted-stable quadrants, and the ED group is placed at approximately a 20° angle bisecting the neurotic-extraverted and stable-introverted quadrants. Given, then, the small negative correlation between anxiety and impulsivity composites for the research sample, the placement of these groups, AF and ED, are consistent with the direction and magnitude of this correaltion.

Prediction of group memberships. Two sets of discriminant function analyses were performed in order to determine whether either introversion-extraversion (EPI-E) and neuroticism-stability (EPI-N) (Eysenck's model) or anxiety (ANX) and impulsivity (IMP) (Gray's model) best predicted group membership. For each of these sets of analyses, two discriminant analyses were performed sequentially in order to detemine the extent to which each of the independent variables entered into the model predicted categorical group membership (i.e., anxious-fearful [AF], erratic-dramatic [ED], no personality disorder [NO

PD]; n = 66 this analysis). The first of these analyses within each set was performed with the STEPDISC command (SAS Institute, 1985) using stepwise selection. With this procedure, all independent variables were first evaluated in terms of their discriminatory power as indexed by Wilks' lambda. Variables which evidence significant ($p < .05$) discriminatory power were entered sequentially into the model based on the magnitude of their predictive ability until which time no variables remained that significantly added to the prediction of group membership.

When EPI-E and EPI-N were used as predictors, both of these variables were found to emerge as significant predictors, accounting for 23% of the variance (average squared canonical correlation = .23). The results of this analysis are presented in Table 24a. Results from STEPDISC were then evaluated further using the DISCRIM procedure (SAS Institute, 1985). That is, only those independent variables which emerged as significant predictors were entered into the model as independent variables (i.e., EPI-E and EPI-N), and subsequently evaluated in terms of the proportion of cases which were correctly and incorrectly classified. Table 24b presents proportions of cases which were correctly and incorrectly assigned to their subject groups based on the subjects' scores on the independent variables used in the model. Sixty-three percent of all subjects were correctly classified, with most of the misclassifications (48% of all misclassifications) occurring with the no personality disorder group, of which only 54% were correctly classified. Eighty percent of the anxious-fearful group was correctly classified, as was 55% of the erratic-dramatic group.

When ANX and IMP were used as predictors, both of these variables were found to emerge as significant predictors, accounting for 25% of the variance (average squared canonical correlation = .25). The results of this analysis are presented in Table 25a. Results from STEPDISC were then evaluated further using the DISCRIM procedure (SAS

Institute, 1985). That is, only those independent variables which emerged as significant predictors were entered into the model as independent variables (i.e., ANX and IMP), and subsequently evaluated in terms of the proportion of cases which were correctly and incorrectly classified. Table 25b presents proportions of cases which were correctly and incorrectly assigned to their subject groups based on the subjects' scores on the independent variables used in the model. Sixty-eight percent of all subjects were correctly classified, with most of the misclassifications (59% of all misclassifications) occuring with the no personality disorder group, of which only 50% were correctly classified. Eighty percent of the anxious-fearful group was correctly classfied, as was 75% of the erratic-dramatic group. These findings, constrasted with those for EPI-E and EPI-N, suggest that ANX and IMP are better predictors of anxious-fearful and erratic-dramatic group membership, but are not better predictors for persons who fail to evidence significant personality disorder pathology. This observation will be further evaluated in the following analyses.

The results from the STEPDISC procedure in both of the analyses described above indicate that the greatest number of misclassifications occurred with the no personality disorder control group. Since one primary purpose of the study is to differentiate anxious-fearful from erratic-dramatic disorders in terms of their predominant underlying features, both of the above sets of analyses were rerun without the inclusion of the no personality disorder control group ($\underline{n}$ = 40 for the following analyses).

When EPI-E and EPI-N were included in the model, only EPI-E emerged as a significant predictor (Table 26a), accounting for 49% of the variation (average squared canonical correlation = .49) in group membership. This single variable was able to correctly classify 88% of the subjects (Table 26b).

When ANX and IMP were included in the model, both ANX and IMP emerged as significant predictors (Table 27a), accounting for 49% (average squared canonical correlation = .49) of the variation in group membership. The combination of these two variables resulted in the correct classification of 82% of the subjects into groups (Table 27b). Considering these last two findings, it would appear that ANX and IMP predict personality disorder cluster membership better than EPI-E and EPI-N only when there is an additional group of persons who do not exhibit significant personality pathology. When this group is removed from the analysis, however, both models predict about equally well.

An interpretation of the results from the discriminant function analyses above might be facilitated by an examination of Figure 10. Suppose for a moment that there were four groups, each of which were plotted exactly in the middle of each of the four quadrants. Under these circumstances, one would predict that both sets of analyses (i.e., where EPI-E and EPI-N were used as predictors in one analysis and ANX and IMP as predictors in the other analysis) would produce identical findings, provided that EPI-E and EPI-N were uncorrelated and ANX and IMP were uncorrelated. This would be the case as each point on the plot is equidistant from the others, referenced along two uncorrelated dimensions. As such, any two uncorrelated dimensions located within this two dimensional model would produce the same results.

In the discriminant analyses presented above, then, one would expect that the findings from the two sets of analyses would result in similar findings. The fact that they are not quite identical reflects the fact that the locations of the anxious-fearful group (AF) and the erratic-dramatic group (ED) are not quite at right angles to each other (correlation = 0.00). Rather, Figure 10 reveals that there is a slight negative correlation between the two, where the angle representing their locations in two-dimensional space is greater than 90°.

Performance on Verbal Conditioning Task

A number of analyses, presented below, were performed in order to determine the impact that the administration of reward and punishment, as well as non-consequation of responses, had on the use of words associated with each of these contingencies across the duration of the verbal conditioning task, and if word usage associated with different contingencies further varied as a function of group membership. The chief aims of the analyses presented below were (a) to evaluate if group membership was significantly related to the use of rewarded, punished, and non-consequated words (analyzed separately for purposes of clarity), (b) to determine if the frequency of word usage associated with each of these contingencies changed over time (i.e., blocks of trials), and if such change over time varied as a function of group membership, and (c) to determine if awareness of response-consequence relations differed as a function of group membership. All subjects from the categorical group configuration ($n = 66$) were included in these analyses.

To evaluate the change in behavior as a function of group membership, time (i.e., blocks of trials), and the interaction of group and time for each of the three contingencies, analyses presented below begin with a MANOVA analysis, where conditioning scores for each block are used as dependent variables (three scores total). Categorical group membership and conditioning block served as the between and within subjects' factors, respectively. In the event that multivariate F statistics from the MANOVA analyses were significant (using Wilk's lambda approximation), univariate follow-up ANOVAs were conducted, with Greenhouse-Geisser corrections performed on degrees of freedom to control for within subject autocorrelation across scores. In all instances, MANOVA analyses preceeded univariate ANOVAs as a means to control the experimentwise critical alpha level ($p < .05$) (Bray & Maxwell, 1985), and because repeated measures ANOVAs are not robust with regard to violations of homogeneity of covariances, which can result in

artifically high F values (McCall & Appelbaum, 1973). Such violations in this research might be expected, as response levels for adjacent blocks of trials would be expected to evidence greater correlations than nonadjacent blocks. When univariate F statistics were found to be significant, planned post-hoc comparisons were performed. In the event of significant F statistics associated with group effects only, Tukey's Honestly Significant Difference Test (HSD) was employed. This conservative pairwise comparision test is desirable as it exercises maximal control over the false rejection of the null hypothesis (Klockars & Sax, 1986). In the event of significant F statistics associated within subject factors, Bonferroni (Dunn) paired t-tests (Toothaker, 1991) were performed for evaluating the significance among differences in means. This multiple comparison test was used on these occasions as it is the only test appropriate for repeated measures designs (Toothaker, 1991). Following the procedures for performing this multiple comparison test (Klockars & Sax, 1986; Toothaker, 1991) and the suggestions made by Kirk (1982), the critical alpha level for determining the significance of differences across means was derived by dividing the alpha level of .05 by the number of comparisons made within each range test in order to maintain an experimentwise error rate of .05.

Before proceeding with the analyses outlined above, three separate one-way ANOVAs were first performed in order to determine if baseline (i.e., Block 1) frequency of responding with pronouns that would subsequently be rewarded, punished, or responded to with behavioral non-consequence (dependent variables) differed significantly across groups (independent variable). In none of these analyses did any significant differences emerge, indicating that subjects from all three groups used pronouns associated with each contingency type with about equal frequency during the baseline phase. For rewarded words, baseline means as a function of group were 6.25 for the anxious-fearful group (AF), 6.65 for the erratic-dramatic group (ED), and 7.58 for the no personality disorder

group (NO PD). Baseline means for punished words were 5.46 for NO PD, 6.55 for AF, and 7.50 for ED. Non-consequated word frequency means were 5.85 for ED, 6.96 for NO PD, and 7.20 for AF.

Rewarded words. A two-way, mixed model MANOVA on rewarded word frequency (after adjusting for baseline use of words) revealed a significant effect for Block, $F(2, 62) = 11.57$, $p < .0001$, and a marginally significant effect for the Block by Group interaction, $F(4,124) = 2.35$, $p < .06$. In a follow-up univariate ANOVA (with Greenhouse-Geisser correction) (Table 28a), the effect for Group was found to be non-significant, $F(2,63) = 1.91$, $p = .16$, with the effects for Block, $F(1,63) = 15.05$, $p < .0001$, and the Block by Group interaction, $F(2,63) = 2.58$, $p = .05$, maintained. Bonferroni (Dunn) paired t-tests for the effect for Block (Table 28b) revealed that means for Blocks 2 and 3 significantly differed from that of Block 4 (means: 1.58 for Block 2, 2.41 for Block 3, and 4.09 for Block 4). These findings indicate that there was a significant change in responding for rewarded words, with the most significant increase found for Block 4.

Bonferroni paired t-test planned comparisons for the Block by Group interaction were conducted as follows. Important comparisons for this interaction were: (a) differences in scores across group for any given block (means compared across columns in Table 28b), and (b) changes in the use of the frequency of use of rewarded words for a given group across consecutive blocks (means compared across rows in Table 28b). Comparisons where one subject group is contrasted with another for different blocks (e.g., ED Block 2 means as compared with AF Block 4 means) were viewed as not providing useful information, and as such, were not computed. With Bonferroni correction, the critical p-value for differences between means was .017 in order to maintain an

experimentwise error rate of .05. A summary of means for each level of this analysis are presented in Table 28b.

An examination of the significance of the differences across means revealed no significant column effects; that is, there were no significant differences in the use of rewarded words across groups for any given block. Examination of the significance of differences across block means for each subject group (i.e., differences in means across rows) revealed that only the erratic-dramatic and no personality disorder groups showed significant change in the use of rewarded words across blocks. For the erratic-dramatic group, the greatest difference in rewarded word frequency was found between Blocks 2 and 3. For the no personality disorder group, the greatest difference obtained between means occurred between Blocks 3 and 4. The anxious-fearful group did not show a significant increase in their use of rewarded words across blocks.

A series of three t-tests were performed in order to determine if Block 4 means were significantly different from zero as an indication of whether rewarded word usage significantly increased from baseline block to the last conditioning block for each of the groups. In order to maintain an experimentwise error rate of .05, this critical alpha level was divided by three (i.e., the number of t-tests performed). As such, the critical alpha level for rejecting the null hypothesis was set at .017. With this criterion, only the erratic-dramatic group significantly increased their use of rewarded words from baseline block to Block 4 ($p = .0004$). Both the anxious-fearful and no personality disorder groups just failed to meet this criterion level ($ps = .03$ for both groups).

Punished words. A two-way, mixed model MANOVA for use of punished words (after correcting for baseline use) revealed a significant effect for Block, $F(2,62) = 6.12$, $p < .01$, and a significant effect for the Block by Group interaction, $F(4,124) = 3.07$, $p < .02$. In a follow-up univariate ANOVA (with Greenhouse-Geisser correction) (Table 29a),

the effect for Group was found to be non-significant, $\underline{F} = 1.44$, $\underline{p} = .24$, with the effects for Block, $\underline{F}\ (1,63) = 8.11$, $p < .001$, and the Block by Group interaction, $\underline{F}\ (2,63) = 3.59$, $\underline{p} = .01$, maintained. Bonferroni (Dunn) paired t-tests for the effect for Block (Table 29b) revealed that means for Blocks 2 and 4 significantly differed from one another (means: -0.59 for Block 2, -1.33 for Block 3, and -1.81 for Block 4). These findings indicate that there was a significant change in responding for punished words, with the most significant decrease found for Block 4.

Bonferroni paired t-test planned comparisons for the Block by Group interaction were conducted in a manner identical to that reported for rewarded words. With Bonferroni correction, the critical p-value for differences between means was .017 in order to maintain an experimentwise error rate of .05. A summary of means for each level of this analysis are presented in Table 29b.

An examination of the significance of the differences across means revealed no significant column effects; that is, there were no significant differences in the use of punished words across groups for any given Block. Examination of the significance of differences across Block means for each subject group (i.e., differences in means across rows) revealed that only the erratic-dramatic group showed significant change in the use of punished words across Blocks, with the greatest difference found between Blocks 2 and 3. The remaining two groups did not show a significant decrease in the use of punished words across Blocks.

A series of three t-tests were performed in order to determine if Block 4 means were significantly different from zero as an indication of whether punished word usage significantly decreased from baseline block to the last conditioning block for each of the groups. In order to maintain an experimentwise error rate of .05, this critical alpha level was divided by three (i.e., the number of t-tests performed). As such, the critical alpha

level for rejecting the null hypothesis was set at .017. With this criterion, only the erratic-dramatic group significantly decreased their use of punished words from baseline block to Block 4 (p = .0008). Both the anxious-fearful (p = .21) and no personality disorder groups (p = .51) failed to meet this criterion level.

Non-Consequated words. A two-way, mixed model MANOVA for use of non-consequated words (after correcting for baseline use) revealed a significant effect for Block, F (2,62) = 7.62, p = .001, and an insignificant effect for the Block by Group interaction, F (4,124) = 0.72, p = .72. In a follow-up univariate ANOVA (with Greenhouse-Geisser correction) (Table 30a), the effect for Group was found to be non-significant, F (2,63) = 0.45, p = .64, with the effects for Block, F (1,63) = 7.06, $p <$ .002, and the Block by Group interaction, F (2,63) = 0.58, p = .66, maintained. Bonferroni (Dunn) paired t-tests for the effect for Block (Table 30b) revealed that means for Blocks 2 and 4 and Blocks 3 and 4 significantly differed (means: -0.98 for Block 2, -1.08 for Block 3, and -2.27 for Block 4). These findings indicate that there was a significant change in responding for non-consequated words, with the most significant decrease occurring between Blocks 3 and 4.

A series of three t-tests were performed in order to determine if Block 4 means were significantly different from zero as an indication of whether non-consequated word usage significantly decreased from baseline block to the last conditioning block for each of the groups. In order to maintain an experimentwise error rate of .05, this critical alpha level was divided by three (i.e., the number of t-tests performed). As such, the critical alpha level for rejecting the null hypothesis was set at .017. With this criterion, only the erratic-dramatic (p = .004) and no personality disorder (p = .008) groups significantly decreased their use of non-consequated words from baseline block to Block 4. The anxious-fearful group (p = .06) just failed to meet this criterion level.

Differences in awareness across subject groups. A chi-square analysis (Table 31) was performed to determine if awareness of contingencies on behavior differed across groups. This analysis indicated that there were signficant differences in awareness across the three groups, $\underline{X}^2$ (2) = 9.24, $\underline{p}$ = .01. Inspection of Table 31 suggests that the greatest difference occurred with the erratic-dramatic group, who were more aware of the behavioral contingencies than the remaining two groups (cell chi-square for "unaware" for the erratic-dramatic group was 2.64, for "aware" for this group cell chi-square was 3.58; remaining cell chi-squares were less than 1.50). Seventy percent of the erratic-dramatic group was aware of at least one of the operative contingencies, whereas this value was only 35% for the anxious-fearful group and 27% for the no personality disorder group.

Knowledge of specific operative contingencies was also examined across groups, and expressed in terms of proportions of subjects within groups who were aware of the contingency in question. In the proportions presented below, knowledge of one type of reinforcement contingency does not necessarily preclude knowledge of other types of reinforcement contingencies. Hence, proportions for each subject group sum to values greater than the total proportion of subjects within a given group who were aware of any of the behavioral contingencies, presented in Table 31. Chi-square analyses were not performed on the following group by contingency type proportions due to the presence of two or fewer cases in some cells.

Proportions of the no personality disorder group (NO PD) who were able to verbalize the following contingencies were: 23% for reward, 8% punishment, and 4% for behavioral non-consequence. For the anxious-fearful (AF) group, these proportions were 30% for reward, 10% for punishment, and 5% for behavioral non-consequence. Finally, proportions for the erratic-dramatic (ED) group were as follows: 50% for reward, 45% for punishment, and 10% for behavioral non-consequence. For subjects who were aware of

any of the operative contingencies across groups, subjects were generally most aware of the reward contingency, followed by the punishment contingency, and then the behavioral non-consequence contingency. When group differences in awareness of any specific type of reinforcement contingency were examined, only two significant differences emerged. The erratic-dramatic group was found to be more aware of the punishment contingency than both the no personality disorder group ($p < .05$, Fisher's exact test, two-tailed) and the anxious-fearful group ($p < .05$, Fisher's exact test, two-tailed).

Research Sample: Dimensional Group Configuration

Overview

Results previously reported from the factor analysis of individual personality disorder dimensional scores revealed two factors, one corresponding to the erratic-dramatic cluster and the other to the anxious-fearful cluster. Given recent discussion of the merits of dimensional (as opposed to categorical) descriptions of personality disorders, all 77 subjects in the research sample were reconfigured, and arranged into four separate groups. Groups were determined by median splits of the Factor 1 and Factor 2 scores, resulting in four groups: (a) those low on both Factor 1 and Factor 2 (LOF1/LOF2), (b) those high on Factor 1 and low on Factor 2 (HIF1/LOF2), (c) those low on Factor 1 and high on Factor 2 (LOF1/HIF2), and (d) those high on both Factor 1 and Factor 2 (HIF1/HIF2). Factor scores were used define groups as opposed to the summary dimensional cluster scores for the anxious-fearful and erratic-dramatic disorders, as these dimensional scores moderately correlated ($r = .43$), resulting in proportionately fewer cases on the off-diagonals and, consequently, unequal numbers of subjects across groups.

The resulting subject groups essentially represent rotations of Gray's dimensions back onto Eysenck's dimensions, assuming that impulsivity and anxiety largely correspond to Factors 1 and 2, respectively. If one examines Figure 1, the points where anxiety and impulsivity would be maximally highly correlated would be represented at the points where subjects' scores on these constructs would be either both high or both low. These points would be represented by the neurotic and stable ends of the neuroticism-stability continuum. In contrast, impulsivity and anxiety would be maximally negatively correlated at the points where one of these constructs is high and the other low. These points would be represented by the introversion and extraversion ends of the the introversion-extraversion dimension.

Descriptive Sample Statistics

Subject Demographics. The median splits of Factor 1 and Factor 2 dimensions for all 77 subjects resulted in creation of four separate subject groups. LOF1/LOF2 consisted of 20 persons (8 males, 12 females), HIF1/LOF2 18 persons (8 males, 10 females), LOF1/HIF2 19 persons (9 males, 10 females), and HIF1/HIF2 20 persons (10 males, 10 females). A chi-square analysis of subject gender as a function of group membership was not significant, $\underline{X}^2$ (3) = .442, p = .93, indicating equal proportions of gender across groups (Table 32). An ANOVA with group as the independent variable and age as the dependent variable revealed no significant differences in age across groups, $\underline{F}$ (3,73) = 1.49, $\underline{p}$ = .22 (Table 33).

Questionnaire data. Table 34 presents means and standard deviations for each of the dependent measures as a function of group membership. Means on these measures are expressed in terms of standard deviation units, as referenced to the normative sample. The LOF1/LOF2 group is characterized as being neither introverted nor extraverted (i.e.,

"ambiverted") and stable as opposed to neurotic. They are about average in terms of their reported levels of anxiety and impulsivity. As such, this group will be labled "STABLE". The HIF1/LOF2 group tended to be extraverted but stable as opposed to neurotic. They evidence above average levels of impulsivity and below average levels of anxiety. As such this group is labeled "impulsive without anxiety" (IMP/NO ANX). LOF1/HIF2 tended to be introverted and somewhat neurotic. They evidenced marked anxiety but below average levels of impulsivity. As such, they are labled "anxious without impulsivity" (ANX/NO IMP)". HIF1/HIF2 were neither introverted nor extraverted but were found to evidence marked elevations in neuroticism. They are also both highly anxious and impulsive. As such, this group is labeled "NEUROTIC".

A series of one-way ANOVAs were performed (Tables 35a to 38a) to evaluate the significance of differences in introversion-extraversion, neuroticism-stability, anxiety, and impulsivity across the four groups. The effect for extraversion (Table 35a) was found to be highly significant, $F(3,73) = 15.84$, $p < .0001$. Tukey's post-hoc comparisons (Table 35b) revealed that only the ANX/NO IMP group differed significantly from the other three groups. The difference between the IMP/NO ANX group and the remaining groups failed to reach statistical significance.

Neuroticism-stability was also found to be significantly different across groups, $\underline{F}(3,73) = 31.94$, $\underline{p} < .0001$ (Table 36a). Tukey's post-hoc (Table 36b) comparisons revealed that the STABLE and IMP/NO ANX groups were similar in means on this dimension, but significantly different (lower) from the remaining groups. Both ANX/NO IMP and NEUROTIC were found to significantly differ from one another, with NEUROTIC being more neurotic than ANX/NO IMP.

Impulsivity composite scores likewise differed across groups, $\underline{F}(3,73) = 19.30$, $\underline{p} < .0001$ (Table 37a), with Tukey's post-hoc comparisons (Table 37b) indicating that

IMP/NO ANX and NEUROTIC were similar in impulsivity but more impulsive than STABLE and ANX/NO IMP, both of whom had similar impulsivity means.

Finally, anxiety composite scores showed differences across groups, $\underline{F}$ (3,73) = 25.54, $\underline{p} < .0001$ (Table 38a). Tukey's post-hoc comparisions (Table 38b) revealed that ANX/NO IMP and NEUROTIC were more anxious than the remaining two groups, but not significantly different from one another. STABLE and IMP/NO ANX were not significantly different from one another in their reported levels of anxiety.

The results presented in this subsection indicate that Gray's dimensions (impulsivity and anxiety) result in somewhat cleaner differentiations of groups than do Eysenck's dimensions (extraversion and neuroticism). Extraversion only differentiated one group (ANX/NO IMP) from the remaining three, and neuroticism failed to differentiate IMP/NO ANX from the STABLE group. Conversely, those groups who were high on Factor 2 (erratic-dramatic or impulsive personality trait features: IMP/NO ANX and NEUROTIC) were similar in terms of their impulsivity scores (both high on this construct). Similarly, those groups who were both high on Factor 1 (anxious-fearful or anxious personality trait features: ANX/NO IMP and NEUROTIC) were similar in terms of their anxiety scores (both high on this construct). Finally, groups which should not have been different in terms of their level of anxiety (STABLE and IMP/NO ANX) because of their low scores on Factor 2 were found to be similar in their level of anxiety (both low on this construct), and groups which should not have been different in their level of impulsivity (ANX/NO IMP and STABLE) because of their low scores on Factor 1 were found to be similar in their level of impulsivity (both low on this construct).

Validity of Dimensional Groupings of Subjects

To further test the validity of dimensional subject groups, as well as to further clarify the nature of the membership in these groups, frequencies of the eight personality disorders comprising the anxious-fearful and erratic-dramatic groups were determined for each of the four dimensional groups (Table 39). These comparisons essentially amount to a determination of the correspondence between dimensional (i.e., factor) and categorical (i.e., personality disorder diagnosis—present or absent) models of classification. The validity of these dimensions would be supported if (a) there were no personality disorders diagnosed for the STABLE group, (b) anxious-fearful disorders were not diagnosed for persons falling within the IMP/NO ANX group, (c) erratic-dramatic disorders were not diagnosed of persons falling within the ANX/NO IMP group, and (d) persons within the NEUROTIC group evidenced personality disorders from both clusters.

Table 39 supports the validity of these dimensional subject groupings. Only two personality disorders were diagnosed among those persons in the STABLE group. There were no personality disorders from the anxious-fearful cluster present among IMP/NO ANX subjects. Similarly, there were no personality disorders diagnosed from the erratic-dramatic cluster for the ANX/NO IMP group. Finally, the NEUROTIC group evidenced personality disorders from both clusters, as expected.

An examination of the proportion of individual personality disorders falling within each group suggests that (a) dependent and passive-aggressive personality disorders tend to be more associated with the NEUROTIC group than the ANX/NO IMP group, suggesting that these disorders are also characterized by the presence of significant impulsivity, (b) histrionic and borderline disorders tend to be more prelevant among the NEUROTIC group as opposed to the IMP/NO ANX group, suggesting that these disorders are also characterized by the presence of significant anxiety, and (c) that antisocial personality

disorder is more frequent among the IMP/NO ANX group than the NEUROTIC group, suggesting that this particular disorder is more commonly associated with impulsivity and a relative absence of the experience of anxiety.

Tests of Principal Assumptions

Placement of Dimensional Groups within Eysenck's Two-Dimensional Space. Figure 10 displays the placement of the four groups based on Eysenck's dimensions of introversion-extraversion and neuroticism-stability. As this figure shows, placement of the four groups roughly corresponds to the extremities along Eysenck's two orthogonal axes. Such placement would be anticipated, as anxiety and impulsivity would be maximally negatively correlated at the points of high anxiety/low impulsivity and high impulsivity/low anxiety, which would correspond to the two endpoints of the introversion-extraversion dimension. Anxiety and impulsivity would be maximally positively correlated at the points where anxiety and impulsivity are both high and where they are both low, which would correspond to the two endpoints along the neuroticism-stability dimension. Given that Figure 10 indicates that these placements were largely realized, this would provide additional support that anxiety and impulsivity largely underlie the anxious-fearful and erratic-dramatic disorders, respectively.

Although both the STABLE and NEUROTIC groups are placed squarely on the neuroticism-stability dimension, as expected, the ANX/NO IMP and IMP/NO ANX groups are, respectively, slightly above and below the introversion-extraversion dimension. One would have expected that these two groups would have been placed squarely on the introversion-extraversion dimension, assuming orthogonality of anxiety and impulsivity. As previously noted, however, these constructs are not quite orthogonal. As such, the placement of the ANX/NO IMP group above the introversion-extraversion axis represents

anxiety's stronger correlation with neuroticism, as compared to impulsivity. Similarly, IMP/NO ANX is placed slightly below the introversion-extraversion axis because of its weaker association with neuroticism, as compared to anxiety. Given the correlation structure, then, between anxiety and impulsivity, these groups are placed at about their correct locations if one assumes that varying levels of anxiety and impulsivity largely define these groups.

Prediction of group memberships. The procedure for conducting a discriminant function analysis to predict dimensional groups based on factor scores was identical to that presented in a previous section for predicting categorical group membership. Briefly, two sets of analyses were conducted, one based on the independent variables important for Eysenck's two dimensional model (EPI-E and EPI-N) and the other based on independent variables relevant for Gray's model (ANX and IMP). For each of these sets of analyses, independent variables were evaluated in terms of their ability to predict group membership (i.e., STABLE, NEUROTIC, IMP/NO ANX, ANX/NO IMP).

When EPI-E and EPI-N were used as predictor variables (Table 40a), both variables emerged as significant predictors, with these variables accounting for 31% of the variation in group membership (average squared canonical correlation = .31). Sixty-five percent of the cases were correctly classified, with most of the missclassifications occurring for the STABLE and IMP/NO ANX groups (Table 40b).

When ANX and IMP were used as predictor variables (Table 41a), both variables emerged as significant predictors, with these variables accounting for 32% of the variation in group membership (average squared canonical correlation = .32). Sixty-nine percent of the cases were correctly classified, with most of the missclassifications occuring for the occurring for the STABLE and NEUROTIC groups (Table 41b).

An examination of Figure 10 suggests why STABLE and IMP/NO ANX were the poorest classified in the analysis where EPI-E and EPI-N were predictors. The points corresponding to these two groups are the two closest on the plot. Why the STABLE and NEUROTIC groups were the poorest classified in the ANX and IMP analysis is not well illustrated in Figure 10, as points are plotted along Eysenck's axes rather than axes corresponding to impulsivity and anxiety. An inspection of the prediction table from this analysis (Table 41b) would suggest that when plotted along these axes, the STABLE and NEUROTIC groups would be closer to the ANX/NO IMP group than illustrated in Figure 10, perhaps because anxiety correlates more with neuroticism than does impulsivity.

The results from the above analyses are quite good when one considers that groups were defined in terms of median splits of two variables (i.e., factor scores). As with the discriminant function analyses presented for the categorical group configuration, results from the two analyses presented above were quite similar in terms of their findings. As noted previously, the similarity in findings from the two analyses would be expected, as anxiety and impusivity represent approximately 45° rotations of Eysenck's dimensions. Results from the above analyses indicate that when it comes to classifying pathological groups only (i.e., IMP/NO ANX, ANX/NO IMP, NEUROTIC), Gray's model does a little better job. However, when persons without significant pathology (i.e., STABLE) are entered into the model, Eysenck's dimensions predict their group membership a bit better.

Performance on Verbal Conditioning Task

The procedures and aims of the following analyses for performance on the verbal conditioning task are identical to those described previously for the categorical group configuration. The only difference in the following analyses is that the group variable is

now defined at four levels (i.e., STABLE, IMP/NO ANX, ANX/NO IMP and NEUROTIC).

Before proceeding with the analyses outlined above, three separate one-way ANOVAs were first performed in order to determine if baseline (i.e., Block 1) frequency of responding with pronouns that would subsequently be rewarded, punished, or responded to with behavioral non-consequence (dependent variables) differed significantly across groups (independent variable). In none of these analyses did any significant differences emerge, indicating that subjects from all four groups used pronouns associated with each contingency type with about equal frequency during the baseline phase. For rewarded words, baseline means as a function of group were 6.30 for NEUROTIC, 6.32 for ANX/NO IMP, 6.67 for IMP/NO ANX and 7.65 for STABLE. Baseline means for punished words were 5.80 for STABLE, 5.89 for ANX/NO IMP, 7.27 for IMP/NO ANX and 7.30 for NEUROTIC. Non-consequated word frequency means were 6.06 for IMP/NO ANX, 6.40 for NEUROTIC, 6.55 for STABLE, and 7.79 for ANX/NO IMP.

Rewarded words. A two-way, mixed model MANOVA for use of rewarded words (after correcting for baseline use) revealed a significant effect for Block, $F(2,72) = 12.33$, $p < .0001$, and an insignificant effect for the Block by Group interaction, $F(6,144) = 1.18$, $p < .32$. In a follow-up univariate ANOVA (with Greenhouse-Geisser correction) (Table 42a), the effect for Group was found to be non-significant, $F(3,73) = 1.63$, $p = .19$, with the effects for Block ($F(1,73) = 16.02$, $p < .0001$, and the Block by Group interaction, $F(3,73) = 1.32$, $p = .26$, maintained. A comparison of means across Blocks (Table 43b) indicates that the use of rewarded words increased across trial blocks (means: Block 2 = 1.99, Block 3 = 2.94, Block 4 = 4.47). Bonferroni (Dunn) paired t-tests, with the critical alpha level adjusted for the number of comparisons made (number of comparisons = 3; critical alpha = .017), indicated that the difference in means between

Block 2 and Block 3 just failed to reach statistical significance. However, the difference between Blocks 2 and 4 as well as between Blocks 3 and 4 were found to be significantly different.

A series of four t-tests were performed in order to determine if Block 4 means were significantly different from zero as an indication of whether rewarded word usage significantly increased from baseline block to the last conditioning block for each of the groups. In order to maintain an experimentwise error rate of .05, this critical alpha level was divided by four (i.e., the number of t-tests performed). As such, the critical alpha level for rejecting the null hypothesis was set at .012. With this criterion, only the IMP/NO ANX ($p < .0001$) and NEUROTIC ($p = .012$) groups significantly increased their use of rewarded words from baseline block to Block 4. Both the STABLE ($p = .09$) and ANX/NO IMP groups ($p = .021$) failed to meet this criterion level.

Punished words. A two-way, mixed model MANOVA for use of punished words (after correcting for baseline use) revealed a significant effect for Block, $F(2,72) = 5.43$, $p < .01$, and an insignificant effect for the Block by Group interaction, $F(6,144) = 0.98$, $p = .44$. In a follow-up univariate ANOVA (with Greenhouse-Geisser correction) (Table 43a), the effect for Group was found to be marginally significant, $F(3,73) = 2.54$, $p = .06$, with the effects for Block, $F(1,73) = 7.42$, $p < .002$, and the Block by Group interaction, $F(3,73) = 1.08$, $p = .38$, maintained. Tukey post-hoc comparisons to assess differences in means across subject groups were not significant (Table 43b). Punished words were found to be less frequently used by all subjects across conditioning blocks (means: Block 2 = -0.95, Block 3 = -1.69, Block 4 = -2.12) (Table 43b). Bonferroni paired t-tests indicated, with the critical alpha level adjusted for the number of comparisons made (number of comparisons = 3; critical alpha = .017), indicated that the difference in means between Block 2 and Block 3 reached statistical significance, as did the difference between

Blocks 2 and 4. The difference between Blocks 3 and 4 failed to reach conventional levels of significance.

A series of four t-tests were performed in order to determine if Block 4 means were significantly different from zero as an indication of whether punished word usage significantly decreased from baseline block to the last conditioning block for each of the groups. In order to maintain an experimentwise error rate of .05, this critical alpha level was divided by four (i.e., the number of t-tests performed). As such, the critical alpha level for rejecting the null hypothesis was set at .012. With this criterion, only the IMP/NO ANX ($p < .0001$) and NEUROTIC ($p = .012$) groups significantly decreased their use of punished words from baseline block to Block 4. Both the STABLE ($p = .87$) and ANX/NO IMP groups ($p = .26$) failed to meet this criterion level.

Non-Consequated words. A two-way, mixed model MANOVA for use of punished words (after correcting for baseline use) revealed a significant effect for Block, $F(2,72) = 9.26$, $p < .001$, and an insignificant effect for the Block by Group interaction, $F(6,144) = 0.43$, $p = .86$. In a follow-up univariate ANOVA (with Greenhouse-Geisser correction) (Table 44a), the effect for Group was found to be non-significant, $F(3,73) = 0.80$, $p = .50$, with the effects for Block, $F(1,73) = 9.01$, $p < .001$, and the Block by Group interaction, $F(3,73) = 0.53$, $p = .77$, maintained. Non-consequated words evidenced a decrease in their frequency of use across trial blocks (means: Block 2 = -1.04, Block 3 = -1.25, Block 4 = -2.35). Bonferroni (Dunn) paired t-tests (Table 44b), with the critical alpha level adjusted for the number of comparisons made (number of comparisons = 3; critical alpha = .017), indicated that the difference in means between Block 2 and Block 3 failed to reach statistical significance. However, the difference between Blocks 2 and 4 and between Blocks 3 and 4 reached conventional levels of significance.

A series of four t-tests were performed in order to determine if Block 4 means were significantly different from zero as an indication of whether non-consequated word usage significantly decreased from baseline block to the last conditioning block for each of the groups. In order to maintain an experimentwise error rate of .05, this critical alpha level was divided by four (i.e., the number of t-tests performed). As such, the critical alpha level for rejecting the null hypothesis was set at .012. With this criterion, only the IMP/NO ANX (p = .0009) and ANX/NO IMP (p = .009) groups significantly decreased their use of non-consequated words from baseline block to Block 4. Both the STABLE (p = .017) and NEUROTIC groups (p = .23) failed to meet this criterion level.

Differences in awareness across groups. A chi-square analysis (Table 45) was performed to determine if awareness of any of the behavioral contingencies differed across groups. This analysis indicated that there were no differences in awareness across the four subject groups, X^2 (3) = 2.88, p = .41. Knowledge of specific operative contingencies was also examined across groups, and expressed in terms of proportions of subjects within groups who were aware of the contingency in question. In the proportions presented below, knowledge of one type of reinforcement contingency does not necessarily preclude knowledge of other types of reinforcement contingencies. Hence, proportions for each subject group sum to values greater than the total proportion of subjects within a given group who were aware of any of the behavioral contingencies, presented in Table 45. Chi-square analyses were not performed on the following group by contingency type proportions due to the presence of two or fewer cases in some cells.

Proportions of the STABLE group who were able to verbalize the following contingencies were: 25% for reward, 10% punishment, and 5% for behavioral non-consequence. For the IMP/NO ANX group, these proportions were 50% for reward, 22% for punishment, and 5% for behavioral non-consequence. For the ANX/NO IMP group,

similar proportions were obtained: 42% for reward, 11% for punishment, and 5% for behavioral non-consequence. Finally, proportions for the NEUROTIC group were as follows: 35% for reward, 33% for punishment, and 10% for behavioral non-consequence. For subjects who were aware of any of the operative contingencies across groups, subjects were generally most aware of the reward contingency, followed by the punishment contingency, and then the behavioral non-consequence contingency. A series of Fisher's exact tests were perfomed to evaluate possible differences in awareness of each of the specific contingencies as a function of group membership. None of these analyses revealed significant differences in awareness of reward, punishment, and behavioral non-consequence contingencies across the four groups.

CHAPTER IV
DISCUSSION

Unlike many other forms of psychopathology, the empirical study of personality disorders has generally not benefitted from the presence of a guiding theoretical framework. Although a number of theoretical formulations have been proposed (e.g., Beck, Freeman, & Associates, 1990; Kernberg, 1975; Millon, 1981), there have been few empirical tests of the basic assumptions of these theories. Rather, much of the existing work within the area of personality disorders has been limited to descriptive studies. This study was an attempt to apply a well-researched structural and behavioral model of personality (Gray, 1970; 1987b) to a subset of the personality disorders using both multivariate and behavioral approaches. The principal aim of this research was to detemine if this model can usefully serve as a guiding theoretical framework for future empirical work on the majority of the personality disorders.

Multivariate Findings

Appraisal

The basic assumptions of Gray's structural model of personality, as well as its applicability to the anxious-fearful and erratic-dramatic personality disorders of DSM-III-R, were examined in this study. Findings from two independent samples (a normative and research sample) provided converging support. First, the basic assumptions of Gray's

theory, specifically the placement of the dimensions of anxiety and impulsivity within Eysenck's two dimensional model, were demonstrated (Figures 2, 3, 4, 9, and 10). Consistent with previous studies (see Gray, 1970, for a review), the dimension of anxiety was found to bisect the neurotic-introvert and stable-extravert quadrants at about 40 to 70°. Similarly, and consistent with previous studies (e.g., S. B. G. Eysenck & Eysenck, 1969), impulsivity was found to bisect the neurotic-extravert and stable-introvert quadrants at about 20° to 45°.

Also as anticipated, the dimensions of anxiety and impulsivity, respectively, were found to underlie the disorders and traits associated with the anxious-fearful and erratic-dramatic personality disorders of DSM-III-R. Evidence in support of this contention is evident in multiple analyses, including simple means tests on anxiety and impulsivity measures, placement of individual personality disorders and disorder clusters within Eysenck's model, a factor analysis of personality disorder dimensional scores, and discriminant function analyses to predict group membership. All of these analyses produced largely consistent findings, even when subjects were grouped in accordance with categorical and dimensional approaches.

Major findings from the multivariate analyses on personality disorders and personality disorder traits are as follows. Personality disorder features associated with the eight personality disorders from the anxious-fearful and erratic-dramatic clusters tend to be internally consistent, with features associated with personality disorders from the anxious-fearful cluster tending to be orthogonal (uncorrelated) to those from the erratic-dramatic cluster. Personality disorders and personality disorder traits from the anxious-fearful cluster tend to fall within the neurotic-introvert quadrant (or along the anxiety axis), and those from the erratic-dramatic cluster tend to fall within the neurotic-extravert quadrant (or along the impulsivity axis).

When subjects were grouped according to their predominant personality disorder cluster membership (i.e., categorical approach), persons who primarily evidence anxious-fearful personality disorders tended to be introverted, neurotic, and anxious, although they did not evidence elevated levels of impulsivity beyond that observed among non-personality disordered individuals. Conversely, persons who primarily evidenced erratic-dramatic personality disorders tended to be extraverted, neurotic, and impulsive, although they did not evidence elevated levels of anxiety beyond that observed among non-personality disordered individuals.

When subjects were grouped according to their relative proportions of anxious-fearful and erratic-dramatic personality disorder features (i.e., dimensional grouping), four groups were derived, which were characterized by (a) elevated levels of neuroticism, impulsivity and anxiety, (b) attenuated levels of neuroticism, anxiety and impulsivity, (c) high levels of impulsivity and extraversion but low levels of anxiety, and (d) high levels of anxiety but low levels of impulsivity and extraversion. When personality disorder categories were applied to these dimensional subject groups (Table 39), there were only two instances of personality disorder diagnoses among those low in anxiety and impulsivity. More importantly, perhaps, erratic-dramatic disorders were diagnosed among those who were either impulsive and not anxious or both anxious and impulsive. Similarly, anxious-fearful disorders were only diagnosed among those who were highly anxious and not impulsive or both anxious and impulsive. The group characterized as being high in anxiety and impulsivity evidenced a mixture of erratic-dramatic and anxious-fearful disorders. These findings, in contrast to those for the categorical grouping of subjects, would suggest that if the goal were to study cases of individuals with personality pathology who were relatively "pure" in their manifest levels of anxiety and impulsivity, a

categorization scheme based on personality disorder dimensional scores (as opposed to personality disorder diagnoses) would be preferable.

The findings from the research sample, regardless of the type of subject group configuration employed, strongly support the applicability of Gray's dimensions to an understanding of anxious-fearful and erratic-dramatic personality disorders of DSM-III-R. Furthermore, these findings suggest common underlying features associated with subgroups of the personality disorders. Anxious-fearful disorders and traits have has their underlying dimension of similarity the experience of anxiety. Conversely, erratic-dramatic disorders and traits have as their underlying dimension of similarity the experience of impulsivity.

Behavioral Findings

Appraisal

With the correspondence between Gray's structural model of personality with the anxious-fearful and erratic-dramatic disorders of DSM-III-R firmly established, a number of analyses were conducted to evaluate specific behavioral predictions arising from Gray's structural model for persons who predominantly evidence anxious-fearful and erratic-dramatic personality disorders or traits associated with these disorders. The paradigm used to evaluate these predictions was Taffel's (1955) verbal operant conditioning task, a paradigm previously used to test some of basic assumptions of Gray's individual difference theory of behavior (Gupta, 1976; Gupta & Nagpal, 1978). Depending on responses during this tasks, subjects were either rewarded, punished, or neither rewarded nor punished (i.e., behavioral non-consequence) for their use of particular pronouns during a sentence construction task. It was hypothesized that those high in anxiety (or introversion

relative to extraversion) would be especially sensitive to signals of punishment, and would produce proportionately fewer punished responses over time than other groups. Conversely, those high in impulsivity (or extraversion relative to introversion) were expected to be especially sensitive to signals of reward, and would produce proportionately more rewarded responses over time that the other groups. For non-consequated word usage, it was hypothesized that persons without significant personality pathology followed by anxious individuals would produce more of these responses relative to other groups. Finally, it was expected that anxious (or introverted), impulsive (or extraverted), and anxious and impulsive (or neurotic) subjects would demonstrate approximately equal knowledge of the reinforcement contingencies operative during the Taffel task, although it was assumed that there would be some differences in the awareness of specific operative contingencies (as indexed by varying levels of behavior change across contingencies) among the subject groups.

Results from the Taffel task, for both categorical and dimensional subject groupings, generally failed to conform to Gray's behavioral predictions arising form his structural model. As expected, there was a significant effect for blocks of trials for each contingency type, with the direction of this effect in each analysis being consistent with that predicted. That is, across all subjects in the research sample, rewarded words significantly increased in frequency of usage over time, and both punished and non-consequated words significantly decreased in usage over time.

More importantly for Gray's theory, however, there were no main effects for group in any analysis for the usage of rewarded, punished, and non-consequated words. Similarly, when the significant block by group interaction found with the categorical subject grouping was explored with post-hoc tests, no significant differences across groups were noted for any of these contingencies at a specific point in time (i.e., a specific block of

trials). Rather, the significance of the block by group interaction found with the categorical subject configuration was due to differences in behavioral change over the duration of the task as a function of group membership. Follow-up post-hoc comparisons revealed (a) only the erratic-dramatic and no personality disordered subjects significantly increased their usage of rewarded words between Blocks 2, 3, and 4, and (b) only erratic-dramatic subjects decreased their usage of punished words between Blocks 2, 3, and 4. Although finding (a) is consistent with Gray's predictions, finding (b) runs counter to Gray's assertion that anxious individuals are the most sensitive to signals of punishment. Similar analyses which compared differences in scores between baseline block (i.e., Block 1) and Block 4 revealed that (c) only the erratic-dramatic group increased their use of rewarded words from Block 1 to Block 4, with the anxious-fearful and no personality disorder groups just failing to meet the criterion, (d) only the erratic-dramatic subjects significantly decreased their use of punished words from Block 1 to Block 4, and (e) only the erratic-dramatic and no personality disorder groups significantly decreased their usage of non-consequated words between Block 1 and Block 4, with the anxious-fearful group just failing to meet the criterion. Whereas finding (c) is consistent with Gray's theory, finding (d) is inconsistent with the theory, as anxious subjects were hypothesized to be the most reactive to the punishment contingency.

Also in contrast to Gray's predictions, in addition to a lack of a main effect for group when subjects were grouped according to the dimensional approach, there were also no significant block by group interactions observed for any of the contingency types. The absence of a group by block interaction with the dimensional grouping indicated that (a) no subject group differed from any other in their use of either rewarded, punished, or non-consequated words at Blocks 2, 3 and 4, and (b) no subject group significantly increased their use of rewarded words between Blocks 2, 3, 4, and no subject group significantly

decreased their use of punished and non-consequated words over Blocks 2, 3, and 4. Additional analyses which compared differences in scores between baseline block (i.e., Block 1) and Block 4 revealed that (c) only IMP/NO ANX and NEUROTIC groups significantly increased their use of rewarded words between Block 1 and Block 4, (d) only IMP/NO ANX and NEUROTIC groups significantly decreased their use of punished words between Block 1 and Block 4, and (e) only IMP/NO ANX and ANX/NO IMP significantly decreased their use of non-consequated words between Block 1 and Block 4. Finding (c) is entirely consistent with Gray's behavioral predictions, whereas finding (d) is only partially supportive of the theory. Although one would expect, given Gray's theory, that the NEUROTIC group would significantly decrease their use of punished words between baseline and the last conditioning block (which it did), one would also expect this to be true of ANX/NO IMP, which did not significantly decrease their use of these words. Finding (e) also differs somewhat from that predicted, as it was expected that ANX/NO IMP and the STABLE groups would evidence the smallest decrease in the use of non-consequated words between Blocks 1 and 4.

When subjects were grouped according to the categorical approach, there was an indication that erratic-dramatic subjects showed greater awareness of operative contingencies than anxious-fearful and no personality disorder groups (70% versus 35% and 26.9%, respectively), with subsequent follow-up tests indicating that the erratic-dramatic group was significantly more aware of the punishment contingency than either the anxious-fearful or erratic-dramatic groups. Overall, both the erratic-dramatic and anxious-fearful subjects were expected to be similar in their knowledge of any of the operative contingencies, and were anticipated to be significantly more knowledgeable than the no personality disorder group. This finding, coupled with those indicating that (a) only the erratic-dramatic and non-personality disorded subjects significantly increased their usage of

rewarded words and (b) only erratic-dramatic subjects decreased their usage of punished words over time and were significantly more aware of the punishment contingency than the remaining two groups, suggests that the absence of group differences may be due to the lack of effect of the punishment contingency among anxious-fearful subjects. Overall, anxious-fearful subjects appeared to be not as affected by the punishment contingency as the erratic-dramatic subjects were affected by the reward contingency. Although it was anticipated that anxious-fearful subjects would not be as reactive to the reward contingency as the erratic-dramatic group, it was expected that they would be more reactive to the punishment contingency than other groups. One possible explanation for this lack of effect for the punishment contingency for the anxious-fearful group might be that the loss of money and verbal disapproval (e.g., "not so good" following punished responses) were not potent punishers. As Spence (1966) and Ominsky and Kimble (1966) have suggested, the addition of situationally produced anxiety further facilitates conditioning among persons who show elevations in trait anxiety. It may have been the case that the punishment contingency during the Taffel task was not very threatening or emotionally arousing, and as such failed to produce situationally-based anxiety that would facilitate conditioning. Alternatively, anxious-fearful (or introverted) subjects may have reacted less than expected to both the punishment and reward contingencies because they may be generally less or no more sensitive to signals of reward or punishment than other groups. Newman and Kosson (1986), for example, found that psychopaths (who are presumed to be extraverted; see this study and Newman et al., 1985) in comparison to non-psychopaths, are equally or more responsive to a variety contingency types, including punishment. Since much of the empirical support in favor of Gray's behavioral predictions generally comes from non-pathological samples, additional research needs to be performed with groups who evidence

significant pathology in order to demonstrate the applicability of his behavioral theory to persons who evidence extremes in impulsivity and anxiety.

Another puzzling finding was the lack of group differences in the use of rewarded, punished, or non-consequated words both generally and at any given point in time, even though there were differences in awareness of response-consequence relations across categorical subject groups. Although erratic-dramatic subjects evidenced greater knowledge of operative contingencies, this difference did not translate into behavioral differences in responding across groups. One possible reason for the absence of predicted findings, despite group differences in awareness of contingencies, has to do with the amount of variablity observed across subjects in their use of rewarded, punished, and non-consequated words. During the Taffel task, an absence of awareness of the operative contingencies resulted in behavior that was largely unmodified, whereas awareness of such contingencies produced marked behavioral change in predicted directions (Figures 6, 7, and 8). Given this pattern, one would expect that variablity in responding would be at its maximum if 50% of the subjects showed awareness of the operative contingencies, as half of the subjects would be responding near the ceiling and the other half near the floor, with few, if any, subjects in between (i.e., a bimodal distribution). Forty-four percent of all subjects in the research sample verbalized some knowledge of the operative contingencies, resulting in huge amounts of variation in the usage or rewarded, punished, and non-consequated words across subjects. Even though there were moderate differences in means across subject groups for the use of words associated with these contingencies, these differences failed to translate into statistically significant differences, ostensibly because of the wide amount of variation in responding across all subjects. In additional analyses (not reported in the results section), subjects who evidenced awareness of

response-consequence relations were examined in isolation in order to determine if predicted effects would be evident for these persons. No significant results were obtained.

The observation that awareness of response-consequence relations produced marked and rapid behavior change and lack of such awareness resulted in almost no behavior change lend support cognitive and social learning views of the role that cognitive mediation plays in learning (e.g., Bandura, 1977; Spielberger & DeNike, 1966) and call into question Skinner's (1963, p. 510) assertion that persons "can seldom accurately describe the way in which he [sic] has actually been reinforced". Findings from this study suggest that the ability to accurately describe the operative reinforcement contingencies is a prerequisite for behavior change. Radical behaviorists (e.g., Galizio, 1979; Skinner, 1963; Vaughan, 1985), however, have proposed that instructional control (an environmental event) or self-rules (Zettle & Hayes, 1982) can account for findings usually attributed to the role of awareness (a cognitive event). The nature of this present research does not permit conclusions as to which account may be the most accurate in explaining behavior change during the Taffel task.

Finally, an absence of stable group differences during the Taffel task for both categorical and dimensional subject groupings may be reflective of problems associated with the paradigm selected to test individual differences in behavior as a function of operative reinforcement contingencies. The problem of excessive variation in responding has already been noted. This variation may have been reduced if the Taffel task were extended for at least another block of trials. This would have provided greater opportunity for behavior to come under the control of the operative contingencies, thus reducing the amount of within group variability. Also, the Taffel task was modified somewhat for this study so as to include a punishment contingency. Previous studies which examined Gray's behavioral predictions using the Taffel task (Gupta, 1976; Gupta & Nagpal, 1978) did not

include such a contingency. Although it is unclear what effect this modification may have had on responding, an alternative approach to that employed here might be the use of reward and punishment as a between subjects' factor, where subjects are exposed to only one of these contingencies.

Summary, Implications, and Future Directions

Results from this study suggest that Gray's structural model of personality is a viable model for defining relations between eight of the eleven DSM-III-R personality disorders. As such, this study establishes a common theoretical and empirical basis for conceptualizing eight of the eleven personality personality disorders subsumed under an atheoretical and minimally empirically validated classification scheme (i.e, the DSM system). As a consequence, this study goes considerably beyond the simple descriptive studies which permeate the published literature on personality disorders. Rather, results from this study suggest a guiding theoretical framework to facilitate the evaluation and integration of assumptions and observations related to the anxious-fearful and erratic-dramatic personality disorders of DSM-III-R.

Another added benefit of this research is that it suggests that empirical findings from other areas within psychology may be applicable to an understanding of the personality disorders. Given that in this study anxious-fearful and erratic-dramatic personality disorders were found to have striking associations with anxiety, impulsivity, neuroticism, and extraversion, there is a suggestion that the existent published literature on these constructs may further illuminate various aspects of these disorders which are currently not well understood.

Another implication derived from the multivariate findings from this study is that anxious-fearful disorders are internally consistent, and quite similar on the dimensions of introversion, neuroticism, and anxiety. As such, it may be the case that the four disorders comprising this cluster are more similar than different in important respects. Similarly, erratic-dramatic disorders were likewise found to be internally consistent, and quite similar on the dimensions of extraversion, neuroticism, and impulsivity. As such, the four disorders comprising this cluster may also be more similar than different in important ways.

Findings from this study also suggest possible areas for intervention when treating persons who evidence disorders from the anxious-fearful and erratic-dramatic clusters. If, for example, a given client displays predominant features associated with anxious-fearful disorders, a principle goal for therapy might be the attentuation or management of the experience of anxiety. Similarly, if a given client displays predominant features associated with erratic-dramatic disorders, therapy might emphasize the development of impulse control skills or the controlled modulation of affect and drive. Remaining characterological features not strongly correlated with anxiety or impulsivity might be a focus of intervention once affective management and control have been established.

Findings from this study do not support Gray's behavioral predictions stemming from his structural model of personality. No stable individual differences in terms of sensitivity to reward, punishment, or behavioral non-consequence were observed among groups based on relative proportions of anxious-fearful and erratic-dramatic disorders, or groups based on relative proportions of traits associated with these disorders. Given the widespread support of Gray's behavioral predictions from other researchers (e.g., Boddy et al., 1986; Kantorowitz, 1978; Gupta, 1976; Gupta & Nagpal, 1978; McCord & Wakefield, 1981; Seunath, 1975; Spence, 1964), further evaluation of the applicability of

Gray's behavioral model to the personality disorders should be performed before definite conclusions are drawn. This could be accomplished by using experimental paradigms different from that utilized in this study, such as computer tasks or observations of behavior under naturalistic conditions. Treating contingency type (e.g., reward, punishment, and behavioral non-consequence) as a between subjects' factor may also produce more clearly defined results. Other modifications in procedure, such as the use of alternative self-report measures or indicies of constructs of interest (e.g., behavioral samples) might produce different findings. This study is also limited in that subjects were predominantly white and from middle-class backgrounds. As such, future research might also examine the stability of the reported findings among diverse racial and economic groups.

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APPENDIX A

FIGURES

Figure 1: Gray's Structural and Behavioral Model of Personality

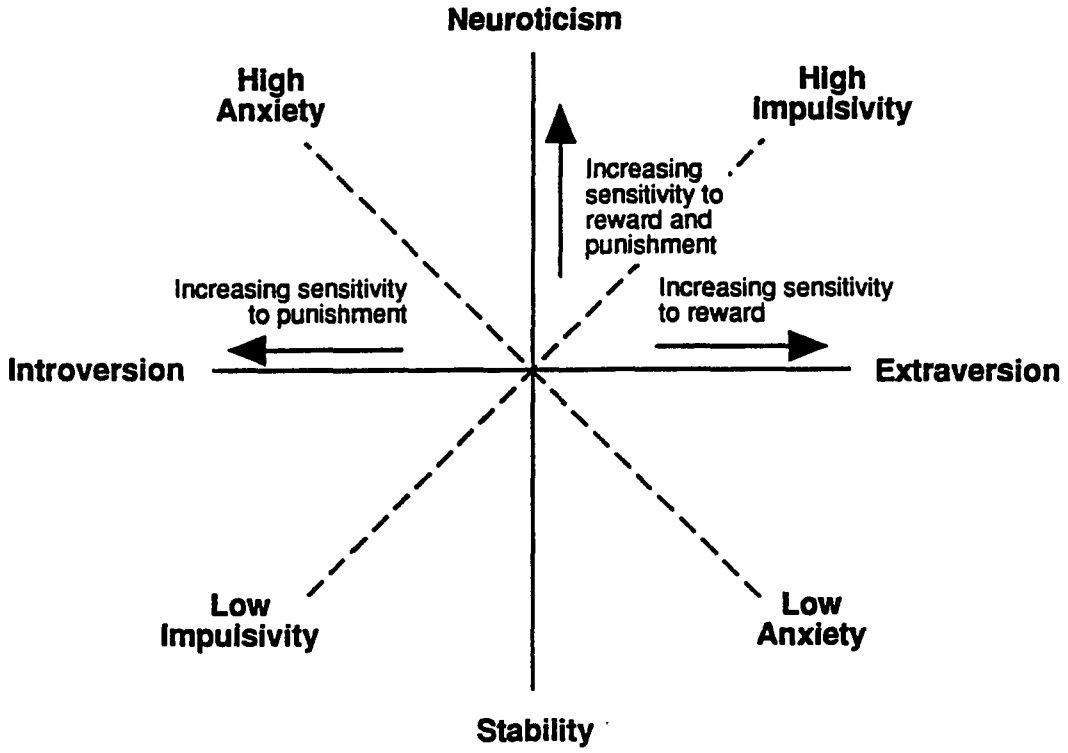

Neuroticism
High Anxiety
High Impulsivity
Increasing sensitivity to reward and punishment
Increasing sensitivity to punishment
Increasing sensitivity to reward
Introversion
Extraversion
Low Impulsivity
Low Anxiety
Stability

Figure 2: Location of the Dimensions of Anxiety and Impulsivity with Reference to Eysenck's Personality Dimensions. Normative Sample

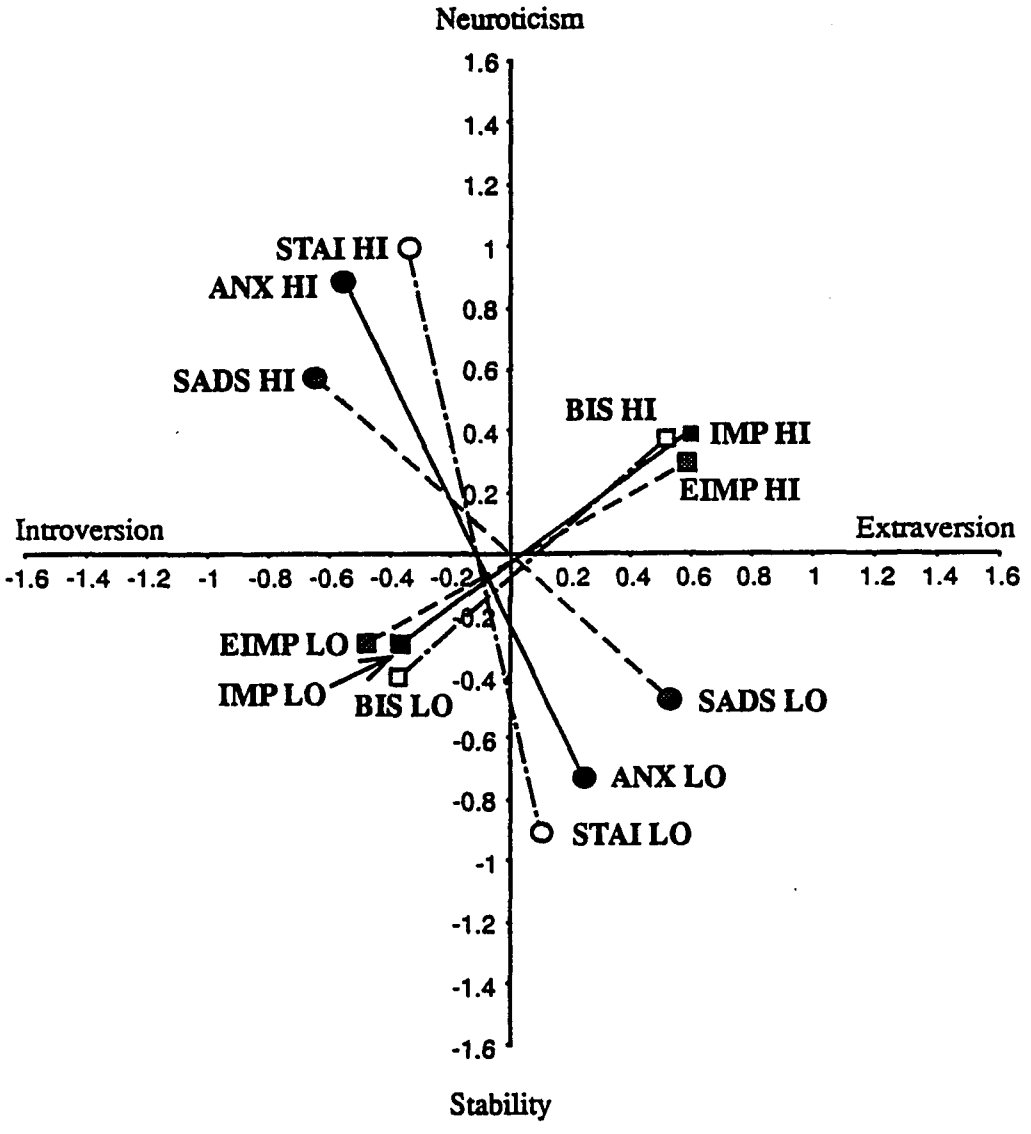

Neuroticism
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
Stability
Introversion
Extraversion
-1.6 -1.4 -1.2 -1 -0.8 -0.6 -0.4 -0.2 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6
STAI HI
ANX HI
SADS HI
BIS HI
IMP HI
EIMP HI
EIMP LO
IMP LO
BIS LO
SADS LO
ANX LO
STAI LO

Figure 3: Placement of Anxious-Fearful and Erratic-Dramatic Personality Disorders within Eysenck's Personality Dimensions: Research Sample

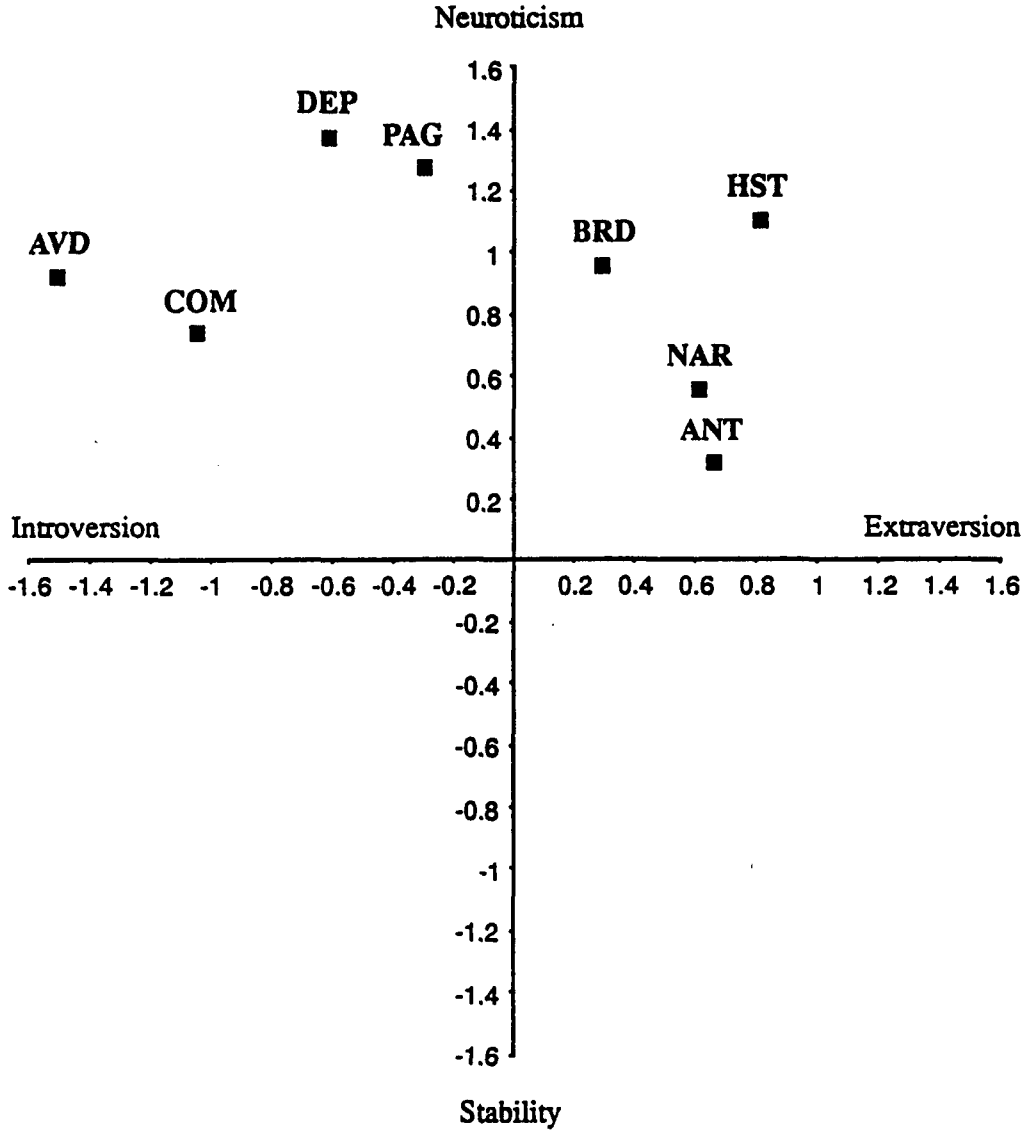

Neuroticism
DEP
PAG
HST
BRD
AVD
COM
NAR
ANT
Introversion
Extraversion
Stability
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.6 -1.4 -1.2 -1 -0.8 -0.6 -0.4 -0.2
0.2 0.4 0.6 0.8 1 1.2 1.4 1.6

Figure 4: Placement of Individual Personality Disorder Factor Loadings within Two-Dimensional Factor Space: Research Sample

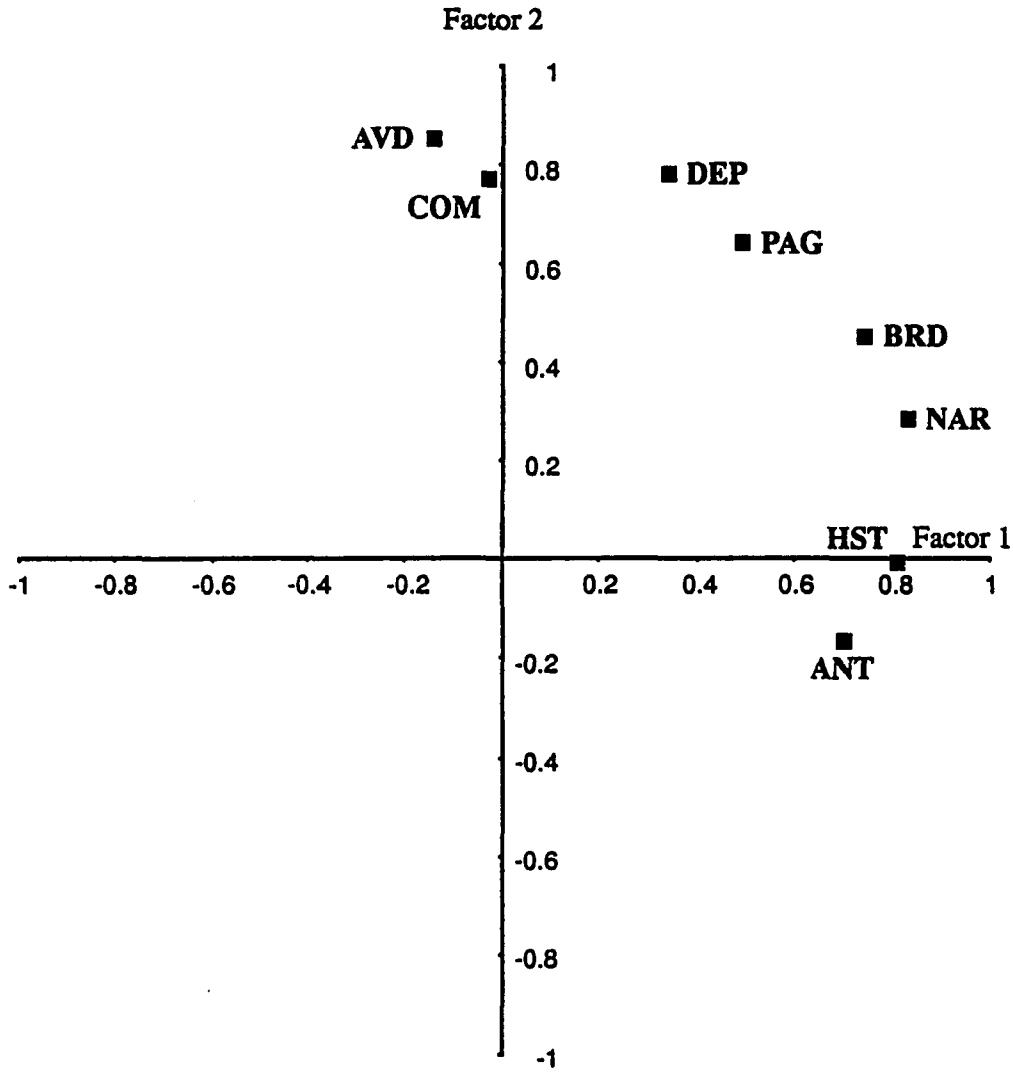

Factor 2
1
0.8
0.6
0.4
0.2
-0.2
-0.4
-0.6
-0.8
-1
AVD
COM
DEP
PAG
BRD
NAR
HST
ANT
Factor 1
-1
-0.8
-0.6
-0.4
-0.2
0.2
0.4
0.6
0.8
1

Figure 5: Change in Behavior over Time as a Function of Type of Behavior Contingency: All Subjects

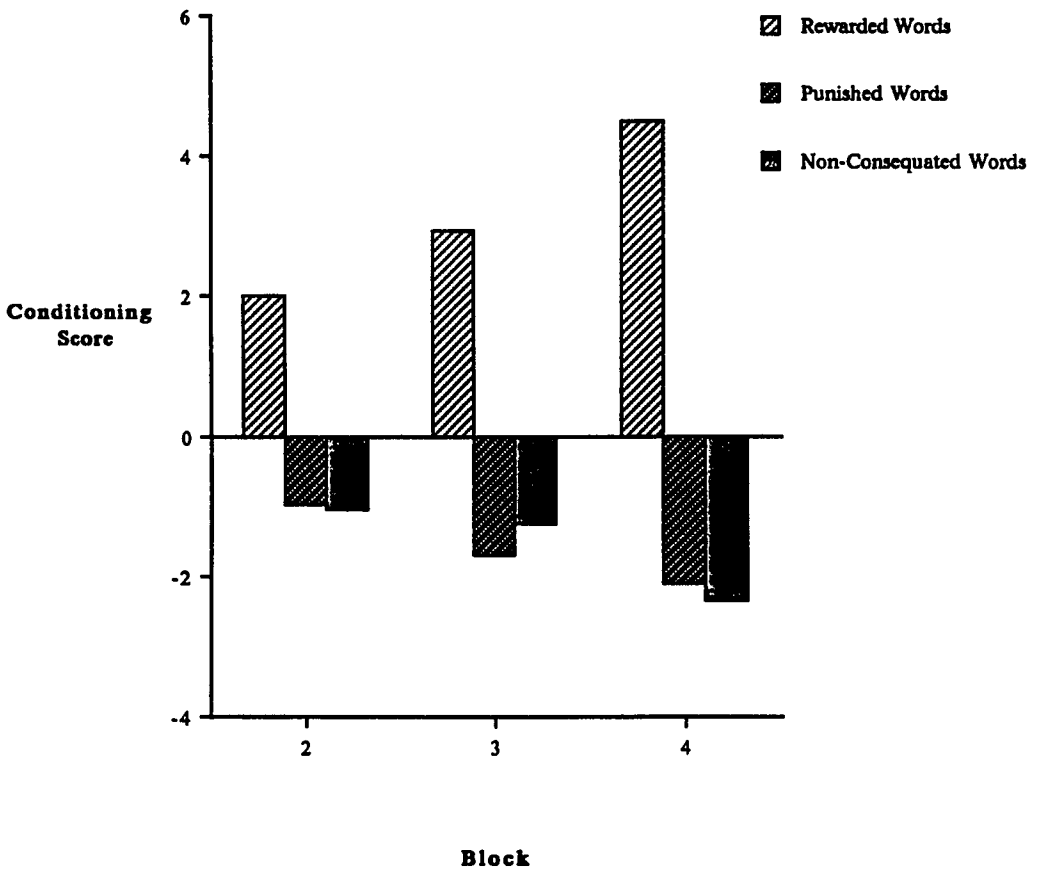

Rewarded Words
Punished Words
Non-Consequated Words
Conditioning Score
6
4
2
0
-2
-4
2
3
4
Block

Figure 6: Change in Behavior over Time as a Function of Knowledge of Behavioral Contingencies: Rewarded Words—All Subjects

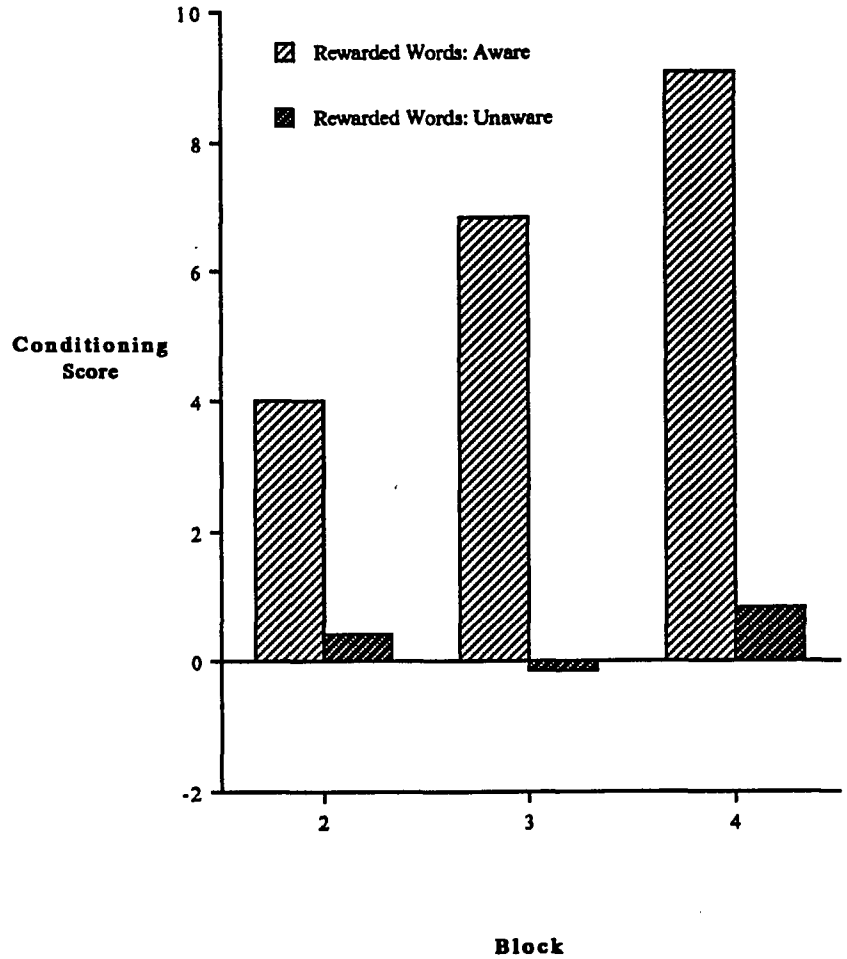

10
8
6
4
2
0
-2
Rewarded Words: Aware
Rewarded Words: Unaware
Conditioning Score
2
3
4
Block

Figure 7: Change in Behavior over Time as a Function of Knowledge of Behavioral Contingencies: Punished Words—All Subjects

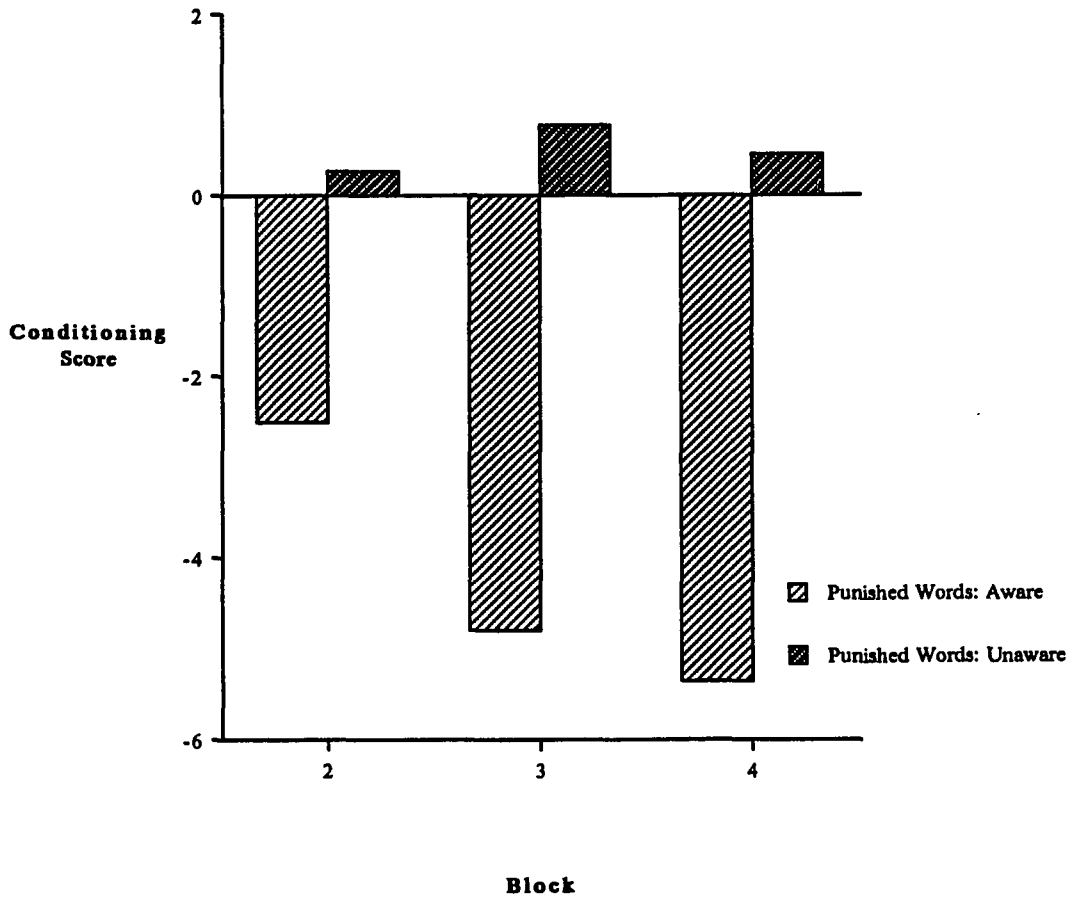

2
0
-2
-4
-6
Conditioning Score
2
3
4
Block
Punished Words: Aware
Punished Words: Unaware

Figure 8: Change in Behavior over Time as a Function of Knowledge of Behavioral Contingencies: Non-Consequated Words—All Subjects

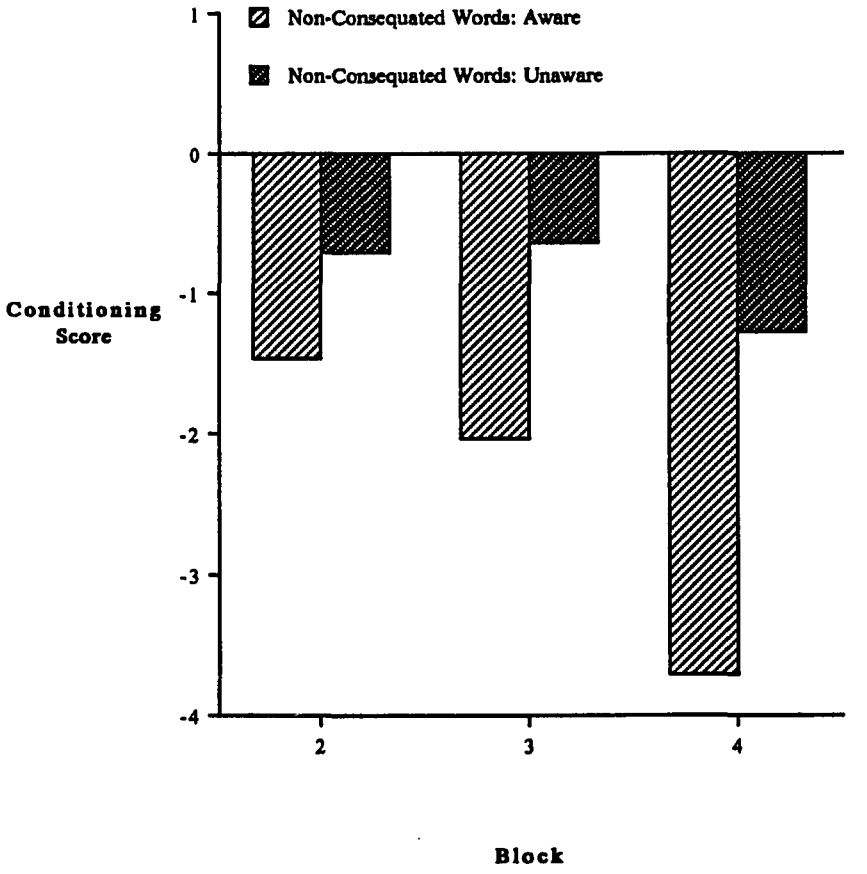

Non-Consequated Words: Aware
Non-Consequated Words: Unaware
1
0
-1
-2
-3
-4
Conditioning Score
2
3
4
Block

Figure 9: Placement of Categorical Subject Groups within Eysenck's Personality Dimensions: Research Sample—Categorical Group Configuration

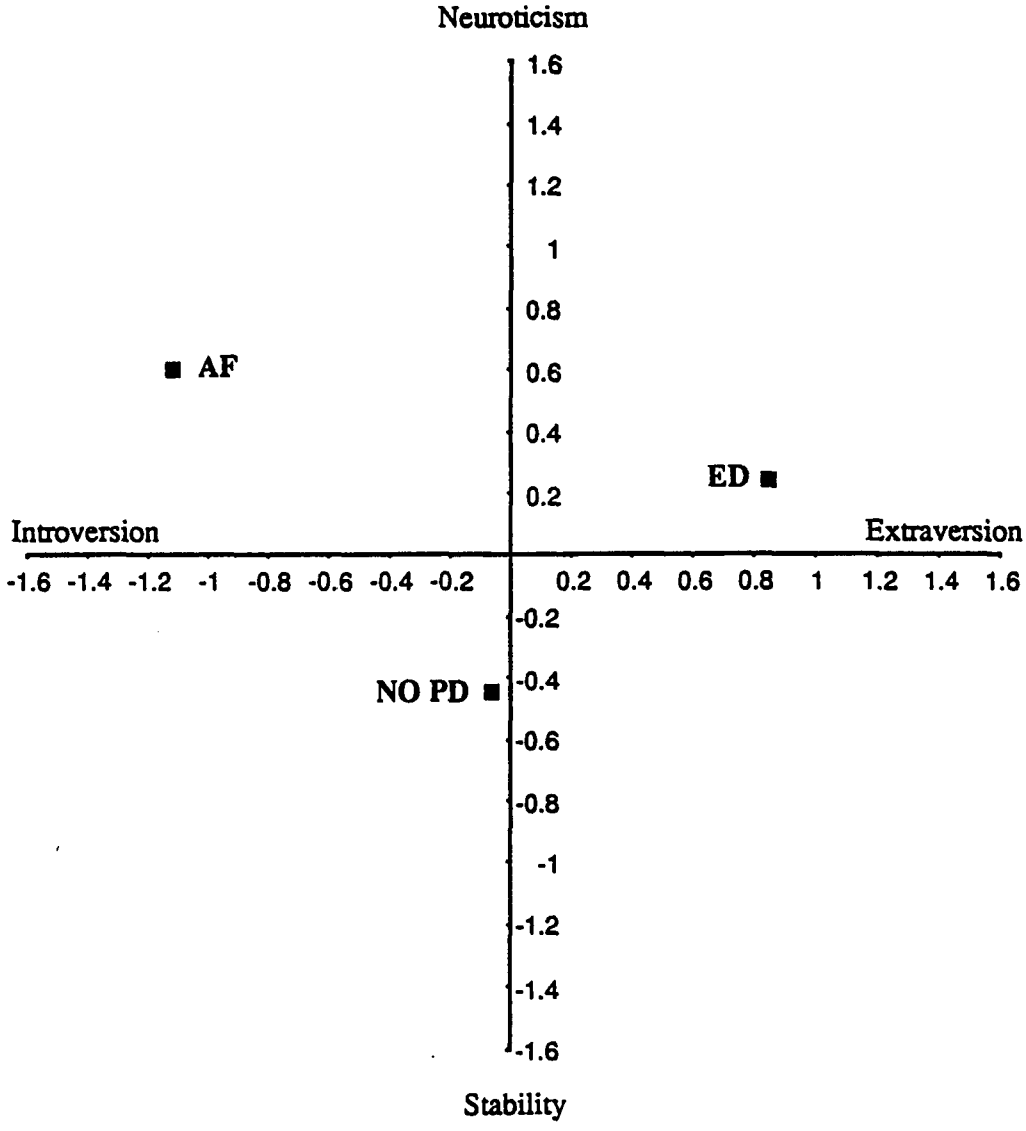
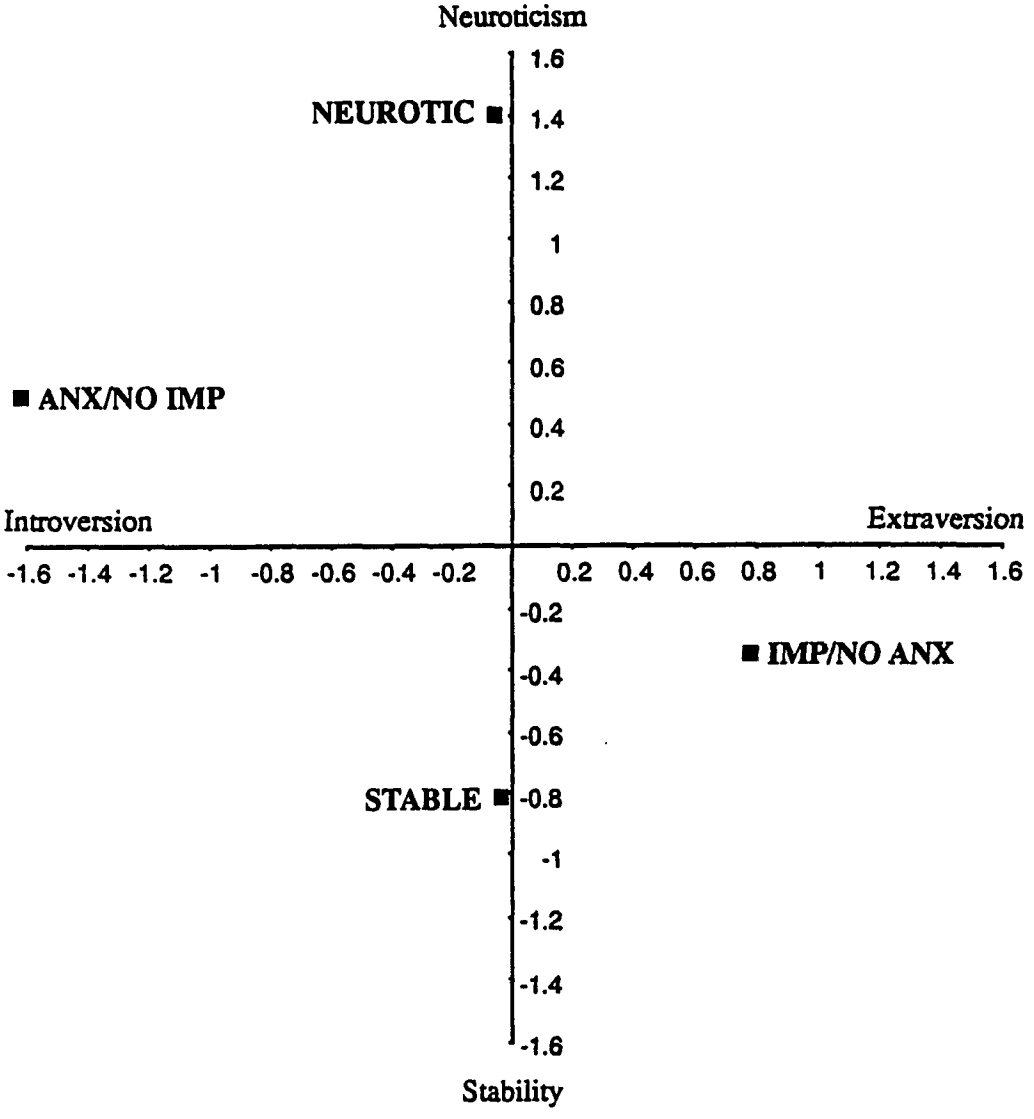

Neuroticism
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
AF
ED
Introversion
Extraversion
-1.6 -1.4 -1.2 -1 -0.8 -0.6 -0.4 -0.2
0.2 0.4 0.6 0.8 1 1.2 1.4 1.6
-0.2
-0.4
NO PD
-0.6
-0.8
-1
-1.2
-1.4
-1.6
Stability

Figure 10: Placement of Dimensional Subject Groups within Eysenck's Personality Dimensions: Research Sample—Dimensional Group Configuration


Neuroticism
1.6
NEUROTIC
1.4
1.2
1
0.8
0.6
ANX/NO IMP
0.4
0.2
Introversion
Extraversion
-1.6 -1.4 -1.2 -1 -0.8 -0.6 -0.4 -0.2
0.2 0.4 0.6 0.8 1 1.2 1.4 1.6
-0.2
IMP/NO ANX
-0.4
-0.6
STABLE
-0.8
-1
-1.2
-1.4
-1.6
Stability

APPENDIX B

TABLES

Table 1:
Relationship Between Extraversion and the Erratic-Dramatic Cluster of Personality Disorders of DSM-III-R

Features of Extraversion	Corresponding Axis II Symptom		
"...aggressive and lose temper quickly"	Antisocial	C(3):	"Is irritable or aggressive, as indicated by repeated physical fights"
	Narcissistic	1:	"Reacts to criticism with feelings of rage"
	Borderline	4:	"Inappropriate, intense anger or lack of control of anger"
"...generally an impulsive individual"	Antisocial	C(5):	"Fails to plan ahead, or is impulsive"
	Borderline	2:	"Impulsive in at least two areas"
"...not always a reliable person"	Antisocial	C(4):	"Repeatedly fails to honor financial obligations"
		C(8):	"Lacks ability to function as a responsible parent"
	Narcissistic	2	"Is interpersonally exploitative"
"...takes chances"	Antisocial	C(7):	"Is reckless regarding his or her own or others' personal safety, as indicated by driving while intoxicated, or recurrent speeding"
"...feelings are not kept under tight control"	Antisocial	B(3):	"Often initiated physical fights"
		B(4):	"Used a weapon in more than one fight"
		B(5):	"Forced someone into sexual activity with him or her"
		B(6):	"Was physically cruel to animals"
		B(7):	"Was physically cruel to other people"
		B(8):	"Deliberately destroyed others' property"
		B(9):	"Deliberately engaged in fire-setting"
	Borderline	3:	"Affective instability"
		4:	"Inappropriate, intense anger or lack of control of anger"
	Histrionic	6:	"Displays rapidly shifting and shallow expressions of emotion"
	Narcissistic	1:	"Reacts to criticism with feelings of rage, shame, or humiliation"

Table 2:
Relationship Between Introversion and the Anxious-Fearful Cluster of Personality Disorders of DSM-III-R

Features of Introversion	Corresponding Axis II Symptom		
"...fond of books rather than people"	Avoidant	2:	"Has no close friends or confidants"
		4:	"Avoids social or occupational activities"
"...reserved and distant except to intimate friends"	Avoidant	4:	"Avoids social or occupational activities"
		5:	"Is reticent in social situations"
	Compulsive	4:	"Excessive devotion to work and productivity to the exclusion of leisure activities and friendships"
"...keeps feelings under close control"	Avoidant	6:	"Fears being embarrassed by blushing, crying, or showing signs of anxiety"
	Compulsive	7:	"Restricted expression of affection"
"...likes a well-ordered mode of life"	Avoidant	7:	"Exaggerates the potential difficulties, physical dangers, or risks involved in doing something ordinary but outside his or her usual routine"
	Compulsive	2:	"Preoccupation with details, rules, lists, order, organization, or schedules"
"...mistrusts the impulse of the moment"	Dependent	1:	"Is unable to make everyday decisions without an excessive amount of advice or reassurance from others"
		2:	"Allows others to make most of his or her important decisions"
		3:	"Agrees with people even when he or she believes they are wrong"
		4:	"Has difficulty initiating projects or doing things on his or her own"
	Pass-Aggressive	1:	"Procrastinates"
	Compulsive	5:	"Indecisiveness"
"...seldom behaves in an aggressive manner"	Dependent	5:	"Volunteers to do things that are unpleasant or demeaning in order to get other people to like him or her"
"...takes matters of everyday life with proper seriousness"	Compulsive	1:	"Perfectionism that interfers with task completion"
		4:	"Excessive devotion to work and productivity"
"...places great value on ethical standards"	Compulsive	6:	"Overconscientiousness, scrupulousness, and inflexibility about matters of morality, ethics, or values"

Table 3
Sample Statistics: Normative Sample

Measure	n	Untransformed Scores		z-Transformed Scores	
		Mean	SD	Mean	SD
Eysenck Personality Inventory—Extraversion Scale (EPI-E) (Eysenck & S. B. G. Eysenck, 1968)	442	13.76	4.36	0.00	1.00
Eysenck Personality Inventory—Neuroticism Scale (EPI-N) (Eysenck & S. B. G. Eysenck, 1968)	452	11.48	4.93	0.00	1.00
State-Trait Anxiety Inventory, Trait Scale, Form Y (STAI) (Spielberger et al., 1983)	460	39.18	10.15	0.00	1.00
Social Avoidance and Distress Scale (SADS) (Watson & Friend, 1969)	463	7.70	6.05	0.00	1.00
Anxiety Composite (ANX)	448	--	--	0.00	0.87
Barratt Impulsiveness Scale, Version 10 (BIS) (Barratt, unpublished mimeo)	435	54.22	14.80	0.00	1.00
Impulsiveness Questionnaire, Version 7 (EIMP) (S. B. G. Eysenck et al., 1985)	451	7.30	4.39	0.00	1.00
Impulsiveness Composite (IMP)	413	--	--	0.00	0.94

Table 4:
Intercorrelations of Dependent Measures:
Normative Sample (n = 477)

	1.	2.	3.	4.	5.	6.	7.	8.
1. EPI-E	1.0	-.12	-.20	-.51	-.41	.43	.49	.49
2. EPI-N		1.0	.73	.45	.68	.30	.29	.31
3. STAI			1.0	.51	.87	.36	.30	.35
4. SADS				1.0	.87	.07	.05	.06
5. ANX					1.0	.26	.21	.25
6. BIS						1.0	.76	.93
7. EIMP							1.0	.94
8. IMP								1.0

Table 5:
Sample Statistics: Research Sample—All Subjects (n = 77)

Measure	Untransformed (Raw) Scores Mean	SD	z-Transformed Scores Mean	SD
Eysenck Personality Inventory—Extraversion Scale (EPI-E) (Eysenck & S. B. G. Eysenck, 1968)	12.70	5.99	-0.24	1.37
Eysenck Personality Inventory—Neuroticism Scale (EPI-N) (Eysenck & S. B. G. Eysenck, 1968)	12.40	5.62	0.19	1.14
State-Trait Anxiety Inventory, Trait Scale, Form Y (STAI) (Spielberger et al., 1983)	45.95	11.77	0.67	1.16
Social Avoidance and Distress Scale (SADS) (Watson & Friend, 1969)	11.43	8.89	0.62	1.47
Anxiety Composite (ANX)	–	–	0.64	1.19
Barratt Impulsiveness Scale, Version 10 (BIS) (Barratt, unpublished mimeo)	64.60	20.88	0.70	1.41
Impulsiveness Questionnaire, Version 7 (EIMP) (S. B. G. Eysenck et al., 1985)	9.53	5.16	0.51	1.18
Impulsiveness Composite (IMP)	–	–	0.60	1.23

Table 6:
Intercorrelations of Dependent Measures: Research Sample—All Subjects (n = 77)

	1.	2.	3.	4.	5.	6.	7.	8.
1. EPI-E	1.0	-.16	-.39	-.74	-.65	.75	.67	.75
2. EPI-N		1.0	.76	.49	.68	.10	.16	.13
3. STAI			1.0	.62	.88	-.05	.03	-.01
4. SADS				1.0	.92	-.41	-.36	-.41
5. ANX					1.0	-.28	-.21	-.26
6. BIS						1.0	.82	.96
7. EIMP							1.0	.95
8. IMP								1.0

Table 7:
Inter-Rater Agreement as to the Presence or Absence of Personality Disorders and Individual Symptom Ratings: Research Sample—All Subjects (n = 77)

	Kappa		Pearson Correlations
Diagnostic Category	Category (Presence/Absence)	Symptoms (Degree of Presence)	Dimensional Scores
Avoidant	.88	.71	.99
Dependent	1.0	.60	.96
Obsessive-Compulsive	.72	.52	.96
Passive-Aggressive	1.0	.62	.95
Paranoid	1.0	.74	.98
Schizotypal	.45	.61	.74
Schizoid	[a]	.39	.55
Histrionic	1.0	.68	.95
Narcissistic	.86	.62	.92
Borderline	1.0	.62	.94
Antisocial	1.0	.69	.98
All Personality Disorders	.89	.65	.93

[a]Kappa cannot be computed for this disorder as both raters agreed across all reliability assessments that the disorder was absent.

Table 8:
Frequency of Individual Personality Disorder Diagnoses: Research Sample—All Subjects (n = 77)

Diagnostic Category	Number of Times Diagnosed	Proportion of All Diagnoses[a]
Anxious-Fearful Cluster		
Avoidant (AVD)	13	10%
Dependent (DEP)	9	7%
Obsessive-Compulsive (COM)	17	13%
Passive-Aggressive (PAG)	12	9%
Odd-Eccentric Cluster		
Paranoid (PAR)	18	14%
Schizotypal (SZT)	9	7%
Schizoid (SCD)	1	1%
Erratic-Dramatic Cluster		
Histrionic (HST)	11	8%
Narcissistic (NAR)	17	13%
Borderline (BRD)	18	14%
Antisocial (ANT)	8	6%

[a] Proportions sum to a value larger than 100% because of rounding.

Table 9:
Correlations between Personality Disorder Dimensional Scores and Introversion-Extraversion (EPI-E), Neuroticism-Stability (EPI-N), and Impulsivity (IMP) and Anxiety (ANX) Composite Scores: Research Sample—All subjects (n = 77)

	Measures			
Personality Disorder Trait	EPI-E	EPI-N	IMP	ANX
Anxious-Fearful Disorders				
Avoidant	-.55	.56	-.34	.81
Dependent	-.14	.67	.09	.57
Obsessive-Compulsive	-.46	.54	-.24	.64
Passive-Aggressive	.02	.65	.28	.45
Erratic-Dramatic Disorders				
Histrionic	.48	.29	.55	-.12
Narcissistic	.28	.48	.42	.24
Borderline	.06	.63	.32	.43
Antisocial	.38	.12	.58	-.01

Table 10:
Factor Loadings of Individual Personality Disorder Dimensional Scores: Research Sample—All Subjects (n = 77)

Personality Disorder	Factor 1	Factor 2
Avoidant (AVD)	-.14	.85
Dependent (DEP)	.34	.78
Obsessive-Compulsive (COM)	-.03	.77
Passive-Aggressive (PAG)	.49	.64
Histrionic (HST)	.81	-.01
Narcissistic (NAR)	.83	.28
Borderline (BRD)	.74	.45
Antisocial (ANT)	.70	-.17

Table 11:
Correlations between Personality Disorder Factor Scores with Measures of Introversion-Extraversion (EPI-E), Neuroticism-Stability (EPI-N), and Anxiety (ANX) and Impulsivity (IMP) Composite Scores: Research Sample—All Subjects (n = 77)

	Measures			
Personality Disorder Factors	EPI-E	EPI-N	IMP	ANX
Factor 1	.52	.37	.68	-.01
Factor 2	-.50	.72	-.25	.83

Table 12a:
Rewarded Words: One-Way ANOVA (with Greenhouse-Geisser Corrections) for the Change in Frequency of Use of Rewarded Words Over Blocks of Trials: Research Sample—All Subjects (n = 77)

Source	df	SS	F	p
Block	1	120.64	15.28	< .0001
Error	76	1200.06		

Table 12b:
Bonferroni (Dunn) Paired t-Test Multiple Comparisons: Means for Use of Rewarded Words Across Trial Blocks: Research Sample: All Subjects (n = 77)

Trial Block	Means
Block 2	1.99[a]
Block 3	2.94[ab]
Block 4	4.47[c]

Note: Means with different superscripts are significantly different at $p < .05$.

Table 13a:
Punished Words: One-Way ANOVA (with Greenhouse-Geisser Corrections) for the Change in Frequency of Use of Punished Words Over Blocks of Trials: Research Sample—All Subjects (n = 77)

Source	df	SS	F	p
Block	1	26.92	7.10	< .002
Error	76	576.16		

Table 13b:
Bonferroni (Dunn) Paired t-Test Multiple Comparisons: Means for Use of Punished Words Across Trial Blocks: Research Sample: All Subjects (n = 77)

Trial Block	Means
Block 2	-0.95[a]
Block 3	-1.69[b]
Block 4	-2.12[b]

Note: Means with different superscripts are significantly different at $p < .05$.

Table 14a:
Non-Consequated Words: One-Way ANOVA (with Greenhouse-Geisser Corrections) for the Change in Frequency of Use of Non-Consequated Words Over Blocks of Trials: Research Sample—All Subjects (n = 77)

Source	df	SS	F	p
Block	1	76.55	8.96	< .001
Error	76	649.45		

Table 14b:
Bonferroni (Dunn) Paired t-Test Multiple Comparisons: Means for Use of Non-Consequated Words Across Trial Blocks: Research Sample: All Subjects (n = 77)

Trial Block	Means
Block 2	-1.04[a]
Block 3	-1.25[ab]
Block 4	-2.35[c]

Note: Means with different superscripts are significantly different at $p < .05$.

Table 15:
Chi-Square Analysis of Gender as a Function of Group Membership: Research Sample—Categorical Grouping (n = 66)

Frequency (Percent)	Males	Females
Anxious-Fearful (AF)	9 (13.6)	11 (16.7)
Erratic-Dramatic (ED)	12 (18.2)	8 (12.1)
No Personality Disorder (NO PD)	10 (15.2)	16 (24.2)

Table 16:
One-Way ANOVA: Age as a Function of Group Membership: Research Sample—Categorical Grouping (n = 66)

Source	df	SS	F	p
Group	2	200.87	1.42	0.25
Error	63	4444.58		

Table 17:
Means (z-Transformed Scores) (and Standard Deviations) by Group: Research Sample—Categorical Group Configuration (n = 66)

Measure	Anxious-Fearful Cluster (AF) (n = 20)	Erratic-Dramatic Cluster (ED) (n = 20)	No Personality Disorder (n = 26)
Eysenck Personality Inventory—Extraversion Scale (EPI-E) (Eysenck & S. B. G. Eysenck, 1968)	-1.12 (1.24)	0.85 (.76)	-0.06 (1.26)
Eysenck Personality Inventory—Neuroticism Scale (EPI-N) (Eysenck & S. B. G. Eysenck, 1968)	0.60 (.87)	0.24 (1.29)	-0.45 (1.04)
State-Trait Anxiety Inventory, Trait Scale, Form Y (STAI) (Spielberger et al., 1983)	1.27 (.86)	0.49 (1.28)	-0.01 (1.04)
Social Avoidance and Distress Scale (SADS) (Watson & Friend, 1969)	1.78 (1.42)	-0.32 (.96)	0.08 (1.13)
Anxiety Composite (ANX)	1.53 (.96)	0.08 (1.03)	0.03 (1.03)
Barratt Impulsiveness Scale, Version 10 (BIS) (Barratt, unpublished mimeo)	0.31 (1.33)	1.64 (1.16)	0.41 (1.36)
Impulsiveness Questionnaire, Version 7 (EIMP) (S. B. G. Eysenck et al., 1985)	0.01 (1.10)	1.36 (.88)	0.33 (1.01)
Impulsiveness Composite (IMP)	0.16 (1.16)	1.50 (.95)	0.37 (1.01)

Table 18a:
One-Way ANOVA: Introversion-Extraversion (EPI-E) z-Scores as a Function of Group Membership: Research Sample—Categorical Grouping (n = 66)

Source	df	SS	F	p
Group	2	38.55	15.23	< .0001
Error	63	79.72		

Table 18b:
Tukey's Honestly Significant Difference (HSD) Post Hoc Tests: Means for Introversion-Extraversion (EPI-E) as a Function of Group Membership: Research Sample—Categorical Grouping (n = 66)

Group	Means
Anxious-Fearful (AF)	-1.12[a]
Erratic-Dramatic (ED)	0.85[b]
No Personality Disorder (NO PD)	-0.06[c]

Note: Means with different superscripts are significantly different at $p < .05$.

Table 19a:
One-Way ANOVA: Neuroticism-Stability (EPI-N) z-Scores as a Function of Group Membership: Research Sample—Categorical Grouping (n = 66)

Source	df	SS	F	p
Group	2	13.26	5.70	.0053
Error	63	73.20		

Table 19b:
Tukey's Honestly Significant Difference (HSD) Post Hoc Tests: Means for Neuroticism-Stability (EPI-N) as a Function of Group Membership: Research Sample—Categorical Grouping (n = 66)

Group	Means
Anxious-Fearful (AF)	0.60[a]
Erratic-Dramatic (ED)	0.24[a]
No Personality Disorder (NO PD)	-0.44[b]

Note: Means with different superscripts are significantly different at $p < .05$.

Table 20a:
One-Way ANOVA: Anxiety Composite (ANX) Scores as a Function of Group Membership: Research Sample—Categorical Grouping (n = 66)

Source	df	SS	F	p
Group	2	30.14	14.78	< .0001
Error	63	64.24		

Table 20b:
Tukey's Honestly Significant Difference (HSD) Post Hoc Tests: Means for Anxiety Composite Scores (ANX) as a Function of Group Membership: Research Sample—Categorical Grouping (n = 66)

Group	Means
Anxious-Fearful (AF)	1.53[a]
Erratic-Dramatic (ED)	0.08[b]
No Personality Disorder (NO PD)	0.03[b]

Note: Means with different superscripts are significantly different at $p < .05$.

Table 21a:
One-Way ANOVA: Impulsivity Composite (IMP) Scores as a Function of Group Membership: Research Sample—Categorical Grouping (n = 66)

Source	df	SS	F	p
Group	2	21.31	9.20	.0003
Error	63	72.92		

Table 21b:
Tukey's Honestly Significant Difference (HSD) Post Hoc Tests: Means for the Impulsivity Composite Scores (IMP) as a Function of Group Membership: Research Sample—Categorical Grouping (n = 66)

Group	Means
Anxious-Fearful (AF)	0.16[a]
Erratic-Dramatic (ED)	1.50[b]
No Personality Disorder (NO PD)	0.37[a]

Note: Means with different superscripts are significantly different at $p < .05$.

Table 22a:
One-Way ANOVA: Anxious-Fearful Personality Disorder Dimensional Scores as a Function of Group Membership: Research Sample—Categorical Grouping (n = 66)

Source	df	SS	F	p
Group	2	0.94	25.94	< .0001
Error	63	1.14		

Table 22b:
Tukey's Honestly Significant Difference (HSD) Post Hoc Tests: Means for the Anxious-Fearful Personality Disorder Dimensional Scores as a Function of Group Membership: Research Sample—Categorical Grouping (n = 66)

Group	Means
Anxious-Fearful (AF)	0.45[a]
Erratic-Dramatic (ED)	0.26[b]
No Personality Disorder (NO PD)	0.17[b]

Note: Means with different superscripts are significantly different at $p < .05$.

Table 23a:
One-Way ANOVA: Erratic-Dramatic Personality Disorder Dimensional Scores as a Function of Group Membership: Research Sample—Categorical Grouping ($\underline{n}$ = 66)

Source	df	SS	F	p
Group	2	1.02	27.23	< .0001
Error	63	1.18		

Table 23b:
Tukey's Honestly Significant Difference (HSD) Post Hoc Tests: Means for the Erratic-Dramatic Personality Disorder Dimensional Scores as a Function of Group Membership: Research Sample—Categorical Grouping (n = 66)

Group	Means
Anxious-Fearful (AF)	0.24[a]
Erratic-Dramatic (ED)	0.41[b]
No Personality Disorder (NO PD)	0.14[a]

Note: Means with different superscripts are significantly different at $p < .05$.

Table 24a:
Stepwise Discriminant Function Analysis: Prediction of Group Membership as a Function of Introversion-Extraversion (EPI-E) and Neuroticism-Stability (EPI-N) Scores: Research Sample—Categorical Grouping (n = 66)

Variable	Step Entered	Wilks' Lambda	Partial R^2	F	p
EPI-E	1	0.67	0.33	15.23	< .0001
EPI-N	2	0.58	0.14	5.23	< .0001

Table 24b:
Prediction Table: Discriminant Function Analysis of Introversion-Extraversion (EPI-E) and Neuroticism-Stability (EPI-N) Scores for the Prediction of Group Membership: Research Sample—Categorical Grouping (n = 66)

	Predicted Group Classification			
Actual Group Classification	Anxious-Fearful (AF)	Erratic-Dramatic (ED)	No Personality Disorder (NO PD)	Total
Anxious-Fearful (AF)	16	1	3	20
Erratic-Dramatic (ED)	2	11	7	20
No Personality Disorder (NO PD)	5	7	14	26
Total	23	19	24	66

Table 25a:
Stepwise Discriminant Function Analysis: Prediction of Group Membership as a Function of Anxiety Composite Scores (ANX) and Impulsivity Composite Scores (IMP): Research Sample—Categorical Grouping (n = 66)

Variable	Step Entered	Wilks' Lambda	Partial R^2	F	p
ANX	1	0.68	0.32	14.78	< .0001
IMP	2	0.55	0.19	7.41	< .0001

Table 25b:
Prediction Table: Discriminant Function Analysis of Anxiety (ANX) and Impulsivity (IMP) Composite Scores for the Prediction of Group Membership: Research Sample—Categorical Grouping (n = 66)

	Predicted Group Classification			
Actual Group Classification	Anxious-Fearful (AF)	Erratic-Dramatic (ED)	No Personality Disorder (NO PD)	Total
Anxious-Fearful (AF)	16	2	2	20
Erratic-Dramatic (ED)	2	15	3	20
No Personality Disorder (NO PD)	5	8	13	26
Total	23	25	18	66

Table 26a
Stepwise Discriminant Function Analysis: Prediction of Group Membership as a Function of Introversion-Extraversion (EPI-E) and Neuroticism-Stability (EPI-N) Scores: Research Sample—Anxious-Fearful and Erratic-Dramatic Groups Only (n = 40)

Variable	Step Entered	Wilks' Lambda	Partial R^2	F	p
EPI-E	1	0.51	0.49	36.32	< .0001
EPI-N	[Not significant]				

Table 26b:
Prediction Table: Discriminant Function Analysis of Introversion-Extraversion (EPI-E) Scores for the Prediction of Group Membership: Research Sample—Anxious-Fearful and Erratic-Dramatic Groups Only (n = 40)

	Predicted Group Classification		
Actual Group Classification	Anxious-Fearful (AF)	Erratic-Dramatic (ED)	Total
Anxious-Fearful (AF)	18	2	20
Erratic-Dramatic (ED)	3	17	20
Total	21	19	40

Table 27a
Stepwise Discriminant Function Analysis: Prediction of Group Membership as a Function of Impulsivity (IMP) and Anxiety (ANX) Composite Scores: Research Sample—Anxious-Fearful and Erratic-Dramatic Groups Only (n = 40)

Variable	Step Entered	Wilks' Lambda	Partial R^2	F	p
ANX	1	0.65	0.35	20.87	< .0001
IMP	2	0.51	0.21	9.93	< .0001

Table 27b:
Prediction Table: Discriminant Function Analysis of Anxiety (ANX) and Impulsivity (IMP) Composite Scores for the Prediction of Group Membership: Research Sample—Anxious-Fearful and Erratic-Dramatic Groups Only (n = 40)

	Predicted Group Classification		
Actual Group Classification	Anxious-Fearful (AF)	Erratic-Dramatic (ED)	Total
Anxious-Fearful (AF)	16	4	20
Erratic-Dramatic (ED)	3	17	20
Total	19	21	40

Table 28a:
Rewarded Words: Two-Way ANOVA (with Greenhouse-Geisser Corrections) for the Change in Frequency of Use of Rewarded Words Over Blocks of Trials and by Group: Research Sample—Categorical Configuration (n = 66)

Source	df	SS	F	p
Group	2	313.43	1.91	.16
Subjects (Groups)	63	5157.45		
Block	1	227.23	15.05	< .0001
Block x Group	2	77.77	2.58	.05
Error	63	950.88		

Table 28b:
Bonferroni (Dunn) Paired t-Test Multiple Comparisons (for Within Subject Factors): Means for Use of Rewarded Words as a Function of Block and Blocks by Group Interaction: Research Sample–Categorical Grouping (n = 66)

Block	Means
Block 2	1.58[a]
Block 3	2.41[a]
Block 4	4.09[b]

Block x Group Interaction (Comparisons of Means Across Columns)

	AF	ED	NO PD
Block 2	1.25[a]	2.15[a]	1.38[a]
Block 3	1.25[a]	5.10[a]	1.23[a]
Block 4	3.10[a]	6.55[a]	2.96[a]

Block x Group Interaction (Comparisons of Means Across Rows)

	AF	ED	NO PD
Block 2	1.25[a]	2.15[a]	1.38[ab]
Block 3	1.25[a]	5.10[b]	1.23[b]
Block 4	3.10[a]	6.55[b]	2.96[a]

Note: Means with different superscripts within comparisions are significantly different at $p < .05$.

Table 29a:
Punished Words: Two-Way ANOVA (with Greenhouse-Geisser Corrections) for the Change in Frequency of Use of Punished Words Over Blocks of Trials and by Group: Research Sample—Categorical Configuration (n = 66)

Source	df	SS	F	p
Group	2	150.43	1.44	.24
Subjects (Groups)	63	3283.11		
Block	1	59.99	8.11	< .001
Block x Group	2	53.14	3.59	.01
Error	63	465.76		

Table 29b:
Bonferroni (Dunn) Paired t-Test Multiple Comparisons (for Within Subject Factors): Means for Use of Punished Words as a Function of Block and Blocks by Group Interaction: Research Sample–Categorical Grouping (n = 66)

Block	Means
Block 2	-0.59[a]
Block 3	-1.33[ab]
Block 4	-1.81[b]

Block x Group Interaction (Comparisons of Means Across Columns)

	AF	ED	NO PD
Block 2	-0.20[a]	-0.90[a]	-0.65[a]
Block 3	-0.55[a]	-3.20[a]	-0.50[a]
Block 4	-1.50[a]	-3.60[a]	-0.69[a]

Block x Group Interaction (Comparisons of Means Across Rows)

	AF	ED	NO PD
Block 2	-0.20[a]	-0.90[a]	-0.65[a]
Block 3	-0.55[a]	-3.20[b]	-0.50[a]
Block 4	-1.50[a]	-3.60[b]	-0.69[a]

Note: Means with different superscripts within comparisions are significantly different at $p < .05$.

Table 30a:
Non-Consequated Words: Two-Way ANOVA (with Greenhouse-Geisser Corrections) for the Change in Frequency of Use of Non-Consequated Words Over Blocks of Trials and by Group: Research Sample—Categorical Configuration (n = 66)

Source	df	SS	F	p
Group	2	30.40	0.45	.64
Subjects (Groups)	63	2121.82		
Block	1	64.07	7.06	< .002
Block x Group	2	10.50	0.58	.66
Error	63	571.97		

Table 30b:
Bonferroni (Dunn) Paired t-Test Multiple Comparisons (for Within Subject Factors): Means for Use of Non-Consequated Words as a Function of Block: Research Sample–Categorical Grouping (n = 66)

Block	Means
Block 2	-0.98[a]
Block 3	-1.08[ab]
Block 4	-2.27[c]

Note: Means with different superscripts within comparisions are significantly different at $p < .05$.

Table 31:
Chi-Square Analysis for Differences in Awareness of Behavioral Contingencies as a Function of Group Membership: Research Sample—Categorical Groupings (n = 66)

Frequency (Percent) [Cell Chi-Square]	Unaware	Aware
Anxious-Fearful (AF)	13 (65.0) [0.19]	7 (35.0) [0.26]
Erratic-Dramatic (ED)	6 (30.0) [2.64]	14 (70.0) [3.58]
No Personality Disorder (NO PD)	19 (73.1) [1.09]	7 (26.9) [1.47]

Table 32:
Chi-Square Analysis for Differences in Gender as a Function of Group Membership: Research Sample—Dimensional Groupings (n = 77)

Frequency (Percent)	Males	Females
STABLE (LOF1/LOF2)	8 (40.0)	12 (60.0)
IMP/NO ANX (HIF1/LOF2)	8 (44.4)	10 (55.6)
ANX/NO IMP (LOF1/HIF2)	9 (47.4)	10 (52.6)
NEUROTIC (HIF1/HIF2)	10 (50.0)	10 (50.0)

Table 33:
One-Way ANOVA: Age as a Function of Group Membership: Research Sample—Dimensional Grouping (n = 77)

Source	df	SS	F	p
Group	3	287.29	1.49	0.22
Error	73	4685.96		

Table 34
Means (z-Transformed Scores) (and Standard Deviations) by Group: Research Sample—Dimensional Group Configuration (n = 77)

Measure	STABLE (n = 20)	IMP/NO ANX (n = 18)	ANX/NO IMP (n = 19)	NEUROTIC (n = 20)
Eysenck Personality Inventory—Extraversion Scale (EPI-E) (Eysenck & S. B. G. Eysenck, 1968)	-0.04 (1.12)	0.78 (0.78)	-1.62 (1.18)	-0.06 (1.20)
Eysenck Personality Inventory—Neuroticism Scale (EPI-N) (Eysenck & S. B. G. Eysenck, 1968)	-0.82 (0.76)	-0.35 (0.94)	0.48 (0.76)	1.39 (0.56)
State-Trait Anxiety Inventory, Trait Scale, Form Y (STAI) (Spielberger et al., 1983)	-0.30 (0.92)	-0.05 (0.74)	1.23 (0.82)	1.75 (0.61)
Social Avoidance and Distress Scale (SADS) (Watson & Friend, 1969)	0.05 (1.35)	-0.55 (0.58)	1.76 (1.01)	1.15 (1.52)
Anxiety Composite (ANX)	-0.12 (1.05)	-0.31 (0.55)	1.50 (0.74)	1.45 (0.93)
Barratt Impulsiveness Scale, Version 10 (BIS) (Barratt, unpublished mimeo)	0.24 (1.10)	1.57 (1.04)	-0.44 (1.16)	1.46 (1.28)
Impulsiveness Questionnaire, Version 7 (EIMP) (S. B. G. Eysenck et al., 1985)	0.09 (0.85)	1.30 (0.87)	-0.59 (0.85)	1.25 (0.95)
Impulsiveness Composite (IMP)	0.17 (0.83)	1.43 (0.91)	-0.51 (0.97)	1.36 (1.03)

Table 35a:
One-Way ANOVA: Introversion-Extraversion (EPI-E) z-Scores as a Function of Group Membership: Research Sample—Dimensional Grouping (n = 77)

Source	df	SS	F	p
Group	3	56.60	15.84	< .0001
Error	73	86.94		

Table 35b:
Tukey's Honestly Significant Difference (HSD) Post Hoc Tests: Means for Introversion-Extraversion (EPI-E) as a Function of Group Membership: Research Sample—Dimensional Grouping (n = 77)

Group	Means
STABLE	-0.04[a]
IMP/NO ANX	0.78[a]
ANX/NO IMP	-1.62[b]
NEUROTIC	-0.06[a]

Note: Means with different superscripts are significantly different at $p < .05$.

Table 36a:
One-Way ANOVA: Neuroticism-Stability (EPI-N) z-Scores as a Function of Group Membership: Research Sample—Dimensional Grouping (n = 77)

Source	df	SS	F	p
Group	3	55.91	31.94	< .0001
Error	73	42.60		

Table 36b:
Tukey's Honestly Significant Difference (HSD) Post Hoc Tests: Means for Neuroticism-Stability (EPI-N) as a Function of Group Membership: Research Sample—Dimensional Grouping (n = 77)

Group	Means
STABLE	-0.82[a]
IMP/NO ANX	-0.35[a]
ANX/NO IMP	0.48[b]
NEUROTIC	1.39[c]

Note: Means with different superscripts are significantly different at $p < .05$.

Table 37a:
One-Way ANOVA: Impulsivity Composite (IMP) Scores as a Function of Group Membership: Research Sample—Dimensional Grouping (n = 66)

Source	df	SS	F	p
Group	3	51.24	19.30	<.0001
Error	73	64.60		

Table 37b:
Tukey's Honestly Significant Difference (HSD) Post Hoc Tests: Means for the Impulsivity Composite Scores (IMP) as a Function of Group Membership: Research Sample—Dimensional Grouping (n = 77)

Group	Means
STABLE	0.17[a]
IMP/NO ANX	1.43[b]
ANX/NO IMP	-0.51[a]
NEUROTIC	1.36[b]

Note: Means with different superscripts are significantly different at $p < .05$.

Table 38a:
One-Way ANOVA: Anxiety Composite (ANX) Scores as a Function of Group Membership: Research Sample—Dimensional Grouping (n = 77)

Source	df	SS	F	p
Group	3	54.83	25.54	< .0001
Error	73	52.24		

Table 38b:
Tukey's Honestly Significant Difference (HSD) Post Hoc Tests: Means for Anxiety Composite Scores (ANX) as a Function of Group Membership: Research Sample—Dimensional Grouping (n = 77)

Group	Means
STABLE	-0.12[a]
IMP/NO ANX	-0.31[a]
ANX/NO IMP	1.50[b]
NEUROTIC	1.45[b]

Note: Means with different superscripts are significantly different at $p < .05$.

Table 39:
Correspondence Among Dimensional Subject Groups to Diagnostic Categorical Membership: Frequency (and Proportion) of Personality Disorder Diagnoses among Dimensional Subject Groups: Research Sample—Dimensional Grouping (n = 77)

	Dimensional Groups				
Personality Disorder	STABLE	IMP/NO ANX	ANX/NO IMP	NEUROTIC	Total
Avoidant	1 (8%)	0 (0%)	7 (54%)	5 (38%)	13
Dependent	0 (0%)	0 (0%)	2 (22%)	7 (78%)	9
Obsessive-Compulsive	1 (6%)	0 (0%)	7 (41%)	9 (53%)	17
Passive-Aggressive	0 (0%)	0 (0%)	3 (25%)	9 (75%)	12
Histrionic	0 (0%)	4 (36%)	0 (0%)	7 (64%)	11
Narcissistic	0 (0%)	8 (47%)	0 (0%)	9 (53%)	17
Borderline	0 (0%)	5 (28%)	0 (0%)	13 (72%)	18
Antisocial	0 (0%)	5 (63%)	0 (0%)	3 (38%)	8
Total	2 (2%)	22 (21%)	19 (18%)	62 (59%)	105

Table 40a:
Stepwise Discriminant Function Analysis: Prediction of Group Membership as a Function of Introversion-Extraversion (EPI-E) and Neuroticism-Stability (EPI-N) Scores: Research Sample—Dimensional Grouping (n = 77)

Variable	Step Entered	Wilks' Lambda	Partial R^2	F	p
EPI-N	1	0.43	0.57	31.94	< .0001
EPI-E	2	0.27	0.38	14.67	<.0001

Table 40b:
Prediction Table: Discriminant Function Analysis of Introversion-Extraversion (EPI-E) and Neuroticism-Stability (EPI-N) Scores for the Prediction of Group Membership: Research Sample—Dimensional Grouping (n = 77)

	Predicted Group Classification				
Actual Group Classification	STABLE	IMP/NO ANX	ANX/NO IMP	NEUROTIC	TOTAL
STABLE	10	6	4	0	20
IMP/NO ANX	7	9	0	2	18
ANX/NO IMP	1	1	15	2	19
NEUROTIC	0	1	3	16	20
Total	18	17	22	20	77

Table 41a:
Stepwise Discriminant Function Analysis: Prediction of Group Membership as a Function of Anxiety (ANX) and Impulsivity (IMP) Composite Scores: Research Sample—Dimensional Grouping (n = 77)

Variable	Step Entered	Wilks' Lambda	Partial R^2	F	p
ANX	1	0.49	0.51	25.54	< .0001
IMP	2	0.27	0.44	19.21	<.0001

Table 41b:
Prediction Table: Discriminant Function Analysis of Anxiety (ANX) and Impulsivity (IMP) Composite Scores for the Prediction of Group Membership: Research Sample—Dimensional Grouping (n = 77)

	Predicted Group Classification				
Actual Group Classification	STABLE	IMP/NO ANX	ANX/NO IMP	NEUROTIC	TOTAL
STABLE	13	3	4	0	20
IMP/NO ANX	3	13	0	2	18
ANX/NO IMP	2	1	15	1	19
NEUROTIC	0	3	5	12	20
Total	18	20	24	15	77

Table 42a:
Rewarded Words: Two-Way ANOVA (with Greenhouse-Geisser Corrections) for the Change in Frequency of Use of Rewarded Words Over Blocks of Trials by Group: Research Sample—Dimensional Configuration (n = 77)

Source	df	SS	F	p
Group	3	423.61	1.63	.19
Subjects (Groups)	73	6307.16		
Block	1	294.71	16.02	< .0001
Block x Group	3	61.88	1.32	.25
Error	73	1138.18		

Table 42b:
Bonferroni (Dunn) Paired t-Test Multiple Comparisons (for Within Subject Factors): Means for Use of Rewarded Words as a Function of Block: Research Sample–Dimensional Grouping (n = 77)

Block	Means
Block 2	1.99[a]
Block 3	2.94[ab]
Block 4	4.47[c]

Note: Means with different superscripts within comparisions are significantly different at $p < .05$.

Table 43a:
Punished Words: Two-Way ANOVA (with Greenhouse-Geisser Corrections) for the Change in Frequency of Use of Punished Words Over Blocks of Trials by Group: Research Sample—Dimensional Configuration (n = 77)

Source	df	SS	F	p
Group	3	360.38	2.54	.06
Subjects (Groups)	73	3445.72		
Block	1	56.04	7.42	< .002
Block x Group	3	24.54	1.08	.38
Error	73	551.61		

Table 43b:
Tueky Post-Hoc Comparisons (for Between Subject Factor) and Bonferroni (Dunn) Paired t-Test Multiple Comparisons (for Within Subject Factors): Means for Use of Punished Words as a Function of Group and Block: Research Sample–Dimensional Grouping (n = 77)

	Block Means		
Group	Block 2	Block 3	Block 4
STABLE	0.00[a]	0.15[a]	-0.20[a]
IMP/NO ANX	-2.00[a]	-3.50[a]	-4.11[a]
ANX/NO IMP	-0.26[a]	-0.74[a]	-1.52[a]
NEUROTIC	-1.60[a]	-0.28[a]	-2.80[a]

Block	Means
Block 2	-0.95[a]
Block 3	-1.69[b]
Block 4	-2.12[b]

Note: Means with different superscripts within comparisions are significantly different at $p < .05$.

Table 44a:
Non-Consequated Words: Two-Way ANOVA (with Greenhouse-Geisser Corrections) for the Change in Frequency of Use of Non-Consequated Words Over Blocks of Trials by Group: Research Sample—Dimensional Configuration (n = 77)

Source	df	SS	F	p
Group	3	80.25	0.80	.50
Subjects (Groups)	73	2441.03		
Block	1	78.48	9.01	< .001
Block x Group	3	13.74	0.53	.77
Error	73	635.71		

Table 44b:
Bonferroni (Dunn) Paired t-Test Multiple Comparisons (for Within Subject Factors): Means for Use of Non-Consequated Words as a Function of Block: Research Sample-Categorical Grouping (n = 66)

Block	Means
Block 2	-1.04[a]
Block 3	-1.25[ab]
Block 4	-2.35[c]

Note: Means with different superscripts within comparisions are significantly different at $p < .05$.

Table 45:
Chi-Square Analysis for Differences in Awareness of Behavioral Contingencies as a Function of Group Membership: Research Sample—Dimensional Groupings (n = 77)

Frequency (Percent)	Unaware	Aware
STABLE	14 (70.0)	6 (30.0)
IMP/NO ANX	8 (44.4)	10 (55.6)
ANX/NO IMP	11 (57.9)	8 (42.1)
NEUROTIC	10 (50.0)	10 (50.0)

APPENDIX C: Text of Cover Letter

Thank you very much for your interest in participating in psychology research at UNCG. As we discussed over the phone, this study takes place in three parts: (a) filling out questionnaires at your home, (b) participating in a clinical interview at UNCG, and (c) participating in an experiment at UNCG on the same day that you come in for the clinical interview. The questionnaires should take about one and one half hours to complete, and the clinical interview and experiment should take about an hour each to complete. You are guaranteed $20.00 for your participation, and you may have an opportunity to earn additional money during the experimental portion of this study.

In this envelope you will find following:

-A map to UNCG, which locates parking lots and the Psychology Department.
-A parking permit attached to the map.
-A "Consent for Research Participation" form.
-A packet of questionnaires.

About the map to UNCG: The map shows the major streets located around the UNCG campus. You may park in any of the lots labeled "A", which are shaded on the map. The Psychology Department is located in a six-story, tan brick building on the corner of Walker and McIver streets. This building is labeled as the Eberhart Building on the enclosed map.

About the parking permit: Please write in your car's license plate number in the space provided. Once you arrive, please hang this permit from your rear-view mirror.

About the "Consent for Research Participation" form: Before filling out any of the questionnaires, please read this consent form. If you are agreeable to participating in the study once you have read it, please sign and date the form. Should you have any questions once you have read the form, please give me a call at 334-5662. Please bring this form with you to your appointment.

About the questionnaires enclosed: Please fill out all of the questionnaires prior to your appointment at UNCG. Many people have reported that they find it easier to fill out the questionnaires when alone in a room where it is unlikely that they will be bothered or interrupted. As you fill out the questionnaires, you may notice that there is some redundancy across items. If you would, though, please try to answer all questions as accurately as possible. Please bring the completed questionnaires with you to your appointment.

The date and time of your appointment is:

If you discover that you cannot keep this time or decide that you wish not to participate in this study, please call me at 334-5662 as soon as possible.

Again, many thanks for your interest in participating in psychology research at UNCG.

Sincerely,

APPENDIX D: Text of Consent Form

CONSENT FOR RESEARCH PARTICIPATION

I, _____, hereby agree to fill out a number of questionnaires which assess aspects of my personality style and emotional experience, participate in a clinical interview, and participate in a psychology experiment. I further understand that the clinical interview and psychology experiment will take place at the University of North Carolina at Greensboro (UNCG), and that I will fill out the questionnaires at my home prior to my appointment at UNCG.

I have been informed that the purpose of my responses to the questionnaires and the clinical interview is to assess features associated with my personality style and emotional experiences, and that the chief aim of the experiment is to evaluate the quality of sentences I construct from words provided to me by the experimenter. I have been told that the questionnaires will take about one and one-half hours to complete. I am also aware that the interview will take about one hour, and that the experiment will require an attitional hour of my time. For my participation in this research, I agree that I will receive at least $20.00.

I have been informed and I hereby consent to have the clinical interview and sentence construction portions of this research investigation audiotaped in the recognition that the recording of these aspects of this study is for data recording purposes only, and that the recordings of my interview and sentence constructions will be erased once the data collection phase of this study is completed.

I understand that all of my responses to the questionnaires, interview questions, and sentences I construct during the experimental task will be kept strictly confidential and will only be made available to persons working directly on this research. This includes Richard Farmer, the principal investigator of the study, and Dr. Rosemery Nelson-Gray, Professor of Psychology at UNCG.

I understand that my participation in this research is completely voluntary, and that I may withdraw from the study at any time. I further understand that following the experimental portion of this study, I will be informed about the questions addressed in this study and how such questions were examined, and that I may ask any questions I might have about this research at that time.

Signed: _____ Date: _____

Printed Name:_____

APPENDIX E: Post-Experimental Interview

1.) Did you usually give the first sentence which came to your mind?
2.) How did you go about deciding which words to use?
3.) Did you think you were were using some of the words more often than others? Which words? Why?
4.) What did you think the purpose of this study was?
5.) What did you think about while going through the cards?
6.) While going through the cards did you think that you were supposed to make up your sentences in any particular way?
7.) Did you get the feeling that you were supposed to change the way in which you made up your sentences? How?
8.) What did my saying "good" or "not good" mean to you?
9.) Did you try to figure out what made me say "good" or "not good" or why or when I was saying "good" or "not good".
10.) What ideas do you have about what was making me say "good" or "not good"?
11.) While going through the cards did you think that my saying "good" or "not good" had anything to do with the words that you chose to begin your sentences? What?

[If subjects verbalized a correct contingency at any time during the interview, the above schedule was discontinued and and the following questions were asked.]

12.) Is that something you were actually aware of while going through the cards or is it something you thought of just now?
13.) Do you remember when, while going through the cards, that the idea occurred to you?
14.) Did the fact that you realized this have any effect on the way in which you made up your sentence? In other words, did you try and make up your sentences in that way because I was saying "good" or "not good"?

APPENDIX F: SCID-II Coding Sheet

1. (1). ? 1 2 3
2. (2). ? 1 2 3
3. (3). ? 1 2 3
4. & 5. (4). ? 1 2 3
6. (5). ? 1 2 3
7. (6). ? 1 2 3
8. (7). ? 1 2 3

AVD: At least 4: 1 3

9. (1). ? 1 2 3
10. (2). ? 1 2 3
11. (3). ? 1 2 3
12. (4). ? 1 2 3
13. (5). ? 1 2 3
14. & 15. (6). ? 1 2 3
16. (7). ? 1 2 3
17. (8). ? 1 2 3
***(9). ? 1 2 3

DEP: At least 5: 1 3

18. (1). ? 1 2 3
19. (2). ? 1 2 3
20. & 21. (3). ? 1 2 3
22. (4). ? 1 2 3
23. (5). ? 1 2 3
24. & 25. (6). ? 1 2 3
26. (7). ? 1 2 3
27. (8). ? 1 2 3
28. (9). ? 1 2 3

OC: At least 5: 1 3

29. (1). ? 1 2 3
30. (2). ? 1 2 3
31. (3). ? 1 2 3
32. (4). ? 1 2 3
33. (5). ? 1 2 3
34. (6). ? 1 2 3
35. (7). ? 1 2 3
36. (8). ? 1 2 3
37. (9). ? 1 2 3

P-A: At least 5: 1 3

(go to 50, next column)

50. (1). ? 1 2 3
51. (2). ? 1 2 3
52. (3). ? 1 2 3
53. (4). ? 1 2 3
54. (5). ? 1 2 3
55. (6). ? 1 2 3
56. (7). ? 1 2 3

PAR: At least 4: 1 3

57. & 58. (1). ? 1 2 3
59. (2). ? 1 2 3
60. & 61. (3). ? 1 2 3
62, 63, 64 (4). ? 1 2 3
***(5). ? 1 2 3
***(6). ? 1 2 3
***(7). ? 1 2 3
***(8). ? 1 2 3
***(9). ? 1 2 3

SZT: At least 5: 1 3

65. (1). ? 1 2 3
66. (2). ? 1 2 3
67. (3). ? 1 2 3
68. (4). ? 1 2 3
69. (5). ? 1 2 3
***(6). ? 1 2 3
***(7). ? 1 2 3

SCD: At least 4: 1 3

70. (1). ? 1 2 3
71. & 72. (2). ? 1 2 3
73. (3). ? 1 2 3
74. (4). ? 1 2 3
75. (5). ? 1 2 3
***(6). ? 1 2 3
76. (7). ? 1 2 3
***(8). ? 1 2 3

HST: At least 4: 1 3

77. (1). ? 1 2 3
78. & 79. (2). ? 1 2 3
80. & 81. (3). ? 1 2 3
82. (4). ? 1 2 3
83. & 84. (5). ? 1 2 3
85. (6). ? 1 2 3
86. (7). ? 1 2 3
87. (8). ? 1 2 3
88. (9). ? 1 2 3

NAR: At least 5: 1 3

89. (1). ? 1 2 3
90. (2). ? 1 2 3
91. (3). ? 1 2 3
92, 93, 94 (4). ? 1 2 3
95. (5). ? 1 2 3
96 97 98 99. (6). ? 1 2 3
100. (7). ? 1 2 3
101. (8). ? 1 2 3

BRD: At least 5: 1 3

102. (1). ? 1 2 3
103. (2). ? 1 2 3
104. (3). ? 1 2 3
105. (4). ? 1 2 3
106. (5). ? 1 2 3
107. (6). ? 1 2 3
108. (7). ? 1 2 3
109. (8). ? 1 2 3
110. (9). ? 1 2 3
111. (10). ? 1 2 3
112. (11). ? 1 2 3
113. (12). ? 1 2 3

114. (1). ? 1 2 3
115. (2). ? 1 2 3
116. (3). ? 1 2 3
117. (4). ? 1 2 3
118. (5). ? 1 2 3
119. (6). ? 1 2 3
120. (7). ? 1 2 3
121. (9). ? 1 2 3
122. (10). ? 1 2 3

ANT(1): At least 3: 1 3
ANT(2): At least 4: 1 3
ANT(1&2): Both 3: 1 3

APPENDIX G: Taffle Task Instructions

Please read the following statement to the experimental participants:

For this part of the study, I am interested in the quality of sentences you construct. Before you are a stack of 80 cards [point]. Each card has a verb typewritten in the center of the card [point], and a series of words typewritten along the lower left hand corner [point].

Your task for this experiment is to say to me a sentence using the words typed on each card. Please make sure that the first word in the sentence is one of the words typed along the lower left hand corner of the card [point], and that you include in your sentence the verb typed in the center of the card [point]. Please say, without any censoring, the first sentence that comes to your mind. Once you have finished with a card, go on to the next card.

You will notice that on occasion I might say "good" and give you a dime, and other occasions I will say "not so good", and will remove a dime from the pile of dimes before you. You will start out with a total of 30 dimes. Any dimes that you have in the pile before you by the end of this experiment are yours to keep. Do you have any questions before we begin?

APPENDIX H: Debriefing Statement

The research in which you just participated was primarily concerned with clarifying the relationships between anxiety and impulsivity with sensitivity to reward and punishment. The questionnaires you completed and the interview in which you participated attempted to clarify to what degree you are susceptible to anxiety and impulsivity. The experimental task attempted to determine your sensitivity to reward and punishment.

During the experimental task, you may have noticed that you were rewarded (i.e., given 10¢) or punished (i.e., the removal of 10¢) when you constructed sentences using particular pronouns. Two pronouns were consistently associated with reward, two consistently associated with punishment, and two pronouns were consistently neither rewarded nor punished.

Given past research, we would expect that persons who tend to be impulsive would be very sensitive to reward and less sensitive to punishment, whereas persons who tend to be anxious would be very sensitive to punishment and less sensitive to reward.

This research, it is believed, will aid in the identification of the conditions under which certain individuals will best learn. It is further believed that findings from this study will tell us more about how certain individuals experience their world. It may be the case, for example, that anxious individuals tend to primarily see potential punishers in certain situations and overlook potential rewards, and consequently, are more likely to be inhibited. Conversely, it may be the case that impulsive individuals tend to primarily see potential rewards in a situation and overlook potential punishers, and consequently, appear to be somewhat disinhibited.