



THESIS

2

This is to certify that the
dissertation entitled
**Psychological Adaptability and Exercise Adherence:
The Influence of Personality
on Exercise Habits**

presented by

Kay Ellen Ketzenberger

has been accepted towards fulfillment
of the requirements for

Ph.D degree in Counseling Psychology

Linda Ferrett

Major professor

Date February 9, 1995

**LIBRARY
Michigan State
University**

**PLACE IN RETURN BOX to remove this checkout from your record.
TO AVOID FINES return on or before date due.**

DATE DUE	DATE DUE	DATE DUE
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

MSU is An Affirmative Action/Equal Opportunity Institution

c:\circ\datedue.pm3-p.1

PSYCHOLOGICAL ADAPTABILITY AND EXERCISE ADHERENCE:

THE INFLUENCE OF PERSONALITY

ON EXERCISE HABITS

By

Kay Ellen Ketzenberger

A DISSERTATION

**Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of**

DOCTOR OF PHILOSOPHY

**Department of Counseling, Educational Psychology
and Special Education**

1995

ABSTRACT

PSYCHOLOGICAL ADAPTABILITY AND EXERCISE ADHERENCE: THE INFLUENCE OF PERSONALITY ON EXERCISE HABITS

By

Kay Ellen Ketzenberger

Studies of exercise adherence have been guided primarily by atheoretical or predominately cognitive/behavioristic theoretical perspectives. This study employed a psychodynamic framework to examine exercise habits, thus contributing to a theoretical expansion of research approaches to the study of exercise adherence. Psychological adaptability was hypothesized to impact exercise persistence; psychological adaptability was operationalized by personality variables of low compulsiveness, low impulsiveness, low perceptual rigidity, and high tolerance for ambiguity. Assessment instruments included the Obsessive Compulsive Scale (OCS), the Barratt Impulsiveness Scale-10th Revision (BIS-10), the Breskin Rigidity Test (BRT), the Tolerance for Ambiguity Scale (AT20), and a demographic questionnaire. Demographic data and data on other factors shown to influence exercise adherence were also collected: age, gender, exercise enjoyment, partner support, exercise format, exercise type, and intensity. Subjects were volunteers from private health clubs, the university community, and a community club for recovering alcoholics (N=405). The subject pool consisted

of 257 women and 148 men, with a mean age of 40 years, ranging from 18 to 84 years. Subjects were categorized into four exercise groups based on their report of how often they exercised per week, and how long they had been exercising. Groups consisted of super-exercisers, general exercisers, intermittent exercisers, and non-exercisers. Correlation analysis identified the relationships among the psychological variables, in particular an interesting lack of relation between compulsiveness and impulsiveness. The correlation of the psychological variables and other factors with exercise group membership was examined through the use of discriminant analysis. Exercise enjoyment was the most powerful predictor of exercise group membership, with impulsiveness contributing a statistically significant but practically minor addition to predictive accuracy. None of the other variables were statistically significant. The implications of these findings is discussed, as well as directions for future research.

Copyright by
KAY ELLEN KETZENBERGER

1995

ACKNOWLEDGEMENTS

Writing this dissertation has been one of the more complex, difficult, perplexing, engrossing, and exhausting experiences of my life. Throughout the process of dealing with both the fascination and the paralysis involved in completing a dissertation, I was fortunate enough to receive the support of the following people.

I wish to acknowledge the impact of several early mentors. My undergraduate academic advisor, Jeri Falk, M.S., played a pivotal role in encouraging me to complete my undergraduate studies and continue with graduate work. Sally Grenard-Moore, Ph.D and Melba J. T. Vasquez, Ph.D. were both wonderful models of counseling psychologists and sparked my interest in pursuing the doctoral degree in this field; both their influence and encouragement to pursue my academic career were invaluable, and I will be forever thankful to know them. I would especially like to thank Sally Grenard-Moore for her unwavering support and humor throughout all the steps involved in this graduate program.

Of course, I would like to take this opportunity to formally thank the members of my dissertation committee, Drs. Linda Forrest (Chair), John Powell, Deborah Feltz, and Martha Ewing. All have provided valuable and experienced

feedback throughout the process of this project. I want to particularly thank Dr. Linda Forrest, who has been my academic advisor throughout my tenure at Michigan State University. Her commitment to student development (both professional and personal) is, I believe, unparalleled among the faculty at this University, and I appreciate her availability and willingness to see this project through even while on sabbatical. Her support and guidance throughout my graduate experience have been treasured, and I am grateful to have had the opportunity to work with her.

I would also like to thank two good friends, Ann Hower and Karyn Boatwright, who were always ready to either laugh or commiserate, and generally shared both the best and the worst of the process.

Lastly, I want to acknowledge the tremendous support of my family. My parents have been a well-spring of encouragement, and have provided both the emotional and financial foundation from which I've operated throughout my graduate program. I'm grateful to have had them as parents. Thanks also to my brother Steve and sister-in-law Ellen, who helped me maintain perspective and whose home provided a welcome respite from the University. Finally, I want to thank my brother Patrick, for the simple fact of his existence and that he and his family are part of my life. I missed you.

TABLE OF CONTENTS

LIST OF TABLES	ix
CHAPTER 1: INTRODUCTION	1
Research Question	6
Hypotheses	15
Significance of the Study	19
A Caveat	20
CHAPTER 2: LITERATURE REVIEW	22
Adaptability, Impulsivity/Reflectivity/Compulsivity and Rigidity	22
Personal Factors Influencing Exercise Adherence	32
Situational Factors	43
Miscellaneous Factors	45
Summary	46
CHAPTER 3: METHODS	47
Subjects	47
Data Collection	48
Design	50
Measures	51
Hypotheses	59
Data Analysis	62

CHAPTER 4: RESULTS	65
Tests of Hypotheses	65
Post-Hoc Analysis	80
Statistical Assumptions	81
Summary	84
CHAPTER 5: DISCUSSION	85
Sampling and Measurement Considerations..	85
Discussion of Results	86
Implications for Practice	97
Limitations	99
Directions for Future Research	100
Summary	106
APPENDICES:	
A: Variable Codes	108
B: Invitation to Participate Poster	109
C: Consent Form	110
D: Demographic Questionnaire	111
E: Assessment Instruments	
E.1 - Barratt Impulsiveness Scale (BIS10) ..	113
E.2 - Obsessive Compulsive Scale (OCS)	114
E.3 - Ambiguity Tolerance Scale (AT-20) ...	115
E.4 - Breskin Rigidity Test (BRT)	117
REFERENCES	118

LIST OF TABLES

TABLE 3.1	
Research Survey Distribution and Return Rate	50
TABLE 3.2	
Means and Standard Deviations for Enjoyment, Impulsiveness, and Intensity for the Total Sample and for Exercisers Only	61
TABLE 3.3	
Exercise Group Membership	63
TABLE 4.1	
Correlation Matrix for Personality Variables	66
TABLE 4.2	
Means and Standard Deviations for Personality Factors (with MANOVA Results)	68
TABLE 4.3	
Discriminant Function Results for Analysis including OCS, BIS10, BRT and AT20	70
TABLE 4.4	
Standardized Discriminant Function Coefficients for Function 1	70
TABLE 4.5	
Classification Results for Analysis 1a with OCS, BIS10, BRT and AT20 as Predictors	71
TABLE 4.6	
Classification Results for Analysis 1b with BIS10 as Predictor	72
TABLE 4.7	
Classification Results for Analysis 1c with ENJOY as Predictor	74
TABLE 4.8	
Classification Results for Analysis 2 with ENJOY as Predictor for All Exercisers	75

TABLE 4.9	
Classification Results for Non-exercisers vs.	
All exercisers with ENJOY	76
TABLE 4.10	
Classification Results for Non-exercisers vs.	
Super-exercisers with ENJOY and BIS10	77
TABLE 4.11	
Summary Statistics for Discriminant Analyses	79
TABLE 4.12	
Means and Standard Deviations for ENJOY across	
Exercise Groups	80
TABLE 5.1	
Comparison of Norm vs. Current Subjects	
on the Psychological Variables	89

Chapter 1: INTRODUCTION

There is widespread agreement that physical exercise results in considerable health benefits. Numerous studies offer evidence that exercise contributes to improved physical health (Cooper, Pollack, Marin, White, Linnerud, & Jackson, 1976; Haskell, 1984), as well as to improved psychological functioning, particularly with anxiety and depressive states (Folkins & Sime, 1981; Morgan, 1977a; Morgan, 1979; Morgan, Roberts, Brand & Feinerman, 1970). Physical activity has also been found to be strongly associated with healthier psychological functioning in adolescent women (Covey & Feltz, 1991). Thus, not only does physical activity improve physical and emotional functioning in adults, but it is also related to healthy psychological development in adolescence. Unfortunately, "Even among those . . . enrolled in structured exercise programs, both for prevention/health enhancement and for rehabilitation following . . . coronary heart disease (CHD), adherence is disappointingly low: Roughly half of the participants will have dropped out by 3 to 6 months (noncardiac subjects)" (Martin, et al, 1984, p. 795). The literature is in strong agreement that, on average, 50% of exercise participants drop out within the first six months (Dishman, Sallis, & Orenstein, 1985; Taylor, Buskirk, & Remington, 1973; Ward & Morgan, 1984), and some ". . . data show that the largest percent dropout in an exercise program occurs during the first 12 weeks." (Pollock, 1988, p. 262). People

undertaking solitary, individual exercise regimens are even less likely to maintain adherence (Massie & Shepard, 1971).

The problem of exercise adherence has become a major interest to researchers and practitioners in a variety of fields, most notably medicine and exercise science. Interest continues to grow as the relationship between regular physical exercise and improved physical and mental health becomes clearer, and as ever greater numbers of people undertake exercise programs (Tuson & Sinyor, 1993). Given this cultural trend towards greater physical activity, all those professions committed to healthy development and improved quality of life should make correspondingly greater efforts toward understanding the factors that impact exercise adherence.

The majority of the research has stemmed from medical efforts to treat and prevent coronary heart disease; most of the remainder of the research has been conducted under the auspices of university exercise science and kinesiology departments, generally in the service of identifying specific factors associated with adherence in normal populations. Unfortunately, "The use of psychological variables in adherence research has been characterized by the lack of accompanying models . . ." (Sonstroem, 1988, p. 125-126). Dishman (1982), cited in Sonstroem (1988), pointed out that ". . . adherence research has evolved from applied and pragmatic questions and has been characteristically atheoretical in nature" (p. 125).

More recently, researchers have generated an increasing number of investigations grounded in one or another psychological theory, primarily based on cognitive and social-cognitive (Bandura, 1977, 1986) theories. This psychologically based research foundation includes investigations of the influence of self-efficacy on exercise (Garcia & King, 1991; McAuley, 1992; McAuley & Jacobson, 1991; McAuley & Gill, 1983), the role of outcome expectancies (Desharnais, Bouillon, & Godin, 1986; Maddux, Norton, & Stoltenberg, 1986; Rodgers & Brawley, 1991), the effects of self-schema and other cognitive activity on exercise behavior (Kendzierski, 1988, 1993) commitment to physical activity (Corbin, Nielsen, Borsdorf, & Laurie, 1987; Deeter, 1988), and the influence of affect on the experience of exercise (Gauvin & Rejeski, 1993; Hardy & Rejeski, 1989; Kendzierski & DeCarlo, 1991; McAuley & Courneya, 1994).

With the exception of the last area mentioned, that of affect and its influence, the recent theoretically-based research has focused almost exclusively on cognitive factors. In their metapsychological discussion of the exercise psychology research base, Fahlberg, Fahlberg and Gates (1992) note that

Although the cognitive behavioral approaches used in exercise psychology differ from classical behaviorism, these approaches, when viewed from a metapsychological perspective, still represent only the behavioristic

force of psychology. . . .the current models in exercise psychology, including for example the psychological model for physical activity participation . . . , the psychobiological screening model . . . , the health belief model . . . , the theory of reasoned action . . . , locus of control . . . , and the various "self" theories (e.g., self-esteem . . . self-efficacy . . . perceived competence . . .) represent only the behavioristic force in psychology. That is, they do not stem from psychoanalytic, humanistic/existential, or transpersonal psychology. . . . Although psychodynamic and phenomenological approaches to exercise behavior have been published and presented (e.g., Berger, 1980; Berger & Mackenzie, 1980; Fahlberg, 1990a; Kostrubala, 1981; Perry & Sacks, 1981; Sours, 1981), they remain a rarity (pp. 174-175).

These authors suggest that research stemming from other psychological approaches (e.g., humanistic/existential, psychodynamic, transpersonal) would contribute ". . . a new psychological understanding of exercise behavior through an expanded perspective that helps to overcome the reductionism of prevailing approaches" (p. 175). Keeping in mind that the early research in most fields of inquiry are descriptive and tend to focus on the observable, "It is not being suggested that behavioristic approaches are wrong but rather that they are partial." (p. 177).

The recent interest in the influence of affect on

exercise behavior represents an expansion towards a more existential/psychodynamic approach; that is, the *meaning* and/or *experience* of exercise is the focus. The theoretical base of the study to be described here is more closely related to a psychodynamic orientation, in that ". . . certain aspects of behavior are viewed as a result of processes that occur in the mind in the form of conflicting conscious and unconscious forces (May & Yalom, 1989)" (p. 175).

Although psychology certainly holds no exclusive claim to expanding and/or generating relevant theory, the profession does have considerable expertise in applying theory to behavior. Counseling psychology in particular should become more involved in the study of exercise adherence, for two major reasons.

First, counseling psychology has traditionally focused on normal populations, been committed to developing theoretical foundations relevant to practice, and facilitating healthy development. Since a primary purpose of exercise research is to help develop interventions for facilitating adherence, counseling psychology's expertise in theory development, and the development of interventions, would be a valuable addition.

Second, there are clearly psychological factors that impact adherence, and the investigation of such factors should include the perspective of those educated in psychological theory. The field of exercise adherence can

only benefit from including the perspectives and skills of psychologists in a multidisciplinary team effort to better understand this area, as the larger field of sport psychology has benefitted from such a team approach.

Research Question

This study addresses the question of whether a relationship exists between an exerciser's level of psychological adaptability and their likelihood of adhering to exercise. Although the behavioral observation that long-term adherers are more often achievement-oriented, hard-driving, Type A personalities is commonplace (R. K. Dishman, August, 1992, personal communication), it is descriptive only and lacks explanatory power. The focus on a psychological factor such as adaptability is an effort to deepen our understanding of such observations by explaining them as behavioral manifestations of psychological operations and thus identify the psychological bases of observable behaviors. Hardy and Rejeski's (1989) work on the relation between exercise-induced affect and level of perceived exertion supports this line of investigation.

They

argue that physiological cues are most ambiguous under conditions of moderate physical strain. The theoretical and practical intrigue of this finding is that attraction to the level of physical exertion accompanying an effective aerobic stimulus may have strong social psychological foundations. (p. 313)

The rationale for investigating the impact of psychological adaptability rests upon a basic premise about the effects of exercise. This premise and its implications represent a theoretical foundation for linking psychological adaptability with exercise initiation and adherence.

Basic Premise: Exercise has two important effects:

- a) it causes fatigue and physiological changes
 - b) it induces unfamiliar, ambiguous stimuli
- (Hardy & Rejeski, 1989), results in heightened physical perceptions and fosters increased self-awareness (Berger & Mackenzie, 1980; Kostrubala, 1976).

Supporting the unfamiliarity of exercise stimuli is Hardy and Rejeski's (1989) work on in-task exercise affect, which found that subjects' recall of their affect during a moderate intensity exercise session was uncorrelated with the affect reported during the task itself. Conversely, posttask recall of in-task affect for easy and difficult workloads were significantly correlated. They concluded that "the absence of any relationship between the FS [affect reported during the exercise task] and recall of affect at the 60% workload suggests there is something unusual about moderate work intensity [and suggested that] this ambiguity of physiological cues at moderate work intensity requires additional research" (p. 313).

The changes induced by exercise require significant

adjustments on the part of the exerciser. Perhaps most obvious is the need to accomodate an increased sense of fatigue and lower energy level so often experienced by the beginning exerciser, either by modifying the exercise regimen or by making adjustments to one's daily schedule. Though less obvious, it is even more important to integrate internally the unfamiliar, often ambiguous bodily sensations that accompany exercise and lead to heightened physical and emotional self-awareness.

For example, several researchers have noted the relationship between running and increases in self-awareness (cited in Berger, 1984): "Running provides a woman with an outstanding opportunity to increase awareness of her feelings and behavior and encourages her to examine the underlying psychodynamics" (p. 187). Whether this increased awareness is experienced as positive, negative, or ambiguous, it represents a change in self-perception that must somehow be integrated into the self-concept to avoid debilitating cognitive dissonance and eventual dropout from exercise. "Changes in the body as a result of fitness training might reasonably be expected to alter one's body image, which is highly correlated with and might be expected to radiate to self-concept (Zion, 1965) . . ." (Folkins & Sime, 1981, p. 380). The exerciser's level of psychological adaptability is postulated as a direct influence on the ability to successfully adjust to and integrate these changes, and thus acts as a direct influence on exercise

behavior.

Psychological adaptability, then, is the variable of interest in this study. Adaptability is defined as "the quality of being . . . able to change without difficulty so as to conform to new or changed circumstances" (Webster's New Twentieth Century Dictionary, 1983, p. 21). Rephrasing this definition into psychological terms, psychological adaptability will be defined herein as the ability to recognize and respond constructively to conditions that challenge some element of one's current psychological reality, and therefore adjust to new situations and circumstances. If the basic premise of this study is accepted, that the initiation of exercise induces unfamiliar, ambiguous physical and emotional experiences that the exerciser must adjust to, then some minimum level of psychological adaptability should be necessary to the continuation of physical exercise.

Unfortunately, there appears to be no established measure for directly assessing psychological adaptability. Therefore, it will be operationalized as a continuum of impulsiveness/reflectivity/compulsiveness, rigidity, and tolerance of ambiguity. The rationale for operationalizing adaptability in these terms is given below.

Psychological Adaptability and a Continuum of
Impulsiveness/Reflectivity/Compulsiveness

Viewing psychological adaptability in terms of impulsiveness, reflectivity and compulsiveness is based on Miller's (1988) integrative model of cognitive processing, which hypothesizes an impulsivity-reflectivity-compulsivity continuum of cognitive style. Composed of ". . . regularities and variations in the basic ego functions of perceiving, thinking, remembering, and judging" (Messer & Schacht, 1986), cognitive styles vary in ". . . having a narrow, concentrated field of attention rather than a broad, diffuse one [and in] being relatively more or less tolerant of ambiguous stimuli or unfamiliar experiences" (Miller, 1988, p. 64), and serve to shape a person's "general mode of functioning" and "more general aspects of the personality" (p. 65), thus representing a broadly influential personality trait.

Most supportive of the rationale behind this proposal is Miller's (1988) conclusion that ". . . impulsivity and compulsivity both teeter at the periphery of a more stable, mature central hub of reflectivity, a core of ego-autonomous integrative processing" (p. 70). Though Miller does not use the term, psychological adaptability seems essentially synonymous with ego-autonomous integrative processing, or reflectivity. According to this model, both impulsive and compulsive cognitive styles interfere with effective integrative processing by impairing reflectivity,

and should therefore also interfere with attempts to persevere in any activity that requires such integrative processing, such as an exercise program.

Impulsives are relatively deficient in the ability to ". . . modulate attention, affect, thought, and behavior . . . and explains why, under conditions of social frustration or ambiguity, behavior regresses to the use of more primitive response strategies. . ." (p. 66). Shapiro (1965) points out that the impulsive's subjective experience of impulse and whim is different from the non-impulsive person's experience, that

the experience of urge or impulse is not, from this point of view, a detached perception of an actual seizure that overrides what one wants to do, but rather is a distortion and attenuation of the normal experience of wanting in which the sense of active intention and deliberateness is especially impaired and, usually, even further disavowed for defensive reasons (p. 137).

This lack of active intention and deliberateness ". . . follows from a general deficiency of active organizing and integrative mental functions" (Shapiro, 1965, p. 138-139); together with the impulsive's deficiencies in internal modulation (Miller, 1988), an impulsive cognitive style should drastically impair the ability to tolerate ambiguity and integrate new experience.

Though impulsive and compulsive cognitive styles are

usually thought of as radically different, the core process appears to be the same. Both impulsive and compulsive people have substantial difficulty tolerating much affective variety or fluctuations because they lack adequate reflectivity, which ". . . expresses itself as the tendency to reflect on the validity of problem solving under conditions where several possible alternatives are available and there is some uncertainty over which is the most appropriate" (Miller, 1988, p. 68). Messer and Schacht (1986) write that ". . . reflective individuals appear superior to impulsives across a range of cognitive and perceptual tasks. . ." (p. 157), but also note the likelihood of overlap between very high reflectiveness and compulsiveness:

It is important to keep in mind that *extreme* reflectivity (expressed in obsessive, brooding, ruminative, or perseverative styles) can be as maladaptive in its own way as is impulsivity. With the exception of this extreme, however, reflectivity generally offers an adaptive advantage over impulsivity. (p. 157)

At this other extreme, compulsive personality styles entail ". . . a special restriction of attention which is always narrowly concentrated and sharply focused, never relaxed or just diffusely aware. This results in a severe limitation in the overall mobility and range of attention in daily activities. . ." (Miller, 1988, p. 66), and are

". . . characterized by a 'superreflectivity' that is really a pseudo reflectivity. Personal events are scanned and probed so deliberately and concentratedly that, instead of being allowed to normally 'sink in' to memory and consciousness, they are actually prevented from being integrated . . ." (p. 69). The compulsive personality's difficulty in understanding and integrating new and different experiences has also been noted by Shapiro (1965):

Elements on the periphery of attention, the new or the surprising, that which can only be apprehended impressionistically - all these are only potentially distracting and disruptive to the obsessive-compulsive, and they are avoided exactly by the intensity and the fixed narrowness of his preoccupation. . . ." (p. 30)

This lack of reflective problem solving with ambiguous and unclear stimuli seems highly applicable to the physical/affective experiences engendered by physical exercise; robust reflectivity should represent the level of psychological adaptability most supportive of the ability to tolerate ambiguity and adapt psychologically to the physical and emotional changes resulting from physical exercise.

Psychological Adaptability, Rigidity and Tolerance of Ambiguity

The proposed inverse relationship between psychological adaptability and rigidity can be supported by two lines of reasoning. First, it is intuitively logical that the

ability to adapt to changes that impact the physiological and cognitive/emotional spheres requires a certain degree of cognitive and emotional flexibility. Flexibility and rigidity have been treated throughout the literature as diametric opposites on a bipolar continuum (i.e., Breskin, 1968; Rubenowitz, 1963); "Rigidity and flexibility are two traits lying on the extremes of the same bipolar continuum (sic) varying only in degree and not in kind" (Chhaya, 1985, p. 14). Since no psychometric measures were found for flexibility, and a good measure for rigidity does exist (Breskin, 1968), the alternative is to assess adaptability through this inverse factor.

Second, cognitive rigidity has been noted as one of the primary hallmarks of the compulsive cognitive style (Shapiro, 1965); this connection has since been carried to the point of operationalizing compulsiveness in terms of rigidity (Primavera, Hochman, & Reynolds, 1975). Rigidity has been found to correlate highly with factors that also correlate with compulsiveness:

The finding that non-verbal rigidity was positively related to the need for Order and negatively related to the need for Change seems to be consistent with [findings that] the BRT [Breskin Rigidity Test] may measure what has been termed 'obsessive-compulsive intellectual rigidity'. An active search for order and an active avoidance of change would appear to be characteristic of the behavior of many obsessive-

compulsive personality types. (Simon, Primavera, Klein, & Cristal, 1972, p. 130).

Also, rigidity and intolerance of ambiguity have been found to be strongly associated (Frenkel-Brunswik, 1948b; Thurstone, 1944), an important correlation considering Hardy and Rejeski's (1989) findings that moderately intense exercise is frequently experienced as generating ambiguous affects. Thus, the ability to tolerate ambiguity should impact adaptability for two reasons: 1) directly, as the ability to tolerate the ambiguous physiological cues and affects induced by exercise, and 2) indirectly, through its inverse connection with rigidity.

Hypotheses

This study sought to examine the relationships among the personality variables of compulsiveness, impulsiveness, rigidity, and tolerance of ambiguity. Specific hypotheses regarding their relationships are specified in the Methods chapter. The study also hypothesized that a positive relationship exists between psychological adaptability and exercise adherence.

Psychological adaptability is operationalized as low impulsiveness, low compulsiveness, low rigidity, and high tolerance of ambiguity; a measure for each of these traits will be used.

The utility of this model would lie in its ability to predict the likelihood of adherence for individuals; however, whether these personality traits are systematically

related to exercise behavior at all needs to be established first. If so, these traits should be able to distinguish different categories of exercisers, with the categories based on frequency and duration of exercise. For the purposes of this study, four adherence categories have been defined, including super-exercisers, general exercisers, intermittent exercisers, and non-exercisers; these categories will be fully described in the Methods chapter.

It is possible that a subject must cut back or stop exercising due to injury, which precludes a choice for continued exercise. Therefore, a question on the demographic questionnaire asks subjects why they stopped or cut back exercising; those who indicate that injury precluded continuous exercise but have resumed exercising will be classified as though no interruption occurred; those who note injury as the reason for exercise cessation and are no longer exercising will not be classified and not included in the exercise analysis.

Since impulsive, compulsive, rigid, and intolerant personality styles are hypothesized as impairing the ability to adapt to an activity that generates heightened self-perceptions requiring integration into the self-concept, the model's strongest prediction is that general exercisers should score significantly lower on these traits than people who exercise only intermittently.

As it stands, this model may account less well for super-exercisers, and so predicting how they will score on

these variables is more difficult. The only clear prediction is that super-exercisers will score significantly lower on impulsiveness than either general or intermittent exercisers; they may also score low on compulsiveness and rigidity, and higher on tolerance of ambiguity as the model would currently predict.

The prediction that low compulsiveness is associated with super-adherence runs counter to the common-sense intuition that high compulsiveness should be positively related to high adherence, particularly at the very high frequencies of super-exercisers. The existence of exercise addiction would seem to support this view of a linear relationship between compulsiveness and adherence. A modification of the theory could, however, reverse this prediction and account for high compulsiveness in super-exercisers.

Basically, the modification suggests that exercise is a different psychological experience for super-exercisers than for general and intermittent exercisers. Supporting this possibility is the reality of exercise addiction. The extreme compulsiveness associated with "exercise addiction" serves a qualitatively different function than normal (or even relatively high) levels of compulsiveness in normal populations, with much in common with other addictions, including withdrawal symptoms upon the cessation of exercise. Addictive exercise, then, fulfills a different need for the exercise addict than it does for a normal, non-

addicted exerciser. For the addict, exercise is a ritualized behavior serving the same anxiety-suppressing function as other compulsive behaviors (such as excessive handwashing and obsessive checking). If exercise addicts comprise a significant portion of the super-exerciser group, this group should evidence very high scores on compulsiveness, significantly higher than any of the other exercise groups. They should also score in the rigid and intolerant directions. It is intuitively reasonable that high compulsiveness would support the ability to maintain very high frequency exercise.

The possibility that exercise is a different psychological experience for super-exercisers suggests a modification to the model of how the personality traits of interest are related to exercise behavior. At some point, high compulsiveness stops being a liability and becomes a behavioral asset for maintaining high-frequency exercise. Whether it becomes a psychological asset, however, is open to question, given the possibility of exercise addiction.

According to this modified model, super-exercisers will score significantly higher on compulsiveness than all other groups. Given the theoretical connections between compulsiveness, rigidity, and tolerance of ambiguity, super-exercisers should also score significantly higher than all other groups on rigidity and lower on tolerance of ambiguity. Again, however, this is only a speculative prediction. It will be interesting to see whether the data

support either model.

How the non-exercise group will score on the personality measures is also unclear, primarily because the motivations behind people's choices regarding whether or not to exercise are so diverse. People who choose to remain sedentary may differ from those who initiate exercise on any number of variables, and so may well represent quite a different population than exercisers. Therefore, they may show wide variability on the personality traits of interest here. The non-exercise group may serve best as a comparison group for the various exercise groups.

In summary, this proposal hypothesizes that the personality traits of impulsiveness, compulsiveness, rigidity, and tolerance of ambiguity will be able to distinguish between super-exercisers, general exercisers, intermittent exercisers, and possibly non-exercisers. This general hypothesis will be stated more specifically in the Methods section. The assessment instruments to be used will also be discussed there.

Significance of the Study

This study offers several possible benefits. Clinically, the ability to distinguish between intermittent, general, and super-exercisers at the beginning of an exercise program would aid in targeting specific interventions towards the different groups in the service of group-specific goals, with particular focus on the intermittent group in hopes of increasing adherence.

Theoretically, significant results would support further investigation from the psychodynamic/existential perspective discussed by Fahlberg, et al (1992), and serve to further expand the research base of exercise adherence.

A Caveat

A caution is warranted. The model proposed above addresses only intrapsychic factors, and suggests that overt exercise behavior is systematically affected by these internal, individual factors. Attention to internal, psychological factors is still a relatively new area of inquiry, one worth exploring.

However, this model is incomplete as a comprehensive explanation of exercise behavior, in that it ignores the social context within which exercise decisions and behaviors occur. Considerable research attention has focused on the social context of exercise, particularly the difference in adherence between individual and group exercisers, and found contextual variables to have significant impact on exercise persistence. The power of social reality on behavior is not contested; rather, the internal, intrapsychic factors in this proposal very likely interact with the social context so that the behavior of interest is multiply determined and interactional in nature.

To eventually understand the interaction between social and intrapsychic variables, however, the intrapsychic must first become better defined through initial studies. Intrapsychic factors will likely explain only a small to

moderate amount of variance in exercise adherence; once the contribution of such factors is better understood, the task will be to better integrate these intrapsychic, individual influences with the interpersonal, social, and cultural influences on exercise behavior.

Chapter 2: Literature Review

Psychological adaptability, impulsiveness, reflectivity, compulsiveness, and rigidity are the central constructs in this study. Therefore, the first portion of this chapter will review the current state of knowledge regarding these factors. The review will then focus on the exercise adherence literature, with an initial focus on the personal factors that have been hypothesized to impact exercise adherence, including psychological and biological variables. Lastly, the relationships between various situational factors and exercise adherence will be reviewed, and several miscellaneous variables will then be covered.

Adaptability, Impulsivity/Reflectivity/Compulsivity and Rigidity

Psychological Adaptability

Unfortunately, no research has yet sought to investigate the influence of psychological adaptability, impulsiveness, reflectivity, compulsiveness, or rigidity on exercise behavior. A model of psychological adaptation to trauma and victimization has been proposed in the broader psychological literature (McCann, Sakheim, & Abrahamson, 1988), where psychological adaptation is defined as ". . . emotional, biological, cognitive, behavioral, and interpersonal response patterns" (p. 558). Defining psychological adaptation as response patterns, however, identifies it in terms of extrapsychic consequences rather

than an intrapsychic process resulting in observable behavior. In McCann's et al (1988) view, psychological adaptation is primarily the result of a variety of cognitive operations rather than a cause of behavior (though a degree of reciprocity is acknowledged); the rationale of this current proposal postulates that the process of adaptability has effects as well. Thus, McCann's et al (1988) model does not appear applicable to this proposal, and no other psychological approach to the process of adaptability was found in the literature. This proposal, therefore, will attempt to assess adaptability indirectly through the measurement of factors either shown to be associated with adaptiveness or factors that can theoretically be expected to influence adaptability.

Impulsiveness/Reflectivity/Compulsiveness

Miller's (1988) model of impulsivity-reflectivity-compulsivity is based on the construct of reflection-impulsivity originally introduced by Kagan, Rosman, Day, Albert, and Phillips (1964), and the cognitive style of compulsiveness elucidated by Shapiro (1965), and Reed (1968, 1977). Reflection-impulsivity (R-I) has generated a great deal of research, primarily with children. Miller (1988) contends that this research base is generalizeable to adults, having ". . . broad applicability to individuals in different age ranges" (p. 68).

The reflective style has been found to be the more

mature and adaptive style across practically every dimension studied. Reflective children display significantly more verbal control of behavior, and use more covert, private speech than impulsives; the authors concluded that reflectives were more mature in their use of speech (Meichenbaum & Goodman, 1969). Schleifer and Douglas (1973) found that reflectives based their judgments more often on intentions than on consequences, indicating that reflectives use more mature moral judgment. Also, Salkind and Nelson (1980) note that impulsivity is the earlier response pattern in terms of development, with reflectivity developing only as a child ages. Thus, reflectivity represents a more mature and adaptive developmental level.

There is strong evidence that reflectives are significantly more field independent than impulsives (Campbell & Douglas, 1972; Schleifer & Douglas, 1973), and that both reflectivity and field independence contribute positively to effective problem-solving (Neimark, 1975). Also, "On a variety of perceptual, conceptual, and perceptuomotor problem-solving tasks involving response uncertainty (i.e., when the answer is not immediately obvious), reflectives consistently perform better than impulsives, behaving like more mature children" (Messer, 1976, p. 1037). Perhaps this superior problem-solving ability (compared to impulsives) is related to findings that reflectives are more efficient information processors (Swanson & Schumacher, 1986). The only study found that

used adult subjects (a college sample), found no relation between reflection-impulsivity and problem-solving. However, the authors speculated that their nonsignificant results could have resulted from the likelihood that the college population is skewed toward reflectivity and therefore the sample likely represented a restricted range of R-I; thus, the separation of the sample into reflective and impulsive categories was nonrepresentative of the general population (Wolfe, Egelston, & Powers, 1972).

The relationship between reflectivity and problem-solving has been called into question, based on findings that a positive relationship exists between reflectivity and IQ (Barrett, 1977; Block, Block, & Harrington, 1974). In response, Messer (1976) reviewed the literature concerned with reflectivity and IQ, and confirmed a very modest correlation that accounted for 3% to 11% of the variance in reflectivity. The correlation between reflectivity and IQ was most noticeable when the IQ test questions were multiple-choice and/or nonverbal, and therefore less dependent on verbal production and more similar in format to the MFFT. Also, the correlation decreased when the IQ test was given first, indicating an operative practice effect; and, the relationship declined with age. Messer and Schact (1986) state

Apart from the relatively small size of the R-I/IQ correlation, which appears to pose only a small threat to the discriminant validity of the R-I construct, the

precise meaning of this research remains elusive because composite IQ scores typically represent a hodge-podge of abilities, skills, preferences, and styles. Such composite scores are likely to share some variance with almost any other cognitive dimension, simply by virtue of their diversity. (p. 185)

Thus, reflection-impulsivity can be considered a robust dimension of cognitive style largely unthreatened by IQ.

The positive correlates to reflectivity noted above should not be taken to mean there are no negative consequences to high reflectivity. Reflectives have been shown to manifest greater anxiety than non-reflectives, lower ego strength, and lower self-satisfaction (Spitzer, 1981). Surprisingly, reflectivity was not associated with either self-awareness or a tendency to attend to internal stimuli more than non-reflectives, but was correlated with an ideal-self discrepancy and anxiety (Jennings, Holstrom & Karp, 1986);

The ideal-self discrepancy suggests that the anxiety may be associated with a self-critical psychological posture, and attendant feelings of low self-esteem . . . and dissatisfaction with self. . . .

[reflectives show more of a] readiness to adopt some evaluative distance from oneself, often with critical self-appraisal and accompanying psychological distress.

(p. 92)

Although these findings are relatively tentative, and

considerably outweighed by the positive associations discussed above, there may be a price to be paid for a heightened ability for self-evaluation and seeing oneself clearly.

In terms of adaptability, then, reflectivity appears to have both advantages and disadvantages. Automatically assuming that the findings of heightened anxiety and ideal-self discrepancy are disadvantages, however, is faulty; after all, a major rationale underlying psychotherapy is that growth, development, and adjustment are best facilitated by realistic and clear perceptions about self and other (Miller, 1986).

The other pole of the impulsivity-reflectivity-compulsivity continuum (compulsivity) lacks a significant research base, particularly among non-clinical populations. Shapiro (1965) described quite well the compulsive cognitive style, discussed above. Reed (1968) concurred with Shapiro's view of the compulsive style as a special restriction of awareness, but hypothesized also that the compulsive's mental processing is functionally impaired in terms of the structure and integration of experience. Compulsives attempt to compensate for impairment in their ability to spontaneously organize and synthesize experience, by over-intellectualizing and analyzing the available data to the virtual exclusion of all intuitive processing and understanding (Reed, 1977). This impairment in integration of experience should also necessarily impair the

compulsive's ability to sustain activity that generates ambiguous experiences, as in a physical exercise regimen. Unfortunately, this theory lacks the support of an empirical research base, due to the dearth of research on compulsiveness in non-clinical populations.

Rigidity

The concept of rigidity has received considerable attention in the psychological literature. Interest in rigidity originated in the study of perception; the term "rigidity" was used to describe perseverative behavior and difficulties in shifting from one task to another (Cattell, 1935). Subsequently, the accepted definition of rigidity became ". . . sluggishness in the variation of a response" (Werner, 1946, p. 43). A link between personality and rigidity (as perseverative behavior) was first postulated by Lewin (1935), who suggested that rigidity was the degree of fixity and tension between the various psychic systems that make up the personality.

Of particular importance to the present proposal, Werner (1946) identified rigidity as a non-adaptive pattern by distinguishing it from stability. Leach (1967) summarized Werner as ". . . pointing out that rigidity was not be confused with stability. In a constantly changing environment, if behavior is to be stable, response must be flexible. Differentiation of response is therefore essential to stability" (p. 13).

A link between attitudes and individual differences in perception was provided by Thurstone's (1944) study of perceptual rigidity, which found, among other things, that ". . . speed of various perceptual functions, such as speed of closure, [was] shown to be related to such variables as tolerance of ambiguity" (Leach, 1967, p. 13). Bruner (1948) expanded this connection between perception and attitudes to include the influence of deeper personality factors: "What emerges in the individual's perceptual field is a compromise reflecting his adjustive needs . . ." (p. 167).

With the end of World War II and the blossoming interest in ethnocentricity and authoritarianism, a great deal of attention was turned to examining the relationship between perceptual rigidity and social attitudes and relationships. The rigid social thinking found in prejudiced people was associated with rigid problem-solving (Rokeach, 1948), and prejudiced people markedly oversimplified both current conscious thought and, over time, their memories as well (Fisher, 1951). Also, intolerance of ambiguity was positively associated with the acceptance of popular misconceptions (Levitt, 1953). More specific to the rigidity-flexibility continuum, Rubenowitz (1963) found that flexible people were ". . . more intrceptive and more able to analyse foreign stimuli and situations than rigid people" (p. 215). More recently, rigidity has been found to be negatively associated with both problem-solving and creativity (Gorman & Breskin,

1969), and positivity correlated with field dependence in women (Breskin & Gorman, 1969).

Prime among these investigations was a study of prejudiced children, with findings that highly prejudiced children displayed high perceptual rigidity (Frenkel-Brunswik, 1948a), leading to the conclusion that perceptual rigidity was not only correlated with personality traits, but was also, in essence, a manifestation of the total personality itself, with its beginnings in a lack of tolerance for emotional ambivalence (Frenkel-Brunswik, 1948b). Also, highly authoritarian people were found to be intolerant of ambiguity, and tended ". . . to arrive at premature closure as to valiative aspects, often at the neglect of reality" (Frenkel-Brunswik, 1949, p. 115). This researcher viewed rigidity and intolerance of ambiguity as always going hand-in-hand, if not exactly synonymous.

Summary

Though the majority of Frenkel-Brunswik's work focused primarily on social ambiguity, I am proposing that, by extension, rigid people are also intolerant of ambiguity in their own emotional and phenomenological experiences. Frenkel-Brunswik's (1948b) conclusion that rigidity stems from and is a manifestation of intolerance of emotional ambivalence is highly supportive of the hypothesis that rigidity negatively influences an exerciser's ability to tolerate and adjust to the frequently ambiguous stimuli

resulting from exercise.

That a rigid personality style constricts perception and thereby impairs adaptability appears to be supported by the literature. Leach (1967) discussed this constriction of perception, stating that ". . . the rigid individual . . . selects out and filters stimuli in accordance with his defensive needs" (p. 17), conceiving of

. . . rigidity as a fundamental restriction on the individual's perception of his environment, and therefore of the use which he could make of that environment. Earlier workers had thought that individuals needed this kind of restriction on their perceptual intake, as a defence against ego-involving situations which they found threatening. (p. 18)

Surely there is little that has more ego-threatening potential than ambiguous stimuli regarding one's body and self-concept. Also, Werner's (1946) supposition that behavioral stability requires cognitive/emotional flexibility is clearly applicable to exercise adherence; certainly at least the beginning exerciser's internal environment is in a continuing state of flux between physical activity, and rest and recovery, as well as occasional physical soreness. Thus, if the ". . . rigid individual would require a greater degree of structure in his environment than a non-rigid person" (Breskin, 1968, p. 1203), and if this greater structure is as necessary in the exerciser's internal environment as the external

environment, then higher rigidity would make psychological adaptation to exercise difficult due to its negative influence on the ability to tolerate ambiguity.

As noted earlier, no research to date has linked the cognitive variables discussed above to exercise performance or adherence. This review will now focus on those factors that have been investigated in relation to exercise adherence.

Personal Factors Influencing Exercise Adherence

Investigations of exercise adherence have generally classified the variables of interest into personal and situational categories. The personal category includes psychological and biological factors; situational variables include the influence of social support, exercise intensity, and convenience.

Psychological Factors

Recent research has employed theoretical models of how people perceive themselves in attempts to better understand some of the internal forces affecting exercise performance. Self-efficacy theory (Bandura, 1977) in particular has been employed to investigate the influence of self-perception in a variety of areas, including sport and exercise behaviors. Also, the effect of self-schema, or how people generalize about themselves, has also been investigated in regard to exercise.

Although the impact of self-efficacy has been studied in a number of arenas (including attitudes toward math and

science, behavioral medicine, and sport and motor performance), "it is only recently that researchers have begun to examine the potential value of efficacy cognitions in explaining and predicting exercise behaviors" (McAuley, 1992, p. 110). An early study sought to identify predictors of adoption and continuation of physical activity (Sallis, Haskell, Fortmann, Vranizan, Taylor, and Solomon, 1986); they found that the importance of individual factors varied depending on the stage of activity (i.e., adoption or maintenance), as well as across differing levels of intensity. This study identified self-efficacy as a significant predictor of exercise adoption, and also significantly influential in maintaining moderate intensity exercise once begun.

Another early study examined whether self-efficacy and outcome expectations could discriminant between adherers and dropouts in a twice weekly, 11-week exercise program (Desharnais, et al, 1986). Results indicated that both self-efficacy and outcome expectations contributed significantly to the ability to distinguish between adherers and dropouts, although ". . . self-efficacy [was] a more central determinant of adherence than expectation of outcome" (p. 1158). Unfortunately, this study suffered a number of shortcomings that confound its findings. First, the adherence criteria did not account for whether subjects exercised outside the program. Also, the criteria were appeared arbitrary; adherers were those who attended at

least 20 of the 22 total sessions, while missing no more than one session in any given week. Thus, an exerciser who attended 19 of the 22 total sessions was classified a dropout, with no theoretical difference between the 19-session attender and the 20-session attender. Lastly, the measurement of self-efficacy was crude, consisting of only one item on a 7-point Likert scale, and therefore of questionable value in fully tapping subjects' beliefs regarding their ability to complete the program. Although interesting and supportive of further research, this study's results were weakened by methodological flaws.

McAuley and Gill (1983) addressed the measurement issue in an earlier work that developed a Physical Self-Efficacy Scale (PSE). Working with collegiate women's gymnastics, they found that the PSE was a reliable measure for general physical self-efficacy. For predicting actual performance, however, only the task-specific items of the PSE and the subjects' individual predictions of performance were significant predictors. The authors interpreted these findings as support for Bandura's (1986) contention that self-efficacy is highly task specific, and therefore the most appropriate measurement of self-efficacy is at the microanalytic level that taps one's beliefs about the ability to perform the tasks specific to the overall behavior, and the ability to overcome the typical obstacles to performance, rather than a general or global level.

McAuley, Duncan, Wraith, and Lettunich (1991)

investigated the effects of a successful exercise experience on self-efficacy beliefs regarding a variety of future exercise behaviors, which included walking, biking, and sit-ups. After successfully completing a submaximal bicycle ergometer workout, self-efficacy perceptions were significantly raised for all subjects, and for all three types of exercise. This study demonstrated strong support for the reciprocal relationship between self-efficacy and past performance accomplishments posited by Bandura (1986).

No studies using an appropriate, task-specific measure of self-efficacy have yet failed to find a statistically significant effect for self-efficacy, even when modest. Thus, self-efficacy theory appears a very promising avenue for further research interest on cognitive mediation of exercise behaviors.

Another framework of cognitive mediation of behavior receiving recent attention is self-schemata, originally introduced by Markus (1977), and defined ". . . as implicit theories used by individuals to make sense of their own past behavior and to direct the course of future behavior" (p. 78). In applying schema theory to the exercise domain, Kendzierski (1988) defines self-schemata in more cognitive terms, as ". . . cognitive generalizations about the self derived from past experience and focused on those aspects of the self that are regarded by the individual as important . . ." (p. 45). Subjects who were self-schematic for exercise were found to exercise more frequently, did a variety of

exercise activities, and had developed more strategies for getting themselves to exercise when they did not feel like it than non-exerciser schematics or aschematics (Kendzierski, 1988). Another study found that exercise-schematic subjects were significantly more likely to have adopted an exercise program than non-schematics (Kendzierski, 1990). This study also examined the information processing of a sample of exercise-schematics, finding that schematics differed from non-schematics in endorsing more phrases related to exercise as self-descriptive, took significantly less time to make schema-congruent judgments, and reported more past exercise experiences.

In summary, the influence of cognitive mediation on exercise perceptions and behaviors is undoubtedly significant and important to pursue in future research. Clearly, how people think about themselves and their abilities greatly influences behavior, and interventions aimed at strengthening those thoughts and beliefs appear quite possible from these cognitive frameworks.

Other research on psychological factors has focused primarily on attitudes toward physical activity, and level of self-motivation. To date, attitudes toward physical activity have not been found particularly useful in identifying exercise adherers or dropouts in adult populations (Dishman & Gettman, 1980; Dishman, Sallis, and Orenstein, 1985; McCreedy & Long, 1985). Dishman (1982)

concluded that attitudes toward physical activity have been unable to predict either initiation of or adherence to exercise, finding that nonadherers possessed attitudes toward exercise as favorable as regular exercisers. However, his conclusions were based on studies that used widely different as well as very broad definitions of attitudes, calling into question the reliability of the construct he was reviewing. Also, the Physical Estimation and Attraction Scales (PEAS), the measure most commonly used to assess attitudes, was developed on adolescent males and has only limited generalizeability to adults (Sonstroem, 1978), though efforts are being made to revise the PEAS scales to develop more valid adult scales (Safrit, Wood, & Dishman, 1985).

Although the full PEAS scores were not predictive of adherence, the Attraction Scale of the PEAS has been shown to influence the initial adoption of an exercise program (Dishman, 1978; Sonstroem & Kampper, 1980). Though the research is limited to adolescent males, attitudes have also been strongly associated with self-esteem (Fox, Corbin, & Couldry, 1985; Sonstroem, 1976) and lack of maladjustment or neuroticism (Sonstroem, 1976).

Given these findings, Rejeski and Thompson (1993) concluded that "In short, in 1982, it was premature to suggest that attitudes were unrelated to either initiation of or continued involvement in physical activity" (p. 23). With the development of a more valid instrument for the

measurement of attitudes in adults, ". . . interest in vigorous physical activity and self-perceived ability at activity could become components of a future, more complex model explaining adult activity participation" (Sonstroem, 1988, p. 129).

One of the better researched psychological factors to date is self-motivation, defined by Dishman and Gettman (1980) as ". . . a generalized, non-specific tendency to persist in the absence of extrinsic reinforcement and is thus largely independent of situational influence" (p. 297). Self-motivation is thought to reflect a personality trait that helps determine task persistence of many kinds, and is believed to have a situationally invariant, trait-like nature (Dishman & Ickes, 1981). Its relationship with exercise adherence has been defined as positive and linear; as self-motivation increases, so does adherence.

Unfortunately, research investigating self-motivation has provided very mixed results. The Self-Motivation Inventory (SMI) was developed to measure this construct (Dishman & Ickes, 1981); the validation studies were interpreted as supporting the utility of the SMI, since ". . . the mean self-motivation score of the dropouts . . . was significantly ($p < .05$) lower than that of the adherers . . ." (Dishman & Ickes, 1981, p. 427). Factor analysis supported the authors' contention that the SMI measures a unitary trait (Dishman, Ickes & Morgan, 1980). Another study identified percent fat, self-motivation, and

body weight as sufficient for 78.9% accuracy overall in classifying adherers and dropouts (Dishman & Gettman, 1980). This was a 39% gain over base rate prediction for dropouts, but only a 16% gain over base rate for adherers.

The main problem with this initial core of construction and validation studies is that, though the experimental groups were found to be significantly different in their SMI mean scores, the utility of the SMI's predictive ability is overstated. Group findings have not led to a practical ability to predict adherence/dropout for individuals. Ward and Morgan (1984) used Dishman and Ickes' (1981) body weight, percent fat, and SMI equation to predict adherence in two exercise programs; adherers were predicted well but dropouts were not. Overall accuracy was not different from chance for women, and was only 68% for men. Other researchers and reviewers (Dishman, 1986; Martin & Dubbert, 1985) have also concluded that the SMI is a considerably better predictor of adherence than of dropout, a finding that contradicts the Dishman and Gettman (1981) results mentioned above.

Other studies have obtained results supportive of the utility of self-motivation. Heiby, Onorato, and Sato (1987) studied marathoners, finding significant negative correlations between self-motivation and trait anxiety and depression, and positive correlations with frequency of self-reinforcement, current exercise habits, and motivation to exercise. Pain and Sharples (1986) used the SMI to

predict the completion of a graduate course in psychological counseling, finding a significantly positive correlation between SMI score and course completion. This study was interesting in that it examined the SMI with a non-exercise population; its significant results indicates that the construct underlying the SMI generalizes beyond the exercise population.

Other studies have failed to find significant relationships between the SMI and adherence. Weber and Wertheim (1989) investigated the effects of self-monitoring, special staff attention, body fat percent and self-motivation on adherence to individualized exercise programs at a community gym. Findings were significant for type of intervention, but not for either fat percent or self-motivation at any point during the 12 weeks of the study. This is particularly interesting since the criterion for adherence was relatively liberal compared to previous work.

Gale, Eckhoff, Mogel, and Rodnick (1984) also failed to find a relationship between self-motivation and exercise adherence in their six month study. For both men and women, self-motivation scores did not distinguish nonadherers and occasional attenders from adherers; self-motivation did identify early dropouts from adherers and occasional attenders for men, but not for women. As mentioned above, Ward and Morgan's (1984) study failed to distinguish between adherers and nonadherers; subjects obtained very similar scores on the SMI regardless of rate of adherence.

This review of the self-motivation literature is relatively brief; however, it is representative of the diversity of findings regarding this construct, and serves to point out the controversial nature of self-motivation. Part of the problem is definitional: "The exact nature of the behavioral tendency to persevere and of what is being measured by Dishman's questionnaire is not yet clearly defined" (Knapp, 1988, p. 220). Dishman and Gettman's (1981) definition of self-motivation as "a generalized, non-specific tendency to persist" may be less than adequate, particularly since motivation is most frequently viewed as a multidimensional, variable factor (Cassidy & Lynn, 1989), not the unitary construct tapped by the SMI. Also, "self-motivation" cannot be considered synonymous with "intrinsic" motivation, since intrinsic motivation has also been found to be multidimensional in nature (Reeve & Robinson, 1987). Also, Dishman and Gettman's (1981) conclusion that the absence of extrinsic reinforcement means self-motivation is independent of situational influences cannot be supported; the number of intrinsic reinforcers is, for all practical purposes, infinite, and can easily be situationally dependent.

In summary, more definitional work is required before the construct of self-motivation can be sufficiently understood. The literature is equivocal regarding a positive relationship between self-motivation and exercise adherence, with some studies finding a moderate relationship

with adherence and others finding little or no correlation. Unfortunately, self-motivation as measured by the SMI has very limited utility in predicting adherence or dropout, and cannot be considered reliable for predicting the exercise behavior of individual exercisers (Gale, et al, 1984; Weber & Wertheim, 1989).

Biological Factors

Early evidence pointed to a relationship between adherence and both body weight and percent body fat (Dishman, 1981; Dishman & Ickes, 1981; Massie & Shephard, 1971), with higher values of each contributing to lower adherence. Dishman and Ickes (1981) also found metabolic capacity to be significantly related to adherence, but Dishman and Gettman (1980) failed to replicate this finding. Other research examining body fat as a variable, however, has not been consistently supportive (Sonstroem, 1988). Weber and Wertheim (1989) failed to find any correlation between body fat and adherence, and Ward and Morgan (1984) were unable to replicate Dishman and Ickes' (1981) findings, which had body fat as a significant predictor of adherence (along with body weight and self-motivation). Morgan's (1977b) early review concluded that the balance of the research at that time pointed to the nonsignificance of percent body fat in predicting exercise adherence.

Other medical factors, such as systolic blood pressure, angina, and persistent cough, have been found significantly related to adherence for patients recovering from myocardial

infarction (Oldridge, et al, 1982), but have not been investigated in non-cardiac subjects.

In summary, no biologic factors have unequivocal or even strong support in the literature as impacting exercise adherence in normal populations, which is the population of interest in this proposal. The research on body weight and percent body fat has been highly inconsistent (Sonstroem, 1988), and the cardiac factors that impact cardiac exercisers have not been studied in normal populations.

Situational Factors

The most salient situational correlates with exercise adherence are social support influences and exercise program variables (Dishman, 1984; Martin & Dubbert, 1985). Exercisers with supportive spouses persisted twice as often as those whose spouses were either negative toward or even neutral to the exercise program (Andrew, et al, 1981; Andrew & Parker, 1979; Heinzlemann & Bagley, 1970). There is also considerable evidence that social support from within the exercise program exerts great influence. Exercisers in group programs were twice as likely to adhere than individual exercisers (Massie & Shephard, 1971), and 90% of the subjects in another study stated their preference for exercising either in a group or with another person (Heinzlemann and Bagley, 1970). There is a strong consensus that exercising in a group format fosters persistence in the exercise program (Wankel, 1985; Wankel, Yardley, & Graham,

1985).

Other situational variables that have been shown to vary systematically with adherence are the intensity of the exercise, and convenience of the exercise setting. Higher exercise intensity has been associated with lower adherence (Mann, Garrett, Farhi, Murray, & Billings, 1969; Pollock, Gettman, Milesis, Bah, Durstine, & Johnson, 1977). Andrew, et al (1981) suggested that higher intensity exercise contributes to exercise dropout through increased levels of perceived exertion and fatigue. Also, Pollock, et al (1977) and Mann, et al (1969) found that half their subjects dropped out of the program due to injury, which was attributed to the intensity of the exercise. Only one study found no relationship between intensity and adherence (Oldridge, 1979); however, the intensity in this study was not as high as in other studies, and both high and low intensity exercisers experienced high social support. These results were interpreted to mean that high social support can moderate the effect of moderate intensity exercise and serve to equalize the adherence and dropout rates.

Convenience of the exercise program has also been noted as an important factor in continuing to exercise (Andrew & Parker, 1979; Massie & Shephard, 1971; Teraslinna, Partanen, Koskela, & Oja, 1969). However, the convenience factor has been assessed primarily through retrospective inquiries into why people had dropped out of exercise, and the credibility or accuracy of such hindsight self-reports is questionable.

Miscellaneous Factors

Other variables that have been of occasional interest to researchers include occupational status, cigarette smoking, past participation in sport or exercise, age, and perception of physical competence, among others. Of these, only occupation and smoking can be confidently associated with exercise adherence; findings on the other variables are too mixed to interpret reliably, probably because of definitional, measurement, and methodological differences and difficulties.

Adherence to exercise appears to be consistently poorer in exercisers with blue-collar occupations and for exercisers who smoke (Fielding, 1982; Oldridge, 1982; Oldridge, et al, 1983). The occupational influence may result from worker perception, in that "if the blue collar worker perceives the exercise intensity to be lower than in his daily work, he may be likely to question the need for the extra, "unnecessary" exercise" (Oldridge, et al, 1983, p. 73). Smokers consistently drop out of exercise programs more often than non-smokers, according to the same studies, although Shephard, Corey, and Kavanagh (1981) failed to find a positive correlation between smoking and adherence. In general, "Continued smoking after an infarction is an indicator of poor compliance with health behavior change" (Oldridge, et al, 1983, p. 73), and may indicate an insufficient commitment to exercise.

Summary

This chapter has reviewed the literature on the elements of cognitive style thought to be relevant to continued participation in exercise, particularly the elements of impulsivity, compulsivity, and rigidity. The literature supports cognitive style as an influence on psychological adaptability in a variety of arenas; therefore, it is hypothesized here that these elements of cognitive style should also impact one's ability to adapt to the physical and emotional changes that result from regular exercise, because they influence the exerciser's affective experience and emotional state.

The exercise adherence literature was also reviewed, with many inconsistent findings reported. One conclusion to be drawn from this literature is that the atheoretical approach to studying adherence is beginning to expand into more theory-driven approaches to research, and the field is benefiting from this expansion.

Chapter 3: METHODS

This chapter will specify the methodology and procedures used in this study. The subject pool will be described, along with the data collection procedure and study design. Operational measures will then be reviewed. Lastly, the research hypotheses will be stated and the data analysis described. Assessment instruments, the variable coding scheme, introduction/consent letter, and the demographic questionnaire are in the appendices.

Subjects

A total of 434 surveys were obtained from eight sites. Of that total, 24 included invalid responses to the validity items of the Obsessive Compulsive Scale (OCS) and were therefore excluded completely from the analysis. Two other surveys were excluded because the subject failed to complete at least two of the instruments, and three were excluded because the subjects indicated they had been treated for cardiac problems. The remaining 405 surveys comprised the total subject pool.

The sample consisted of 148 men (36.5%) and 257 women (63.5%). The average age was 40 (SD = 12.4) years, ranging from 18 to 84; mean age for men was 40.4 (SD = 13.4; range = 53) and for women 39.7 (SD = 11.9; range = 66).

Subjects were recruited from five health/fitness clubs (four in the mid-Michigan area and one in rural Virginia), from the Michigan State University community (including worksite wellness participants, and faculty and graduate

students), and from a community club for recovering alcoholics. The alcoholic subsample was recruited in an effort to include non-university, non-health club subjects. These sites were collapsed into three: private health/fitness clubs (which required a membership fee); the MSU community, including participants in the university worksite wellness program, graduate students in a summer course, and individual graduate students and faculty known to the investigator; and the recovering alcoholic group.

Data Collection

The study survey consisted of a demographic questionnaire and four assessment instruments. Ten graduate students completed the survey before distribution and were able to infer the purpose of the measures for compulsiveness and impulsiveness; consequently, those scales were counterbalanced in presentation in order to counterbalance the possible ordering effects.

The health/fitness facilities all agreed to allow a poster and flyers calling attention to the study to be posted, and kept packets of test surveys at the front desk. Health club personnel distributed the packets to those people who expressed an interest in participating. The MSU worksite wellness program announced the study in their monthly newsletter for three months, and mailed out surveys to members who called and requested one. The wellness program also advertised in their newsletter for non-exercisers for two months. Other MSU faculty and graduate

students were invited to participate; the study was described to a graduate substance abuse class and surveys distributed to those who expressed interest, and nine surveys were distributed to friends and acquaintances of the PI, all within the MSU community. Surveys were also distributed from a table set up at a local club for recovering alcoholics, with a poster describing the study and inviting participation. All subjects completed the survey at their leisure and returned them to the PI through the mail with the stamped envelope provided. Participation was fully voluntary and anonymous. The total time required to complete the survey was roughly 20-25 minutes.

A record of the number of packets distributed through each source was maintained, and return envelopes were color coded according to their distribution sites. This permitted the return rate of distributed surveys to be determined.

Distribution of Surveys

A total of 804 surveys were distributed through the various sites. Table 3.2 summarizes the number issued, distributed and returned for each site.

TABLE 3.1
Research Survey Distribution and Return Rate

	Total Issued to Sites	Total Distributed to Potential Subjects	Returned
Private health clubs	725	500	249
University subjects	388	194	102
Recovering alcoholics	110	110	54
	1223	804	405

The PI issued 725 surveys to the various health club managements. Health club front desk personnel then distributed them to members who requested to participate. Those surveys returned to the PI comprised the sample.

All scoring was performed by the PI, with 10% of the surveys re-scored as reliability checks. Two errors in scoring were found, indicating a possible 5% error rate. Subjects were categorized into exercise groups by the principal investigator based on the information they provided about their exercise frequency and duration. The variable coding scheme is listed in Appendix 1.

Design

Since the research base on the contribution of personality factors to exercise adherence is still quite sparse, this study utilized a correlational design in a

natural setting. Although correlational designs do not permit cause-effect conclusions, they are useful for predictive questions and ". . .in the pilot stages of ongoing research, or during a research program at a point where overall inspection of inter-correlations is called for" (Gelso, 1979, p. 17). Also, a prime strength of the correlational field study is that it permits high generalizeability to the population of interest.

Measures

Obsessive-Compulsive Scale (OCS)

Psychometric measures of compulsivity have only recently been developed. The most direct measure of compulsivity appears to be the Obsessive-Compulsive Scale (OCS). Also, some researchers believe the Breskin Rigidity Scale (BRT) may measure obsessive-compulsive traits (Primavera, et al, 1975); for the purposes of this study, however, the BRT will operationalize flexibility by assessing rigidity, its opposite.

The OCS is a 22-item true-false scale containing 2 non-scored validity items (Gibb, Bailey, Best, & Lambirth, 1983). Scores can range from 0 - 20, with higher scores representing greater compulsiveness; the validation sample of 46 men and 68 women students, and 57 individual therapy clients, had a mean of 11.32 and SD = 4.13; range was not reported. Internal consistency was assessed through item-total correlations, with each item found to be significantly correlated with total score. Test-retest reliability was .82

over three weeks. A measure of concurrent validity was obtained by having two clinical psychologists rate client subjects' degree of obsessive-compulsive traits. These ratings correlated .79 with the OCS, a reasonably high association offering the OCS good construct credibility. No sex differences and no differences between student and client groups were found; however, the client group included a wide variety of concerns, and was not meant to represent clinical examples of obsessive-compulsive traits. There was no reason to believe that compulsiveness is any more endemic to a general client population than it would be in a general student population. This scale appeared to be quite a good measure of compulsivity.

Breskin Rigidity Test (BRT)

A measure of perceptual rigidity has been developed by Breskin (1968), based on the perspective that

. . . the rigid person's requirement for structure would be manifested in the use of the laws of Praeganz, i.e., a more rigid person, given the opportunity to express a preference between pairs of figures differing only in "goodness of fit," will tend to select the "better" fit. (pp. 1203-1204).

Thus, the Breskin Rigidity Test (BRT) uses ". . . a perceptual rather than a conceptual frame of reference to measure rigidity" (Breskin, 1968, p. 1203), is not dependent on verbal or mathematical ability, and has been found to be independent of intelligence (Breskin & Rich, 1971;

Primavera & Simon, 1971).

The BRT was constructed and standardized on a sample of 132 undergraduates (68 men and 64 women), and validated by comparing the scores of art students to accounting and secretarial students. Significant differences exist between males and females, with men scoring in the more rigid direction; the mean for men was 8.5, with a standard deviation of 3.6, while for women the mean was 6.7 with a standard deviation of 3.0. The BRT is a 15-item forced choice scale that asks subjects to choose between two figures that differ in their degree of perceptual closure; a choice for the "better fit" or for higher closure is scored as a rigid response (Breskin, 1968). Scores can range from 0-15, with higher scores indicating greater rigidity. Reliability is considered more than adequate, with odd-even reliability equal to .78 and a .98 KR-20. The BRT takes only 2-3 minutes to complete.

Low rigidity as measured by the BRT has been found to be significantly associated with creativity and problem-solving (Gorman & Breskin, 1969), whereas high rigidity was inversely related to anxiety at a significant level (Primavera, et al, 1975), implying that rigidity may be one manner in which the ego effectively binds anxiety. The literature supports the BRT as a good measure of rigidity.

Barratt Impulsiveness Scale - 10th Revision

The Barratt Impulsiveness Scale - 10th Revision (BIS-10) has been used extensively with adults. Also,

impulsivity as measured by this scale is well-grounded within a neuropsychological framework that includes biological, cognitive, and behavioral components (Barratt, 1985a).

The BIS-10 is a 34-item paper-and-pencil scale scored on a 4-point scale ranging from "rarely-never", "occasionally", "often", to "almost always-always". It contains three subscales, representing the three components of impulsiveness proposed by Barratt (1985b): motor impulsiveness (Im), non-planning impulsiveness (Inp), and cognitive impulsiveness (Ic). The multifactorial nature of the BIS scale (all revisions) has been made clear in a number of studies (Barratt, 1965, 1972, 1983; Barratt & Patton, 1983; Barratt, Patton, Olsson & Zuker, 1981); the three factors mentioned above have been confirmed, although the cognitive subtrait is the least psychometrically sound (Barratt, in press; Luengo, Carrillo-de-la-Pena & Otero, 1991).

Barratt (1985b) reported reliabilities ranging from .89 to .92 for the three subscales (alpha coefficients), although Luengo et al. (1991) found somewhat lower reliabilities ranging from .56 to .65. They also reported a test-retest reliability of .60 over one year. A standardization subsample of 412 undergraduates obtained a mean of 43.24 and standard deviation of 15.11.

The BIS-10 has been used in a wide variety of studies, and construct validity is well-established. Impulsiveness

as measured by the BIS-10 has been positively associated with a number of perceptual-motor tasks (such as reaction time and visual tracking), intra-individual variability in performance, cognitive performance (such as time estimation), and a number of psychophysiological measures (Barratt, 1985b). High-impulsive subjects perform poorly at psychomotor tasks and process information less efficiently (Barratt, 1987), easily angered people are significantly more impulsive (Barratt, 1991), and the BIS-10 successfully differentiated subjects diagnosed with antisocial personality disorder from subjects diagnosed with thought disorders, mood disorders, and substance abuse disorders (Barratt, 1985b). In summary, the BIS-10 is a reliable and highly valid instrument for measuring impulsiveness.

Tolerance of Ambiguity Scale - AT-20

MacDonald's (1970) Ambiguity Tolerance Scale (AT-20) is a revision of the Rydell and Rosen (1966) scale. The AT-20 is a 20 item, true-false, paper-and-pencil measure scored for high tolerance of ambiguity. The addition of four items to the Rydell and Rosen (1966) test to form the AT-20 improved the original .64 split-half reliability to a split-half reliability of .86, representing a sizable increase in reliability. Test-retest reliability was .63 over six months, and is consistent with test-retest reliabilities of .71 and .57 (over 1 and 2 months, respectively) of the original Rydell and Rosen (1966) scale. The AT-20 has been shown to be free of social desirability effects as well,

with a correlation of only .02 (MacDonald, 1970).

The AT-20 was administered to a validation sample of undergraduate students; a mean of 10.51 and a standard deviation of 3.32 was obtained; no sex differences were observed. AT-20 scores were significantly correlated with rigidity, dogmatism, and frequency of church attendance. An interesting result was obtained with a subsample of male physical education majors, which revealed a significantly negative ($-.30, p < .01$) correlation between ambiguity tolerance and rigidity.

In summary, the AT-20 possesses high reliability and validity, and should be a useful instrument for the measurement of ambiguity tolerance.

Dependent Variables

The dependent variables vary according to the analysis used. To determine whether the exercise group means differ across the assessment instruments, the assessment scores are the dependent variables for the MANOVA. For the predictive analysis utilizing discriminant analysis, the dependent variables are the exercise categories. Subjects were classified according to the frequency and duration of exercise reported on the demographic questionnaires. Categories were defined as follows:

- 1) Super-exercisers: people who had exercised very frequently (5 or more times per week) for 6 months or more. Those who indicated they had cut back or stopped exercising in the past were classified as super-

exercisers only if they had been exercising for three years or more, the reason(s) for interruption were unavoidable (injury, surgery, pregnancy, relocation) with no motivational elements, i.e., "time constraints", "work obligations", etc., and exercise was resumed as soon as possible. If the subject had exercised for less than three years or if motivation was part of the reason for the interruption(s), the exerciser was classified as an intermittent exerciser.

- 2) General exercisers: people who exercised an average of 2-4 times per week for 6 months or more. Those who indicated they had cut back or stopped exercising in the past were classified as general exercisers only if they indicated they had exercised for three years or more, whose reasons for interruption did not include motivational elements, and exercise was resumed as soon as possible. Otherwise they were classified as intermittent exercisers.
- 3) Intermittent exercisers:
 - a) people who exercised 2-4 times weekly for 3 months or more and then reported having stopped or cut back on frequency to once a week or less, and/or
 - b) people who initiated an exercise plan and failed to adhere to it for at least 3 months (the traditional dropouts), and/or
 - c) people who exercised once a week or less.
 - d) those who had been exercising for less than 6

months, but had previously dropped out of regular exercise.

Though this category includes those traditionally defined as dropouts, it is broader in scope by including those who exercise steadily for short periods of time and those who exercise irregularly. This more inclusive definition will hopefully better represent real world exercisers.

- 4) Non-exercisers: people who never initiated an exercise plan, or had not exercised in the last three years.

People who indicate that they had been exercising regularly for less than 6 months, but had not previously exercised and then stopped, were not classified into an exercise category, since it was uncertain whether they would continue for the requisite six months; their responses were included only in the correlational analysis of the assessment instruments. Subjects who indicated they stopped exercising or cut back on exercise frequency due to injury were not classified; their responses were used only in the correlational analysis. These classification rules should make the categories as clean and mutually exclusive as possible.

Covariates

Information on a number of possible confounding variables was collected. These included age, sex, perceived enjoyment of exercise, whether the exerciser's efforts were supported by a partner, the exercise format (alone, with a

partner, or in a group), type of exercise (aerobic, anaerobic, or mixed), and exercise intensity. Information on these variables was supplied by the subject on the demographic questionnaire; age was measured in years, and degree of enjoyment and exercise intensity were both recorded on 10-point Likert scales. The specific coding scheme for each variable is listed in Appendix A.

Hypotheses

The research questions in this study were twofold. First, the relationships between the personality variables of impulsiveness, compulsiveness, rigidity, and ambiguity tolerance were examined. The following are the hypotheses regarding these relationships:

- 1) Compulsiveness will be negatively related to both impulsiveness and tolerance of ambiguity.
- 2) Compulsiveness and rigidity will be positively related.
- 3) Impulsiveness and tolerance of ambiguity will be negatively related.
- 4) Tolerance of ambiguity and rigidity will be negatively related.

The remainder of the research question asks whether a relationship exists between psychological adaptability and level of exercise adherence. Psychological adaptability is operationalized as low impulsiveness, low compulsiveness, low rigidity, and high tolerance of ambiguity. Specifically:

- 5) general exercisers will score significantly lower on impulsiveness, compulsiveness, and rigidity, and higher

- on tolerance of ambiguity than intermittent exercisers,
- 6) super-exercisers will score significantly higher on rigidity and compulsiveness than other exercise groups, and lower on impulsiveness and tolerance of ambiguity.

By group, the personality measures should fall as follows:

	COMP (OCS)	IMP (BIS10)	RIG (BRT)	TOL-AMB (AT20)
Non-exercisers	Wide range of all variables			
Intermittent exercisers	Moderate	High	Moderate	Moderate
General exercisers	Low	Moderate	Low	High
Super-exer.	High	Low	High	Low

COMP = compulsiveness IMP = impulsiveness RIG = rigidity
INT-AMB = intolerance of ambiguity

- 7) Compulsiveness, impulsiveness, rigidity, and intolerance of ambiguity will combine to predict exercise group membership.

Site Characteristics

Data were collected from several types of sites: private health clubs, the university community (excluding undergraduates), and recovering alcoholics. A preliminary MANOVA was conducted to assess whether the data from the differing categories of sites could reasonably be combined into one subject pool, by determining whether there were differences among the three sites on the predictor

variables. A significant overall multivariate effect was found ($F = 3.74$, $p = .000$); followup univariate F-tests revealed significant effects for: impulsiveness ($F = 14.67$, $p = .000$, $\eta^2 = .07$), perceived enjoyment ($F = 16.97$, $p = .000$, $\eta^2 = .08$), and perceived intensity ($F = 17.57$, $p = .000$, $\eta^2 = .09$). No differences were found for either age or sex differences.

For enjoyment, the difference among sources is accounted for by the non-exerciser group, which was recruited among the university community and the alcoholic subgroups. Logically, the recruitment of non-exercisers at the exercise facilities is unlikely. Table 3.1 compares the means and standard deviations for enjoyment, impulsiveness, and intensity across the three sources, for the total sample versus exercisers only (non-exercisers excluded). However, intensity is irrelevant for non-exercisers, so only exercisers' reported intensity can be shown in the table.

TABLE 3.2
Means and Standard Deviations for Enjoyment, Impulsiveness, and Intensity
for the Total Sample and for Exercisers Only

Source	Enjoyment				Impulsiveness				Intensity	
	Total		Exer. only		Total		Exer. only		Exercisers only	
	X	SD	X	SD	X	SD	X	SD	X	SD
Private health clubs	2.23	1.64	2.18	1.56	46.71	14.96	46.65	14.84	7.03	1.58
University community	3.32	2.29	2.38	1.45	40.78	12.82	41.13	13.38	5.83	1.97
Recovering alcoholics	3.44	2.22	2.22	1.51	53.69	14.57	49.50	13.27	6.05	1.53

As the table shows, the site differences for enjoyment disappear when non-exercisers are excluded. The results of a followup ANOVA for enjoyment by source revealed no significant difference when non-exercisers were excluded from the analysis ($F = .51$, $p = .601$). Since the observed effect was attributable to membership in one of the exercise groups, which was one of the factors of interest in this study, concern for differential results by site was unwarranted for the enjoyment variable.

There was somewhat more concern for the impulsiveness and intensity variables. As the table shows, the exercisers scored lower than the total sample only for the alcoholic subsample; thus, non-exercisers exerted only moderate differential influence for impulsiveness. The pattern of site difference remained the same. For intensity, there was no non-exercise group with which to compare.

However, the amount of variance accounted for by site was low (7% for impulsiveness and 9% for intensity). Also, the practical significance of a difference in means of 1.2 points for intensity is questionable. Therefore, the sites were aggregated into a total sample.

Data Analysis

Type I alpha was set at .10, reflecting the exploratory nature of this research. Efforts were made to ensure that power equaled .80; however, since the effect size was unknown, it was difficult to determine the number of subjects necessary. Hypothesizing a small effect size of

.30, 140 subjects per group were necessary to meet a .80 power requirement. It was not possible to recruit this number, as may be seen in Table 3.3.

TABLE 3.3
Exercise Group Membership

	n
Non-exercisers	44
Intermittent exercisers	132
General exercisers	92
Super-exercisers	116
Unclassifiable	21
TOTAL	405

There were 21 surveys that were not classifiable. The most frequent reason was that the exerciser had been exercising less than six months. The Unclassifiable group was included only in the correlational analysis, which did not include the exercise data.

The Non-exerciser group, at $n = 44$, was the most difficult to recruit, primarily because of the liberal definition of exercise used in this study. If the effect size is as small as postulated, this number may reduce the power of the analysis to .40 for those analyses including the Non-exercise group. For the exercise groups, the 92

General-exercisers limit power to .65 for those analyses including only the exercisers. If the effect size were to be slightly higher at .40, power would also increase.

Hypotheses #1 - 4: These hypotheses were tested through determination of the correlations between the measures of impulsiveness, compulsiveness, rigidity, and intolerance of ambiguity.

Hypotheses 5 & 6: The hypotheses regarding the mean scores of the exercise groups were tested by a multivariate analysis of variance (MANOVA).

Hypothesis # 7: Discriminant analysis was used to assess the degree to which compulsiveness, impulsiveness, rigidity, and tolerance of ambiguity predicted exercise group membership, while accounting for the possible influence of covariates and mediating variables. This technique is particularly well-suited to assess which variables differentiate most effectively between groups. Also, it predicts group membership for individual subjects, which is then compared to the actual group membership. The percentage of correct predictions can then be compared with the percent of group membership expected by chance. Discriminant analysis can be used to predict group membership for both dichotomous outcomes and for more than two groups.

Chapter 4: RESULTS

The purpose of this study was to explore two related research questions: 1) the relationships between compulsiveness, impulsiveness, rigidity, and tolerance of ambiguity, and 2) the degree to which compulsiveness, impulsiveness, rigidity, and tolerance of ambiguity influence exercise habits. The chapter will first test the hypotheses listed in the preceding chapter, with supporting or disconfirming conclusions drawn. Considerations regarding the statistical assumptions underlying discriminant analysis will be discussed, and post-hoc analyses presented.

Tests of Hypotheses

Hypotheses 1-4:

It was hypothesized that:

- 1) Compulsiveness will be negatively related to both impulsiveness and tolerance of ambiguity.
- 2) Compulsiveness and rigidity will show a positive linear relationship.
- 3) Impulsiveness and tolerance of ambiguity will be negatively related.
- 4) Tolerance of ambiguity and rigidity will be negatively related.

Table 4.1 shows the correlation matrix for the personality variables, with the associated probability estimates (2-tailed probability).

TABLE 4.1
Correlation Matrix for Personality Variables

	OCS	BRT	BIS10	AT20
OCS	1.00 $p = .$			
BRT	.324 $p = .000$	1.00 $p = .$		
BIS10	-.081 $p = .120$	-.267 $p = .000$	1.00 $p = .$	
AT20	-.526 $p = .000$	-.281 $p = .000$	-.072 $p = .170$	1.00 $p = .$

OCS = Obsessive-Compulsive Scale

BRT = Breskin Rigidity Test

BIS10 = Barratt Impulsiveness Scale - 10th Revision

AT20 = Ambiguity Tolerance Scale

Hypothesis #1 is partially supported; compulsiveness and tolerance of ambiguity show the strongest relationship of all, with a negative correlation of $r = -.526$, $p = .000$. However, compulsiveness and impulsiveness failed to show a significant difference. Hypothesis #2 is supported, with compulsiveness and rigidity being positively related at $r = .324$, $p = .000$.

Tolerance of ambiguity and impulsiveness were not significantly related; therefore, Hypothesis #3 cannot be supported. Tolerance of ambiguity and rigidity, however, showed a significant negative correlation of $r = -.281$, $p = .000$, which supports Hypothesis #4.

The hypotheses as stated addressed only linear

relationships; the possibility of nonlinear relationships was explored, however, by examining the scatterplots of the psychological variables against each other. Unfortunately, no type of curvilinear relationship could be distinguished between any of the variables. The significant correlations noted above were clearly linear when scatterplots were inspected.

Hypotheses #5 and 6:

It was hypothesized that:

- 5) general exercisers will score significantly lower on impulsiveness, compulsiveness, and rigidity, and higher on tolerance of ambiguity than intermittent exercisers, and
- 6) super-exercisers will score significantly higher on compulsiveness and rigidity than the other groups, and lower on impulsiveness and tolerance of ambiguity.

Groups were hypothesized to score as follows:

	COMP (OCS)	IMP (BIS10)	RIG (BRT)	TOL-AMB (AT20)
Non-exercisers	Wide range of all variables			
Intermittent exercisers	Moderate	High	Moderate	Moderate
General exercisers	Low	Moderate	Low	High
Super-exer.	High	Low	High	Low

Means and standard deviations of the psychological variables are presented in Table 4.2:

TABLE 4.2
Means and Standard Deviations for Personality Factors
(with MANOVA Results)

	OCS		BIS10		BRT		AT20	
	X	SD	X	SD	X	SD	X	SD
Non-exer.	11.77	4.18	48.48	14.22	8.33	3.50	8.44	3.72
Inter-exer.	10.75	3.87	48.24	15.71	7.71	3.48	9.50	3.64
Gen-exer.	10.67	4.26	47.55	14.81	8.21	3.27	9.71	4.17
Super-exer.	11.04	4.65	42.26*	13.96	7.91	3.25	9.52	4.17

OCS = Obsessive-Compulsive Scale; BRT = Breskin Rigidity Test
 BIS10 = Barratt Impulsiveness Scale-10th Revision;
 AT20 = Ambiguity Tolerance Scale; * - $p = .01$
 df (3, 266)

These hypotheses were tested with a multivariate analysis of variance (MANOVA). The results identified a significant overall multivariate effect ($F = 1.69$, $p = .063$). Follow-up univariate F-tests were conducted, and identified a significant difference between the exercise groups on impulsiveness, between the super-exercise group and all other groups ($F = 3.94$, $p = .009$); no other significant differences were found. Follow-up univariate F-tests, though they do not control Type I error in themselves, are considered "protected" when used to further analyze MANOVA results (Bray and Maxwell, 1982), since the MANOVA procedure controls for the inflation of Type I error inherent in doing several univariate procedures, and a non-significant MANOVA result is a priori not analyzed further. Although several more conservative methods exist for those

situations involving highly correlated predictors and when the linear combinations of variables are complex, ". . . if the purpose of the analysis is to control Type I error rate for a set of p univariate ANOVAs, then these methods are generally appropriate" (Bray and Maxwell, p. 343). In view of the exploratory nature of this study, protected F-tests are considered logically sufficient to answer the questions of which variables contributed to the overall significant MANOVA and whether group differences existed for each variable. Thus, these data indicate that Hypothesis #5 was not supported. Hypothesis #6 was partially supported, since super-exercisers scored significantly lower on impulsiveness than all others. They did not score higher on either compulsiveness or rigidity.

Hypothesis #7:

It was hypothesized that compulsiveness, impulsiveness, rigidity, and intolerance of ambiguity will combine to predict exercise group membership. Several discriminant analyses were performed to test this hypothesis; covariates were included to examine their possible influence.

The first discriminant analysis was employed to predict group membership in all four groups (the three exercise groups and the non-exercisers). Membership in the three exercise groups was then analyzed. Next, an analysis tested whether non-exercisers could be distinguished from all exercisers, and from super-exercisers in particular. Finally, an attempt was made to differentiate intermittent

from general exercisers.

Analysis #1: The OCS, BRT, BIS10, and AT20 were used to predict group membership in the four exercise groups. The variable selection criteria employed was the minimization of Wilks' lambda, which develops the classification functions so as to minimize the residual or unexplained variance. Since there were unequal numbers of subjects in the exercise groups, the probability of being assigned to each group by chance was specified as the ratio of each group to the total (proportional prior probabilities). Table 4.3 presents the three discriminant functions derived and Table 4.4 the standardized coefficients for each of the variables entering the equation for the one significant function:

TABLE 4.3
Discriminant Function Results for Analysis
including OCS, BIS10, BRT and AT20

	X ²	p	Canonical Correlation	Eigenvalue	Percent of Variance
Function 1	18.90	.026	.191	.038	71.51
Function 2	5.44	.245	.101	.010	19.29
Function 3	1.76	.185	.070	.005	9.20

TABLE 4.4
Standardized Discriminant Function Coefficients
for Function 1

	Discriminant Function
BIS10	1.023
OCS	-.162
BRT	.437

(AT20 did not enter the equation)

Of the three discriminant functions derived, only the first was significant ($X^2 = 18.9$, $p = .026$). Classification accuracy was 37.63%; a significance test for the classification rate may be carried out using either the proportional chance criterion or the maximum chance criterion (Huberty & Barton, 1989). The proportional chance criterion is generally used when individual group accuracy is considered a higher priority than overall accuracy, and thus is the more appropriate criterion in this case. Using the proportional chance criterion, the classification rate of 37.63% was statistically significant ($z = 3.34$, $p = .001$). Unfortunately, all but one of the non-exercisers were misclassified and 88% of the general exercisers were misclassified. Table 4.5 shows the classification table.

TABLE 4.5
Classification Results for Analysis 1a
with OCS, BIS10, BRT and AT20 as Predictors

Actual Group	No. of Cases	Predicted Group Membership			
		1	2	3	4
Non-exercisers	43	1 2.3%	23 53.5%	1 2.3%	18 41.9%
Intermittent exercisers	126	1 .8%	73 57.9%	8 6.3%	44 34.9%
General exercisers	90	0 .0%	47 52.2%	11 12.2%	32 35.3%
Super exercisers	116	0 .0%	51 45.1%	7 6.2%	55 48.7%

Percent of cases correctly classified: 37.63%
Predicted Group Key: 1 = Non-exercisers; 2 = Intermittent exercisers;
3 = General exercisers; 4 = Super-exercisers

As can be seen by the discriminant function coefficients, and the fact that the BIS10 was the only variable entering the one significant function, the BIS10 appeared to carry most of the discriminatory power. Thus, a second analysis was performed using only the BIS10 as a predictor. The function derived was significant ($X^2 = 12.31$, $p = .006$); the canonical correlation was .179, with an eigenvalue of .033. Classification accuracy was almost exactly the same as for the first analysis at 38.90%. Again using the proportional chance criterion, this classification rate was significantly better than chance ($z = 17.58$, $p = .000$). However, none of the non-exercisers or general exercisers were classified correctly. Table 4.6 shows the classification table.

TABLE 4.6
Classification Results for Analysis 1b
with BIS10 as Predictor

Actual Group	No. of Cases	Predicted Group Membership			
		1	2	3	4
Non-exercisers	44	0 .0%	32 72.7%	0 .0%	12 27.3%
Intermittent exercisers	132	0 .0%	91 68.9%	0 .0%	41 31.1%
General exercisers	91	0 .0%	56 61.5%	0 .0%	35 38.5%
Super exercisers	116	0 .0%	58 50.0%	0 .0%	58 50.0%

Percent of cases correctly classified: 38.90%

These first two analyses used only the personality factors as predictors, and although their predictive

accuracy was better than chance, individual group accuracy was very poor, with few or none of the non-exercisers and general exercisers correctly classified. Also, as the ratio of between-groups to within-groups variation, an eigenvalue of .033 marks a poor function. Squaring the canonical correlation of .179 reveals that the analysis accounts for only 3% of the variance. Thus, although the discriminant function is statistically significant, impulsiveness alone has little practical utility for predicting exercise group membership.

Several variables have been identified, however, as likely covariates or mediating variables, and their possible contribution to classification was examined next. A preliminary oneway ANOVA on age, and chi-squares on sex, support of significant other, exercise format (whether the exercise was performed alone, with a partner, or in a group), and exercise type (aerobic, anaerobic, or mixed) revealed no significant differences among the groups, and none of these variables contributed to any significant discriminant functions. Perceived enjoyment (ENJOY) entered the equation along with impulsiveness (BIS10).

The best model for discriminating among all four groups included only ENJOY as a predictor. The significant discriminant function ($X^2 = 177.47$, $p = .000$) produced an eigenvalue of .594 and a canonical correlation of .610, accounting for 37% of the variance and resulting in a classification accuracy of 48.96%, which was significantly

better than chance. Table 4.7 shows the classification.

TABLE 4.7
Classification Results for Analysis 1c
with ENJOY as Predictor

Actual Group	No. of Cases	Predicted Group Membership			
		1	2	3	4
Non-exercisers	44	21 47.7%	22 50.0%	0 .0%	1 2.3%
Intermittent exercisers	132	12 9.1%	92 69.7%	0 .0%	28 21.2%
General exercisers	92	5 5.4%	57 62.0%	0 .0%	30 32.6%
Super exercisers	116	2 1.7%	39 33.6%	0 .0%	75 64.7%

Percent of cases correctly classified: 48.96%

Although including the BIS10 with ENJOY did result in a second significant discriminant function ($X^2 = 7.58$, $p = .0226$), this function did not increase classification accuracy. Instead, accuracy decreased slightly to 47.00%. Thus, the best model for classifying subjects into the four exercise groups employed ENJOY as the sole predictor.

Analysis #2: The next analysis attempted to discriminate between the three exercise groups. This permitted exercise intensity (INTENS) to be included; intensity was irrelevant for non-exercisers, and so could not be used in previous analyses. Enjoyment and intensity, however, were significantly correlated ($r = -.35$, $p = .000$); the analysis was not improved when both were included, and ENJOY was a slightly better predictor when tested separately. Therefore, ENJOY was retained in the model and INTENS was dropped.

Again, the best classificatory model included only ENJOY as the predictor. The significant function ($X^2 = 32.9$, $p = .000$) exhibited an eigenvalue of .103 and produced a canonical correlation of .305, accounting for 9.3% of the variance, and correctly classified 52.65% of subjects, which was significantly better than chance ($z = 6.34$, $p = .000$). Table 4.8 shows the classification results for the predictive model including ENJOY by itself.

TABLE 4.8
Classification Results for Analysis 2
with ENJOY as Predictor for All Exercisers

Actual Group	No. of Cases	Predicted Group Membership		
		2	3	4
Intermittent exercisers	132	104 78.8%	0 .0%	28 21.2%
General exercisers	92	62 67.4%	0 .0%	30 32.6%
Super exercisers	116	41 35.3%	0 .0%	75 64.7%

Percent of cases correctly classified: 52.65%

Interestingly, the deletion of the non-exercisers from the analysis resulted in much less of the variance being explained (37% when all four groups were predicted, only 9% for the three exercise groups). To investigate this, a discriminant analysis was conducted to attempt to distinguish between the non-exercisers and all exercisers. Again, the best predictor was ENJOY, with a significant discriminant function ($X^2 = 147.7$, $p = .0000$), an eigenvalue of .474, and a canonical correlation of .5673, accounting for 32% of the variance. Classification accuracy was

89.06%, significantly better than chance ($z = 4.14$, $p = .000$). As before, the very unequal group sizes (non-exercisers = 44, exercisers = 340) were taken into account through specification of prior probabilities, and the use of the proportional probabilities criterion with which to derive the test statistic. Table 4.9 displays the classification table.

TABLE 4.9
Classification Results for Non-exercisers vs. All exercisers
with ENJOY

Actual Group	No. of cases	Predicted Group Membership	
		Non-exer.	All exercisers
Non-exercisers	44	21 47.7%	23 52.3%
All exercisers	340	19 5.6%	321 94.4%

Percent of cases correctly classified: 89.06%

Interestingly, including the BIS10 resulted in no change in classification accuracy for either individual groups or the overall subject group.

Analysis #3: As Table 4.2 notes, the only significant difference in means across exercise groups was for impulsiveness, with super-exercisers scoring lower than all other groups. Thus, an analysis was run to examine whether the two extremes (non-exercisers and super-exercisers) could be distinguished.

The best model for discriminating between these two groups was perceived enjoyment and impulsiveness. The significant function ($X^2 = 140.18$, $p = .000$) produced an

eigenvalue of 1.44, and a canonical correlation of .768, accounting for 59% of the variance. Table 4.10 presents the classification table for non-exercisers versus super-exercisers.

TABLE 4.10
Classification Results for Non-exercisers vs. Super-exercisers
with ENJOY and BIS10

Actual Group	No. of cases	Predicted Group Membership	
		Non-exer.	Super-exer.
Non-exercisers	44	34 77.3%	10 22.7%
Super-exercisers	116	4 3.4%	112 96.6%

Percent of cases correctly classified: 91.25%

The percent of cases correctly classified was 91.25%, which was significantly better than chance ($z = 8.65$, $p = .000$).

Deleting impulsiveness from the equation decreases overall accuracy only slightly, to 89.38%, and by that criterion it would not seem particularly useful. However, its deletion loses 9% accuracy in the classification of non-exercisers, though losing only .8% accuracy for the super-exercisers; thus, impulsiveness is a useful factor in maximizing the identification of non-exercisers versus super-exercisers.

Analysis #4: Keeping in mind the theoretical distinction between intermittent and general exercisers, the last discriminant analysis sought to distinguish between these two exercise groups. ENJOY and BIS10 gave the best results; although the function was significant

($X^2 = 3.61$, $p = .05$), the eigenvalue was very small at .016, the canonical correlation of .128 accounted for only 1.6% of the variance, and the classification equation assigned every subject to the intermittent category when proportional prior probabilities were specified. Since the group proportions were not too dissimilar (59% intermittents, 41% general), the analysis was re-run using equal prior probabilities. Summary statistics all remained the same, but overall classification accuracy dropped from 58.93% to 54.02%. However, assignments were made to each group rather than assigning all subjects to the largest group; 48.5% of intermittent exercisers were correctly classified, and 62.0% of general exercisers were correctly classified. Using the proportional chance criterion, this classification rate was not significantly different from chance ($z = 1.21$, $p = .22$). Thus, intermittent and general exercisers could not be distinguished using these variables.

Summary of Discriminant Analyses: Given the lack of influence of the personality variables in distinguishing the exercise groups, Hypothesis #7 is not supported, with the exception that impulsiveness contributes to the discrimination between non-exercisers and super-exercisers. Perceived enjoyment of exercise, however, proved a significant predictor between all four groups, between the three exercise groups, between non-exercisers and all exercisers, and between non-exercisers and super-exercisers. General and intermittent exercisers were indistinguishable.

Table 4.11 summarizes the pertinent statistics for each of the discriminant analyses (for the significant functions)

TABLE 4.11
Summary Statistics for Discriminant Analyses

Analysis	p	Eigenvalue	Canonical Correlation(CC)	Classification CC ²	Accuracy
1 v 2 v 3 v 4 (with OCS, BRT, BIS10, and AT20)	.026	.038	.191	3.6%	37.63%
1 v 2 v 3 v 4 (with BIS10 only)	.006	.033	.179	2.9%	38.90%
1 v 2 v 3 v 4 (with ENJOY only)	.000	.594	.610	37.2%	48.96%
2 v 3 v 4 (with ENJOY only)	.000	.103	.305	9.3%	52.65%
1 v 2, 3, & 4 (with ENJOY only)	.000	.474	.567	32.1%	89.06%
1 v 4 (with ENJOY & BIS10)	.000	1.44	.768	58.9%	91.25%
2 v 3 (with ENJOY & BIS10)	.05	.016	.128	1.6%	54.02%

1 = Non-exercisers; 2 = Intermittent exercisers
3 = General exercisers; 4 = Super exercisers

As the table shows, all the functions were statistically significant, and all but the last analysis gave statistically significant classification results. However, only three of the eigenvalues were large enough to indicate a meaningful ratio of between-group to within-group variance; also, their associated canonical correlations were the only ones large enough to explain a reasonable amount of variance. All three of the most meaningful analyses included the non-exercise and super-exercise groups, which were the most different on both the enjoyment and impulsiveness variables; differentiating between the

superexercisers and the intermittent and general exercisers was the next most useful result, though still accounting for only 9.3% of the variance. The other three analyses, though statistically significant, contained little if any practical utility in distinguishing between exercise groups.

Post-hoc Analysis

Given the finding that perceived enjoyment was the most discriminating factor found, enjoyment was examined a bit further. A one-way ANOVA for enjoyment across exercise groups was significant ($F = 71.49$, $p = .000$). Table 4.11 shows the means and standard deviations for ENJOY across the exercise groups. As the table shows, most of the difference lies between the non-exerciser and the other three exercise groups.

TABLE 4.12
Means and Standard Deviations for ENJOY across Exercise Groups

	X	SD
Non-exercisers	5.84	2.33
Intermittent exercisers	2.75	1.70
General exercisers	2.32	1.42
Super-exercisers	1.64	1.25
Total sample	2.67	1.98

Also, there was a slight but significant negative correlation between enjoyment and tolerance of ambiguity ($r = -.1322$, $p = .01$), though not with any of the other personality variables.

Only one variable showed significant sex differences. Given that the literature on the Breskin Rigidity Test (BRT) had identified differences between male and female scores, a oneway ANOVA was performed to determine if these differences were present in this sample as well; results indicated that men did score significantly higher on rigidity than women ($F = 4.32$, $p = .04$); however, the difference in means was less than one point, and thus there is little practical significance to this difference.

Statistical Assumptions

As with most statistical techniques, the robustness of discriminant analysis results depends on the standard assumptions of normality and homogeneity of variance. In the multivariate case, the assumptions are that the independent variables come from a multivariate normal population, and the population covariance matrices are equal for all predictors.

All variables except ENJOY showed a largely normal distribution on a scatterplot. ENJOY was not at all normal, instead exhibiting a strong ceiling effect of the measurement method (a 10-point Likert scale). Super-exercisers overwhelmingly indicated that they love to exercise, and showed the least amount of variance compared to the other groups. General and intermittent exercisers showed a slightly higher mean and somewhat more variability; the non-exerciser group alone showed a faintly normal distribution, and the most variation.

Along with nonnormality, ENJOY also evidenced heterogeneity of variance across the exercise groups, with non-exercisers being the most variable. Box's M-test was used to test for homogeneity of variance as part of the discriminant analysis; a significant result indicates that the groups have significantly different variances. Again, ENJOY was the only variable that failed the homogeneity of variance assumption.

Although ENJOY clearly fails to meet the model assumptions for discriminant analysis, its relevance and value to distinguishing between exercise groups should not be summarily dismissed. Box's M-test tends to result in small probability values (indicating heterogeneity) when sample sizes are large, even when the group covariance matrices are not too different, as seems to be indicated by Table 4.12. Also, the test is quite sensitive to non-normality, and will identify the group variances as unequal when the normality assumption is violated (Norusis/SPSS, 1990). Given the relatively large sample size in this study, and the non-normal distribution of ENJOY, the unequal variances for ENJOY is not of primary concern.

The violation of the normality assumption, however, is still an issue, since "If multivariate normality is violated, tests of significance and estimated classification rates may be biased" (Dillon & Goldstein, 1984, pp. 380-381). More specifically,

" . . . the performance of the linear discriminant

function in nonnormal situations can be very misleading. In particular, though the overall classification error rates were usually not severely affected, the individual group error rates were distorted in that error rates were generally much larger than the optimal value for one population group, and much small for the other . . . however, . . . the linear discriminant function is likely to be affected least when each variable is bounded . . ., in contrast to the case where the range of each variable is infinite" (p. 381).

Measurement of enjoyment was a bounded measure, which gives some support to the judgment that the discriminant analyses run with ENJOY as a predictor are reasonably robust to the violation of the normality assumption. Also, comparative analyses were performed using logistic regression, which is considered quite robust to violation of assumptions; results were very similar to those reported above. The reason logistic regression was not chosen as the primary analytic technique was that it requires a dichotomous outcome; analysis of more than two groups was not possible.

Therefore, though ENJOY exhibits a markedly non-normal distribution and significantly heterogeneous variances, the results reported above should still be considered tentatively viable and defensible. For the reasons discussed above, we should be able to place at least provisional confidence in these results.

SUMMARY

This study sought to determine: 1) the relationships among the personality factors of compulsiveness, impulsiveness, rigidity, and tolerance of ambiguity, and 2) whether these personality factors influenced exercise habits. Several of the hypotheses regarding the relationships between compulsiveness, impulsiveness, tolerance of ambiguity, and rigidity were supported. Compulsiveness was positively related to rigidity, negatively related to tolerance of ambiguity, and not significantly related to impulsiveness. Rigidity was negatively related to both impulsiveness and tolerance of ambiguity, and impulsiveness and tolerance of ambiguity were not related.

The results indicate that the personality variables examined do not help identify different exercise groups, with the exception of impulsiveness, which helped discriminate between non-exercisers and super-exercisers. Rather, enjoyment of exercise was highly influential, and discriminated significantly among exercise groups. A slight negative correlation between enjoyment and tolerance of ambiguity was also found.

Chapter 5: DISCUSSION

This chapter will begin with a brief discussion of sampling and measurement considerations, followed by a discussion of the results of hypotheses tests. Implications of the results for practice will be considered, and, finally, recommendations for future research will be discussed.

Sampling and Measurement Considerations

Overall, the sampling and measurement efforts in this study were acceptable, though not ideal. The sample size was sufficient to identify relatively subtle effects, and statistical significance was obtained with small absolute differences. The aggregation of sites into one sample pool was also considered acceptable, since the pattern of scores were the same across the exercise groups.

Self-selection of subjects remains a threat to internal validity, since those who agreed to participate may differ in some systematic way from those who chose not to participate. The voluntary nature of participation, however, made this threat unavoidable since random selection was not possible. Since this was primarily a group comparison field study in a naturalistic setting, however, lack of randomization should not seriously compromise generalizeability of the results.

Clearly, the measurement of enjoyment of exercise needs improvement; the ten-point Likert scale used in this study resulted in a ceiling effect, with a great many subjects

scoring at the extreme end of the scale. A measure with greater variability would most likely have offered a more psychometrically sound assessment of enjoyment, permitting much greater confidence in the findings.

Discussion of Results

Relationships Between Personality Factors

The intercorrelations between the personality variables offers some interesting information regarding the relationships among compulsiveness, impulsiveness, rigidity, and tolerance of ambiguity. The most surprising finding was the lack of any relationship between compulsiveness and impulsiveness; a negative relationship was hypothesized but not found (**Hypotheses #1**). This finding implies that compulsiveness and impulsiveness are orthogonal to each other, that they are tapping different psychological processes with little or nothing in common.

Thus, the theory that impulsiveness, reflectiveness, and compulsiveness form a continuum of cognitive style is not supported by these data, at least if the continuum is linear. Since this study fails to provide any empirical support for the continuum theory itself (and the literature provides no experimental support), there is no foundation for operationalizing psychological adaptability as a continuum of impulsiveness, reflectiveness, and compulsiveness. Therefore, the theoretical basis of this study has not been empirically supported.

The strong negative correlation between compulsiveness

and tolerance of ambiguity does, however, support the view that compulsiveness is both cognitively and emotionally limiting. This conclusion is based on the perspective that high tolerance of ambiguity is a psychologically healthy and constructive trait, and supports an ability to function well in unfamiliar and uncertain circumstances.

The positive relationship between compulsiveness and rigidity (**Hypothesis #2**) provides only moderate support for the literature that suggested rigidity and compulsiveness are essentially synonymous; a correlation of .324 accounts for only 10% of the variance in compulsiveness. However, 25% of the variance in compulsiveness is accounted for by tolerance of ambiguity, and thus 35% of the variability in compulsiveness can be explained by a combination of tolerance of ambiguity and rigidity. Also, the negative relationship between tolerance of ambiguity and rigidity (**Hypothesis #4**) support the conclusion that these three factors are integrally related.

The major surprise in these results was the lack of relationship between impulsiveness and compulsiveness, as mentioned earlier; however, impulsiveness and tolerance of ambiguity also failed to show any relationship (**Hypotheses #3**), again indicating that impulsiveness is likely tapping a different psychological mechanism than either compulsiveness or tolerance of ambiguity. The negative correlation between impulsiveness and rigidity, then, is somewhat difficult to explain. The best

possibility is that rigidity may be an element underlying both impulsiveness and compulsiveness. Yet, impulsiveness and compulsiveness themselves share no variance; rigidity must operate differently with each. Unfortunately, I could find no previous work that investigated the relationship between impulsiveness and rigidity with which to compare these results.

Another explanation is that the assessment instruments used in this study were less than acceptable in construct validity, and did not tap the relevant traits adequately. Standardized measures are only the best estimates available for measuring a psychological process, after all, and do not directly represent that process. However, the strong reliability and validity data included in the Methods section suggest that this explanation is not a particularly good one; all the instruments used appear strongly related to the theoretical constructs they represent. Also, the scores on the various assessment instruments in this study appear reasonably similar to the normative data noted in the Methods section, indicating that though this subject pool has greater age variability than the undergraduate samples in the standardization studies, their performance on the variables of interest are similar to prior samples. Such similarity strengthens the view that this sample is not skewed in some systematic way that would threaten generalizeability. Table 5.1 compares the means and standard deviations of the psychological variables obtained

in this study to the normative data provided by the standardization samples:

TABLE 5.1
Comparison of Norm vs. Current Subjects
on the Psychological Variables

	<u>Norm Data</u>		<u>Current Subjects</u>	
	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>
OCS	11.32	4.13	10.96	4.22
BRT(male)	8.5	3.60	8.44	3.63
(female)	6.7	3.00	7.71	3.22
BIS10	43.24	15.11	45.88	14.76
AT20	10.51	3.32	9.39	3.98

Lastly, we should keep in mind that the correlations are only moderate (.324 with compulsiveness, -.267 with impulsiveness), and may simply not be large enough to permit much interpretation.

Exercise Group Results and Influences

Psychological Variables

Though disappointing, the theory that psychological adaptability affects exercise habits is clearly not supported, at least insofar as it was operationalized in this study. Compulsiveness, rigidity, and tolerance of ambiguity showed no relationships to frequency and duration of exercise; impulsiveness showed the only statistically significant influence on exercise group membership, though it contributed only slightly to prediction.

There are several possible reasons for these nonsignificant results. First, the psychological processes

of compulsiveness, rigidity, and tolerance of ambiguity may simply have no connection to exercise choices and habits; this would imply that Hardy and Rejeski's (1989) conclusion that moderate intensity exercise induces ambiguous affect has no effect on how often or how long people exercise. This is the most likely explanation, since there were not even any trends that would encourage further investigation into these factors. This does not suggest, however, that **affect** itself is unrelated to exercise; rather, it is ambiguity that appears irrelevant.

Second, but less likely, is the explanation suggested above that the assessment measures were inadequate to the task of identifying the psychological processes being examined. Although the possibility cannot be ignored that other measures may tap other aspects of compulsiveness, impulsiveness, rigidity, or tolerance of ambiguity that are more directly relevant to exercise, past empirical studies have shown the instruments employed in this study to be reliable and valid measures.

Another possible but unlikely explanation for the lack of significant results is that the sample size may have been insufficient to identify very subtle effects. Though the non-exercise group had only 44 subjects, the smallest group of exercisers were the 92 general exercisers. The power analysis discussed in the methods chapter concluded that a small effect size of .30 had a 40% chance of being discovered even for the those analyses including the

smallest group, and a 65% chance for analyses limited to the exercise groups (Cohen, 1977). This may not seem very powerful; however, even slightly higher effect sizes increase power considerably (effect size of .40: n of 44, = power of 59%; n of 92 = power of 85%). Though the sample sizes in this study may not be sufficiently powerful to identify very small effects, it should be adequate to identify effects that are of a size to be useful. Therefore, insufficient power is not a likely explanation for the nonsignificant results in this study.

Lastly, a methodological explanation for these results would suggest that the criteria by which exercise groups were categorized failed to accurately identify intermittent and general exercisers. Certainly the inability to distinguish between intermittent exercisers and general exercisers on any variable was disappointing, especially given the initial rationale that intermittent and general exercisers should differ on a variety of factors. The categorization criteria used in this study resulted in three exercise groups rather than four: non-exercisers, super-exercisers, and a confusing mix of intermediate exercisers whose exercise schedules varied widely but did not comprise identifiably separate categories. Although subsequent attempts were made to differentiate intermittent from general exercisers by using more stringent, exclusive selection criteria, such attempts were ineffective, and results remained essentially the same as for the original

categorization. Thus, the decision criteria for assignment to exercise groups may have mixed together several types of intermittent and general exercisers that might be distinguishable by other means, resulting in an ambiguous and indistinct category composed of unidentified subgroups.

This inability to distinguish intermittent exercisers from regular, moderate frequency exercisers also implies that many general exercisers, over extended periods of time, may actually be intermittent exercisers, and that this study simply failed to identify the interruptions to the exercise regimen. A meaningful number of general exercisers, however, indicated that there had been **no** interruptions to their exercise programs over many years, and these subjects also could not be distinguished from the obviously intermittent group.

The most likely explanation for the lack of significant results, therefore, is the one offered first: that general and intermittent exercisers simply do not differ on the variables investigated here, and the theory that exercise-induced affect influences these two groups differently is simply incorrect. Thus, this study does not improve our ability to prospectively identify those who struggle with maintaining a regular exercise program, nor contribute directly to intervention efforts aimed at facilitating greater adherence among intermittent exercisers.

Other Variables

The predictive analyses found no relationships between group membership and the control variables of age, sex, support, exercise format, or exercise type. These results are in conflict with previous work that identified spousal and social support as significantly related to adherence (Heinzelmann & Bagley, 1970); previous work has failed to identify any age, sex, or exercise type effects, so these results are not in conflict with past work in these areas.

A possible explanation for this discrepancy in findings is that measurement of support in this study probably differs from previous work, in that many subjects were single, and among those who were partnered the overwhelming majority identified their partners as supportive of their exercise efforts. Heinzelman and Bagley's (1970) subjects were almost all married, and the investigators made the assessment rather than subject self-report; their method of assessing support may have generated different results than in this study.

As stated in the results chapter, perceived enjoyment of exercise was the major factor that distinguished among non-exercisers, intermittent and general exercisers, and super-exercisers. By itself, enjoyment was able to accurately predict group membership for every analysis except the analysis between intermittent and general exercisers. Non-exercisers and super-exercisers were the most distinct on enjoyment, with intermittent and general

exercisers basically indistinguishable in their levels of exercise enjoyment. Considering how strong a predictor enjoyment appears to be, more theoretical and research attention is clearly warranted on the importance of enjoyment as a motivator. This is particularly true since the measurement of enjoyment in this study was quite crude (a 10-point Likert scale); future research employing a more sophisticated measure of enjoyment could make a much greater contribution to our understanding of the importance of exercise enjoyment.

Interest in enjoyment comes primarily from the sport and participation motivation literatures, with only one study found from exercise psychology prior to 1989 that recognized enjoyment as a relevant factor in exercise involvement (Wankel, 1985). Enjoyment as it impacts participation in sports has begun to generate research attention, particularly as a component of a sport commitment model (Scanlan & Lewthwaite, 1986). Most of the work carried out to date on sport enjoyment has focused primarily on the sources of enjoyment, including both intrinsic and extrinsic factors. Earlier theorizing viewed sport enjoyment as a consequence of participating in intrinsically motivating activities (Csikszentmihalyi, 1975; Deci & Ryan, 1985). However, Scanlan and Simons (1992) make a strong case that ". . . sources of enjoyment in sport span a broader spectrum than is subsumed under the concept of intrinsic motivation" (p. 205), pointing out that

Csikszentmihalyi's (1975) list of reasons why soccer, hockey, and basketball players enjoyed their sport emphasized extrinsic over intrinsic reasons. Thus, Scanlan and Simons (1992) define sport enjoyment ". . . as a positive affective response to the sport experience that reflects generalized feelings such as pleasure, liking, and fun" (pp. 202-203), inclusive of both extrinsic and intrinsic factors, and being composed of cognitive and affective elements.

As mentioned, most of the work on enjoyment has focused on enjoyment of sport activities; the sources of sport enjoyment have begun to be identified, and enjoyment has been included as one factor contributing to sport commitment (Scanlan & Lewthwaite, 1986). However, the findings on sport enjoyment may not generalize completely when the focus shifts to exercise enjoyment. An important difference is that most exercise is likely a considerably narrower experience than most sport activities. Of Csikszentmihalyi's (1975) ". . . eight relatively independent reasons for enjoying sport activities . . .

- competition/measuring self against others,
- development of personal skills,
- friendships/companionship,
- activity itself,
- enjoyment of the experience/use of skills,
- measuring self against own ideals,
- prestige/reward/glamour, and

- emotional release" (Scanlan & Simons, 1992, p. 205), which were ranked in order of importance to enjoying the sport experience, several would seem not to apply to the exercise experience, including the two top reasons and the prestige factor. Exercise generally (though certainly not always) lacks a competitive aspect, which helps define the sport experience, and also more often lacks the camaraderie and many of the opportunities for friendship found in team sports.

Thus, the sources of exercise enjoyment are quite likely more circumscribed than those of sport enjoyment, and also seem likely to depend more on intrinsic factors, such as enjoyment of the experience itself, measuring oneself against one's own ideals, and emotional release. The sport enjoyment construct views the intrinsic, experiential source of enjoyment as only one among many, and not necessarily primary; for exercise enjoyment, the intrinsic factors mentioned above all seem based to some degree on the exerciser's sense of "flow", or "the state in which people are so involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake or doing it" (Csikszentmihalyi, 1990, p. 4).

Although extrinsic reasons for engaging in exercise certainly exist and contribute to exercise enjoyment, it seems reasonable that the principal foundations of exercise enjoyment are primarily internal and based in the

exerciser's subjective experience of the exercise activity. The exploratory work on the impact of affective factors in exercise supports this line of reasoning. Although enjoyment, per se, is not directly addressed in the exercise literature, research has begun to focus on positive versus negative psychological affect during and after exercise, at varying workloads, and on developing assessment instruments for the measurement of exercise related affect and enjoyment (Gauvin & Rejeski, 1993; Hardy & Rejeski, 1989; Kendzierski & DeCarlo, 1991; McAuley & Courneya, 1994; Parfitt, Markland & Holmes, 1994). The results of the current study on the influence of enjoyment on how often and how long people exercise strongly supports this research direction.

Implications for Practice

The more interesting results of this study are the findings that super-exercisers are significantly less impulsive than all other exercisers and non-exercisers, and that no relationship existed between impulsiveness and compulsiveness. This challenges the common view that super-exercisers are highly compulsive folks, and that higher compulsiveness among exercisers is linearly related to higher rates of exercise. Instead, impulsiveness appears to have a significant influence on behavior, with exercisers showing no differences on compulsiveness regardless of rate of exercise.

This finding suggests that interventions aimed at helping people return to exercising after interruption may

be useful; to paraphrase the non-smoking slogan "Don't quit quitting", we might suggest "Don't quit starting" to relapse-prone exercisers. Although no interventions to date specifically address impulsiveness as a cause of exercise dropout, that may be a constructive direction to explore.

Perhaps the most meaningful result is the recognition that the exerciser's perception of enjoyment is a strong influence on whether that person will continue exercising. This finding implies that leaders of group exercise programs should encourage enjoyment of the activity as much as possible, to help participants interpret anything ambiguous as enjoyable, and to work at helping exercisers re-interpret mildly negative reactions as neutral or positive.

Although enjoyment and impulsiveness have shown a good ability to distinguish between supers and non-exercisers, research has yet to determine whether that is because of inherent differences between the two groups, or whether enjoyment increases as duration increases; the possibility exists that super-exercisers have **learned** to enjoy exercise. This latter explanation, that enjoyment may be a matter of experience and/or training, appears most likely; Parfitt, et al (1994) investigated psychological responses to low and high workloads by highly active and less active exercisers, and found that high-active exercisers reported significantly more positive psychological affect in the high workload condition than less active subjects, with no differences in the low workload condition; "At a theoretical level this

suggests that high-active individuals may have attenuated their distress schema, whereas the low-active individuals have not" (p. 184). Enjoyment of exercise may well be learned; thus, those interested in helping facilitate exercise adherence would likely do well to encourage moderate workloads for new exercisers, in an effort to keep them engaged long enough to learn to enjoy it.

Limitations

There are several notable limitations to this study. First, all results should be cautiously interpreted given the subject self-selection discussed earlier. Since there is no way to determine whether those who chose to participate in this study differ in any systematic way from those who did not, the assumption that these results would generalize to another exercising sample is only tentative.

The violation of statistical assumptions in the measurement of enjoyment, though moderated as previously discussed in the Results chapter, poses a threat to the reliability of these results, and the need for a more valid assessment of exercise enjoyment is critical. Results need to be interpreted cautiously, especially since correlational studies cannot offer causal inferences.

Lastly, the use of predictive discriminant analysis (PDA) generates a classification rule consisting of those linear combinations of the predictor variables that result in the greatest differentiation of the dependent groups. The ideal method is the generation of an external rule,

"where the cases used to generate the classification table are different from those used to build the classification rule" (Huberty & Barton, 1989, p. 161). The current study, however, employed an internal analysis, where the classification rule was built using the same subjects upon which the classification table was obtained. The problem with internal analyses is that they capitalize on sample-specific variation that may not generalize to other samples, and therefore the predictive accuracy of the analysis may be positively biased. Although not ideal, "an internal analysis may be acceptable if the total number of cases is large; large is defined by the current authors as a data set in which the smallest group size is five times the number of predictor variables" (Huberty, et al, 1989, p. 161). The smallest group size in this study was the non-exerciser group, with 44 subjects, and seven predictors were the most employed in any one analysis. Thus, use of an internal analysis should not taint the results, though cross-validation on a different sample would have strengthened these findings.

Directions for Future Research

Further research on the impact of enjoyment on exercise adherence is clearly indicated, as well as the larger domain of the affective experience of exercise, of which enjoyment is one element. Though infrequent, the calls for attention to the influence of affect on both sport involvement and exercise participation continue to surface. As noted by

Scanlan and Simons (1992), Harter (1981) suggested well over ten years ago that "we should resurrect 'joy' as a legitimate construct and restore affect and emotion to its rightful place, as central to an understanding of behavior" (p. 4). Several years later, Wankel (1985) noted that "If progress is to be made in making exercise a more enjoyable experience . . . information is needed on how participants' goals and program factors are related to the quality of the experience (i.e., enjoyment)" (p. 276). Scanlan and Simons (1992) continue to note a need to "bring positive affect to light . . . on [sport] motivation, and add a little 'heart' to the otherwise highly cognitive treatment of the topic" (p. 199), and others also continue to note that "One relatively unexplored factor is the extent to which an individual enjoys doing the physical activity involved in his or her exercise program" (Kendzierski & DeCarlo, 1991, p. 50). Certainly the results discussed above support further investigation in this direction.

A broader approach to the understanding of enjoyment could also be useful; one promising line of research is the neurophysiology of pleasure. The exercise field has suggested the "runner's high" hypothesis that physical exertion of a sufficient degree releases endorphins, the body's natural narcotics. Another useful and fascinating direction might be to examine the neurophysiological pathways by which substance abuse and addiction impacts and, depending on the substance (i.e., cocaine), impairs the

ability to experience pleasure and enjoyment. Doidge (1990) proposes a rather fascinating connection between psychoanalytic theory and the neurochemistry responsible for pleasureable reactions to cocaine, by suggesting that an analytic theory of appetitive versus consummatory pleasures is congruent with the neurochemistry associated with cocaine use. He summarizes that

Klein's (1987) theory of appetitive and consummatory pleasures, briefly stated, asserts that there are at least two broad, independent pleasure systems. One regulates appetitive pleasure and in normal situations acts to boost energy for the pleasureable pursuit of a goal. A second system of consummatory pleasure underlines the pleasureable enjoyment of food, sex, and other interests already obtained. Each system has its own underlying neurochemical basis. . . . The appetitive pleasure system, once turned on, gives rise to a nonsatiating pleasure. This state is a *desireable* state of desiring, triggered by a sense of imminent satisfaction . . . It is quite different from the yearning kind of desire that is based upon an awareness of a lack of something. (pp. 146-148)

Doidge (1990) then describes the phenomenology of a cocaine high and ties the above theoretical model of pleasure to the neurochemistry of cocaine, and concludes that

This incentive system [the neurochemical response to

cocaine ingestion] has important similarities with Klein's appetitive pleasure system. . . . In summary, the work on cocaine and the work of Klein suggest that exogenous stimulants have the effect of turning on an internal appetitive pleasure system for placing the organism in high gear, increasing energy, and pleasures of pursuit, and apparently, self-esteem (pp. 152-153)

Investigating the neurochemical correlates of exercise may be a highly useful research direction, considering that exercise has been described in much the same terms as above. Such an increased knowledge of the neurophysiology of pleasure could only contribute to attempts to understand the pleasure gained from physical activity and exercise, especially in view of this study's findings that enjoyment, or pleasure, plays a pivotal role in how much and how long people exercise.

Further research on enjoyment will, of course, require an assessment instrument with much better psychometric properties than the 10-point Likert scale used in this study. The affective realm and its impact on exercise participation has captured recent research attention, as evidenced by a recent focus on developing reliable and valid assessment instruments for several aspects of the affective experience of exercise. Kendzierski and DeCarlo (1991) have developed perhaps the most directly applicable scale to the study of enjoyment, with their Physical Activity Enjoyment Scale (PACES), an 18-item scale consisting of 7-point

bipolar scales assessing a variety of affective experiences during physical activity. Validation studies during the scale's development found a significant negative correlation between subjects' PACES scores and scores on a boredom proneness scale. Thus, those who reported being prone to boredom were significantly less likely to enjoy physical activity. The PACES appears able to "provide the necessary tool for examining the relationship between enjoyment and exercise adherence, as well as for identifying variables that affect individuals' enjoyment of both exercise and sport" (pp. 59-60).

Two other promising new assessment tools have recently been developed as well. The Subjective Exercise Experiences Scale (SEES) is a 12-item scale assessing three factors of Positive Well-Being, Psychological Distress, and Fatigue (McAuley & Courneya, 1994). The Exercise-Induced Feeling Inventory (EFI) is also a 12-item scale, measuring Positive Engagement, Revitalization, Tranquillity, and Physical Exhaustion (Gauvin & Rejeski, 1993).

Both scales offer advantages depending on the particular interests of the potential study. The availability of psychometrically strong assessment tools is encouraging, and promises at least the possibility that affect and enjoyment will be further explored.

Related to improved assessment is the question of how to address the problem encountered in this study of how to more accurately classify exercise patterns. A promising

approach would be to analyze the data with a statistical technique capable of utilizing continuous data; the categorization of subjects into exercise groups resulted in the loss of considerable information, since the decision criteria were based on cutoff points of continuous scores rather than easily identified nominal groups (i.e., gender, race, etc.). One such statistical approach would be the use of canonical correlation, which is, in essence, similar to multiple regression with more than one dependent variable. Canonical correlation could use the psychological variable scores to predict exercise frequency and duration, with the advantage that all the variability inherent in continuous data would be preserved and used in the statistical computations. Preservation of all available variability makes this a more sophisticated statistical analysis; canonical correlation represents, therefore, the next logical and appropriate research procedure for this type of data, and would increase the confidence we could place in the results.

Lastly, the finding of low impulsiveness in the super-exerciser group compared to other exercise groups deserves further study. Are super-exercisers low on impulsiveness from the beginning, before they ever begin an exercise program? Would current non-exercisers who score low on impulsiveness be more likely to persevere once they began an exercise program? Conversely, might super-exercisers have learned to moderate those impulsive behaviors that

threatened their ability to continue exercising regularly? If so, impulsiveness could not be considered an unchangeable trait, but rather an aspect of personality and behavior amenable to change. Longitudinal studies could be employed to distinguish unchangeable personality traits from personality changes associated with regular exercise. In either case, our understanding of the factors influencing exercise behavior would be improved, as would our ability to identify potential dropouts and possibly aid those interested in maintaining a steady exercise program.

SUMMARY

Enjoyment of exercise was identified as an important influence on exercise behavior, and one that deserves further study. Of the psychological factors investigated, impulsiveness contributed slightly to the ability to distinguish between non-exercisers and super-exercisers. No other variables were significantly related to exercise group membership.

The ideal goal of obtaining results that would contribute to the development of interventions to promote greater exercise adherence was not achieved. At the applied level, the results suggest that enjoyment and impulsiveness are worth the attention of those attempting to increase adherence to exercise programs. More generally, this research should be viewed as supporting the relatively recent focus on the importance of psychological affect, particularly enjoyment, on exercise experience and habits.

As a field study in a naturalistic setting, these results should be quite strong in external validity. Nothing was manipulated, and results should describe the exercising population well. This study was interested in a healthy exercising population, and therefore drew its sample from that group. It will hopefully add to the research base with non-medical subjects, and should permit credible generalization to exercisers who voluntarily engage in personally determined exercise activities.

APPENDICES

APPENDIX A

Variable Codes

<u>Variable #</u>	<u>Variable Name</u>	<u>Description</u>
1	Case Number	Consecutively numbered cases
2	Source	1 = Private health clubs 2 = University community 3 = Recovering alcoholics
3	Group	1 = Non-exercisers 2 = Intermittent exercisers 3 = General exercisers 4 = Super exercisers 5 = Unclassifiable
4	Age	Age in years
5	Sex	1 = Male 2 = Female
6	ENJOY	1 - 10: 1=Greatly enjoy 10=Greatly dislike
7	EXTYPE	1 = Aerobic exercise 2 = Anaerobic exercise 3 = Mixed
8	SUPPORT	1 = Unattached 2 = Supportive 3 = Neutral 4 = Non-supportive 5 = Not applicable
9	FORMAT	1 = Exercises alone 2 = Exercises with a partner 3 = Exercises in a group 4 = Not applicable
10	INTENSITY	1 - 10: 1=Very easy 10=Very hard
11	OCS	1-20: 1=Low compulsiveness 20=High compulsiveness
12	BRT	1-15: 1=Low rigidity 15=High rigidity
13	BIS10	0-136: 0=Low impulsiveness 136=High impulsiveness
14	AT20	1-20: 1= Low ambig. tolerance 20= High tolerance

APPENDIX B

Invitation to Participate Poster

RESEARCH STUDY

EXERCISE

AND

PERSONALITY

You are invited to participate in a study investigating the influence of personality traits on exercise habits. The survey takes about 20-30 minutes and is anonymous; a stamped return envelope is provided. Results upon request. If interested, please ask at the desk for a questionnaire.
THANK YOU!

If you have any questions, please call:

Kay Ketzenberger, Doctoral Candidate
Counseling Psychology Program
Michigan State University
(517) 353-8112

APPENDIX C

Consent Form

August 11, 1993

Hello:

I am conducting a research study into the possibility that exercisers and non-exercisers differ on several personality traits. It is well-known that many people who begin exercise programs either drop out within a short time or have great difficulty in maintaining regular exercise habits. To better understand the relationship between personal characteristics and exercise, information about the exercise habits of many people is necessary, including those who do not exercise at all. Your participation in this study would help greatly in understanding why some people exercise more regularly than others.

The enclosed questionnaire contains a short demographic survey and several brief psychological assessments. It should take you no longer than 20-25 minutes to complete the survey. Be sure to complete both sides of all double-sided pages. You have the right to refuse to answer any question; however, the information provided by each answer is important in gaining a better understanding of exercise. As a participant, your answers will remain anonymous even from me as the researcher, because names and addresses are not to be put on the questionnaires.

Your participation in this study is entirely voluntary. You may choose not to participate or to end your participation at any time. Completion and return of the questionnaire will indicate you have read this letter and your participation is voluntary.

The results of this research will be made available to professionals in the area of sport and exercise psychology, and to the fitness facilities and gyms who are interested in these results. Also, you may receive a summary of the results by writing "copy of results requested" on the back of the return envelope and printing your name and address below. To insure your anonymity, please do not put this information anywhere on the questionnaires themselves.

I will be glad to answer any questions you might have. Please feel free to call me at (517) 353-8112.

Thank you very much for your help!

Sincerely,

Kay E. Ketzenberger
Doctoral Candidate, Counseling Psychology

The return of the completed survey reflects your informed and voluntary consent to participate in this study.

APPENDIX D

Demographic Questionnaire

1. Age _____ 2. Sex _____ 3. Occupation _____
4. Where did you obtain this questionnaire?
 _____ at my fitness club or gym
 _____ on the MSU campus
 _____ from a friend or acquaintance
 _____ other (specify) _____
5. Have you ever been treated for heart trouble? _____ yes _____ no
 (e.g., been prescribed medication, a specific diet
 or exercise program by a physician for a heart condition)
6. On the following 10-point scale, please mark how much you **enjoy**
 physical exercise:
- | | | | | | | | | | |
|-----------|---|-----------|---|------------|---|---|----------|---|---------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| great- | | moderate | | neutral | | | moderate | | greatly |
| I love it | | enjoyment | | no comment | | | dislike | | dislike |

Current Exercise Habits

7. Are you currently exercising? _____ yes _____ no
 (NOTE: Do not include physician-prescribed physical therapy)

IF YES, complete items 8 - 14, then skip to #18:

IF NO, skip to #15.

8. On average, how often do you exercise?
- _____ every day
 _____ 5-6 days per week
 _____ 2-4 days per week
 _____ once a week
 _____ less than once a week
9. How long have you exercised at this rate?
- _____ less than 3 months
 _____ 3-6 months
 _____ 6 months to 1 year
 _____ over 1 year
 - how long? _____
10. What type of exercise activity do you usually engage in?
 (i.e., running, walking, swimming, weight training, aerobics
 classes, racquetball, etc.)
-
11. Support factors:
- _____ I am currently single/unattached
 _____ My partner is supportive of my exercise efforts
 _____ My partner is neutral toward my exercise efforts
 _____ My partner is non-supportive of my efforts

12. ☐ Most often, I exercise alone
☐ Most often, I exercise with an exercise partner
☐ Most often, I exercise with a group of people
13. On the following 10-point scale, please mark the average **intensity** of your workouts over the past week:
- | | | | | | | | | | |
|---|--------------|---|----------------|---|----------|---|----------------|---|--------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | very
easy | | fairly
easy | | moderate | | fairly
hard | | very
hard |
14. Within the last 3 years, have you begun to exercise and then either stopped exercising completely or dropped to once a week or less?
☐ yes ☐ no IF YES: Why? _____

IF YOU ARE NOT CURRENTLY EXERCISING:

15. Have you ever begun exercising intending to exercise regularly?
☐ yes ☐ no
 IF YES: How long did you exercise? _____
 How long has it been since you stopped exercising? _____
16. Within the last 3 years, have you exercised regularly (2 or more times per week) for a period of 3 months or more, and then stopped exercising entirely?
☐ yes ☐ no
17. Within the last 3 years, have you exercised regularly (2 or more times per week) for a period of 3 months or more, and then dropped to exercising only infrequently (once a week or less)?
☐ yes ☐ no
 IF YES to either of the two previous questions:
 Why? _____

Past Sport Participation

18. Are you now or have you ever participated in intercollegiate sports?
☐ yes ☐ no
 IF YES: Which sport(s)? _____

APPENDIX E.1

PERSONAL EVALUATION - BIS 10

DIRECTIONS: People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and darken the appropriate circle on the right side of the page. Do not spend too much time on any statement. Answer quickly and honestly.

- | | | | | |
|--|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. I plan tasks carefully | ☐ | ☐ | ☐ | ☐ |
| 2. I do things without thinking | ☐ | ☐ | ☐ | ☐ |
| 3. I make up my mind quickly | ☐ | ☐ | ☐ | ☐ |
| 4. I am happy-go-lucky | ☐ | ☐ | ☐ | ☐ |
| 5. I don't "pay attention" | ☐ | ☐ | ☐ | ☐ |
| 6. I have "racing" thoughts | ☐ | ☐ | ☐ | ☐ |
| 7. I plan trips well ahead of time | ☐ | ☐ | ☐ | ☐ |
| 8. I am self-controlled | ☐ | ☐ | ☐ | ☐ |
| 9. I concentrate easily | ☐ | ☐ | ☐ | ☐ |
| 10. I save regularly | ☐ | ☐ | ☐ | ☐ |
| 11. I "squirm" at plays or lectures | ☐ | ☐ | ☐ | ☐ |
| 12. I am a careful thinker | ☐ | ☐ | ☐ | ☐ |
| 13. I plan for job security | ☐ | ☐ | ☐ | ☐ |
| 14. I say things without thinking | ☐ | ☐ | ☐ | ☐ |
| 15. I like to think about complex problems..... | ☐ | ☐ | ☐ | ☐ |
| 16. I change jobs | ☐ | ☐ | ☐ | ☐ |
| 17. I act "on impulse" | ☐ | ☐ | ☐ | ☐ |
| 18. I get easily bored when solving thought problems | ☐ | ☐ | ☐ | ☐ |
| 19. I have regular health check ups | ☐ | ☐ | ☐ | ☐ |
| 20. I act on the spur of the moment | ☐ | ☐ | ☐ | ☐ |
| 21. I am a steady thinker | ☐ | ☐ | ☐ | ☐ |
| 22. I change residences | ☐ | ☐ | ☐ | ☐ |
| 23. I buy things on impulse | ☐ | ☐ | ☐ | ☐ |
| 24. I can only think about one problem at a time | ☐ | ☐ | ☐ | ☐ |
| 25. I change hobbies | ☐ | ☐ | ☐ | ☐ |
| 26. I walk and move fast | ☐ | ☐ | ☐ | ☐ |
| 27. I solve problems by trial-and-error | ☐ | ☐ | ☐ | ☐ |
| 28. I spend or charge more than I earn | ☐ | ☐ | ☐ | ☐ |
| 29. I talk fast | ☐ | ☐ | ☐ | ☐ |
| 30. I often have extraneous thoughts when thinking..... | ☐ | ☐ | ☐ | ☐ |
| 31. I am more interested in the present than the future .. | ☐ | ☐ | ☐ | ☐ |
| 32. I am restless at the theater or lectures | ☐ | ☐ | ☐ | ☐ |
| 33. I like puzzles | ☐ | ☐ | ☐ | ☐ |
| 34. I am future oriented | ☐ | ☐ | ☐ | ☐ |

APPENDIX E.2

OCS

DIRECTIONS: Mark T for true and F for false. Do not spend too much time on an item. There are no right or wrong answers, and so your first response is important.

- ___ 1. I feel compelled to do things I don't want to do.
- ___ 2. I usually check things that I know I have already done.
- ___ 3. I can walk 30 miles an hour.
- ___ 4. I often do things I don't want to do because I can not resist doing them.
- ___ 5. I seldom keep a daily routine.
- ___ 6. I feel compelled to always complete what I am doing.
- ___ 7. I often feel the need to double check what I do.
- ___ 8. I'd rather do things the same way all the time.
- ___ 9. I seldom have recurring thoughts.
- ___ 10. I seldom am compelled to do something I don't want to do.
- ___ 11. I don't feel uncomfortable and uneasy when I don't do things my usual way.
- ___ 12. If I don't feel like doing something it won't bother me not to do it.
- ___ 13. I usually never feel the need to be organized.
- ___ 14. I am uneasy about keeping a rigid time schedule.
- ___ 15. My birthday comes once a year.
- ___ 16. I am often compelled to do some things I do not want to do.
- ___ 17. I like to keep a rigid daily routine.
- ___ 18. I believe there is a place for everything and everything in its place.
- ___ 19. I seldom check things I know I have already done.
- ___ 20. I am not obsessed with details.
- ___ 21. I often have recurring thoughts.
- ___ 22. I like to do things differently each time.

APPENDIX E.3

THE AT-20 SCALE

DIRECTIONS: Please do not spend too much time on the following items. There are no right or wrong answers and therefore your first response is important. Mark T for true and F for false. Be sure to answer every question.

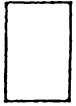
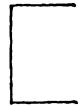
- ___ 1. A problem has little attraction for me if I don't think it has a solution.
- ___ 2. I am just a little uncomfortable with people unless I feel that I can understand their behavior.
- ___ 3. There's a right way and a wrong way to do almost everything.
- ___ 4. I would rather bet 1 to 6 on a long shot than 3 to 1 on a probably winner.
- ___ 5. The way to understand complex problems is to be concerned with their larger aspects instead of breaking them into smaller pieces.
- ___ 6. I get pretty anxious when I'm in a social situation over which I have no control.
- ___ 7. Practically every problem has a solution.
- ___ 8. It bothers me when I am unable to follow another person's train of thought.
- ___ 9. I have always felt that there is a clear difference between right and wrong.
- ___ 10. It bothers me when I don't know how other people react to me.
- ___ 11. Nothing gets accomplished in this world unless you stick to some basic rules.
- ___ 12. If I were a doctor, I would prefer the uncertainties of a psychiatrist to the clear and definite work of someone like a surgeon or X-ray specialist.

- _____ 13. Vague and impressionistic pictures really have little appeal for me.
- _____ 14. If I were a scientist, it would bother me that my work would never be completed (because science will always make new discoveries).
- _____ 15. Before an examination, I feel much less anxious if I know how many questions there will be.
- _____ 16. The best part of working a jigsaw puzzle is putting in that last piece.
- _____ 17. Sometimes I rather enjoy going against the rules and doing things I'm not supposed to do.
- _____ 18. I don't like to work on a problem unless there is a possibility of coming out with a clear-cut and unambiguous answer.
- _____ 19. I like to fool around with new ideas, even if they turn out later to be a total waste of time.
- _____ 20. Perfect balance is the essence of all good composition.

APPENDIX E.4

DIRECTIONS: For each item, place a mark on the line next to the figure that you most prefer. Identify the figure that you like the best of the two in each item.

BRESKIN TEST

1.   _____
2.  _____
3. $2 \cdot 2 \cdot 4$ _____
4.  _____
5.  _____
6.  _____
7.  _____
8. _____
9.   _____
10.  _____
11. $1 + 3 \cdot 4$ _____
12.  _____
13.  _____
14.  _____
15.  _____
9.  _____
10.  _____
11.  _____
12.  _____
13.  _____
14.  _____
15.  _____
9.  _____
10.  _____
11.  _____
12.  _____
13.  _____
14.  _____
15.  _____

LIST OF REFERENCES

REFERENCES

- Andrew, G. M., Oldridge, N. B., Parker, J. O., Cunningham, D. A., Rechnitzer, P. A., Jones, N. L., Buck, C., Kavanagh, T., Shephard, R. J., Sutton, J. R., & McDonald, W. (1981). Reasons for dropout from programs in post coronary patients. Medicine and Science in Sports and Exercise, 13, 164-168.
- Andrew, G. M. & Parker, J. O. (1979). Factors related to dropout of post myocardial infarction patients from exercise programs. Medicine and Science in Sports and Exercise, 11, 376-378.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavior change. Psychological Review, 84, 191-215.
- Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood, Cliffs, NJ: Prentice Hall.
- Barratt, E. S. (1965). Factor analysis of some psychometric measures of impulsiveness and anxiety. Psychological Reports, 16, 547-554.
- Barratt, E. S. (1972). Anxiety and impulsiveness: Toward a neuropsychological model. In: C. D. Spielberger (Ed.), Anxiety: Current trends in theory and research (Vol. 1, pp. 195-222). New York: Academic Press.
- Barratt, E. S. (1983). The biological basis of impulsiveness: The significance of timing and rhythm disorders. Personality and Individual Differences, 4, 387-391.
- Barratt, E. S. (1985a). Impulsiveness defined within a system model of personality. In: C. D. Spielberger & J. N. Butcher (Eds.), Advances in personality assessment (Vol. 5, pp. 113-132). New York: Earlbaum.
- Barratt, E. S. (1985b). Impulsiveness subtraits: Arousal and information processing. In: J. T. Spence & C. E. Itard (Eds.), Motivation, emotional and personality, (pp. 137-146). North Holland: Elsevier.

- Barratt, E. S. (1987). Impulsiveness and anxiety: Information processing and electroencephalograph topography. Journal of Research in Personality, 21, 453-463.
- Barratt, E. S. (1991). Measuring and predicting aggression within the context of a personality theory. Journal of Neuropsychiatry, 3, 535-539.
- Barratt, E. S. (in press). Impulsivity: Integrating cognitive, behavioral, biological and environmental data. In: W. McCown & M. Shure (Eds.), The impulsive client: Theory, research, and treatment. Washington, D.C.: American Psychological Association.
- Barratt, E. S. & Patton, J. H. (1983). Impulsivity: Cognitive, behavioral and psychophysiological correlates. In: M. Zuckerman (Ed.), Biological bases of sensation seeking, impulsivity and anxiety (pp. 77-122). New York: Earlbaum.
- Barratt, E. S., Patton, J. H., Olsson, N. G. & Zuker, G. (1981). Impulsivity and paced tapping. Journal of Motor Behavior, 13, 286-300.
- Berger, B. G. (1984). Running toward psychological well-being. In: M. L. Sachs & G. W. Buffone (Eds.), Running as therapy: An integrated approach (pp. 172-197). Lincoln, Nebraska: University of Nebraska Press.
- Berger, B. G. & Mackenzie, M. M. (1980). A case study of a woman jogger: A psychodynamic analysis. Journal of Sport Behavior, 3, 3-16.
- Barrett, D. E. (1977). Reflection-impulsivity as a predictor of children's academic achievement. Child Development, 48, 1443-1447.
- Block, J., Block, J. H., & Harrington, D. M. (1974). Some misgivings about the Matching Familiar Figures test as a measure of reflection-impulsivity. Developmental Psychology, 10, 611-632.
- Bray, J. H. & Maxwell, S. E. (1982). Analyzing and interpreting significant MANOVAs. Review of Educational Research, 52, 340-367.
- Breskin, S. (1968). Measurement of rigidity, a non-verbal test. Perceptual and Motor Skills, 27, 1203-1206.
- Breskin, S. & Gorman, B. S. (1969). On rigidity and field-dependence. Perceptual and Motor Skills, 29, 541-542.

- Breskin, S. & Rich, K. D. (1971). Correlation of non-verbal rigidity and intelligence in elementary school children. Perceptual and Motor Skills, 32, 194.
- Bruner, J. (1948). Perceptual theory and the Rorschach test. Journal of Personality, 17, 157-168.
- Campbell, S. B. & Douglas, V. I. (1972). Cognitive styles and responses to the threat of frustration. Canadian Journal of Behavioral Science, 4, 30-42.
- Cassidy, T. & Lynn, R. (1989). A multifactorial approach to achievement motivation: The development of a comprehensive measure. Journal of Occupational Psychology, 62, 301-312.
- Cattell, R. B. (1935). On the measurement of perseveration. British Journal of Educational Psychology, 5, 76-92.
- Chhaya, S. (1985). Rigidity-flexibility and sex in relation to Zeigarnik effect. Indian Psychological Review, 28, 14-16.
- Cohen, J. (1977). Statistical power analysis for the behavioral sciences, Revised Edition. New York: Academic Press.
- Cooper, K. H., Pollack, M., Marin, R., White, S., Linnerud, A., & Jackson, A. (1976). Physical fitness levels vs selected coronary risk factors. Journal of the American Medical Association, 236, 166-169.
- Corbin, C. B., Nielsen, A. B., Borsdorf, L. L. & Laurie, D. R. (1987). Commitment to physical activity. International Journal of Sport Psychology, 18, 215-222.
- Covey, L. A. & Feltz, D. L. (1991). Physical activity and adolescent female psychological development. Journal of Youth and Adolescence, 20, 463-474.
- Csikszentmihalyi, M. (1975). Beyond boredom and anxiety. San Francisco: Josey-Bass.
- Csikszentmihalyi, M. (1990). Flow: The psychology of optimal experience. New York: Harper Collins Publishers, Inc.
- Deeter, T. E. (1988). Does attitudinal commitment predict physical activity participation? Journal of Sport Behavior, 11, 177-192.

- Desharnais, R., Bouillon, J., & Godin, G. (1986). Self-efficacy and outcome expectations as determinants of exercise adherence. Psychological Reports, 59, 1155-1159.
- Dillon, W. R. & Goldstein, M. (1984). Multivariate analysis: Methods and applications. New York: John Wiley & Sons.
- Dishman, R. K. (1978). Aerobic power, estimation of physical ability, and attraction to physical activity. Research Quarterly for Exercise and Sport, 49, 285-292.
- Dishman, R. K. (1981). Biologic influences on exercise adherence. Research Quarterly for Exercise and Sport, 52, 143-159.
- Dishman, R. K. (1982). Compliance/adherence in health-related exercise. Health Psychology, 1, 237-267.
- Dishman, R. K. (1984). Motivation and exercise adherence. In J. M. Silva & R. S. Weinberg (Eds.), Psychological foundations of sport. Champaign, Illinois: Human Kinetics Publishers, Inc.
- Dishman, R. K. (1986). Exercise compliance: A new view for public health. The Physician and Sportsmedicine, 14, 127-145.
- Dishman, R. K. & Gettman, L. R. (1980). Psychobiologic influences on exercise adherence. Journal of Sport Psychology, 2, 295-310.
- Dishman, R. K. & Ickes, W. (1981). Self-motivation and adherence to therapeutic exercise. Journal of Behavioral Medicine, 4, 421-438.
- Dishman, R. K., Ickes, W. & Morgan, W. P. (1980). Self-motivation and adherence to habitual physical activity. Journal of Applied Social Psychology, 10, 115-132.
- Dishman, R. K., Sallis, J. F., & Orenstein, D. R. (1985). The determinants of physical activity and exercise. Public Health Reports, 100, 158-171.
- Doidge, N. (1990). Appetitive pleasure states: A biops psychoanalytic model of the pleasure threshold, mental representation, and defense. In R. A. Glick & S. Bone (Eds.). Pleasure beyond the pleasure principle (pp. 138-173). New Haven: Yale University Press.

- Fahlberg, L. L., Fahlberg, L. A., & Gates, W. K. (1992). Exercise and existence: Exercise behavior from an existential-phenomenological perspective. The Sport Psychologist, 6, 172-191.
- Fielding, J. E. (1982). Effectiveness of employee health improvement programs. Journal of Occupational Medicine, 24, 907-916.
- Fisher, J. (1951). The memory process and certain psychosocial attitudes with special reference to the law of Pragnanz. Journal of Personality, 19, 41-47.
- Folkins, C. H. & Sime, W. E. (1981). Physical fitness training and mental health. American Psychologist, 36, 373-389.
- Fox, K. R., Corbin, C. B., & Couldry, W. H. (1985). Female physical estimation and attraction to physical activity. Journal of Sport Psychology, 7, 125-136.
- Franklin, B. A. (1988). Program factors that influence exercise adherence: Practical adherence skills for the clinical staff. In R. K. Dishman (Ed.). Exercise adherence: Its impact on public health (pp. 237-258). Champaign, IL: Human Kinetics Publishers, Inc.
- Frenkel-Brunswik, E. (1948a). Tolerance towards ambiguity as a personality variable. American Psychologist, 3, 268.
- Frenkel-Brunswik, E. (1948b). A study of prejudice in children. Human Relations, 1, 295-306.
- Frenkel-Brunswik, E. (1949). Intolerance to ambiguity as an emotional and perceptual personality variable. Journal of Personality, 18, 108-143.
- Gale, J. B., Eckhoff, W. T., Mogel, S. F., & Rodnick, J. E. (1984). Factors related to adherence to an exercise program for healthy adults. Medicine and Science in Sports and Exercise, 16, 544-549.
- Garcia, A. W. & King, A. C. (1991). Predicting long-term adherence to aerobic exercise: A comparison of two models. Journal of Sport & Exercise Psychology, 13, 394-410.
- Gauvin, L. & Rejeski, W. J. (1993). The Exercise-Induced Feeling Inventory: Development and initial validation. Journal of Sport and Exercise Psychology, 15, 403-423.

- Gibb, G. D., Bailey, J. R., Best, R. H., & Lambirth, T. T. (1983). The measurement of the obsessive-compulsive personality. Educational and Psychological Measurement, 43, 1233-1238.
- Gorman, B. S. & Breskin, S. (1969). Non-verbal rigidity, creativity, and problem solving. Perceptual and Motor Skills, 29, 715-718.
- Hardy, C. J. & Rejeski, W. J. (1989). Not what, but how one feels: The measurement of affect during exercise. Journal of Sport & Exercise Psychology, 11, 304-317.
- Harter, S. (1981). The development of competence motivation in the mastery of cognitive and physical skills: Is there a place for joy? In G. C. Roberts and D. M. Landers (Eds.). Psychology of motor behavior and sport - 1980 (pp. 3-29). Champaign, IL: Human Kinetics.
- Haskell, W. L. (1984). Overview: Health benefits of exercise. In J. D. Matarazzo, S. M. Weiss, J. A. Herd, N. E. Miller, & S. M. Weiss (Eds.), Behavioral health: A handbook of health enhancement and disease prevention. New York: John Wiley & Sons.
- Heiby, E. M., Onorato, V. A., & Sato, R. A. (1987). Cross-validation of the Self-Motivation Inventory. Journal of Sport Psychology, 9, 394-399.
- Heinzelmann, F. & Bagley, R. W. (1970). Response to physical activity programs and their effects on health behavior. Public Health Reports, 85, 905-911.
- Huberty, C. J. (1984). Issues in the use and interpretation of discriminant analysis. Psychological Bulletin, 95, 156-171.
- Huberty, C. J. & Barton, R. M. (1989). Methods, plainly speaking: An introduction to discriminant analysis. Measurement and Evaluation in Counseling and Development, 22, 158-168.
- Jennings, P. S., Holmstrom, R. W., and Karp, S. A. (1986). Personality correlates of reflectivity. Psychological Reports, 59, 87-94.
- Kagan, J., Rosman, B. L., Day, D., Albert, J. & Phillips, W. (1964). Information processing in the child: Significance of analytic and reflective attitudes. Psychological Monographs, 78, (1, Whole No. 578).

- Kendzierski, D. (1988). Self-schemata and exercise. Basic and Applied Social Psychology, 9, 45-59.
- Kendzierski, D. (1990). Exercise self-schemata: Cognitive and behavioral correlates. Health Psychology, 9, 69-82.
- Kendzierski, D. (1993). Excuses, excuses, excuses: A cognitive behavioral approach to exercise implementation. Journal of Sport and Exercise Psychology, 15, 207-219.
- Kendzierski, D. & DeCarlo, K. J. (1991). Physical Activity Enjoyment Scale: Two validation studies. Journal of Sport and Exercise Psychology, 13, 50-64.
- Knapp, D. N. (1988). Behavioral management techniques and exercise promotion. In R. K. Dishman (Ed.), Exercise adherence: Its impact on public health (pp. 203-236). Champaign, IL: Human Kinetics Books.
- Kostrubala, T. (1976). The joy of running. Philadelphia: J. B. Lippincott.
- Leach, P. J. (1967). A critical study of the literature concerning rigidity. British Journal of Social and Clinical Psychology, 6, 11-22.
- Levitt, E. E. (1953). Studies in intolerance of ambiguity. I. The decision-location test with trade-school children. Child Development, 24, 263-268.
- Lewin, K. A dynamic theory of personality. New York: McGraw-Hill.
- Luengo, M. A., Carrillo-de-la-Pena, M. T. & Otero, J. M. (1991). The components of impulsiveness: A comparison of the I.7 Impulsiveness Questionnaire and the Barratt Impulsiveness Scale. Personality and Individual Differences, 12, 657-667.
- Maddux, J. E., Norton, L. W., & Stoltenberg, C. D. (1986). Self-efficacy expectancy, outcome expectancy and outcome value: Relative effects on behavioral intentions. Journal of Personality and Social Psychology, 51, 783-789.
- Mann, G. V., Garrett, H. L., Farhi, A., Murray, H., & Billings, F. T. Exercise to prevent coronary heart disease: An experimental study of the effects of training on risk factors for coronary disease in men. American Journal of Medicine, 46, 12-27.

- Markus, H. (1977). Self-schemata and processing information about the self. Journal of Personality and Social Psychology, 35, 63-78.
- Martin, J. E. & Dubbert, P. M. (1985). Adherence to exercise. Exercise and Sport Sciences Review, 13, 137-167.
- Martin, J. E., Dubbert, P. M., Katell, A. D., Thompson, J. K., Raczynski, J. R., Lake, M., Smith, P. O., Webster, T. S., & Cohen, R. E. (1984). Behavioral control of exercise in sedentary adults: Studies 1 through 6. Journal of Consulting and Clinical Psychology, 52, 795-811.
- Massie, J. F. & Shephard, R. J. (1971). Physiological and psychological effects of training--a comparison of individual and gymnasium programs with a characterization of the exercise "drop-out". Medicine and Science in Sports, 3, 110-117.
- McAuley, E. (1992). Understanding exercise behavior: A self-efficacy perspective. In G. C. Roberts (Ed.), Understanding motivation in exercise and sport (pp. 107-127). Champaign, IL: Human Kinetics.
- McAuley, E. & Courneya, K. S. (1994). The Subjective Exercise Experiences Scale (SEES): Development and preliminary validation. Journal of Sport and Exercise Psychology, 16, 163-177.
- McAuley, E., Courneya, K. S., & Lettunich, J. (1991). Effects of acute and long-term exercise on self-efficacy responses in sedentary, middle-aged males and females. The Gerontologist, 31, 534-542.
- McAuley, E., Duncan, T. E., Wraith, S. C., & Lettunich, M. (1991). Self-efficacy, perceptions of success, and intrinsic motivation. Journal of Applied Social Psychology, 21, 139-155.
- McAuley, E. & Gill, D. L. (1983). Reliability and validity of the Physical Self-Efficacy scale in a competitive sport setting. Journal of Sport Psychology, 5, 410-418.
- McAuley, E. & Jacobson, L. B. (1991). Self-efficacy and exercise participation in sedentary adult female exercise patterns. American Journal of Health Promotion, 5, 185-191.

- McCann, I. L., Sakheim, D. K., & Abrahamson, D. J. (1988). Trauma and victimization: A model of psychological adaptation. The Counseling Psychologist, 16, 531-594.
- McCready, M. L. & Long, B. C. (1985). Locus of control, attitudes toward physical activity, and exercise adherence. Journal of Sport Psychology, 7, 346-359.
- Meichenbaum, D. H. & Goodman, J. (1969). Reflection-impulsivity and verbal control of motor behavior. Child Development, 40, 785-797.
- Messer, S. B. (1976). Reflection-impulsivity: A review. Psychological Bulletin, 83, 1026-1052.
- Messer, S. B. & Schacht, T. E. (1986). A cognitive-dynamic theory of reflection-impulsivity. In J. Masling (Ed.). Empirical studies of psychoanalytic theories, Volume 2. New Jersey: Lawrence Erlbaum Associates, Publishers.
- Miller, A. (1986). Thou shalt not be aware: Society's betrayal of the child. New York: Meridian.
- Miller, L. (1988). Neurocognitive aspects of remorse: Impulsivity--compulsivity--reflectivity. Psychotherapy Patient, 63-76.
- Morgan, W. P. (1977a). Psychological consequences of vigorous physical activity and sport. In M. Gladys Scott (Ed.), The Academy Papers. Iowa City: American Academy of Physical Education.
- Morgan, W. P. (1977b). Involvement in vigorous physical activity with special reference to adherences. In L. I. Gedvillas & M. E. Kneer (Eds.), National College Physical Education Association Proceedings. Chicago: University of Illinois-Chicago.
- Morgan, W. P. (1979). Anxiety reduction following acute physical activity. Psychiatric Annals, 9, 36-45.
- Morgan, W. P. & Pollock, M. L. (1978). Physical activity and cardiovascular health: Psychological aspects. In F. Laundry & Organ (Eds.), Physical activity and human well-being. Miami: Symposium Specialists.
- Morgan, W. P., Roberts, J. A., Brand, F. R., & Feinerman, A. D. (1970). Psychological effects of chronic physical activity. Medicine and Science in Sports, 2, 213-217.

- Neimark, E. D. (1975). Longitudinal development of formal operations thought. Genetic Psychology monographs, 91, 171-225.
- Norusis, M. S./SPSS, Inc. (1990). SPSS/PC+ Advanced Statistics 4.0. Chicago: SPSS Inc.
- Oldridge, N. B. (1979). Compliance with exercise programs. In M. L. Pollock and D. H. Schmidt (Eds.), Heart Disease and Rehabilitation. Boston: Houghton Mifflin.
- Oldridge, N. B. (1982). Compliance and exercise in primary and secondary prevention of coronary heart disease: A review. Preventive Medicine, 11, 56-70.
- Oldridge, N. B., Donner, A. P., Buck, C. W., Jones, N. L., Andrew, G. M., Parker, J. O., Cunningham, D. A., Kavanagh, T., Rechnitzer, P. A., & Sutton, J. R. (1983). Predictors of dropout from cardiac exercise rehabilitation: Ontario exercise-heart collaborative study. The American Journal of Cardiology, 51, 70-74.
- Pain, M. D. & Sharpley, C. F. (1986). Some psychometric data on predictive validity of Self-Motivation Inventory. Perceptual and Motor Skills, 63, 294.
- Parfitt, G., Markland, D. & Holmes, C. (1994). Responses to physical exertion in active and inactive males and females. Journal of Sport & Exercise Psychology, 16, 178-186.
- Perkins, K. A. & Epstein, L. H. (1988). Methodology in exercise adherence research. In R. K. Dishman (Ed.). Exercise adherence: Its impact on public health (pp. 399-416). Champaign, IL: Human Kinetics Publishers, Inc.
- Pollock, M. L. (1988). Prescribing exercise for fitness and adherence. In R. K. Dishman (Ed.). Exercise adherence: Its impact on public health (pp. 259-278). Champaign, IL: Human Kinetics Publishers, Inc.
- Pollock, M. L., Gettman, L. R., Milesis, C. A., Bah, M. D., Durstine, L., & Johnson, R. B. (1977). Effects of frequency and duration of training on attrition and incidence of injury. Medicine and Science in Sports, 9, 31-36.
- Primavera, L. H., Hochman, S. H., & Reynolds, W. F. (1975). Compulsivity, manifest anxiety, and gullibility. Psychological Reports, 37, 505-506.

- Primavera, L. H., & Simon, W. E. (1971). Non-verbal rigidity and academic achievement in high school and college. Perceptual and Motor Skills, 33, 1178.
- Reed, G. F. (1968). Some formal qualities of obsessional thinking. Psychiatric Clinics, 1, 382-392.
- Reed, G. F. (1977). Obsessional personality disorder and remembering. British Journal of Psychiatry, 130, 177-183.
- Reeve, J., & Robinson, D. T. (1987). Toward a reconceptualization of intrinsic motivation: Correlates and factor structure of the Activity-Feeling Scale. Journal of Social Behavior and Personality, 2, 23-36.
- Rejeski, W. J. & Thompson, A. (1993). Historial and conceptual roots of exercise psychology. In P. Seraganian (Ed.), Exercise psychology: The influence of physical exercise on psychological processes (pp. 3-35). New York: John Wiley & Sons, Inc.
- Rodgers, W. M. & Brawley, L. R. (1991). The role of outcome expectancies in participation motivation. Journal of Sport and Exercise Psychology, 13, 411-427.
- Rokeach, M. (1948). Generalised mental rigidity as a factor in ethnocentrism. Journal of Abnormal and Social Psychology, 43, 259-278.
- Rubenowitz, S. (1963). Emotional flexibility-rigidity as a comprehensive dimension of mind: An empirical study of a construct, and its psychological and social implications. Stockholm: Almqvist & Wiksell.
- Safrit, M. J., Wood, T. M. & Dishman, R. K. (1985). The factorial validity of the physical estimation and attraction scales for adults. Journal of Sport Psychology, 7, 166-190.
- Salkind, N. J. & Nelson, C. F. (1980). A note on the developmental nature of reflection-impulsivity. Developmental Psychology, 16, 237-238.
- Sallis, J. F., Haskell, W. L., Fortmann, S. P., Vranizan, M. S., Taylor, C. B., & Solomon, D. S. (1986). Predictors of adoption and maintenance of physical activity in a community sample. Preventive Medicine, 15, 331-341.

- Scanlon, T. K. & Lewthwaite, R. (1986). Social psychological aspects of the competitive sport experience for male youth sport participants: IV. Predictors of enjoyment. Journal of Sport Psychology, 8, 25-35.
- Scanlon, T. K. & Simons, J. P. (1992). The construct of sport enjoyment. In G. C. Roberts (Ed.). Motivation in sport and exercise. Champaign, IL: Human Kinetics Books.
- Schleifer, M. & Douglas, V. I. (1973). Moral judgments, behaviour and cognitive style in young children. Canadian Journal of Behavioural Science, 5, 133-144.
- Shephard, R. J., Corey, P., & Kavanagh, T. (1981). Exercise compliance and the prevention of a recurrence of myocardial infarction. Medicine and Science in Sports and Exercise, 13, 1-5.
- Simon, W. E., Primavera, L. H., Klein, B., & Cristal, R. M. (1972). Personality and nonverbal rigidity: Some preliminary findings. The Journal of Psychology, 82, 127-132.
- Sonstroem, R. J. (1976). The validity of self-perceptions regarding physical and athletic ability. Medicine and Science in Sports, 8, 126-132.
- Sonstroem, R. J. (1978). Physical estimation and attraction scales: Rationale and research. Medicine and Science in Sports, 10, 97-102.
- Sonstroem, R. J. (1988). Psychological models. In R. K. Dishman (Ed.). Exercise adherence: Its impact on public health (pp. 125-154). Champaign, IL: Human Kinetics Publishers, Inc.
- Sonstroem, R. J. & Kampper, K. P. (1980). Prediction of athletic participation in middle school males. Research Quarterly for Exercise and Sport, 51, 685-694.
- Spitzer, (1981). Reflective process. In M. D. Lynch, A. A. Norem-Hebeisen, & K. J. Gergen (Eds.). Self-concept: Advances in theory and research. Cambridge: Ballinger.
- Swanson, H. & Schumacher, G. (1986). Reflection-impulsivity and script-action recall. Bulletin of the Psychonomic Society, 24, 28-30.

- Taylor, H. L., Buskirk, E. R., & Remington, R. D. (1973). Exercise in controlled trials of the prevention of coronary heart disease. Federation Proceedings, 32, 1623-1627.
- Teraslinna, P., Partanen, A., Koskela, A., & Oja, P. (1969). Characteristics affecting willingness of executives to participate in an activity program aimed at coronary heart disease prevention. Journal of Sports Medicine and Physical Fitness, 9, 224-229.
- Thurstone, L. L. (1944). A factorial study of perception. Chicago: University of Chicago Press.
- Tuson, K. M. & Sinyor, D. (1993). On the affective benefits of acute aerobic exercise: Taking stock after twenty years of research. In P. Seraganian (Ed.). Exercise psychology: The influence of physical exercise on psychological processes (pp. 80-121). New York: John Wiley & Sons, Inc.
- Wankel, L. M. (1985). Personal and situational factors affecting exercise involvement: The importance of enjoyment. Research Quarterly for Exercise and Sport, 56, 275-282.
- Wankel, L. M. (1988). Exercise adherence and leisure activity: Patterns of involvement and interventions to facilitate regular activity. In R. K. Dishman (Ed.). Exercise adherence: Its impact on public health (pp. 369-396). Champaign, IL: Human Kinetics Publishers, Inc.
- Wankel, L. M., Yardley, J. K., & Graham, J. (1985). The effects of motivational interventions upon the exercise adherence of high and low self-motivated adults. Canadian Journal of Applied Sport Sciences, 10, 147-156.
- Ward, A. & Morgan, W. P. (1984). Adherence patterns of healthy men and women enrolled in an adult exercise program. Journal of Cardiac Rehabilitation, 4, 143-152.
- Weber, J., & Wertheim, E. H. (1989). Relationships of self-monitoring, special attention, body fat percent, and self-motivation to attendance at a community gymnasium. Journal of Sport and Exercise Psychology, 11, 105-114.
- Webster's New Twentieth Century Dictionary, Unabridged (2nd Ed.). (1983). Cleveland: Simon and Schuster.

Werner, H. (1946). The concept of rigidity: A critical evaluation. Psychological Review, 53, 43-52.

Wolfe, R., Egelston, R., & Powers, J. (1972). Conceptual structure and conceptual tempo. Perceptual and Motor Skills, 35, 331-337.

MICHIGAN STATE UNIV. LIBRARIES



31293014114122