

Running head: WALKING THROUGH ANXIETY

Walking Through Anxiety:  
Examining the Role of Expectancy in Exercise

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of  
Arts in Clinical Psychology

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January 28, 2009



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395 Wellington Street  
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*Your file* *Votre référence*  
*ISBN: 978-0-494-47140-1*  
*Our file* *Notre référence*  
*ISBN: 978-0-494-47140-1*

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## Abstract

Exercise has consistently been found to reduce anxiety (Petruzello, Landers, Hatfield, Kubitz, & Salazar, 1991). However, the mechanisms underlying the effect of exercise on anxiety are unknown. The present study evaluated the expectancy hypothesis, which posits that the anxiolytic effect of exercise is due to the expectation of such benefits from participating in exercise. It was hypothesized that expectancy would have no effect on the anxiolytic effects of exercise. Ninety participants (56 females and 34 males) were randomly assigned to one of three groups: 1) an exercise condition (n=31), 2) a quiet rest condition (n=31), and 3) a no expectancy exercise condition (n =28). State anxiety was measured at baseline, after anxiety manipulation, and following the assigned group condition. Participants in the two exercise conditions experienced a slight decrease in state anxiety while participants in the quiet rest control group experienced a slight increase in state anxiety. Although these changes in state anxiety did not reach significance, participants in the two exercise groups experienced an overall decrease in anxiety which was significantly different from the quiet rest group which experienced an increase in anxiety. These findings support the hypothesis that the anxiety reducing benefit of exercise is unlikely to be due to expectations.

### Acknowledgements

I would like to acknowledge the invaluable contribution and support of many people that had a profound impact on my thesis. I sincerely thank my supervisor and committee members Dr. Peter Voros, Dr. Kirsten Oinonen, and Dr. John Jamieson for their sound ideas, expertise, and comments on the many revisions of this project. The impact of your advice and guidance is evidenced throughout this entire paper. I would also like to thank James Brazeau and Stewart Madon for their statistical assistance (The door is always open for dinner). Special thanks also goes to Ed Roldan for his friendship, feedback and for reading many more revisions than I had a right to ask him. To my parents, thank you for always believing in me and supporting me in all my endeavors. Thank your for always having faith. Finally, my greatest appreciation is to my wife Angela. Thank you for your tireless encouragement and support, and for always pushing me to settle for nothing but my best.

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## Walking Through Anxiety:

### Evaluating the Role of Expectancy in Exercise

Society today is well inured to the idea that exercise should be an integral part of our everyday lifestyle. Furthermore, an abundance of readily available health clubs, personal home gym equipment, and various activities present in most cities have made the ability to exercise easier than ever. However, Health Canada reports that the majority of Canadians are not getting enough exercise. According to a report by the Canadian Fitness and Lifestyle Research Institute (2005), only 49% of Canadians over the age of 20 are moderately active. Being moderately active is defined as approximately equivalent to walking at a moderate pace for 30 minutes a day. The physical health benefits of this moderate amount of exercise are myriad and include: increased cardiovascular health (Mueller, 2007; Swain & Franklin 2006), improvement in diabetes (Praet & van Loon, 2007), and the ability to decrease blood pressure (Thornton, Sykes & Tang, 2004). However, research also indicates that exercise can have profound psychological benefits as well (O'Connor, Raglin & Martinsen, 2000; Otto, Church, Craft, Smits, & Trivedi, 2007; Petruzzello, Landers, Hatfield, Kubitz & Salazar, 1991; Reed & Ones, 2006; Winingger, 2007).

### Exercise and Mental Health

#### *Population Based Studies*

The strong relationship between exercise and mental health is evidenced in several major population based studies. A Finnish population study by Hassmen, Koivula, and Uutela (2000) found that adults who exercised at least two to three times per week experienced less depression, as well as lower levels of perceived stress and anger

than those who exercised less frequently. Furthermore, adults who exercised more frequently reported feeling a stronger sense of coherence and stronger feelings of social integration. In a similar population based study in the United States, researchers found that regular physical activity was associated with significantly decreased rates of major depression and anxiety disorders (Goodwin, 2003). In addition, Schmitz, Kruse and Kugler (2004) conducted a study of clinical subjects with affective, anxiety and substance abuse disorders. They found that physically active subjects reported a higher quality of life compared to inactive subjects, although quality of life was still lower overall than subjects without mental disorders, regardless of their level of exercise.

While population studies are restricted in their ability to infer causation, further support for the positive relationship between physical activity and mental health comes from experimental investigations (Petruzzello, Landers, Hatfield, Kubitz & Salazar, 1991). This research attempts to understand the extent and degree to which physical activity can influence mental health. Although studies have looked at many aspects of mental health impacted by exercise, the majority of the research has been primarily concerned with the areas of affect, depression and anxiety.

### *Experimental Research*

#### *Affect.*

The impact of exercise on affect has become a relatively well established phenomenon (Petruzzello, Landers, Hatfield, Kubitz & Salazar, 1991). Studies evaluating various physical activity interventions on mood have supported the positive effects of physical activity fairly consistently (Wininger, 2007). In one study evaluating the effects of various durations of exercise on mood state by Hansen, Stevens, and Coast (2001), 14

female college students were screened for any contraindicators for physical exercise and then completed four treatment conditions in a repeated measures design. The four treatment conditions consisted of sitting for 30 minutes of quiet rest, and 10, 20 and 30 minutes of bicycle ergometry at 60% of estimated  $VO_{2max}$  respectively, with a warm up and cool down period for each bicycle task. These four conditions were completed over the course of 4 weeks at the same time each week. Prior to, and following each test condition, participants were given the Profile of Mood States inventory (POMS) which is a measure of positive and negative mood states. The authors reported that 10 minutes of exercise at 60% was associated with increased vigour, reduction in fatigue, and an overall reduction in negative mood state. These findings are consistent with other studies evaluating the effects of various exercises and intensities on affect (Berger & Motl, 2000; DiLorenzo et al., 1999; Ekkekakis, Hall, VanLanduyt, & Petruzzello, 2000; Hansen, Stevens & Coast, 2001; Marakia et al., 2005; Nabetani & Tokunaga, 2001; Petruzzello, 1995).

#### *Depression.*

Due to its prevalence, one of the most extensively researched areas of exercise psychology is the treatment of depression. In the year 2000, the World Health Organization ranked depression as the fourth largest health problem in the world (Ustun, Ayuso-Mateos, Chatterji, Mathers, & Murray, 2004). Unfortunately, not all patients with depression respond equally well to current psychological and pharmacological interventions (Nierenberg, Katz, & Faya, 2007; Robinson, Berman, & Neimeyer 1990). Due to the costs involved in pharmacotherapy or psychotherapy, unwanted side effects,

or unavailability of resources, researchers for many years have considered exercise as an alternative form of therapy in the treatment of this pervasive disorder (Martinsen, 2005).

In a recent study, Blumenthal et al. (2007) assessed whether exercise training led to reductions in depression equivalent to sertraline (a standard antidepressant medication). Participants in this relatively large study had obtained a score greater than 12 on the Beck Depression Inventory and subsequently met DSM-IV criteria for Major Depressive Disorder (MDD). Blumenthal et al. randomized the 202 participants into four treatment conditions: supervised aerobic exercise, home based aerobic exercise, sertraline treatment, and a placebo group. Both exercise conditions consisted of treadmill jogging or running at 70% to 80% of maximum heart rate reserve, three times per week for 16 weeks. The researchers found that 45% of the supervised exercise group, 40% of the home-based exercise group, and 47% of the medication group, were in remission after 16 weeks of treatment, while only 31% of the placebo group were in remission. These results are analogous to the findings in a recent meta-analysis conducted by Stathopoulou, Powers, Berry, Smits, and Otto (2006). This meta-analysis looked at 11 treatment outcome studies described by the authors as being empirically sound. These studies confirmed that exercise can and should be used as an intervention along with other empirically supported treatments. Furthermore, in addition to depression, the authors recommend that exercise should be used for anxiety disorders, eating disorders, and substance abuse disorders as well.

#### *Anxiety.*

The recommendation by Stathopoulou, Powers, Berry, Smits, and Otto (2006), that exercise can and should be used as a treatment strategy for anxiety disorders, is

supported by extensive research which indicates that exercise can have a significant therapeutic impact. In one of the largest meta-analyses conducted in this field of research, Petruzzello, Landers, Hatfield, Kubitz, and Salazar (1991) evaluated the results of 104 studies reporting on the effects of exercise on anxiety. These studies evaluated "...state (i.e., acute) or trait (i.e., chronic) anxiety and/or psychophysiological correlates of anxiety (e.g. EMG, EEG  $\alpha$ , blood pressure, Galvanic skin response)" (p.146) each as a separate meta-analysis. From these 104 studies, Petruzzello et al. calculated 408 effect sizes based on a population of 3048 subjects. The authors found that the overall effect sizes from each meta-analysis were significantly greater than zero. Therefore, although the meta-analyses were unable to infer a causal effect between exercise and anxiety, the results indicate that regardless of how anxiety is measured, (e.g., state, trait or psychophysiological), exercise was associated with a decrease in anxiety. Subsequent meta-analyses have reported similar findings. Long and van Stavel (1995), for example, conducted a meta-analysis including 40 studies. In their analysis, they calculated 76 effect sizes and found a low to moderate positive effect in the reduction of anxiety by exercise training.

The potential clinical and health implications for this area of research are immense. The Public Health Agency of Canada (2002) reports that 12% of Canadians are affected by anxiety disorders alone, which function to cause mild to severe impairment. However, anxiety is not limited to clinical populations. Many environments such as school, work or family situations cause increased levels of anxiety in the general population that leads to disruption or inability to function in activities of daily living. According to Lox, Martin and Petruzzello (2003), the cost of anxiety related problems in

North America is in the billions of dollars and accounts for approximately 31.5% of the total costs resulting from *all* mental illness. These costs include both the expenses associated with treatment (e.g., therapy and medications) as well as costs due to lost productivity (Lox, Martin & Petruzzello, 2003). These tangible costs, coupled with the unquantifiable costs associated with impacts on quality of life, make the area of anxiety treatment research an essential one.

## Anxiety

### *Anxiety Disorders*

The *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IV-TR) includes a separate classification for anxiety disorders (DSM-IV-TR, APA, 2000). This division of mental disorders includes, agoraphobia, panic disorder, specific phobias, social phobia, obsessive-compulsive disorder, posttraumatic stress disorder, and generalized anxiety disorder. Although the precise diagnostic criteria for each anxiety disorder are unique, the general symptoms associated with all of the disorders include intense and prolonged feelings of fear and anxiety, which cause distress and impairments in daily functioning. Furthermore, this anxiety occurs out of proportion to the actual threat or danger (DSM-IV-TR, APA, 2000). The concept of anxiety can be additionally broken down into two main areas known as state and trait anxiety.

### *State and Trait Anxiety*

State anxiety is defined as the reaction or response to a situation that an individual perceives as personally threatening or dangerous (Ekkekakis & Petruzzello, 1999; Spielberger, Lushene & McAdoo, 1977). State anxiety can occur in individuals with or without an anxiety disorder. For example, a student having to write an exam or thesis

may experience some anxiety as a result of these events, as would an individual with a specific phobia of spiders who sees a wood spider in the corner of the room. Any of these scenarios reflects the occurrence of state anxiety as the anxiety experienced is a result of a specific, usually transient situation. The most common manifestation of this type of anxiety is seen in disorders such as specific phobias, and social phobia. When confronted with an anxiety provoking situation (such as encountering a room full of people staring, in the case of social phobia) a person experiences high levels of anxiety. However, when the individual or situation is removed, anxiety levels decrease substantially.

In contrast, trait anxiety, reflects a tendency to respond with apprehension, worry, and nervousness across diverse situations (Lox, Martin, & Petruzzello, 2003). Thus, someone who is high in trait anxiety may report feeling generally anxious on a regular basis rather than as a result of a specific stressor (Landers, 1999). This type of anxiety is more commonly observed in individuals with post traumatic stress disorder or generalized anxiety disorder. It should be noted that the concepts of trait and state anxiety are not completely disparate. "Trait anxiety is described as a reflection of frequent past experiences of state anxiety, which increase an individual's proneness or sensitivity to experience future state anxiety" (Gros, Antony, Simms & McCabe, 2007, p. 369). For example, although someone with post traumatic stress disorder may be described as high in trait anxiety in general, certain situations or experiences (such as seeing an object which reminds them of the trauma), may cause the individual to experience heightened levels of anxiety in certain situations. This heightened anxiety as a response to a specific stressor would be seen as a manifestation of state anxiety.

The ubiquity of state anxiety in both clinical and non-clinical populations, as well as the capacity for excessive state anxiety to lead to increases in trait anxiety, makes it an important area of continuing research. Decreasing state anxiety in non-clinical populations, such as test takers, or those undergoing medical treatment, may improve task performance or outcome (Jamison, Parris, & Mayor, 1987; Palakanis, DeNobile, Sweeney & Blankenship, 1994). Furthermore, state anxiety has been found to be co-morbid with other clinical disorders such as substance abuse and depression, and may interfere with the treatment of these disorders (Driessen, et al. 2001). Thus, decreasing state anxiety may also facilitate the treatment of other mental disorders. As with all research regarding treatment, the primary question of concern relates to the most efficient, cost effective and palatable treatments available to clients.

#### *Anxiety Treatment*

Research in the area of treatment of state anxiety and anxiety disorders falls into three main categories, psychological, pharmacological and complementary (or alternative) forms of treatment. The most common form of psychological treatment for anxiety disorders is cognitive behavioural therapy (CBT), and research shows that it is one of the most effective forms of treatment (Butler, Chapman, Forman & Beck, 2005; Gould, Buckminster, Pollack, Otto & Yap, 1997). As outlined by Rector, Bourdeau, Kitchen and Jospheh-Massiah (2005) for the Centre for Addiction and Mental Health,

CBT is a brief, problem-focused approach to treatment based on the cognitive and behavioural aspects of anxiety disorders. In the initial sessions, the person with the anxiety disorder works with the therapist to understand the person's problems. The person's symptoms of anxiety are assessed within a cognitive-behavioural

framework, and the goals and tasks of therapy are established. As the therapy progresses, behavioural and cognitive tasks are assigned to help the person with the anxiety disorder learn skills to reduce anxiety symptoms. (p. 21)

Due to its effectiveness and low risk of side effects, CBT is often the first choice of many clinicians and clients. However, CBT is not equally effective for all clients. Schuurmans et al. (2006) conducted a randomized controlled trial comparing the effects of CBT and pharmacological intervention (sertraline) on generalized anxiety disorder in older adults. They found that although both CBT and sertraline improved symptoms of GAD, sertraline had a greater positive impact on worry. Furthermore, at three months follow-up, the estimated effect sizes for CBT fell in the small to medium range ( $d = 0.35$ ), while effect sizes for sertraline fell into the large range ( $d = 1.02$ ).

Furthermore, in a review by Hunot, Churchill, Teixeira, and Silva de Lima (2008), the authors reported that while the attrition rate of patients in CBT was 15% (which they felt was low) the results of their review indicated that patients undergoing CBT group therapy are more likely to drop out of treatment. Although the reasons for attrition are varied, discontinuing treatment, coupled with the already limited availability, and cost of professional help may preclude many individuals from receiving CBT treatment in a timely manner.

Pharmacological interventions are another standard option for the treatment of anxiety disorders, and are often used in conjunction with CBT. Some common anti anxiety medications include selective serotonin reuptake inhibitors, norepinephrine and serotonin reuptake inhibitors and benzodiazepines. Although the many pharmacological treatments currently available are effective, they are not without their liabilities. Often,

these medications are accompanied by side effects (such as stomach problems, sexual difficulties, dizziness, dry mouth, sleep difficulties and weight gain) which can have an impact on one's quality of life and negatively influence compliance (Golden, 2004; Rosenberg, Bleiberg, Kosci, & Gross, 2003; Schwartz et al. 2007). In addition, Petruzzello, Landers, Hatfield, Kubitz and Salazar (1991) note that the risk of medications interacting with other prescriptions, street drugs or alcohol may limit their ability to be prescribed or reduce their effectiveness. The cost of these drugs may also prevent individuals with low socioeconomic status, or without health care coverage from being able to take advantage of them.

A final area of intervention for anxiety disorders is complementary or alternative therapies. These interventions have been used as stand-alone treatments or in conjunction with empirically validated treatments and can include, meditation, herbal remedies, acupuncture, or exercise. A significant proportion of the literature on complementary anxiety interventions is concerned with exercise (Stathopoulou, Powers, Berry, Smits, & Otto, 2006). As a treatment option, exercise has virtually none of the limitations associated with psychotherapy and pharmacotherapy. Because of its ability to be completed on one's own with limited supervision, exercise treatment is not limited by the time constraints of professionals. In addition, unlike medication treatments, the only negative side effects associated with exercise consist primarily of aches and pains that accompany any new form of physical exertion. These aches and pains are seen as minor discomforts and are likely to become extinct over time as cardiovascular and physical health improves. Furthermore, patients can undertake exercise treatments concurrently with pharmacotherapy without fear of negative interactions between the two treatments.

Other than patients suffering from severe cardiovascular problems or acute infectious disease, there are also virtually no contra indicators to exercising as long as exercise programs are developed according to the client's current fitness level and gradually increased over time (Meyer & Broocks, 2000; Otto, Church, Craft, Smits, & Trivedi, 2007).

## Exercise

### *Exercise as Treatment*

The relevance of physical activity as a possible psychological intervention in clinical anxiety disorders has been affirmed by various notable organizations for many years. The National Institute of Mental Health, in 1987, "concluded that exercise is (i) positively linked with mental health and well-being, (ii) reduces stress and state anxiety, and (iii) has emotional benefits for all ages and in both genders" (Callaghan, 2004, p.477). In 2008, the Canadian Mental Health Association stressed that physical activity is recognized as an integral component in building and maintaining mental fitness, and maintained that physical activity is an effective treatment for both depression and anxiety. Furthermore, experimental research comparing exercise with other treatments (e.g., standard pharmacological treatment, meditation, or relaxation) highlights the benefits of exercise as a stand alone treatment for anxiety disorders.

Broocks et al. (1998) conducted a study comparing the efficacy of exercise (running), standard pharmacological treatment (clomipramine), and placebo in patients with moderate to severe panic disorder. A total of 46 outpatients were randomly assigned to one of the three treatment conditions for 10-weeks. During this time, the exercise group was asked to complete, by walking and running, a 4-mile route at least three times

per week, gradually increasing running duration. Although participants were encouraged to run as much of the route as possible, emphasis was placed on simply completing the route. Subjects in the clomipramine group received 112.5 mg daily, while the control group received an equivalent placebo. The authors utilized four primary outcome measures to determine the efficacy of the treatment conditions, (Hamilton Anxiety Scale, observer-rated and patient-rated versions of the Panic and Agoraphobia Scale, and the rater version of the Clinical Global Impression scale). Analysis indicated that both exercise and clomipramine were significantly more effective than placebo. When comparing the exercise and clomipramine conditions, Broocks et al. found the following:

Direct comparison of the two active treatment conditions revealed that clomipramine was superior to exercise after 4 weeks (rater version of the CGI) and 6 and 8 weeks (rater version of the CGI and observer-rated and patient-rated versions of the Panic and Agoraphobia Scale). At the end of the treatment period, the superiority of clomipramine was evident only in the rater version of the CGI. (p. 606)

These results indicate that after eight weeks of treatment, the anxiolytic effects of exercise were rated as equal to clomipramine by the patients themselves.

Although the authors concluded that exercise treatment is somewhat less effective than clomipramine, they acknowledged that patients receiving clomipramine treatment experienced significantly more side effects, (e.g., dry mouth, sweating, mild tremor, dizziness, tachycardia, constipation, and impaired erection or ejaculation) than the exercise group. Conversely, participants in the exercise condition reported no side effects other than transient muscle or joint complaints that completely disappeared for all but one

subject by the end of the 10 weeks. This disparity in side effects highlights the importance of exercise as an alternative treatment option as many patients may not be able to tolerate the side effects associated with pharmacological treatment. Broocks et al. (1998) also contend that certain groups of individuals may be more predisposed to respond positively to exercise interventions.

In an earlier study examining the impact of exercise on anxiety, Bahrke and Morgan (1978) compared the effects of physical activity and meditation on state anxiety. The authors randomly assigned 75 male participants to one of three groups: (1) exercise, which consisted of walking on a treadmill at 70% of their maximal heart rate, (2) meditation, which consisted of following recorded instructions describing the relaxation response for 20 minutes, or (3) quiet rest (control), which consisted of resting quietly for 20 minutes with the option of reading a recent *Readers Digest* if they desired. Bahrke and Morgan measured anxiety prior to each condition, immediately after, and 10 minutes post treatment using the State Anxiety Inventory. Physiological responses (i.e., oxygen consumption, heart rate, skin temperature and blood pressure) were also measured and used as confirmatory variables. The results of this study indicated that physical activity was equally as effective as meditation and quiet rest in decreasing state anxiety.

Even though the results of this study conclude that quiet rest and meditation are equally as efficacious as exercise in decreasing state anxiety, other studies have found that the anxiolytic effects of exercise last for a longer duration than alternative treatments (Raglin & Morgan, 1987). Additionally, the added benefits of exercise may make it a primary choice for treating anxiety disorders (Landers, 1999). The cardiovascular benefits (Paffenbarger & Hyde, 1988) and improvement in general mood (Meyer &

Broocks, 2000) associated with exercise increase its potential desirability when deciding amongst treatment options. Furthermore, subsequent studies have resulted in inconsistent results for some alternative forms of treatment. For example, contrary to Bahrke and Morgan's study, Boutcher and Landers (1988) found that subjects assigned to a reading control condition did not experience a significant reduction in state anxiety. This finding reduces support for the efficacy of alternative treatment options, such as meditation or quiet rest, in decreasing anxiety.

One essential shortcoming in this area of research is the lack of manipulation of anxiety prior to treatment. Many studies utilize subjects from the general population without known anxiety disorders. The fact that anxiety levels in these subjects were relatively low to begin with may impact the extent to which anxiety can be decreased (Tieman, Peacock, Cureton, & Dishman, 2002). However, studies that do manipulate and increase state anxiety levels prior to treatment generally report much larger effect sizes (Breus & O'Connor, 1998; Youngstedt, O'Connor, Crabbe, & Dishman, 1998). Thus, future research in which state anxiety is manipulated prior to treatment in non-clinical population groups may provide clearer results regarding the anxiolytic effects of exercise.

### *Exercise Modalities*

Exercises that have been studied in the field of exercise psychology can be divided into two groups: aerobic exercise and anaerobic exercise. Aerobic exercise is defined as exercise that takes place over an extended period of time and requires noticeably increased oxygen consumption (Brannon & Feist, 2000). This can include activities such as brisk walking, jogging, swimming or biking. Anaerobic exercises on the other hand, are require only short, intensive bursts of energy and do not result in an

increased level of oxygen consumption (Brannon & Feist, 2000). This type of exercise includes activities such as short bursts of sprinting, weight lifting, and some forms of calisthenics. Research in this area has found that while exercise of an aerobic nature, regardless of the mode (jogging, swimming, dancing or biking) is significantly able to decrease anxiety, anaerobic exercises are not found to be as anxiolytic (Lox, Martin & Petruzzello, 2003). Consequently, although both types of exercise have been considered in the literature, the majority of exercise psychology research has been concerned with aerobic exercise. Additionally, most of the extant literature on the anxiolytic effects of exercise has been concerned with either walking/jogging/running interventions, or cycling ergometry (using an exercise bike).

#### *Duration and Intensity of Exercise*

Although the definition for aerobic exercise refers to a 'dramatically' increased rate of oxygen consumption, research evaluating the optimal duration and intensity of exercise necessary to reduce anxiety has produced contradictory results. The duration of exercise treatments falls into the two broad categories of acute and chronic exercise. Acute exercise conditions are those occurring at a set time for a specified length of time (Landers, 1999) and are of a relatively short duration. Chronic exercise conditions are those that involve exercise conditions that take place on a regular basis (e.g., over several weeks (Landers, 1999), and generally last for longer than acute exercise conditions (e.g. longer than 30-60 minutes per session). Anxiety that is considered 'state' is typically investigated using acute exercise while 'trait' anxiety is generally investigated using chronic exercise.

The literature in this area clearly demonstrates that state anxiety is reduced in both clinical and non-clinical populations following acute exercise conditions (Boutcher & Landers, 1988; Breus & O'Connor, 1998; Daley & Maynard, 2002; Palleschi et al., 1998). Many studies suggest that acute exercise must exceed 20 minutes and be of vigorous intensity for significant positive psychological effects to be seen (Callaghan, 2004; Meyer & Broocks, 2000; Tieman, Peacock, Cureman, & Dishman, 2002). However, other research has indicated that exercise durations of less than 20 minutes and of less intensity may be effective as well (O'Connor, 2005; Petruzzello, Landers, Hatfield, Kubitz, & Salazar, 1991; Rudolph & Butki, 1998). Hansen, Stevens and Coast (2001) evaluated the effects of moderate exercise intensity on a bicycle ergometer for 10, 20, and 30 minutes. Their results indicate that reductions in fatigue, confusion, and overall negative mood occur after only 10 minutes of exercise, with continued improvement found only in confusion up to 20 minutes, and no increased improvement over longer periods. These results support the claim that exercise need not be exceedingly vigorous or of prolonged duration in order to experience both physical and mental health benefits.

Several meta-analyses and reviews report that the absolute minimum amount of exercise duration and intensity necessary to positively impact mental health is as of yet unknown (Ekkekakis & Petruzzello, 1999; Petruzzello, Landers, Hatfield, Kubitz & Salazar, 1991). However, these studies report that exercise interventions of short duration (as low as 10 minutes) and low intensity (such as brisk walking) are efficacious at producing positive mental health benefits. Petruzzello et al. summarize the current state of exercise research, highlighting future research must begin to examine causes rather

than continue to describe what has become a widely accepted correlation. Hence, although the precise answers of intensity and duration of exercise necessary to decrease anxiety may not be fully understood, it may be more important to determine the mechanism or mechanisms at work.

#### Possible Mechanisms at Work

There are many theories as to why exercise treatments may be able to produce reductions in anxiety. Some hypotheses stem from physiological origins while others are psychological in nature. Unfortunately, much of the research is either contradictory or provides incomplete answers (e.g. Petruzzello, 1995). The most prominent physiological explanations are the thermogenic, neurochemical, and sleep/social zeitgeber theory hypotheses, and the most recognized psychological propositions are; self efficacy, distraction, and expectancy theories. Each of these will be discussed in turn.

#### *Physiological Mechanisms*

##### *Thermogenic hypothesis.*

One attempt to explain the anxiolytic effects of exercise is the thermogenic hypothesis. This theory posits that decreases in anxiety are a result of increases in core body temperature brought about through exercising (Petruzzello, Landers, Hatfield, Kubitz & Salazar, 1991; Petruzzello, Landers & Salazar, 1993; Raglin & Morgan, 1985). The underpinnings for this hypothesis stem from research in which experimenters found that whole body warming, as a result of sauna or hot shower, is able to reduce somatic indices of anxiety (e.g., muscle tension, blood pressure) and self-reported state anxiety levels by increasing vasodilation (deVries, 1981; Raglin & Morgan, 1985). Research to date has provided limited support for this hypothesis. Studies attempting to increase core

body temperature through moderate exercise have found that it is quite difficult to do so and elevations in body temperature as a result of exercise tend to be fairly small and short-lived. (Petruzzello et al., 1991). Several studies and meta-analyses have posited that increases in temperature from aerobic exercise may not be the central cause of reductions in anxiety although it may still play a role (Koltyn & Morgan, 1992; Petruzzello et al., 1993).

*Neurochemical hypotheses.*

Several neurochemical explanations have been proposed to explain the anxiolytic effects of exercise. Two prominent explanations are based on the neurochemicals acetylcholine and opioids. In the field of exercise psychology, the Opponents Process Model suggests that exercise activates the sympathetic nervous system that responds by increasing adrenalin levels (Callaghan, 2004). This increase in adrenalin then stimulates the parasympathetic nervous system, which responds by increasing acetylcholine levels. It is this increase in acetylcholine that researchers hypothesize is responsible for the reduction in anxiety by lowering overall arousal (Boutcher & Landers, 1988; Solomon, 1980).

In another attempt at understanding the biochemical effects of exercise, several studies have reported that exercise results in an increase of opioids (e.g., beta-endorphins) within the body (Bouix, Najimi & Orsetti, 1997; Morgan, 1985; Ransford, 1982). In support of this premise, there is an abundance of anecdotal evidence linking this process with the feelings experienced by those who run long distances regularly, known as a 'runners high' (Morgan, 1985). Similar to the Opponents Process Model, this increase in endorphins is thought to be anxiolytic in nature by acting as an inhibitor within the

central nervous system (Thoren, Floras, Hoffman, & Seals, 1990). Unfortunately, the research is somewhat dichotomous in this area. While some studies have reported that subjects who exercise following administration of an opiate antagonist are calmer and less depressed than subjects who do not, other studies have been unable to replicate this effect (Stathopoulou, Powers, Berry, Smits, & Otto, 2006).

*Sleep/Social zeitgeber hypotheses.*

A common symptom in anxiety disorders is disruption in normal sleep patterns (Mellman, 2006; Stathopoulou, Powers, Berry, Smits, & Otto, 2006), which in turn is known to increase anxiety sensitivity (Vein, Dallakyan, Levin, & Skakun, 1983). Anxiety sensitivity is the extent to which someone fears physiological responses (e.g., a rapid heartbeat), and is related to and seen as a precursor to developing an anxiety disorder. As a result, theorists propose that the mediating effect exercise has on anxiety is its ability to regulate the sleep cycle.

A similar hypothesis is the social zeitgeber model proposed by Ehlers, Frank, and Kupfer (1988). This model suggests that everyday stresses in life may cause disruptions in individuals' social routines and, in turn, their biological circadian rhythms (Grandin, Alloy, & Abramson, 2006). Exercise, it is hypothesized, helps to regulate these routines of daily life, which in turn improves affect. Singh, Clements, and Fiatarone (1997), attempted to study this theory by randomly assigning depressed older adults (aged 60 to 84) to a 10 week exercise program or a control group. The authors found that those in the exercise group reported enhanced sleep quality measured by the Pittsburgh Sleep Quality Index as well as improvement in overall quality of life. In addition, depression measures such as the Beck Depression Inventory decreased approximately twice as much as those

in the control group. Although this study shows a correlation between exercise and improvement in daily life routines, which are linked to clinical improvements in depression, it is impossible to determine the nature of this correlation. Fundamentally, there remains uncertainty as to whether improved sleep quality positively impacts depression, or improvement in depression positively impacts sleep quality.

### *Psychological Mechanisms*

#### *Time-Out/Distraction hypothesis.*

Bahrke and Morgan's finding" (1978), that quiet rest was equally as effective as exercise in reducing anxiety, led them to infer that simply taking a time out and focusing on something other than daily stresses or worries may be sufficient to reduce state anxiety. They theorized that:

the basis of beneficence...resulting from exercise and meditation may not rest in the physiologic changes...but rather in the *diversional* aspects of such activities. It is conceivable that "time-out therapy", whether in the form of exercise, meditation, biofeedback, or simple rest breaks, may represent the effective ingredient in therapies designed to reduce anxiety. (p. 331).

In order to explain this phenomenon some researchers have hypothesized that the physiological mechanisms which may be at work when individuals exercise (e.g., temperature and neurochemical changes), may also be occurring with distracting activities (McEntee, 1995; Petruzzello, Landers, Hatfield, Kubitz, & Salazar, 1991). However, subsequent investigations finding that the anxiolytic effects of exercise last for a longer period of time than for other anxiety reducing 'time out' activities (Raglin &

Morgan, 1987), diminish the plausibility of this hypothesis (Petruzzello, Landers, Hatfield, Kubitz, & Salazar, 1991).

*Self efficacy hypothesis.*

Another possible explanation for the anxiolytic effects of exercise is the theory of self-efficacy, which is the belief that one can master and perform a behaviour successfully (Petruzzello, Landers, Hatfield, Kubitz, & Salazar, 1991). Researchers hypothesize that the ability to complete a demanding task (e.g., exercise) affects emotional reactions, and improves one's self-concept or self-esteem (Landers, 1999). In other words, as an individual perceives that his or her capabilities are improving (e.g., being able to run further or lift more weights), their anxiety should also decrease. This theory may have some merit in that self-esteem may be improved, and the ability to counter anxious thoughts associated with some anxiety disorders (e.g., rapid breathing or a pounding heart is interpreted as life threatening) (Rapee et al., 1991) becomes easier. However, it does not account for the results of many studies, which have shown that acute bouts of moderate or even low intensity exercise have had a significant impact on affect and anxiety (Bahrke & Morgan, 1978; Breus & O'Connor, 1998; Steptoe & Cox, 1988; Szabo, 2003). The short duration and low intensity of the exercises involved in these studies do not allow enough time for mastery to occur. Thus, increased self-efficacy or self-esteem is not likely to occur. Furthermore, in many cases, the subjects utilized are physically fit and are being asked to engage in exercise that is of a submaximal intensity. In other words, they have already mastered the activity they are being asked to perform, which again is unlikely to increase feelings of mastery or improved self-efficacy.

*Expectancy hypothesis.*

The placebo effect is the effect on a patient's outcome (improved or worsened) that occurs as a result of a placebo (an inert substance or therapy) (Patterson, 1985). These outcomes are attributed to the expectations of a patient (or provider) that a particular treatment will have some effect (National Library of Medicine, 2008). As with all treatment research, the question of whether the treatment itself is the cause of improvement, rather than expectations or beliefs held by the participant, holds for exercise psychology as well. Society is inundated with the message that exercise is beneficial. From the first gym and health classes in school, to media sources, to government sponsored health promotions, all ages are taught the importance of exercise. These messages may influence the expectancy of subjects in treatment designs who may ultimately improve, or report that they have improved simply because of their preconceived expectancies (Goodwin, 2003; Petruzzello et al., 1991).

Research examining the expectancy effects of exercise on mental and physical health has been primarily concerned with *outcome* expectancies of exercise behaviours. For example, if someone expects that exercise will improve their physique (a desired outcome), then they are more likely to exercise. However, to date no research evaluating the expectancy effect of exercise on anxiety (that exercising can decrease anxiety) has been found. One of the main problems in identifying the possibility of an expectancy effect is that researchers have had difficulty blinding participants to the fact that they are exercising and thus controlling for expectation effects (Broocks et al., 1998; Ojanen, 1994; Seraganian, 1993; Sime, 1984; Tieman, Peacock, Cureton, & Dishman, 2002). Ojanen argues that future research aimed at examining expectancy effects associated with

exercise will require groups where expectations are low in order to reveal the true psychological effects of exercise.

The question of whether the anxiolytic effect of exercise is due to expectancy may be one of the most important ones. If research indicates that expectancy is the actual mechanism involved, then questions of duration and intensity may become moot. Furthermore, evidence for an expectancy effect, while not completely negating the possibility of other theories, would change the direction of future research drastically and would give rise to other questions such as: what is the component of exercise that individuals expect to be anxiolytic? (e.g., exercise environment, getting in shape).

#### Summary

Although there are still some detractors to this area of research, (Schlitt, 1994) the overwhelming majority of research supports the supposition of the anxiolytic effect of exercise. There have been several reviews and large scale meta-analyses evaluating 40 or more studies which provide support for the anxiolytic effects of exercise (Long & van Stavel, 1995; Salmon, 2001; Stathopoulou, Powers, Berry, Smits, & Otto 2006; Wipfli, Rethorst & Landers, 2008). Clearly, despite the unanswered questions in the literature as to the optimal duration, and intensity of exercise required for *maximum* benefit, there is strong evidence that acute bouts of exercise at low intensities are sufficient to produce decreases in anxiety (O'Connor, 2005). Unfortunately, the evidence supporting the anxiolytic effects of exercise notwithstanding, researchers are still unable to clearly determine if 'expectancy' is the primary mechanism at work.

*Aims of the Present Study*

The present study investigated whether the expectancy effect was a possible mechanism of action in the reduction of state anxiety via exercise. In order to expand on the findings of previous studies examining the effects of exercise on state anxiety, this study included two distinctive features.

First, as discussed, the importance of understanding the mechanisms at work in anxiety reduction through exercise are evident. This study examined the effect of expectancy on anxiety by attempting to blind participants to the fact that they were engaging in exercise, which has not been done before in the literature. The blinding of participants was intended to limit the possibility of expectancy effects in this group.

Secondly, levels of state anxiety were manipulated in all participants in an attempt to clearly determine the effects of acute, low intensity walking exercise on state anxiety. The purpose of increasing state anxiety prior to the experimental conditions was to provide a clearer indicator of any anxiety reduction that may have occurred as a result of exercise (e.g. to decrease the possibility of a floor effect).

*Hypotheses*

The current study was designed to examine two primary hypotheses.

1. It was hypothesized that individuals who are not aware that they are exercising, will experience the same reduction in anxiety levels as those individuals who are fully aware of the fact that they are exercising.
2. It was also hypothesized that walking 0.8 kilometers in 10 minutes, would lead to a decrease in state anxiety.

## Methods

### *Participants*

One-hundred-and-fifty-nine participants were recruited from Lakehead University as well as from the Thunder Bay community, and completed the screening and demographic questionnaires. Based on their responses to the questionnaires, 29 participants were excluded based on the following exclusionary criteria: (a) a history of mental health disorder (e.g., depression, anxiety, substance abuse, or schizophrenia), or (b) an affirmative response to any item on the PAR-Q. In total 13 individuals were excluded based on the PAR-Q criteria, 12 individuals were excluded based on the history of mental health disorder criteria, and 4 individuals were excluded based on both exclusionary criteria. After contacting individuals who met eligibility requirements, an additional 40 participants declined to participate further in the study.

As a result, ninety individuals (56 female and 34 males) completed all phases of the study, and were credited with one bonus percentage toward their final mark in either Introductory Psychology or Statistics 2101 and/or were entered into a draw to win a gift certificate valued at \$50 from the Keg restaurant. The participants ranged in age from 18 to 50 years with a mean of 23.43 years ( $SD=6.39$ ). Of the 90 participants, the sample was predominantly Caucasian (73.3%) with the remainder being European (7.8%), Native Canadian (3.3%), Asian (3.3%), and other (12.2%). In addition, all participants had graduated from high school and had completed at least some university education. When asked to indicate how many days per week participants engaged in 30 minutes of moderate physical exercise, individual responses ranged from zero to seven days per week  $M = 3.439$ ,  $SD = 1.76$ .

## *Materials*

### *Soccer Field*

Although treadmills have been predominantly utilized for exercise conditions in anxiety studies (Bahrke & Morgan, 1978; Broman-Fulks, Berman, Rabian, Webster, 2004; Hall, Ekkekakis, Petruzzello, 2002; Nabeani, Tokunaga, 2001; O'Connor, 2005; Petruzzello, 1995), the present study utilized a regulation sized outdoor soccer field. Three sides of the soccer field were bordered by trees while the fourth side faced a parking lot. Due to the fact that the no-expectancy walking group walked outdoors, the expectancy walking group exercised outdoors. This was completed by walking around a soccer field for the allotted time and was done in order to control for environmental factors while exercising.

### *State-Trait Anxiety Inventory (STAI).*

Due to its reliability, validity, and ease of administration, one of the most commonly used psychological tools utilized in the assessment of anxiety levels is the State-Trait Anxiety Inventory (Spielberger, 1983) (Appendix D and E) created by Spielberger (Bartholomew & Linder, 1998; Ekkekakis, Hall, & Petruzzello, 1999; Hale, Koch, & Raglin, 2002; Szabo, 2003). The STAI is made up of two self-report measures for measuring anxiety. The S-Anxiety scale (STAI Form Y-1) consists of 20 items, which measure state anxiety (how much anxiety an individual is experiencing at a given moment). The T-Anxiety scale (STAI Form Y-2) also consists of 20 items and measures trait anxiety (how an individual feels in general). In his analysis, Spielberger (1983), reports that the STAI is a reliable and well validated tool with good internal consistency ranging from .86 to .96, and has a consistent test-retest reliability of .76 for females and

.86 for males (Spielberger, 1983). Furthermore, the alpha reliability coefficients for the state anxiety scale are generally higher when administered under anxiety inducing conditions (Spielberger, 1983).

The STAI S-Anxiety scale measures feelings such as worry, apprehension, and tension. Sample items from the S-Anxiety scale include: “I feel calm”, “I feel jittery”, “I am worried”, “and I feel steady”. Respondents are asked to respond to the items by describing how they feel “*right now, that is at this moment.*” This is done by selecting one of four options on a likert scale ranging from 1 (*not at all*) to 4 (*very much so*). The items on the STAI are divided into anxiety present items and anxiety absent items. Anxiety present items received a weighted score equivalent to the number darkened on the form. Anxiety absent items, receive a reverse weighted score to the item darkened on the form (e.g., 1=4, 2=3, 3=2 and 4=1). The weighted scores are then summed to determine a raw score between 20 and 80. A higher score represents a higher level of state anxiety at that moment.

The STAI T-Anxiety scale measures the relatively stable trait of how prone someone is to respond to a particular situation with increases in their state anxiety. Similarly to the S-Anxiety scale, items are divided into anxiety present and anxiety absent items. Respondents are asked to indicate how they ‘*generally*’ feel. Sample items from the T-Anxiety scale include: “I feel pleasant”, “I feel nervous and restless”, and “I get in a state of tension or turmoil as I think over my recent concerns and interests”. The items on the T-Anxiety scale utilize the same Likert scale and scoring system as the S-Anxiety scale.

*Intelligence Test*

In order to increase anxiety in participants prior to assigned condition, participants were informed that they would be writing a difficult intelligence test after their activity. Due to its ease of administration and brief testing time, the test utilized (Appendix G) was the Mental Rotations test adapted by S.G. Vandenberg (1971). Questions on this test provide participants with a primary three-dimensional object made of connected blocks, and four possible answer choices. Two of the four possible answer choices match the primary object but are presented with a different orientation or rotation. Participants are required to mentally rotate the primary object and indicate which two of the four answer choices are correct. The Mental Rotations Test is divided into two sections with 10 questions in each section. Test takers are given three minutes to complete each section of the test for a total of six minutes testing time. Standard test instructions for the test were utilized (Richards, 2006). For the purpose of this study, participant's results on this test are not considered relevant, and thus were not scored at this time.

*Screening/Demographic Questionnaire*

The screening/demographic questionnaire (Appendix B), consisted of basic demographic questions (e.g., age, highest level of schooling completed), questions about history of mental disorder (for screening purposes), and questions about physical activity levels and testing preferences. Participants were also asked to complete the Physical Activity Readiness Questionnaire (PAR-Q) (Appendix C), at this time. The PAR-Q is a seven item questionnaire which asks individuals between the ages of 15 and 69 about current health concerns which may preclude them from engaging in physical activity prior to consulting with a physician. The PAR-Q recommends that if an individual

answers affirmatively to any one question, they should consult with their doctor before beginning physical activity or becoming much more physically active (Spielberger, 1983). For screening purposes, any participant who answered affirmatively to any one question on the PAR-Q was excluded from further participation.

#### *Visual Analogue Scales*

Visual Analogue Scales (VAS) are a valid and reliable tool used for measuring subjective experience (Wewers, & Lowe, 1990). Although other formats exist, the typical VAS is a horizontal line that is 100 mm long. This line is then anchored by word descriptors at each end that describes the two extremes of what is being measured (e.g., 'Not At All' and 'Always'). The participant is instructed to mark a slash on the line that they feel is indicative of how they feel in response to a given question. The VAS score is then calculated by measuring from the left hand end of the line to the point that the patient marks. Upon completion of all other phases of the study, participants were given a VAS and asked to indicate how much time they spent thinking about the test during their 10 minute activity (e.g., none of the time or all of the time). This question was followed by asking participants to record what other things they thought about during the 10 minutes. These questions were utilized to provide some information on the duration and types of thoughts that may have distracted participants during their assigned activity.

#### *Procedure*

Participants were informed that the general purpose of the study was to examine the effects of exercising simultaneously with another person at various intensities on test taking abilities. This cover story was intended to mask the true nature of the study. Interested participants were then asked to fill out a consent form (Appendix A), a

demographic questionnaire (Appendix B), and the Physical Activity Readiness Questionnaire (Appendix C). They also completed the STAI-Form Y-1 (Appendix D). Participant's scores on this measure were used as a baseline measure of state anxiety. Additionally, participants completed the STAI-Form Y-2 (Appendix E) as an overall measure of trait anxiety.

After being screened for physically activity readiness and prior/current history of mental health disorders, participants were contacted by the researcher to schedule an appointment to complete the study. At that time, participants were reminded of the purpose of the study (investigating the impact of exercising on test taking abilities) and were instructed not to exercise, eat, use tobacco products, or consume alcohol or caffeine for at least two hours prior to their appointment. These instructions (asking participants not to exercise, eat and so on) are fairly common in the literature (although the time restrictions may vary) and have been used by previous researchers investigating the role of exercise on anxiety (Rejeski, Hardy, & Shaw, 1991; Tieman, Peacock, Cureton, & Dishman, 2002). For the current study, this was done to help ensure homogeneity among participants (e.g., it ensured that participants did not fatigue themselves through excessive exercise prior to the experiment). In order to prevent the priming of participants as to which group they were in, all participants were asked to come to their appointment wearing athletic shoes for walking and clothes that are comfortable for walking in as well as appropriate to the weather.

All participants were randomly assigned to one of the three treatment conditions prior to their appointment (see Appendix H for the information provided to the experimental groups). To determine the effects of exercise on state anxiety, this study

attempted to increase the state anxiety levels of participants slightly. Increasing state anxiety in research participants is a common technique. For example, it has been used to evaluate the effects of anxiety on sexual functioning (Seto, 1992), cognitive beliefs (Hall & Crisp, 2003) and information processing (Sengupta & Johar, 1999). In order to increase the state anxiety of the participants, information regarding the task following exercise was revealed prior to the experimental condition in the form of ego-orienting instructions that are evaluative or ego-threatening (Zeidner, 1998) (Appendix F). In order to achieve the desired effect of a slight increase in anxiety, the instructions emphasized the following criteria. 1) the test is a measure of intellectual ability, 2) success on the test is reflective of one's overall personality functioning, 3) the task is of a very brief time limited nature, and 4) the possibility of unfavourable comparison with others (Zeidner, 1998). After this information had been provided, the STAI Form-Y-1 was re-administered.

Upon completion of the STAI Form Y-1, participants completed their assigned exercise condition. They were asked not to speak to the investigator during this time, and were instructed to spend the duration of the condition thinking about the upcoming intelligence test. Immediately upon completion of the exercise task, participants again filled out the STAI Form-Y. They were then administered the Mental Rotations Test (Appendix G). Following the test, participants were given one final questionnaire (Appendix J) to determine the content of their thoughts during the 10 minutes of walking or quiet rest. This questionnaire consisted of a Visual Analogue Scale in which participants were shown a 100 millimeter line with the words 'None Of The Time' at one end and the words 'All Of The Time' at the other end. They were then asked to make a

slash on the line to indicate how much of the 10 minutes they spent thinking about the upcoming test. They were also asked a follow up question inquiring what (if anything else) they thought about during the 10 minutes. Upon completion of this questionnaire participants were informed that they would receive an e-mail detailing the debriefing and results of the study upon completion of the experiment. They were also given a receipt of their participation for their records and were free to go. The appropriate documentation was provided to the psychology department to ensure that bonus points were awarded appropriately.

### *Experimental Conditions*

#### *Control Group.*

In the control group, participants were asked to sit quietly on a bench outside beside the soccer field for 10 minutes with the experimenter sitting on the bench as well.

#### *Expectancy Walking Group.*

In the expectancy walking group, participants were asked to walk around a soccer field for 10 minutes at a pace set by the experimenter. As the other conditions involved interactions with the experimenter (e.g., walking to a new location, sitting on the same bench), the experimenter also walked around the field with them. This was done to account for the cover story of evaluating exercising with another individual on test taking abilities. The pace set was such that the participant walked approximately 0.8 kilometers in 10 minutes, which matched the distance and time walked by the no-expectancy walking group.

*No-Expectancy Walking Group.*

These individuals were informed that they were part of the control group and as with the control group, they were told that they would *not* be exercising. After receiving the ego threatening instructional set and filling out the STAI, these participants were informed that the location the experimenter had planned for them to sit in to complete their test was double booked and were then asked to accompany the researcher to an alternate location. This alternate room was located equivalent to 0.8 kilometers away and took 10 minutes to walk to. This walk took place on a university campus and consisted of a paved sidewalk which was flanked by either trees or buildings. Once at the new location, these participants received the questionnaires and tests in a manner identical to the other groups.

*Debriefing.*

Once the questionnaires and Mental Rotations Test were completed, participants were informed that they would be contacted with the results via email after all data collection has been completed. Participants were emailed a brief description of the study's results along with a full debriefing (Appendix I) outlining the true purpose of the study. The reason for debriefing participants after all of the data collection was complete was to protect the internal validity of the study. The validity of the study may have been compromised if participants spoke with one another and informed others that the 'intelligence' test was not truly part of the study, and that the true purpose of the study was to examine expectation effects. Participants were also provided with contact information should they wish to discuss any of the findings further or to address any potential concerns they may have had.

*Ethical Considerations*

The consent of the participants was completely voluntary and this was clearly outlined on the consent form (Appendix A). Participants were also reminded upon arrival to the lab that their participation was voluntary and that they could withdraw at any time without penalty. Due to the nature of expectancy, it was necessary to use a minimal amount of deception on the consent form and through interaction with the participants. This study operated under three primary deceptions. First, participants were informed that the purpose of the study was to examine the effects of exercising with another individual on test taking abilities (the title of the study on the consent form was altered to reflect this purpose as well). This deception was necessary to avoid priming the participants to the fact that the experiment was actually evaluating the impact of exercise on anxiety. If the participants had become aware of the true nature of the study, their expectancies about the anxiolytic effects of exercise would have confounded the results. In addition, because the experimenter was sitting adjacent to the control group, and walking with the 'no expectancy' group, it was necessary to walk adjacent to the expectancy group as well to ensure uniformity among groups. The cover story thus provided plausible reasoning for having the experimenter exercise alongside the participants.

The second deception consisted of informing the 'no expectancy' group that they were not going to be exercising and then having them walk for 10 minutes. Again, this deception was necessary to control for the expectancies of this group. It is important to note that all potential subjects were informed that the study was evaluating exercise and that there was a possibility that they would have been required to exercise. Thus, each participant was able to give informed consent as to whether or not they wished to

exercise and thus participate. This deception was intended to lower the exercise expectations of this group.

The final deception in this study involved informing participants that they were completing an important test that measured intellectual functioning, with their scores being compared with the scores of other participants. The purpose of this story was to increase state anxiety prior to exercise. As explained previously, increasing state anxiety prior to exercise is likely to provide a more explicit picture of the potential decreases in anxiety produced by exercising in a non-clinical population. The debriefing letter outlined the true purpose of the test and participants were informed that the tests were not ranked or evaluated in relation to other participants.

#### *Data Screening*

Information gathered from the 90 participants via the questionnaires was entered into the Statistical Package for Social Sciences (SPSS) v16. Using the Descriptives option, the data was reviewed to ensure there were no data entry errors, and to determine if there were any missing data. Of the 90 participants, two individuals declined to fill out the STAI Form Y-2, which measures trait anxiety. All 90 participants completed the remaining questionnaires. With regards to the STAI Form Y-1 and Form Y-2, for any participants who omitted 1-2 items, a prorated score was obtained as per the scoring guidelines set out by Spielberger (1983). In these instances, the mean weighted score for the scale items that were completed was obtained, and this value was multiplied by 20. Finally, the final product was rounded up to the next higher whole number. Although it did not occur, had any participant completing the STAI Forms omitted three or more items, that form would have been ineligible for inclusion (Speilberger, 1983).

In order to evaluate changes in anxiety, a variable was created to examine participants change in anxiety. This variable was calculated by subtracting participants score on the STAI Form Y-1 at time 1 (after anxiety induction and prior to assigned condition) from their score on the STAI Form Y-1 at time 2 (immediately after 10 minutes of experimental condition was completed). Using this variable, the Explore function of SPSS was utilized to create histograms and Box Plots in order to determine the distribution and number of outliers for each group. This analysis resulted in the discovery of eight outliers that fell outside the 95<sup>th</sup> percentiles. Following the guidelines as set out in Tabachnick and Fidell (2007), the distribution of the curve of change scores was tested for normality using the Kolmogorov-Smirnov Test. This test revealed that the change score from time 1 to time 2 was normally distributed, and thus no transformations to the data were warranted. However, due to the aberration of extreme scores, the outliers were removed for statistical analysis.

#### *Additional Analyses (State Anxiety Induction)*

For the present study, it was theorized that the anxiety inducing instructional set would significantly increase anxiety. In order to determine if an increase in anxiety occurred, participants initially filled out the STAI Form Y-1 with their preliminary questionnaire package, which provided a baseline measure, and then once again immediately after the anxiety inducing instructional set. These repeated measures scores were analyzed using ANOVA and means were compared which provided a rough estimation of the effectiveness of the anxiety inducing instructional set.

#### *Additional Analyses (Visual Analogue Scale)*

In order to account for the possibility of distraction during the group conditions, participants were asked to spend the 10 minutes of their assigned activity (i.e., quiet rest) thinking about the upcoming intelligence test. After completing the test, participants were asked to indicate on a visual analogue scale how much time they actually spent thinking about the test as well as to indicate what other things they had thought about during the 10 minutes. The slashes made by the participants on the visual analogue scale were measured in millimeters and converted to a percentage which was entered into SPSS. The scores were then compared across the three groups.

### Results

This study utilized a one-factor (exercise condition) three group (exercise group, no expectancy exercise group, quiet rest group) between-subjects ANOVA design. The primary analysis involved examining potential effects of the independent variable of expectancy of exercise on the reported dependent variable of state anxiety. The hypotheses of this study were that individuals who walk 0.8 kilometers in 10 minutes would experience a decrease in state anxiety (hypothesis 2). Furthermore, it was hypothesized that the individuals who were not aware that they were exercising would experience the same reduction in anxiety levels as individuals who were fully aware that they were exercising (hypothesis 1). To examine this, the General Linear Model (GLM) was used to determine whether there was a significant change in anxiety between time 1 and time 2. The data were tested for the assumption of sphericity using Mauchly's Test for Sphericity, and were found to be in violation of that assumption. To correct for degrees of freedom, the Huynh-Feldt estimate of sphericity was used (Tabachnick & Fidell, 2007).

A repeated measures analysis of state anxiety scores prior to and after each of the conditions revealed that there was not a significant change in anxiety across all three groups,  $F(2, 81) = 2.20, p = .117$  (Figure 1). A series of paired samples  $t$  tests was also conducted to compare within group differences. Results indicated that differences within groups were not significant (for all three groups  $p > .05$ ). To evaluate if there was an overall effect of exercise on anxiety both exercise groups were combined and a paired sample  $t$ -test was analyzed. Results indicated that even when both exercise groups were combined, there remained no significant change in anxiety scores from Time 1 to Time 2,  $t(55) = 1.66, p = .101$ .

However, although the overall changes in anxiety scores were not significant, a one way ANOVA looking at group differences over time revealed that there was in fact a significant difference between the anxiety change scores of the three groups at time two  $F(2, 79) = 6.172, p = .003$  (Figure 2). The mean difference scores and SD for each group were: (1) Exercise,  $M = -.89, SD = 3.64$  (2) Quiet Rest,  $M = 1.92, SD = 8.08$ , (3) No Expectancy,  $M = -.93, SD = 4.59$ . Planned analysis comparisons revealed that the difference between the exercise group (which experienced a decrease in anxiety scores) and the quiet rest group (which experienced an increase in anxiety) was significant  $t(79) = 2.977, p = .004, \eta^2 = .81$ . Furthermore, the difference between the no expectancy exercise group (which experienced a decrease in anxiety scores) and the quiet rest condition was also found to be significant  $t(79) = 3.137, p = .002, \eta^2 = .82$ . However, the difference between the exercise group and the no-expectancy exercise group was not found to be statistically significant,  $t(79) = -.27, p = .788, \eta^2 = .08$ .

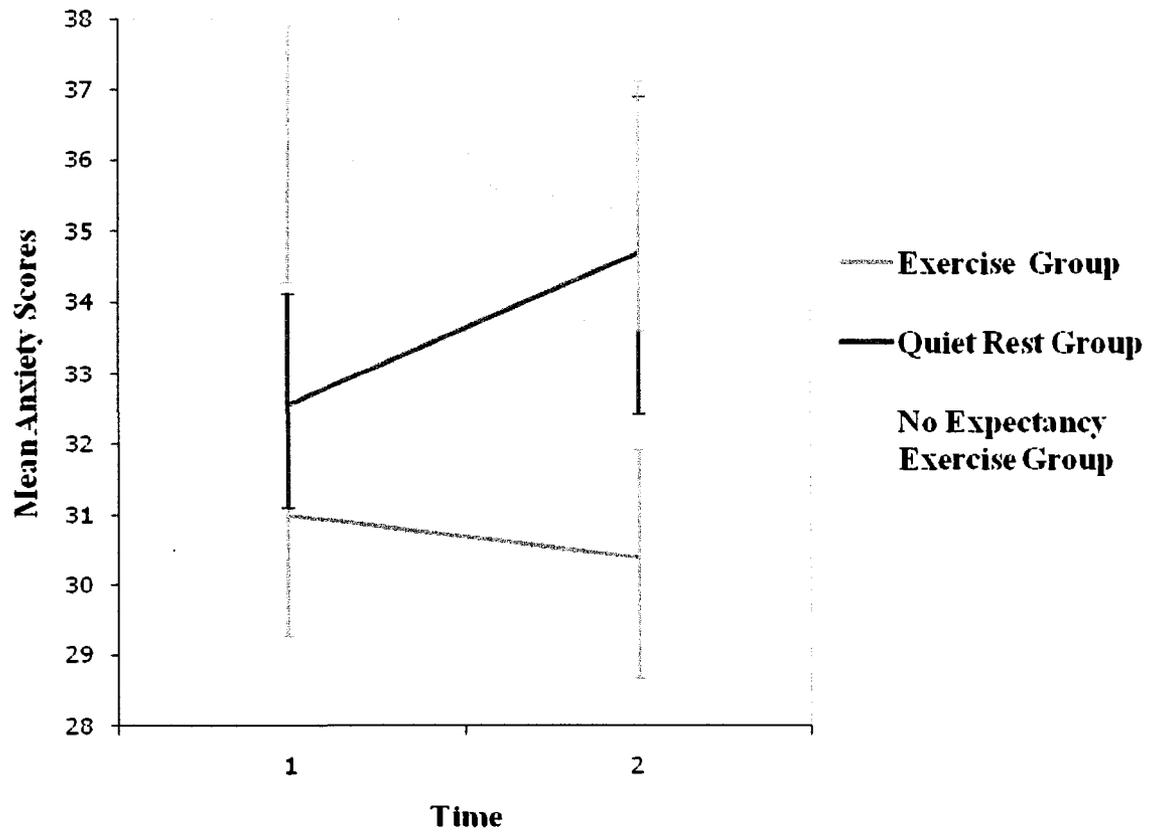


Figure 1. Changes in state anxiety scores of each experimental group from Time 1 (after anxiety induction), to Time 2 (after experimental condition).

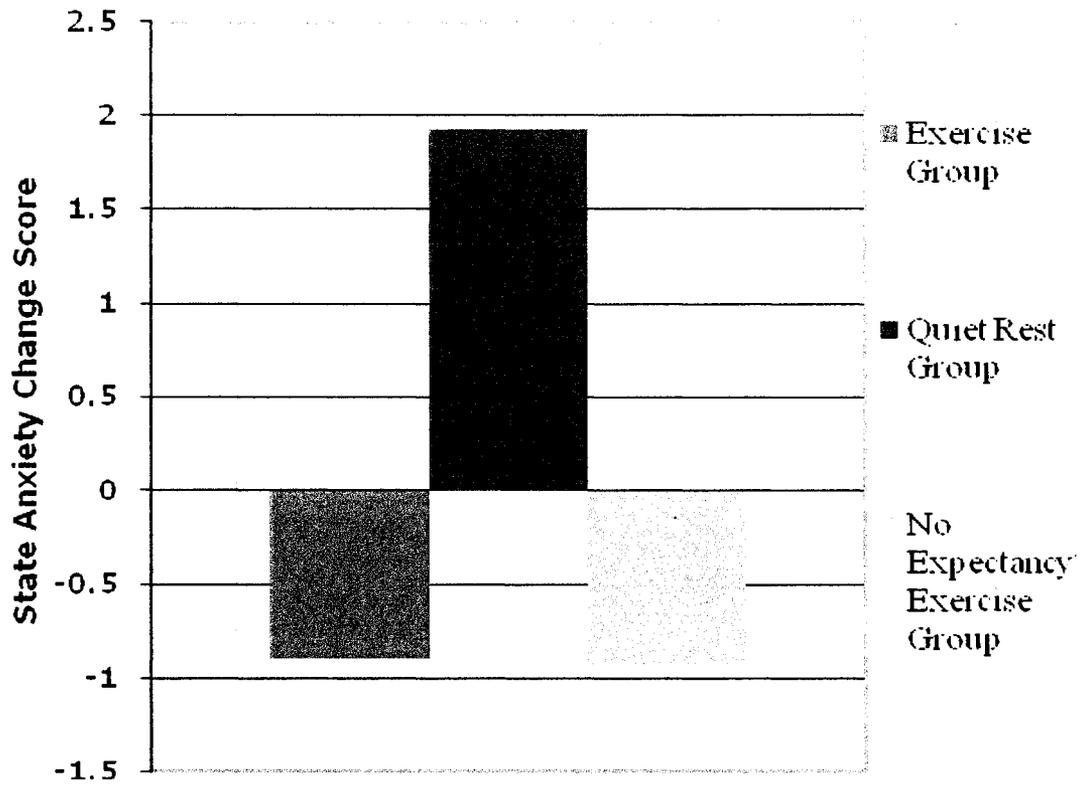


Figure 2. Mean change in state anxiety scores of each experimental group.

Contrary to the expected results that the anxiety inducing script would increase anxiety, overall anxiety did not significantly change from baseline measures,  $F(2, 81) = 1.38, p = .25, \eta^2 = .18$ . In general, anxiety actually decreased, with a mean anxiety score at baseline of 34.66 (SD = 9.87), and a mean anxiety score at Time 1 of 33.76 (SD = 8.48).

When asked to indicate on a Visual Analogue Scale (VAS), how much time the participant actually spent thinking about the test, results indicated that the differences between all three groups were not significant  $F(2, 81) = 2.50, p = .107$ . The mean percentage of time spent thinking about the test by the exercise group and the quiet rest group was 55.19 (SD = 21.76), and 57.67 (SD = 21.71), respectively. While the mean percentage of time spent thinking about the test in the no-expectancy group was slightly lower with a mean of 46.02 (SD = 21.35). When asked to write down what types of things were thought about other than the test, participants indicated a wide range of both externally and internally driven thoughts. External thoughts were considered to be any thought related to the senses and were triggered by external stimuli. These thoughts included hearing things, such as a car or helicopter, seeing things, such as a deer or another person, and so on. Internal thoughts were considered to be any thoughts that were derived from thoughts unrelated to the five senses or external stimuli. These thoughts included, thinking about a homework assignment, friends, planned activities for later and so on. The quality of thoughts unrelated to the test were similar across all groups.

### Discussion

The purpose of the present study was to add to the existing literature on the anxiolytic effects of mild exercise, and primarily to investigate the role of expectancy in

the reduction of state anxiety through exercise. In the past, studies have been concerned with examining other possible mechanisms to explain the anxiety reducing effects of exercise. However, there is a dearth of research that has attempted to study the effects of expectancy of benefits from exercise on anxiety reduction.

Consistent with findings by Stathopoulou, Powers, Berry, Smits, and Otto (2006), it was predicted that exercising by walking at a moderate pace for 10 minutes would lead to a significant decrease in state anxiety as measured by the State Anxiety Inventory (STAI Form Y-1). However, this study found that walking at a moderate pace for 10 minutes did not result in a significant decrease in state anxiety. Nevertheless, there are plausible explanations for the lack of change in state anxiety that may reveal why this discrepancy exists.

Analyses indicated that state anxiety remained relatively constant, and quite low, from the baseline measure of state anxiety to Time 1 for all three groups. Scores on the State Anxiety Inventory can range from a score of 20 to a score of 80, with higher scores indicating a greater degree of anxiety. At baseline, the mean anxiety score for all participants was 34.66 (SD = 9.87). At time 1 (after the anxiety inducing instructions), the average score for all participants was 33.76 (SD = 8.48). The change in anxiety was not significant and indicated that anxiety may have actually decreased slightly between baseline and after the anxiety inducing instructions. The low level of state anxiety experienced by all participants prior to their assigned conditions may have contributed to the finding that anxiety did not change significantly overall for participants in the exercise conditions. Since anxiety levels were not relatively higher after anxiety induction, it was more difficult to measure a decrease in state anxiety. Essentially, the

already low levels of state anxiety indicated prior to the assignment to the conditions left little room for improvement (i.e., a floor effect). Furthermore, it was expected that those in the control group would experience an increase in anxiety during quiet rest since thinking about the intelligence test (and its implications for negative evaluation etc.) for 10 minutes may have led to rumination and worry.

Anxiety induction can be achieved through a passive activity such as watching a stressful film or reading statements with threatening content (Nuevo, Cabrera, Marquez-Gonzalez, & Montorio, 2008), or through active means such as having to give a speech (Phillips & Giancola, 2008; Talbot, Dugas & Ladouceur, 1997), perform a task or complete a test (Zeidner, 1998). When giving a test or task designed to induce anxiety the literature highlights three main components which must be stressed: (i) the time limited nature of the task, (ii) the fact that the test/task is a measure of intelligence, and (iii) the importance of doing well (Zeidner, 1998; Deffenbacher & Hazaleus, 1985).

Although the anxiety inducing instructional set for this study included all three of these points, there are many reasons why the instructions may not have been a sufficient mechanism to induce anxiety in participants. First, given that participants in this study were primarily university students, they may have felt quite comfortable with test taking. As a result, participants may have been inured to anxiety inducing information such as being negatively compared with others, or that they would only have a brief amount of time to complete the test. Additionally, since the anxiety inducing instructional set was quite brief and because participants were not given much information regarding the test itself (i.e., number or type of questions), it is possible that state anxiety did not increase because there was insufficient information with which to focus on. Thirdly, the perceived

negative consequences (i.e., being negatively compared with others) may not have had the desired result of increasing state anxiety since it may have been less anxiety inducing than consequences from more important tests (i.e., exams etc.) in which a poor result has much greater negative implications (i.e., failing a course) than being negatively compared with others. Finally, since anxiety was measured at baseline but not immediately prior to anxiety induction, there is no way of knowing whether or not anxiety did in fact increase due to the instructional set. For example, a participant may have obtained a score of 45 at baseline and then (in the intervening time between baseline and actual experiment) experienced a drop in anxiety that would reflect a score of 25. If after the instructional set, the obtained state anxiety score were 44, it would seem as if anxiety decreased even though it had actually increased significantly.

It is quite conceivable that recruiting participants who are not accustomed to taking tests or individuals with test taking anxiety would result in a higher level of state anxiety. Furthermore, providing participants with more information about the difficulty of the test or increasing the perceived negative consequences of the test may also have increased state anxiety. If these factors were in fact able to increase state anxiety, a greater reduction in state anxiety may have been seen. In addition, utilizing a different mode of anxiety induction such as watching a stressful film or giving a speech may be an effective method for inducing anxiety in this type of research.

Participants were also instructed to spend the entirety of the group condition thinking about the test that they would be completing at the termination of the ten minutes. This was utilized in order to help control for distraction. By thinking about the upcoming test, it was expected that participants would not be distracted by other

external/internal stimuli which may influence the change in anxiety. This is relevant to the quiet rest group since anxiety was expected to increase as they sat and ruminated about the upcoming test. It is likely that their other thoughts, which comprised almost half of the ten-minute condition, prevented them from becoming increasingly anxious about the upcoming test since it was not in the forefront of their thoughts. Conversely, participants in both exercise conditions reported thinking only about the test for approximately half of the allotted time. The fact that participants from both groups thought about other things for approximately half the time may initially seem to indicate that distraction, and not exercise may be responsible for any decreases in state anxiety.

However, it should be noted that the quiet rest group, which reported similar levels and quality of distraction, experienced an increase in anxiety rather than a decrease. Therefore, if distraction was the primary component in anxiety reduction, the similarities in types of distractions and amount of distraction across all groups would indicate that the change in anxiety would also be alike. Future studies may prevent distraction by potentially having the participant hold a copy of the test or by giving participants a sample problem to work through during the exercise and quiet rest conditions.

Both the exercise group and the no-expectancy exercise group experienced a slight decrease in state anxiety while the quiet rest group experienced a slight increase in state anxiety. Planned comparison analyses indicated that the anxiety change scores for the exercise conditions and the control condition were significantly different. However, the differences between the exercise condition and the expectancy condition were not significant. As illustrated in Figure 2, which indicates the change in anxiety scores for the

three groups, the supposition that individuals who exercise experience a greater reduction in anxiety than those who do not, regardless of expectancy is supported. Although group changes in state anxiety were not significant, the results provide support for the assertion that exercise does indeed have an anxiolytic effect and this effect is not a result of a placebo-like reaction. The finding that both the exercise group, and the no expectancy group experienced decreases in state anxiety that were significantly different than the increase experienced by the quiet rest group, indicates that being aware of the fact that one is exercising rather than not expecting that one is exercising does not seem to influence the anxiolytic effects of exercise at moderate levels of exercise.

This preliminary study examining the effects of expectancy of exercise on state anxiety reduction provides some degree of support for the hypothesis that expectancy does not play a role in the anxiolytic effects of exercise. However, it is difficult to make certain conclusions due to the overall lack of change in anxiety as well as the difficulty in controlling the expectations of participants by having them exercise without being aware (Ojanen, 1994). At the completion of a no-expectancy trial, one participant asked if they actually were in an exercise condition. It is possible that other participants in the no-expectancy group were equally as perceptive as this individual but did not raise any questions. If this is the case, then perhaps the change in anxiety experienced by these individuals was similar to the exercise group based solely on the activity of walking and not on expectancy.

In addition to those discussed above, other possible limitations of this study include the lack of increase in anxiety due to induction, the distraction of individuals during the experimental conditions, and the difficulty in controlling for the expectancy of

participants. By utilizing different anxiety inductions or timing data collection to coincide with conditions that naturally result in increased anxiety (i.e., during mid terms, final exams, or prior to a work related presentation or evaluations) a larger change in anxiety may be observed. Alternately, recruiting individuals who are naturally test anxious may result in changes in state anxiety that are significant and thus provide more support with which to draw conclusions.

In order to create a no-expectancy exercise group, this study informed participants that they would not be exercising and then walked them from one end of a university campus to another. Unfortunately, this environment could not feasibly be a closed environment and as a result, there were many possible distractions as previously noted. Furthermore, to ensure the groups were matched as closely as possible, the exercise group also exercised outside by walking. It is possible that many individuals will not have felt that this was truly indicative of exercising. Although low levels of exercise have shown to decrease anxiety (Ekkekakis & Petruzzello, 1999; Petruzzello, Landers, Hatfield, Kubitz & Salazar, 1991), the majority of these studies used exercise apparatus such as treadmills or exercise bikes. These devices may have caused participants to have greater expectations about their level of exercise activity. In subsequent studies, measures of perceived effort may provide some insight into how much an individual felt they had exercised, which could then be compared to the no-expectancy group. Furthermore, studies evaluating expectancy with regards to exercise that is much more effortful may produce different results since expectancy may be higher for exercising at higher levels than lower levels. With creativity and closed environments, it may be possible to increase the level of exercise in participants (i.e., running from one room to another), while still

controlling for expectancy. Studies conducted in this way may be able to provide more conclusive answers concerning the active ingredient (or combination of factors) which contributes to the anxiolytic effect of exercise.

## References

- American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (4<sup>th</sup> ed., test revision). Washington, DC: American Psychiatric Association.
- Bahrke, M.S. & Morgan, W.P. (1978). Anxiety reduction following exercise and meditation. *Cognitive Therapy and Research*, 2(4), 323-333.
- Bartholomew, J.B. & Linder, D.E. (1998). State anxiety following resistance exercise: The role of gender and exercise intensity. *Journal of Behavioral Medicine*, 21(2), 205-219.
- Berger, B.G., & Motl, R.W. (2000). Exercise and mood: A selective review and synthesis of research employing the Profile of Mood States. *Journal of Applied Sport Psychology*, 12, 69-92.
- Blumenthal, J.A., Babyak, M.A., Doraiswamy, P.M., Watkins, L., Hoffman, B.M., Barbour, K.A. et al. (2007). Exercise and Pharmacotherapy in the treatment of major depressive disorder. *Psychosomatic Medicine*, 69, 587-596.
- Bouix, O., Najimi, A. & Orsetti, A. (1997). Involvement and physiological roles of endogenous opioid peptides in adaptation to physical exercise. *Science and Sports*, 12(1), 26-40.
- Boutcher, S. H., & Landers, D. M. (1988). The effects of vigorous exercise on anxiety, heart rate, and alpha activity of runners and nonrunners. The effects of vigorous exercise on anxiety, heart rate, and alpha activity of runners and nonrunners. *Psychophysiology*, 25, 696-702.
- Brannon, L. & Feist, J. (2000). Health psychology: An introduction to behaviour and

health 4<sup>th</sup> ed. California: Wadsworth.

- Breus, M.J. & O'Connor, P.J. (1998). Exercise-induced anxiolysis: a test of the "time out" hypothesis in high anxious females. *Medicine and Science in Sports and Exercise*, 30(7), 1107-1112.
- Broman-Fulks, J.J., Berman, M.E., Rabian, B.A. & Webster, M.J. (2004). Effects of aerobic exercise on anxiety sensitivity. *Behaviour Research and Therapy*, 42, 125-136.
- Broocks, A., Bandelow, B., Pekrun, G., George, A., Meyer, T., Bartmann, U., et al. (1998). Comparison of aerobic exercise, clomipramine, and placebo in the treatment of panic disorder. *American Journal of Psychiatry*, 155(5), 603-609.
- Butler, A.C., Chapman, J.E., Forman, E.M. & Beck, A.T. (2006). The empirical status of cognitive-behavioral therapy: A review of meta-analyses. *Clinical Psychology Review*, 26(1), 17-31.
- Callaghan, P. (2004). Exercise: a neglected intervention in mental health care? *Journal of Psychiatric and Mental Health Nursing*, 11, 476-483.
- Canadian Fitness and Lifestyle Research Institute (2005). Physical activity among Canadians: The current situation. Retrieved July 28, 2007, from [http://www.cflri.ca/eng/statistics/surveys/documents/pam2005\\_sec1.pdf](http://www.cflri.ca/eng/statistics/surveys/documents/pam2005_sec1.pdf)
- Canadian Mental Health Association (n.d.). Get physical. Retrieved February 13, 2008, from [http://www.cmha.ca/bins/content\\_page.asp?cid=2-267-1320-1321&lang=1](http://www.cmha.ca/bins/content_page.asp?cid=2-267-1320-1321&lang=1)
- Daley, A.J. & Maynard, I.W. (2002). Preferred exercise mode and affective responses in physically active adults. *Psychology of Sport and Exercise*, 4, 347-356.
- Deffenbacher, J.L. & Hazaleus, S.L. (1985). Cognitive, emotional, and physiological

- components of test anxiety. *Cognitive Therapy and Research*, 9(2), 169-180.
- deVries, H.A. (1981). Tranquilizer effect of exercise: A critical review. *Physician and Sports Medicine*, 9(11), 46-55.
- Dilorenzo, T.M., Bargman, E.P., Stucky-Ropp, R., Brassington, G.S., Frensch, P.A., LaFontaine, T. (1999). Long-Term effects of Aerobic exercise on psychological outcomes. *Preventative Medicine*, 28(1), 75-85.
- Driessen, M., Meier, S., Hill, A., Wetterling, T., Lange, W., & Junghanns, K. (2001). The course of anxiety, depression and drinking behaviours after completed detoxification in alcoholics with and without comorbid anxiety and depressive disorders. *Alcohol and Alcoholism*, 36(3), 249-255.
- Ehlers, C.L., Frank, E. & Kupfer, D.J. (1988). Social zeitgebers and biological rhythms. *Archives of General Psychiatry*, 45(10), 948-952.
- Ekkekakis, P., Hall, E.E., VanLanduyt, L.M., & Petruzzello, S.J. (2000). Walking in (affective) circles: Can short walks enhance affect? *Journal of Behavioural Medicine*, 23(3), 245-275.
- Ekkekakis, P. & Petruzzello, S.J. (1999). Acute aerobic exercise and affect: Current status, problems and prospects regarding dose-response. *Sports Medicine*, 28(5), 337-374.
- Golden, R.N. (2004). Making advances where it matters: Improving outcomes in mood and anxiety disorders. *CNS Spectrums*, 9(6), 14-22.
- Goodwin, R.D. (2003). Association between physical activity and mental disorders among adults in the United States. *Preventative Medicine*, 36, 698-703.
- Gould, R.A., Buckminster, S., Pollack, M.H., Otto, M.W. & Yap, L. (1997). Cognitive-

behavioral and pharmacological treatment for social phobia: A meta-analysis.

*Clinical Psychology Science and Practice*, 4(4), 291-306.

Grandin, L.D., Alloy, L.B. & Abramson, L.Y. (2006). The social zeitgeber theory, circadian rhythms, and mood disorders: review and evaluation. *Clinical Psychology Review*, 26(6), 679-694.

Griffin, J.C. (2006). Client-centered exercise prescription 2<sup>nd</sup> ed. Illinois: Human Kinetics.

Gros, D.F., Antony, M.M., Simms, L.J. & McCabe, R.E. (2007). Psychometric properties of the State-Trait Inventory for cognitive and somatic anxiety (STICSA): Comparison to the State-Trait Anxiety Inventory (STAI). *Psychological Assessment*, 19(4), 369-381.

Hall, E.E., Ekkekakis, P. & Petruzzello, S.J. (2002). The affective beneficence of vigorous exercise revisited. *British Journal of Health Psychology*, 7, 47-66.

Hale, B.S., Koch, K.R., & Raglin, J.S. (2002). State anxiety responses to 60 minutes of cross training. *British Journal of Sports Medicine*, 36(2), 105-107.

Hall, N.R. & Crisp, R.J. (2003). Anxiety-Induced response perseverence and stereotyping change. *Current Research in Social Psychology*, 8(17), 242-253.

Hansen, C.J., Stevens, L.C., & Coast, J.R. (2001). Exercise duration and mood state: How much is enough to feel better? *Health Psychology* 20(4), 267-275.

Hassmen, P., Koivula, N., & Uutela, A. (2000). Physical exercise and psychological well-being: A population study in Finland. *Preventive Medicine*, 30(1), 17-25.

Hunot V, Churchill R, Teixeira V, Silva de Lima M. (2008). Psychological therapies for

generalised anxiety disorder (Review). *Cochrane Database of Systematic Reviews*, Issue 1.

Jamison, R.N., Parris, W.C., Mayor, W.S. (1987). Psychological factors influencing recovery from outpatient surgery. *Behaviour Research and Therapy*, 25(1), 31-37.

Koltyn, K.F. & Morgan, W.P. (1992). Influence of underwater exercise on anxiety and body temperature. *Scandinavian Journal of Medicine & Science in Sports*, 2(4), 249-253.

Landers, D.M. (1999). The influence of exercise on mental health. In: C.B. Corbin & R.P. Pangrazi (Eds.), *Toward a Better Understanding of Physical Fitness & Activity*, Scottsdale, AZ: Holcomb Hathaway.

Long, B.C., & van Stavel, R. (1995). Effects of exercise training on anxiety: A meta-analysis. *Journal of Applied Sport Psychology*, 7(2), 167-189.

Lox, C.L., Martin, K.A. & Petruzzello, S.J. (2003). *The psychology of exercise: integrating theory and practice*. Arizona: Holcomb Hathaway.

Martinsen, E.W. (2005). Exercise and Depression. *International Journal of Sport and Exercise Psychology*, 3(4), 469-483.

Marakia, M., Tsofliou, F., Pitsiladis, Y.P., Malkova, D., Mutrie, N. & Higgins, S. (2005). Acute effects of a single exercise class on appetite, energy intake and mood. Is there a time of day effect? *Appetite*, 45(3), 272-278.

McEntee, D.J. (1995). *Cognitive group therapy and exercise in the treatment of anxiety and stress*. Boston: University of Massachusetts.

Mellman, T.A. (2006). Sleep and anxiety disorders. *Psychiatric Clinics of North America*, 29(4), 1047-1058.

- Meyer, T., & Brooks, A. (2000). Therapeutic impact of exercise on psychiatric diseases: Guidelines for exercise testing and prescription. *Sports Medicine*, 30(4), 269-279.
- Morgan, W.P. (1985). Affective beneficence of vigorous physical activity. *Medicine & Science in Sports & Exercise*, 17(1), 94-100.
- Mueller, P. J. (2007). Exercise training and sympathetic nervous system activity: Evidence for physical activity dependent neural plasticity. *Clinical and Experimental Pharmacology and Physiology* 34(4), 377-384.
- Nabetani, T. & Tokunaga, M. (2001). The effect of short-term (10- and 15-min) running at self-selected intensity on mood alteration. *Journal of Physiological Anthropology*, 20(4), 233-239.
- National Library of Medicine (2008). Retrieved February 10, 2008, from <http://www.nlm.nih.gov/nichsr/hta101/ta101014.html>
- Nierenberg, A.A., Katz, J. & Faya, M. (2007). A critical overview of the pharmacological management of treatment-resistant depression. *Psychiatric Clinics of North America*, 30(1), 13-29.
- Nuevo, R., Cabrera, I, Marquez-Gonzalez, M. & Montorio, I. (2008). Comparison of two group application procedures designed to induce anxiety. *Annals of Psychology*, 24(1), 106-114.
- O'Connor, P.J. (2005). State anxiety is reduced after maximal, and submaximal exercise among people with panic disorder. *International Journal of Sport and Exercise Psychology*, 3(4), 501-508.
- O'Connor, P.J., Raglin, J.S., & Martinsen, E.W. (2000). Physical activity, anxiety, and anxiety disorders. *International Journal of Sport Psychology*, 31, 136-155.

- Ojanen, M. (1994). Can the true effects of exercise on psychological variables be separated from placebo effects? *International Journal of Sport Psychology*, 25(1), 63-80.
- Otto, M.W., Church, T.S., Craft, L.L., Smits, J.A.J., & Trivedi, M.H. (2007). Exercise for mood and anxiety disorders. *Journal of Clinical Psychiatry*, 9(4), 287-294.
- Paffenbarger, R. S., Jr., & Hyde, R. T. (1988). Exercise adherence, coronary heart disease and longevity. In R. K. Dishman (Ed.), *Exercise adherence: Its impact on public health* (pp. 41–73.). Champaign, IL: Human Kinetics Books.
- Palakanis, K.C., DeNobile, J.W., Sweeney, W.B. & Blankenship, C.L. (1994). Effect of music therapy on state anxiety in patients undergoing flexible sigmoidoscopy. *Diseases of the Colon and Rectum*, 37(5), 478-481.
- Palleschi, L., De Gennaro, E., Sottosanti, G., Vetta, F., Ronzoni, S., Lato, P.F.A. et al. (1998). The role of exercise training in aged subjects with anxiety-depression syndrome. *Archives of Gerontology and Geriatrics*, 6, 381-384.
- Patterson, C.H., (1985). What is the *placebo* in psychotherapy? *Psychotherapy: Theory, Research, Practice, Training*, 22(2), 163-169.
- Petruzzello, S.J. (1995). Anxiety reduction following exercise: Methodological artifact or “real” phenomenon? *Journal of Sport & Exercise Psychology*, 17, 105-111.
- Petruzzello, S.J. (1995). Does physical exercise reduce anxious emotions? A reply to W. Schlicht’s meta-analysis. *Anxiety, Stress & Coping: An International Journal*, 8(4), 353-356.
- Petruzzello, S.J., Landers, D.M., Hatfield, B.D., Kubitz, K.A., & Salazar, W. (1991). A

- meta-analysis on the anxiety reducing effects of acute and chronic exercise: Outcomes and mechanisms. *Sports Medicine*, 11, 143-182.
- Petruzzello, S.J., Landers, D.M. & Salazar, W. (1993). Exercise and anxiety reduction: Examination of temperature as an explanation for affective change. *Journal of Sport & Exercise Psychology*, 15, 63-76.
- Phillips, J.P. & Giancola, P.R. (2008). Experimentally induced anxiety attenuates alcohol-related aggression in men. *Experimental and Clinical Psychopharmacology*. 16(1), 43-56.
- Praet, S.F.E., & van Loon, L.J.C. (2007). Optimizing the therapeutic benefits of exercise in type 2 diabetes. *Journal of Applied Physiology*, 103(4), 1113-1120.
- Public Health Agency of Canada (2002). A report on mental illnesses in Canada. Retrieved January 10, 2008, from [http://www.phac-aspc.gc.ca/publicat/miic-mmacc/pref\\_e.html](http://www.phac-aspc.gc.ca/publicat/miic-mmacc/pref_e.html)
- Raglin, J.S. & Morgan, W.P. (1985). Influence of vigorous exercise on mood state. *Behaviour Therapist*, 8, 179-183.
- Raglin, J.S. & Morgan, W.P. (1987). Influence of exercise and quiet rest on state anxiety and blood-pressure. *Medicine and Science in Sports and Exercise*, 19(5), 456-463.
- Ransford, C.P. (1982). A role for amines in the anti-depressant effect of exercise –A review. *Medicine and Science in Sports and Exercise*, 14(1), 1-10.
- Rapee, R., Craske, M., Meadows, E., Moras, K., Zinbarg, R. & Barlow, D. (1991). The causes of anxiety, panic attacks, and agoraphobia. *Center for Stress and Anxiety Disorders Phobia and Anxiety Disorders Clinic*.
- Rector, N.A., Bourdeau, D., Kitchen, K. & Joseph-Massiah, L. (2005). Anxiety disorders:

An information guide. *Toronto: Centre for Addiction and Mental Health.*

- Reed, J., & Ones, D.S. (2006). The effect of acute aerobic exercise on positive activated affect: A meta-analysis. *Psychology of Sport and Exercise, 7*, 477-514.
- Rejeski, J.W., Hardy, C.J. & Shaw, J. (1991). Psychometric confounds of assessing state anxiety in conjunction with acute bouts of vigorous exercise. *Journal of Sport and Exercise Psychology, 13(1)*, 65-74.
- Richards, Meghan A. (2006) Polymorphic regions of the estrogen receptor, androgen receptor and serotonin transporter genes and their association with mood variability in young women. M.A. dissertation, Lakehead University (Canada), Canada. Retrieved January 15, 2009, from Dissertations & Theses: Full Text database. (Publication No. AAT MR21539).
- Robinson, L.A., Berman, J.S. & Neimeyer, R.A. (1990). Psychotherapy for the treatment of depression: A comprehensive review of controlled outcome research. *Psychological Bulletin, 108(1)*, 30-49.
- Rosenberg, K.P., Bleiberg, K.L., Koscis, J. & Gross, C. (2003). A survey of sexual side effects among severely mentally ill patients taking psychotropic medications: Impact on compliance. *Journal of Sex & Marital Therapy, 29(4)*, 289-296.
- Rudolph, D.L. & Butki, B.D. (1998). Self-efficacy and affective responses to short bouts of exercise. *Journal of Applied Sport Psychology, 10*, 268-280.
- Salmon, P. (2001). Effects of physical exercise on anxiety, depression, and sensitivity to stress: A unifying theory. *Clinical Psychology Review, 21(1)*, 33-61.
- Schlicht, W. (1994). Does physical exercise reduce anxious emotions? A meta-analysis. *Anxiety Stress and Coping: An International Journal, 6(4)*, 275-288.

- Schmitz, N., Kruse, J., & Kugler, J. (2004). The association between physical exercises and health-related quality of life in subjects with mental disorders: results from a cross-sectional survey. *Preventative Medicine, 39*, 1200-1207.
- Schuurmans, J., Comijs, H., Emmelkamp, P.M.G., Gundy, C.M.M., Weijnen, I., Van Den Hout, M. et al. (2006). A randomized, controlled trial of the effectiveness of cognitive-behavioural therapy and sertraline versus a waitlist control group for anxiety disorders in older adults. *American Journal of Geriatric Psychiatry, 14*(3), 255-263.
- Schwartz, T.L., Nasra, G.S., Ashton, A.K., Kang, D., Kumaresan, H., Chilton, M. et al. (2007). An open-label study to evaluate switching from an SSRI or SNRI to tiagabine to alleviate antidepressant-induced sexual dysfunction in generalized anxiety disorder. *Annals of Clinical Psychiatry, 19*(1), 25-30.
- Sengupta, J. & Johar, G.V. (1999). Contingent effects of anxiety on message elaboration and persuasion. Hong Kong: University of Science and Technology.
- Seraganian, P. (Ed.). (1993). Exercise psychology: The influence of physical exercise on psychological processes. New York, NY: John Wiley & Sons Inc.
- Seto, M.C. (1992). A review of anxiety and sexual arousal in human sexual dysfunction. *Annals of Sex Research, 5*(1), 33-43.
- Sime, W.E. (1984). Psychological benefits of exercise training in the healthy individual. 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.
- Singh, N.A., Clements, K.M. & Fiatarone, M.A. (1997). A randomized controlled trial of

- the effect of exercise on sleep. *Journal of Sleep Research & Sleep Medicine*, 20(2), 95-101.
- Solomon, R.L. (1980). The opponent-process theory of acquired motivation: The costs of pleasure and the benefits of pain. *American Psychologist*, 35(8), 691-712.
- Spielberger, C.D. (1983). State-Trait anxiety inventory (Form Y). California: Mind Garden.
- Spielberger, C.D., Lushene, R.E. & McAdoo, W.G. (1977). Theory and measurement of anxiety states. In R.B. Cattell & R.M. Dreger (Eds.), *Handbook of modern personality theory* (pp. 239-253). New York: John Wiley & Sons.
- Stathopoulou, G., Powers, M.B., Berry, A.C., Smits, J.A.J. & Otto, M.W. (2006). Exercise interventions for mental health: A quantitative and qualitative review. *Clinical Psychology: Science and Practice*, 13, 179-193.
- Steptoe, A. & Cox, S. (1988). Acute effects of aerobic exercise on mood. *Health Psychology*, 7(4), 329-340.
- Swain, D.P., & Franklin, B.A. (2006). Comparison of cardioprotective benefits of vigorous versus moderate intensity aerobic exercise. *The American Journal of Cardiology*, 97(1), 141-147.
- Szabo, A. (2003). The acute effects of humor and exercise on mood and anxiety. *Journal of Leisure Research*, 35(2), 152-162.
- Tabachnick, B.G. & Fidell, L.S. (2001) *Using multivariate statistics (4<sup>th</sup> Ed.)* Boston: Allyn & Bacon.
- Talbot, F., Dugas, M. J., & Ladouceur, R. (1997). Anxiety induction with the Public

- Speaking Procedure (PSP): Efficacy and specificity. *Association for Advancement of Behavior Therapy*, Miami Beach, Florida.
- Thoren, P., Floras, J.S., Hoffmann, P. & Seals, D.R. (1990). Endorphins and exercise – Physiological mechanisms and clinical implications. *Medicine and Science in Sports and Exercise*, 22(4), 417-428.
- Thornton, E.W., Sykes, K.S. & Tang, W.K. (2004). Health benefits of Tai Chi exercise: improved balance and blood pressure in middle-aged women. *Health Promotion International*, 19(1), 33-38.
- Tieman, J.G., Peacock, L.J., Cureton, K.J. & Dishman, R.K. (2002). The influence of exercise intensity and physical activity history on state anxiety after exercise. *International Journal of Sport Psychology*, 33, 155-166.
- Ustün, T.B., Ayuso-Mateos J.L., Chatterji, S., Mathers, C. & Murray, C.J. (2004). Global burden of depressive disorders in the year 2000. *British Journal of Psychiatry*, 184, 386-392.
- Vandenberg, S.G. (1971). *Mental Rotations Test*. Boulder Colorado: Institute for Behavioural Genetics.
- Vein, A.M., Dallakyan, I.G., Levin, Y.I. & Skakun, K.E. (1983). Physiological and psychological consequences of single sleep deprivation. *Human Physiology*, 8(6), 392-396.
- Wewers M.E. & Lowe N.K. (1990). A critical review of visual analogue scales in the measurement of clinical phenomena. *Research in Nursing and Health*, 13, 227-236.
- Wininger, S.R. (2007). Improvement of affect following exercise: Methodological

artifact or real finding? *Anxiety, Stress & Coping*, 20(1), 93-102.

Wipfli, B.M., Rethorst, C.D. & Landers, D.M. (2008). The anxiolytic effects of exercise: A meta-analysis of randomized trials and dose-response analysis. *Journal of Sport & Exercise Psychology*, 30(4), 392-410.

Youngstedt, S.D., O'Connor, P.J. & Crabbe, J.B. & Dishman, R.K. (1998). Acute exercise reduces caffeine-induced anxiogenesis. *Medicine and Science in Sports and Exercise*, 30(5), 740-745.

Appendix A

Participant Information Form/Consent Form

Cover letter

Dear Participant:

Thank you for taking part in this research study investigating the effect of exercise on people's test taking abilities. This study is being conducted by Thomas Newman, an MA Psychology graduate student at Lakehead University and is supervised by Dr. Peter Voros, C. Psych. from the department of psychology at Lakehead University.

The primary purpose of this study is to determine if exercising with another individual improves one's mental functioning, concentration, and ability in test taking situations. You will be randomly assigned to one of two possible groups, either an exercise group or a quiet rest group. Participants in the exercise group will exercise at a mild-moderate pace for 10 minutes. Participants in the quiet rest group will sit quietly for 10 minutes.

Your participation requires one visit lasting approximately 20-30 minutes. You are asked to wear appropriate footwear for exercising (i.e. cross trainers) and comfortable clothing appropriate for the weather. During your session you will be asked to fill out several short questionnaires and participate in one of the two conditions. You will also be asked to complete a short test of intelligence. To compensate participants for their time, all participants will be entered in a draw to win a \$50.00 gift certificate for The Keg Restaurant.

Although minimal in nature, there are some risks associated with this study. First, some individuals may not feel comfortable or be able to exercise at a moderate pace for 10 minutes. In addition, because this study is evaluating test taking abilities, some participants may experience some stress associated with completing a test.

This research project has been approved by the Lakehead University Senate Research Ethics Board. Only Dr. Voros and I will have access to the information you provide. Any information that is obtained in connection with this study, and that can be identified with you, will remain confidential and will only be published as composite data. Your responses to questionnaires will not be identified by your name. The data you supply will only be identified by number. When the study is completed, all data will be securely stored for seven years. A summary of findings will be available to those interested via e-mail.

Participation in this research study is voluntary. If for any reason you wish to withdraw from the study, you may do so at any time without penalty. In addition, you are not obligated to answer any question you do not wish to answer. Please do not hesitate to contact me at [tnewman@lakeheadu.ca](mailto:tnewman@lakeheadu.ca) or Dr. Voros (684-6471) should you have any questions or concerns about this study. You may also contact the Lakehead University Research Ethics Board at 343-8283.

Thank you,

Thomas Newman  
M.A. graduate student, Clinical Psychology  
Department of Psychology, Lakehead University

Dr. Peter Voros,  
C. Psych.

Participant Consent Form

My signature on this form indicates that I agree to participate in the study investigating the role of exercise on people's test taking abilities. This study is being conducted by Thomas Newman, in the Department of Psychology, for his Master's thesis under the supervision of Dr. Peter Voros (684-6471). I understand that my participation in this study is conditional on the following:

1. I have read the cover letter and I fully understand what I will be required to do as a participant in the study.
2. I agree to participate in the study.
3. I understand that the associated risks involved in the study are exercising at a moderate pace for 10 minutes, and possible stress associated with completing a test.
4. I am a volunteer and may withdraw from the study, or choose not to answer any question at any time without penalty.
5. My data will remain confidential and will be securely stored for a period of seven years.
6. I will remain anonymous in any publication/public presentation of research findings.
7. I may receive a summary of the project, upon request, following the completion of the project.

\_\_\_\_\_  
Name of Participant (please print)

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Participant

\_\_\_\_\_  
Email Address

Appendix B

Demographic Questionnaire

Screening/Demographic Questionnaire

If you are interested in participating in this research study in the Department of Psychology, please answer the following questions. Participants will be selected based upon the answers they provide to this brief questionnaire.

Name: \_\_\_\_\_ Date of birth: \_\_\_\_\_

Email: \_\_\_\_\_ Phone number: \_\_\_\_\_

How do you prefer to be contacted? Email  Phone

What is your preferred time to be contacted? Day/time \_\_\_\_\_

Gender: Male \_\_\_\_\_ Female \_\_\_\_\_

What is your ethnic background?

Caucasian  South Asian  Hispanic  African-Canadian  European

Native-Canadian  East Asian  Other (please specify): \_\_\_\_\_

Please indicate the highest level of schooling completed:

\_\_\_\_\_

Please circle your answer:

1. Are you or have you ever been diagnosed with, or been treated by a health care provider for any mental health disorder? (i.e. depression, anxiety disorder, schizophrenia)

YES or NO

3. Are you currently taking any prescription medication for a mental health disorder.

YES or NO

4. How many days per week do you get at least 30 minutes of moderate physical activity?

0    1    2    3    4    5    6    7

5. Rate your enjoyment of the following activities on the following scale

- 1 = do not enjoy this type of activity at all
- 2 = very little enjoyment of this type of activity
- 3 = moderate amount of enjoyment for this activity
- 4 = quite a bit of enjoyment for this activity
- 5 = Extremely enjoy this activity

a) Competitive Team Activities (i.e. baseball, hockey, soccer etc.)

1      2      3      4      5

b) Competitive Individual Activities (i.e. tennis, running etc.)

1      2      3      4      5

c) Non Competitive Group Activities (i.e. dancing, group aerobics etc.)

1      2      3      4      5

d) Non Competitive Individual Activities (i.e. gardening, yoga, etc.)

1      2      3      4      5

6. What time of day are you most physically active?

\_\_\_ Morning (i.e. 6am-12pm)

\_\_\_ Afternoon (i.e. 12pm-6pm)

\_\_\_ Evening (i.e. 6pm-12am)

7. How often do you exercise with other people present? (Circle one)

Always   Often   Sometimes   Rarely   Never

Please explain your answer (eg. I prefer the company of others, exercising with others makes me exercise more, I am self conscious when I exercise with others, others cannot keep up to my pace when exercising)

---

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---

---

8. What is your preferred type of test format?

Multiple choice

Fill in the blank

Short Answer

Essay

9. What time of day is your preferred time to study?

Morning (i.e. 6am-12pm)

Afternoon (i.e. 12pm-6pm)

Evening (i.e. 6pm-12am)

10. Please rate where you believe your IQ level to be.

Less than 90 (Below Average)

90-110 (Average)

110-120 (Above Average)

120-130 (Superior Intelligence)

130 or above (Very Superior)

Please answer the next 5 questions using the following scale:

1 = Not at all able

2 = Minimally able

3 = Somewhat able

4 = Very able

5 = Extremely able

11. How strong is the ability of exercise able to improve your mood?

1      2      3      4      5

12. How much is exercise able to increase your ability to concentrate?

1      2      3      4      5

13. When you are feeling sad or depressed, how much is exercise able to make you feel better?

1      2      3      4      5

14. When you are feeling anxious, how much is exercise able to make you feel calm or relaxed?

1      2      3      4      5

15. How much is exercise able to help you think clearly?

1      2      3      4      5

Appendix C

Physical Activity Readiness Questionnaire

Physical Activity Readiness  
Questionnaire - PAR-Q  
(revised 2002)

# PAR-Q & YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

YES	NO	
<input type="checkbox"/>	<input type="checkbox"/>	1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?
<input type="checkbox"/>	<input type="checkbox"/>	2. Do you feel pain in your chest when you do physical activity?
<input type="checkbox"/>	<input type="checkbox"/>	3. In the past month, have you had chest pain when you were not doing physical activity?
<input type="checkbox"/>	<input type="checkbox"/>	4. Do you lose your balance because of dizziness or do you ever lose consciousness?
<input type="checkbox"/>	<input type="checkbox"/>	5. Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity?
<input type="checkbox"/>	<input type="checkbox"/>	6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?
<input type="checkbox"/>	<input type="checkbox"/>	7. Do you know of any other reason why you should not do physical activity?

If  
you  
answered

### YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

### NO to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active — begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal — this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

### DELAY BECOMING MUCH MORE ACTIVE:

- if you are not feeling well because of a temporary illness such as a cold or a fever — wait until you feel better; or
- if you are or may be pregnant — talk to your doctor before you start becoming more active.

**PLEASE NOTE:** If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

**Informed Use of the PAR-Q:** The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

**No changes permitted. You are encouraged to photocopy the PAR-Q but only if you use the entire form.**

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

"I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction."

NAME \_\_\_\_\_

SIGNATURE \_\_\_\_\_

DATE \_\_\_\_\_

SIGNATURE OF PARENT  
or GUARDIAN (for participants under the age of majority) \_\_\_\_\_

WITNESS \_\_\_\_\_

**Note: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.**



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Appendix D

STAI Form Y-1

# SELF-EVALUATION QUESTIONNAIRE

Developed by Charles D. Spielberger  
 in collaboration with  
 R. L. Gorsuch, R. Lushene, P. R. Vagg, and G. A. Jacobs

STAI Form Y-1

Name \_\_\_\_\_ Date \_\_\_\_\_ S \_\_\_\_  
 Age \_\_\_\_\_ Sex: M \_\_\_\_ F \_\_\_\_ T \_\_\_\_

**DIRECTIONS:** A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you feel *right now*, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

VERY MUCH SO  
 MODERATELY SO  
 SOMEWHAT  
 NOT AT ALL

- |  |   |   |   |
|--|---|---|---|
| 1. I feel calm .....                                       | ① | ② | ③ |
| 2. I feel secure .....                                     | ① | ② | ③ |
| 3. I am tense .....  | ① | ② | ③ |
| 4. I feel strained .....                                   | ① | ② | ③ |
| 5. I feel at ease .....                                    | ① | ② | ③ |
| 6. I feel upset .....                                      | ① | ② | ③ |
| 7. I am presently worrying over possible misfortunes ..... | ① | ② | ③ |
| 8. I feel satisfied .....                                  | ① | ② | ③ |
| 9. I feel frightened .....                                 | ① | ② | ③ |
| 10. I feel comfortable .....                               | ① | ② | ③ |
| 11. I feel self-confident .....                            | ① | ② | ③ |
| 12. I feel nervous .....                                   | ① | ② | ③ |
| 13. I am jittery .....                                     | ① | ② | ③ |
| 14. I feel indecisive .....                                | ① | ② | ③ |
| 15. I am relaxed .....                                     | ① | ② | ③ |
| 16. I feel content .....                                   | ① | ② | ③ |
| 17. I am worried .....                                     | ① | ② | ③ |
| 18. I feel confused .....                                  | ① | ② | ③ |
| 19. I feel steady .....                                    | ① | ② | ③ |
| 20. I feel pleasant .....                                  | ① | ② | ② |



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Appendix E  
STAI Form Y-2

**SELF-EVALUATION QUESTIONNAIRE**

STAI Form Y-2

Name \_\_\_\_\_ Date \_\_\_\_\_

**DIRECTIONS:** A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

ALMOST NEVER  
SOMETIMES  
ALMOST ALWAYS  
OFTEN

- 21. I feel pleasant ..... ① ② ③
- 22. I feel nervous and restless ..... ① ② ③
- 23. I feel satisfied with myself ..... ① ② ③
- 24. I wish I could be as happy as others seem to be ..... ① ② ③
- 25. I feel like a failure ..... ① ② ③
- 26. I feel rested ..... ① ② ③
- 27. I am "calm, cool, and collected" ..... ① ② ③
- 28. I feel that difficulties are piling up so that I cannot overcome them ..... ① ② ③
- 29. I worry too much over something that really doesn't matter ..... ① ② ③
- 30. I am happy ..... ① ② ③
- 31. I have disturbing thoughts ..... ① ② ③
- 32. I lack self-confidence ..... ① ② ③
- 33. I feel secure ..... ① ② ③
- 34. I make decisions easily ..... ① ② ③
- 35. I feel inadequate ..... ① ② ③
- 36. I am content ..... ① ② ③
- 37. Some unimportant thought runs through my mind and bothers me ..... ① ② ③
- 38. I take disappointments so keenly that I can't put them out of my mind ..... ① ② ③
- 39. I am a steady person ..... ① ② ③
- 40. I get in a state of tension or turmoil as I think over my recent concerns and interests ..... ① ② ③

Appendix F

Anxiety Inducing Instructional Set

### Anxiety Inducing Instructional Set

After the 10 minutes are over, you will be given one of several challenging tasks to complete. These tasks are designed to measure your intelligence and have been selected for their high level of difficulty. They will evaluate your ability to think logically and perform successfully under pressure. You will have very little time to complete your assigned task and you are expected to work as quickly and accurately as possible. Incorrect answers will be counted against you. Test scores will then be compiled with the rest of the participants and you will be given a percentile rank score. Therefore, if 90% of the other participants answered more questions correctly, you will receive a percentile rank score that will fall in the bottom 10 percent of those who completed the task. During the next 10 minutes I ask that you not speak but simply think about the upcoming test.

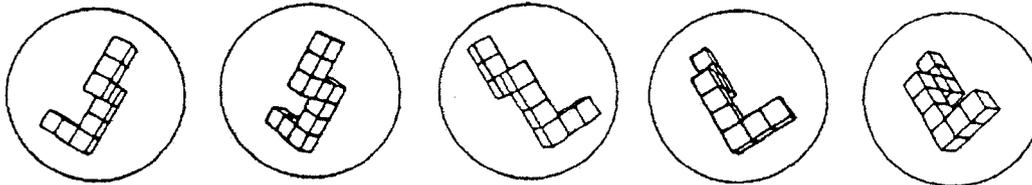
Appendix G

Mental Rotations Test

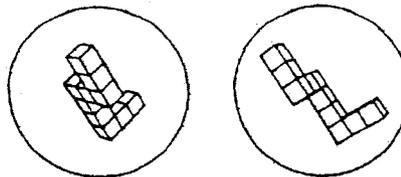
M.R.T. Test

Date \_\_\_\_\_

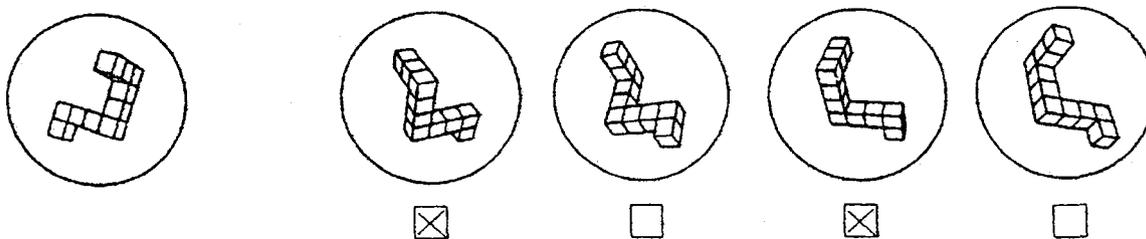
This is a test of your ability to look at a drawing of a given object and find the same object within a set of dissimilar objects. The only difference between the original object and the chosen object will be that they are presented at different angles. An illustration of this principle is given below, where the same single object is given in five different positions. Look at each of them to satisfy yourself that they are only presented at different angles from one another.



Below are two drawings of new objects. They cannot be made to match the above five drawings. Please note that you may not turn over the objects. Satisfy yourself that they are different from the above.



Now let's do some sample problems. For each problem there is a primary object on the far left. You are to determine which two of four objects to the right are the same object given on the far left. In each problem always two of the four drawings are the same object as the one on the left. You are to put Xs in the boxes below the correct ones, and leave the incorrect ones blank. The first sample problem is done for you.

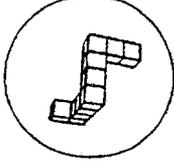
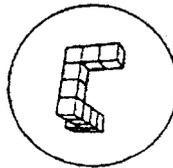
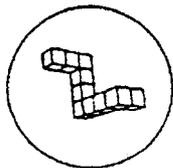
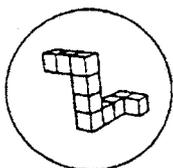
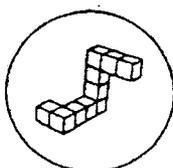


Go to the next page

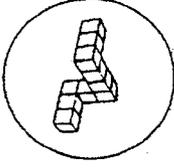
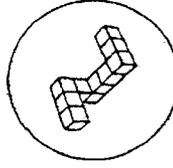
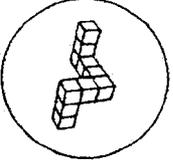
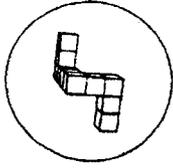
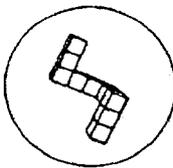
Adapted by S. G. Vandenberg, University of Colorado, July 15, 1971  
 Revised instructions by H. Crawford, U. of Wyoming, September, 1979  
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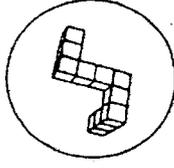
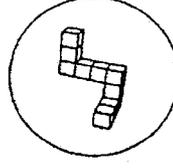
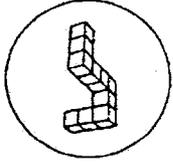
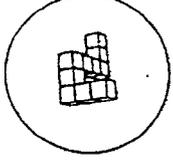
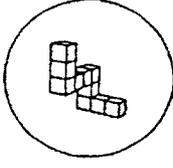
Do the rest of the sample problems yourself. Which two drawings of the four on the right show the same object as the one on the left? There are always two and only two correct answers for each problem. Put an X under the two correct drawings.

1.     

2.     

3.     

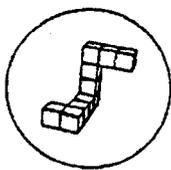
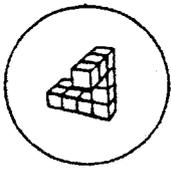
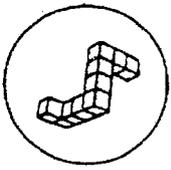
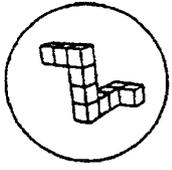
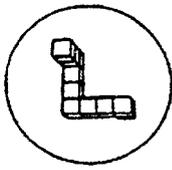
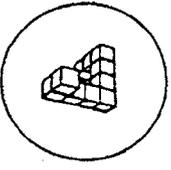
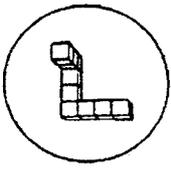
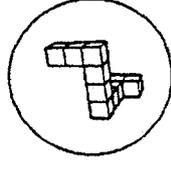
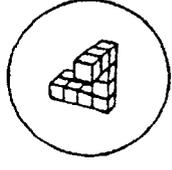
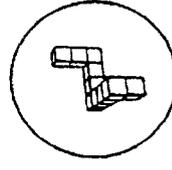
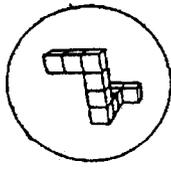
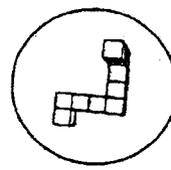
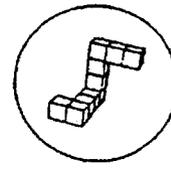
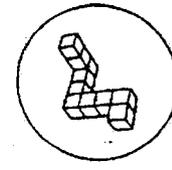
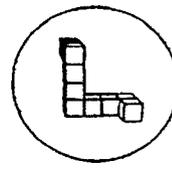
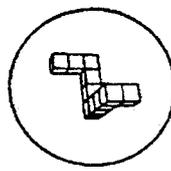
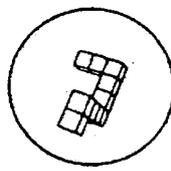
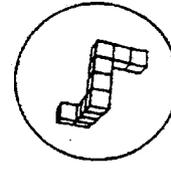
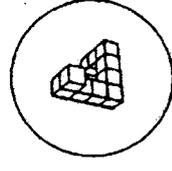
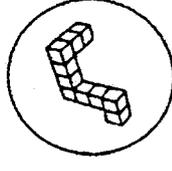
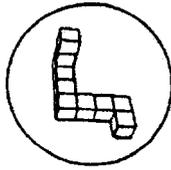
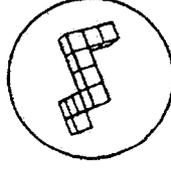
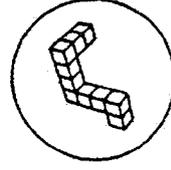
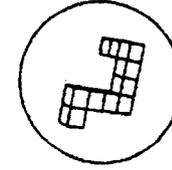
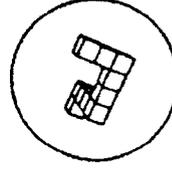
- Answers: 1. first and second drawings are correct  
 2. first and third drawings are correct  
 3. second and third drawings are correct

This test has two parts. You will have 3 minutes for each of the two parts. Each part has two pages. When you have finished Part I, STOP. Please do not go on to Part 2 until you are asked to do so. Remember: There are always two and only two correct answers for each item.

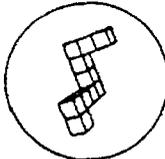
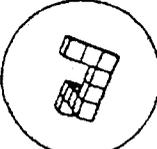
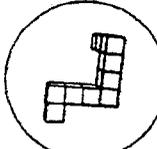
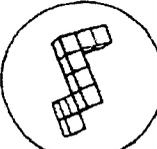
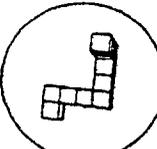
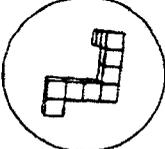
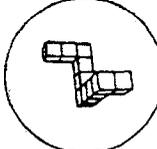
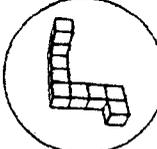
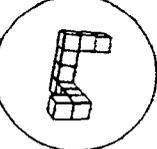
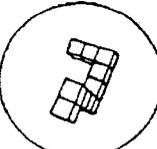
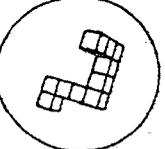
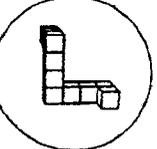
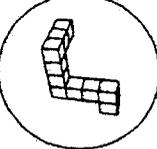
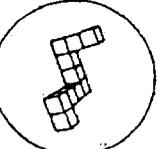
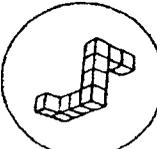
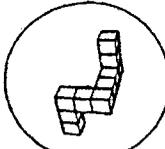
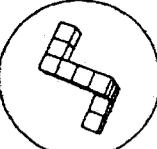
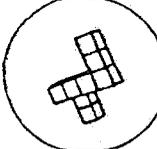
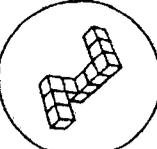
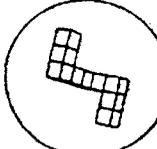
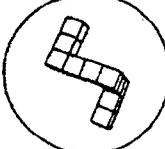
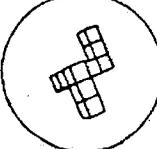
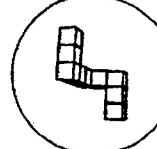
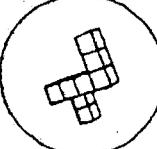
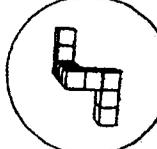
Work as quickly as you can without sacrificing accuracy. Your score on this test will reflect both the correct and incorrect responses. Therefore, it will not be to your advantage to guess unless you have some idea which choice is correct.

DO NOT TURN THIS PAGE UNTIL ASKED TO DO SO.

PART I

1.					
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2.					
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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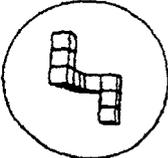
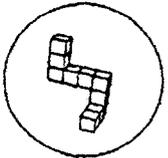
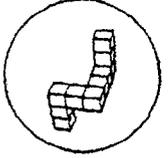
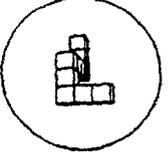
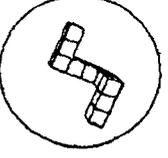
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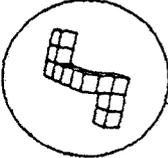
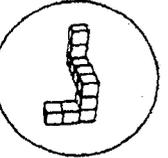
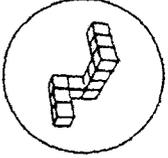
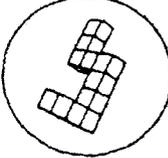
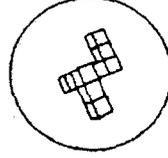
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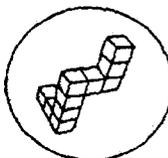
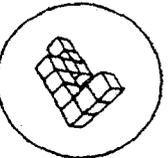
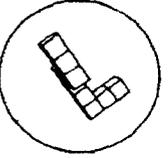
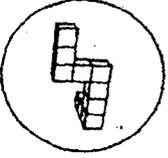
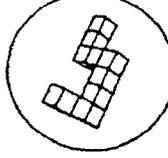
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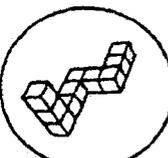
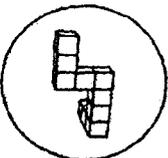
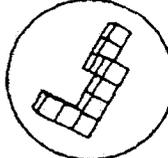
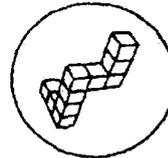
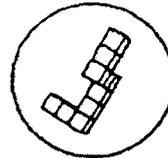
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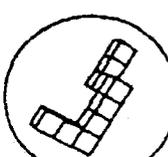
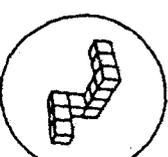
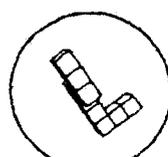
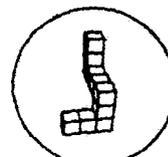
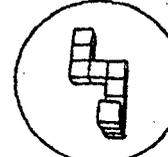
PART II

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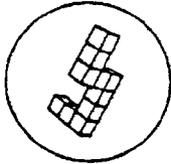
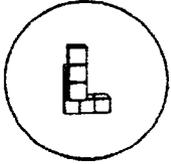
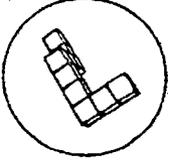
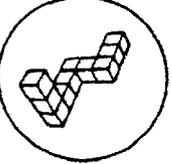
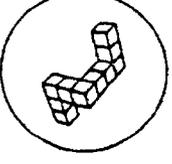
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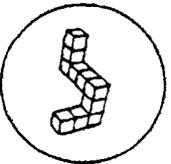
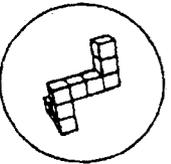
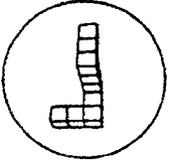
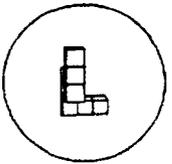
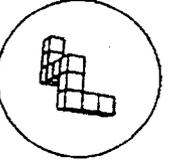
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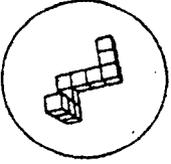
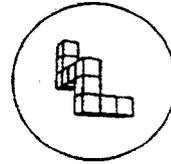
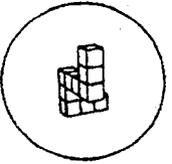
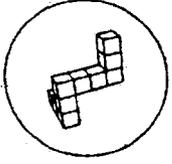
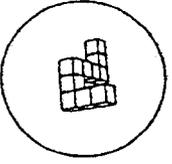
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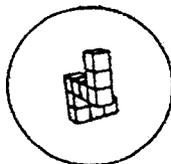
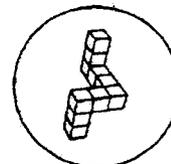
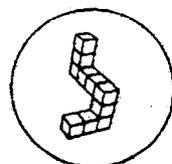
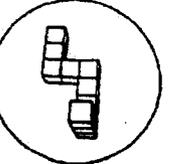
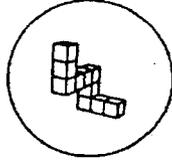
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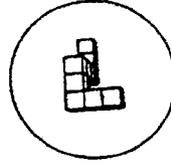
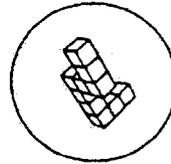
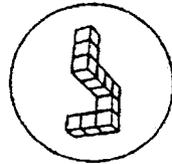
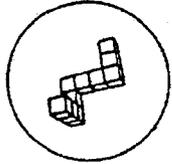
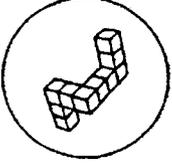
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Appendix H

Introduction and Group Assignment Script

Hi, (name of participant), welcome to the lab. Thank you for coming today. Before we begin I want to remind you that your participation in this study is completely voluntary and you can withdraw at any time without penalty. Do you have any questions about that? I also want to make sure that you brought appropriate footwear. (If not already wearing footwear, they will be asked to put them on at this time). Now, during the experiment I will be giving you instructions and reminders about what you should be doing. I would ask that you not ask any questions or make comments until we are completely finished unless you are concerned about your safety and well being. If you do happen to ask a question I will simply remind you to ask me when we are finished. Do you have any questions about that?

#### Exercise Group

Now, you have been randomly assigned to the exercise group. What this means is that you will be exercising by walking around the soccer field for 10 minutes while I walk beside you. Please keep pace with me while I walk. (Read the anxiety inducing instructional set, Administer STAI)

#### No-Exercise Group

Now, you have been randomly assigned to the non-exercise group. What this means is that you will NOT be exercising at all. Instead, you will sit quietly while I sit beside you. (Read the anxiety inducing instructional set, Administer STAI)

#### No Expectancy Exercise Group

Now, you have been randomly assigned to the non-exercise group. What this means is that you will NOT be exercising at all. Instead, you will sit quietly while I sit beside you. (Read the anxiety inducing instructional set, Administer STAI). Unfortunately, this room has been double booked. However, I have found an alternate room where you can write your test. If it's ok with you, I'd like to go there now.

Appendix I

Follow Up Questionnaire



Appendix J

Debriefing Letter

### Debriefing Letter

You are receiving this letter as a result of your participation in the exercise study I conducted. The purpose of this letter is to provide you with the results of the study as well as to reveal the true nature of the study.

Currently in the research literature there is much debate as to why exercise is able to decrease anxiety in both clinical and non-clinical populations. One of the proposed mechanisms involved is the expectancy effect. That is, when individuals are exercising they 'expect' that their anxiety will decrease and thus it does decrease. This is akin to the placebo effect. The true purpose of my study was to determine if expectancy truly played a role in decreasing anxiety through exercise. As a result, I utilized three different subject groups as opposed to only two. The first group consisted of individuals who walked around a soccer field for 10 minutes. The second group of subjects were told that they were not going to be exercising, and sat quietly for 10 minutes. The final group was also told that they would NOT be exercising. However, this group was then asked to walk to a different room. This walk was comparable to the time and distance walked by the first group. It was hypothesized that this group would experience similar anxiety reduction as the first group, despite not having the same expectations.

In addition, all participants were informed that they would be writing a difficult intelligence test following the 10 minutes. This was done in order to slightly elevate anxiety levels prior to exercising. Research has shown that when anxiety is increased prior to intervention, then potential decreases in anxiety are more easily verified. Since the true purpose of the intelligence test was solely to increase anxiety prior to exercise,

your tests were not scored for this study, nor were they compared or ranked with the score of any other participant.

It was hypothesized that those participants in the no expectancy exercise group would experience an overall reduction in anxiety similar to those in the no expectancy group. Furthermore, it was also expected that participants in the quiet rest group would experience no change or an increase in anxiety while they sat for 10 minutes. Data analysis revealed that there was no significant change in anxiety across all three groups. What this means is that participants scores did not change very much (either increased or decreased) as a result of the exercise or quiet rest conditions. However, it is interesting to note, that there was a significant difference between the two exercise conditions and the quiet rest condition. Participants in both exercise groups generally experienced a decrease in anxiety while those in the quiet rest group generally experienced an increase in anxiety.

Although much more research needs to be conducted these results seem to indicate that even mild forms of exercise may have a positive impact on anxiety. Furthermore, in this particular study expectancy did not seem to have an impact on overall anxiety reduction. Further research is necessary to continue to evaluate the role of expectancy as well as to examine the anxiety reducing effectiveness of low intensity exercise.

Should you have any questions or concerns please do not hesitate to contact me by e-mail at [tnewman@lakeheadu.ca](mailto:tnewman@lakeheadu.ca), any feedback is appreciated. Once again, thank you for your time and effort in this study. One name will be chosen at random to win the

gift certificate from The Keg, and that person will be notified in a separate e-mail to maintain confidentiality.

Sincerely

Tom Newman