COGNITIVE STRATEGIES USED DURING MODERATE INTENSITY RUNNING

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A Thesis

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ABSTRACT

Bonnie Berger, Advisor

Cognitive strategies have been used by experienced and inexperienced exercisers in order to achieve positive psychological states, improved physiological functioning, and enhance performance. However, the type of cognitive strategy used, association or dissociation, differentially influences the possible outcomes and benefits of exercise. The primary purpose of the current study was to examine how the cognitive strategies of association and dissociation influenced psychological, physiological, and performance outcomes. More specifically, exercise enjoyment, mood states, self-efficacy, heart rate, ratings of perceived exertion, and time to completion were examined as male, recreational exercisers completed a 1.5-mile jog at a moderate-intensity. Participants included 21 male, recreational exercisers who exercised for at least 120 minutes/week in the previous month. Participants’ completed two 1.5 mile jogging sessions using both an associative and dissociative strategy. During the exercise, heart rate and ratings of perceived exertion were recorded every four laps, and time to completion and state enjoyment were recorded following the completion of the run. Self-efficacy and mood states were measured pre- and post-exercise. No evidence was produced that to indicate that state enjoyment, heart rate, ratings of perceived exertion, time to completion, and scheduling self-efficacy were influenced by the type cognitive strategy used. However, participants did report increases in RPE over time and increases in coping self-efficacy and task self-efficacy pre- to post-exercise. The participants’ mood states of Tension, Confusion, and Depression were found to decrease, but only when using the dissociation intervention first. It was concluded that the cognitive strategy intervention did not directly influence any dependent variables, and that this outcome was likely the result of a controlled intensity instead of a self-selected intensity.
Nonetheless, following a 20-minute exercise, male recreational exercisers were able to enhance positive psychological outcomes and increase coping and task self-efficacy. Future studies should examine how cognitive strategies can influence an exercisers’ self-efficacy outside of a preferred exercise as well as exercise modes other than running.
ACKNOWLEDGEMENTS

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## Attention Manipulation

- Manipulation check
- Distressful Thoughts
- Exercise State Enjoyment
- Trait Enjoyment
- Mood

Order – Association intervention first
Order – Dissociation intervention first

### Performance (Time to complete 1.5-mile run)

Heart Rate
Ratings of Perceived Exertion
Exercise Self-Efficacy
Coping self-efficacy
Task self-efficacy
Scheduling self-efficacy

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### CHAPTER V: DISCUSSION

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- Mood Alteration with Exercise
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CHAPTER I: INTRODUCTION

Self-efficacy theory posits that behavioral changes are modified by the beliefs an individual holds in their ability to execute an action and satisfy situational demands (Bandura, 2006). These behavioral changes are then expressed through the activities chosen, effort expended, and persistence in the face of adversity (Berger, Pargman, & Weinberg, 2007, pp. 213-214). Derived from this theory, reciprocal determinism further states that these behavioral changes come from interrelated aspects of the behavior, the person, and the environment. Therefore, looking into the person as a mediator may provide an understanding of how cognitions, mood, and physiology influence the frequency and intensity of the behavior. Because it has been reported that self-efficacy influences likelihood of exercise participation, and chronic and acute exercise influences self-efficacy (Berger et al., 2007, pp. 213-214), cognitive strategies (known as mental processes taking place during execution of a task) used during running may provide a further understanding of how specific cognitions influence exercise behaviors. Therefore, the assessment of self-efficacy in relation to types of cognitive strategies will be studied to determine if, and what type of, a relationship exists.

Cognitive strategies have long been used by runners, swimmers, and rowers as well as other athletes and exercisers in distance sports, especially those that are closed and predictable, as a means to shift attention and thinking towards or away from the current activity (Berger et al., 2007, p. 104). While exercise can result in many positive changes both physically and psychologically (Berger et al., 2007, p. 104), employing different cognitive strategies may enhance, or even negate these benefits. Salmon, Hanneman, and Harwood (2010) have reported changes in enjoyment, effort, mood states, and performance in relation to the use of specific cognitive strategies.
Cognitive strategies, specifically attentional focus strategies of association and dissociation, potentially can be offered as an intervention to increase enjoyment (Drylund & Wininger, 2008), self-efficacy, and exercise adherence (Higgins, Middleton, Winner, & Janelle, 2014) as well as control physical effort (Ives & Shelly, 2003). In this study, the potential influence exercise has on self-efficacy, mood and enjoyment, and perceived effort will be examined in relation to the cognitive strategies employed by exercisers.

**Cognitive Strategies and Exercise**

Association and dissociation, specific cognitive strategies, have long been used by runners, foot messengers, and exercisers in aerobic and strength training settings (Morgan, 1978; Stevinson & Biddle, 1998). The cognitive strategy of association, defined simply as attention towards the task, allows for the exerciser to control and focus their thoughts on the task at hand (Goode & Roth, 1993; Masters and Ogles, 1998a). When running, marathoners can use a cognitive strategy of association to control their pace by keeping close to other runners, monitoring heart rate and respiration rate, and focusing on the “feel” of their muscles to regulate speed (Morgan, 1978).

The cognitive strategy of dissociation, defined simply as attention away from the task, comes from an effort, or preference, to forget about the task at hand and distract oneself from it (Goode & Roth, 1993; Masters and Ogles, 1998a). Instead of regulating pace by sensory feeling, marathon runners, and other closed-sport athletes, may dissociate, purposefully diverting their attention away from the task. This includes examples of listening to music, recalling old relationships from high school, or completing mathematical operations (Morgan, 1978). Each of these strategies provides examples of diverse mental strategies used by runners and exercisers.
Early researchers set out to investigate what made elite runners so elite (Morgan, 1978). Efforts focused on collecting thoughts of exercisers during the run, and thus, researchers began to develop the associative and dissociative classifications. Cognitive strategies have become a focus of research not only in recalling thoughts during a run, but as a treatment modality to modify and manipulate the thought process and determine if different foci yielded different psychological and physiological outcomes. After an intervention composed of association and/or dissociation strategies, performances increased (Neumann & Brown, 2013; Neumann & Piercy, 2013), fatigue lessened (Goode & Roth, 1993), and positive psychological outcomes such as satisfaction were more apparent (Goode & Roth, 1993; Neumann & Brown, 2013). Because no single strategy is beneficial for all individuals, it is necessary to focus on the findings and apply what may be relevant for the exerciser as an individual. One exerciser may prefer to dissociate based on desired outcomes; another may prefer to associate.

**Attentional Focus: Association and Dissociation**

Association and dissociation strategies used during a run can yield varying psychological, physiological, and performance results. Psychological benefits of exercise include lowering depressive symptoms and fatigue scores and raising vigor, enjoyment, and satisfaction (Berger et al., 2007, p. 107). The cognitive strategy a runner employs may have an effect on potential mood outcomes as well as other psychological variables such as satisfaction and enjoyment, which have been shown to increase using dissociative strategies (Goode and Roth, 1993) but decrease or remain the same using associative strategies (Fillingim & Fine, 1986; Pennebaker & Lightner, 1980). Environmental factors, such as the use of a treadmill in comparison to an outdoor run, are also significant when manipulating psychological outcomes. LaCaille, Masters, and Heath
specifically found the greatest psychological outcomes following an outdoor run versus a run on a treadmill or track.

Physiologically, as intensity increases and heart rate increases, one’s own perception of his or her physical exertion (ratings of perceived exertion; RPE) also increases (Borg, 1982). With the use of different cognitive strategies, however, it has been found that RPE is actually lowered when exercising at the same intensity under dissociation than when exercising under association (Razon, Basevitch, Land, Thompson, & Tenenbaum, 2009; Stanley, Pargman, & Tenebaum, 2007). Multiple authors reveal more efficient muscle recruitment and utilization under a dissociative condition (Marchant, 2011; Marchant, Greg, and Scott, 2009; Wulf, 2013). During the use of a dissociative strategy, exercise Heart Rate (HR) also may become lower (Neumann & Brown, 2013), respiratory exchange ratio (RER) may be lower (Hatfield, Spalding, & Mahon, 1992), and the ability to sustain exercise for a longer duration may increase (Neumann & Piercy, 2013; Razon et al., 2009). The disadvantage of dissociation, in some cases, is that it may lengthen the time required to complete a run due to the lack of being able to monitor oneself and keep a consistent pace (Brick, MacIntyre, & Campbell, 2014).

In contrast, adapting an associative strategy may allow the runner to modulate, meaning control and modify, pace which keeps running stride and form consistent (Schomer, 1986). Although the dissociative strategy may lower RPE by keeping the runner preoccupied away from internal feelings, pace may become inconsistent and potentially slower (Masters & Ogles, 1998a; Schomer, 1986). In light of this, a tradeoff may exist as to which strategy may be beneficial to the exerciser based on his or her desired outcomes of effort versus time.

One specific strategy has not been defined as better for achieving the previously stated psychological, physiological, and performance outcomes (Goode and Roth, 1993; Pennebaker &
Lightner, 1980). In fact, there exists a tradeoff among psychological, physiological, and performance factors. If a runner uses a dissociation strategy, she/he will most likely run with lower perceived exertion, report more enjoyment, but at a slower pace. If a runner uses an associative strategy, she/he may run with higher perceived effort, report fewer improvements in positive affective states, but run at a faster and steadier pace. It seems as though it might be a better strategy, if results are conclusive, to use a strategy that falls in line with the benefits one wants and the benefits one is willing to sacrifice.

Knowing that low and moderate intensity exercise is associated with psychological (Berger, 2004; Reed & Buck, 2009) and physical health benefits (Centers for Disease Control, 2011; Ekkekakis, 2009), it would helpful to determine which cognitive strategies will enable the exerciser to achieve his or her greatest changes in mood, self-efficacy, and performance. Understanding these intrinsic (motivated within the self) outcomes and how they potentially influence exercise participation may allow researchers to better create programs and interventions to help the obese population become more physically fit.

As reported by the Centers for Disease Control (2014), the percentage of the obese population increases nearly 10% in the next decade after the age of 24 years. Thus, assessing college students and different cognitive strategies used during running may provide insight as to which cognitive strategies show greatest psychological benefits and performance results, which in turn may encourage exercise adherence and involvement based on these outcomes. Because it was reported that elite runners initially became involved in running through intrinsic reasons and stayed involved through intrinsic reasons (Morgan, O’Connor, Ellickson, and Bradley, 1998), this may similarly relate to the average exerciser. The average exercise may also become
involved in exercise through intrinsic reasons such as enjoyment and the building of self-efficacy, and stay involved for the same intrinsic reasons, which is relevant to the current study.

**Exercise and Self-Efficacy**

Self-efficacy is one of the strongest and most consistent, positive correlations with habitual exercise; as self-efficacy increases, habitual exercise increases (Allen & Morey, 2010). Self-efficacy contributes to the confidence for exercise participation in the present and it has been shown to predict future exercise adherence (Allen & Morey, 2010). Other psychological factors such as exercise enjoyment, expected benefits, motivation and perceived fitness also may be associated with exercise participation (Allen & Morey, 2010). Noting that these factors such as enjoyment and self-efficacy can be enhanced through exercise, these should become key areas of measurement in a designed intervention surrounding exercise adherence, and additionally cognitive strategies. Cognitive strategies may have an underlying relationship with exercise enjoyment, adherence, and self-efficacy that has not yet been established.

Self-efficacy is a consistent predictor and outcome of exercise and physical activity and can be influenced by a variety of factors such as previous experiences, verbal persuasion, and feedback (Bandura, 2006). With the confidence in the ability to execute actions for desired outcomes, increases in self-efficacy also correlate with increases in exercise behavior (Everett, Salamonson, & Davidson, 2009; Higgins et al., 2014). The reverse is also true. Regular exercisers reported higher levels of exercise self-efficacy than those who exercise less frequently and intermittently (Everett et al., 2009; Shin, Jang, & Pender, 2001). Noting that exercise self-efficacy can be enhanced by exercise intervention, it is still undetermined if the use of association or dissociation strategies influence self-efficacy differently.
**Exercise and Affect**

Exercise has been defined by Berger (2004) as “planned sessions of large muscle activity, which generally are of moderate to high levels of intensity” (p. 51). Berger (2004) also stated that exercise is typically performed to achieve goals of mood enhancement, weight management, physical fitness, overall health, enjoyment, and fun. Mood enhancement includes increases in positive qualities such as vigor, relaxation, and elation and decreases in undesirable elements of mood such as depression, anger, and tension (Berger, 2004).

The mood benefits of exercise can also emerge after exercise of just 20 minutes and can be largely in desirable directions. Among college students, males and females reported increases in scores of vigor and decreases in tension, depression, anxiety, and confusion after 20-minute bouts of exercise of low or moderate-intensity (Berger & Owen, 1998). Summarizing their findings, Berger and Owen (1998) suggested that more people may include physical activity in their daily lives knowing that even low-intensity exercise has psychological benefits and that it can only take 20 minutes to achieve these benefits. Exercisers may then exercise for other benefits, such as health benefits, knowing the mood benefits will also occur.

Additionally, in a meta-analysis of 109 studies that included 9,840 participants, Reed and Buck (2009) found that aerobic exercise programs increase levels of positive affect favorably and that affect is slightly moderated by the dose of exercise including duration and intensity. An exercise of the proper dose, meaning, duration and intensity fit for the individual, will illicit the greatest positive-affect response and greatest benefits psychologically. Thus, exercising at a preferred intensity may enable the exerciser to achieve increases in positive affect.

“Exercise prescriptions based on preferred intensities should be safe and health promoting for most healthy adults. A preferred intensity of exercise may promote better
adherence than a strict prescription if those criteria conflict with a person’s intensity preference” (Dishman, Patton, Smith, Weinberg, & Jackson, 1987). A preferred, or self-selected intensity of exercising refers to the amount of energy one enjoys expending for a period of time. Morgan (1997) offers that preferred intensity exercising is more likely to result in positive psychological outcomes. Rose and Parfitt (2007) further concluded that focus of concentration, such as association or dissociation strategies, along with perceptions of control and interpretation of the exercise intensity contributed to an increased affective response. Even though participants in the current study were instructed to jog at a moderate intensity, they self-selected whether to jog at the lower end (40% Heart Rate Reserve; HRR) or the higher end (60% HRR) of moderate intensity. Exercising at a preferred intensity may allow for the exerciser then to continually achieve mood benefits as well as the simultaneous health benefits.

**Exercise and Health**

Participation in regular physical activity is related to better overall health. The U.S. Department of Health and Human Services (Centers for Disease Control, 2011) reports that while cutting calories helps to lose weight, regular physical activity is the only way to maintain it. More importantly, the benefits of regular physical activity include reduced symptoms of depression and anxiety, and reduce risks of cardiovascular disease, type 2 diabetes, stroke, heart attack, and several forms of cancer (Centers for Disease Control, 2011). Thus, increases in self-efficacy may encourage the exerciser to adhere to exercise and therefore, achieve more health benefits.

**Research Objectives of the Current Study**

Cognitive strategies have typically been studied on the elite and less-elite running populations. However, these studies have high standards in classifying athletes as elite and less-
elite and categorize marathoners as both elite and non-elite (Morgan & Pollock, 1977). The current study is an examination of a college male exercising population that is non-elite, or recreational, and maintains recommended exercise standards for health that include 20-60 minutes daily (≥ 150 min/week; ACSM, 2014) of aerobic, anaerobic, and weight training exercise. The present investigation also examines self-efficacy because of how it may be influenced by an individual’s cognitions. While self-efficacy has been studied extensively in relation to exercise, there have been few studies measuring association and dissociation strategies and their direct influence on self-efficacy beliefs.

The current study examined if the use of association or dissociation strategies influenced runners’ measures of enjoyment, mood, and performance among general, college-age male exercisers. With exercisers dropping out of normal exercise routines post-college graduation (Soliah, Walter, & Antosh, 2008), and the obesity rate increasing after 24 years of age (Centers for Disease Control, 2014), it may be that exercisers are not enjoying the benefits associated with exercise such as increased mood and raised levels of self-efficacy (Allen & Morey, 2010).

By employing the specific cognitive strategies of association or dissociation during a 1.5 mile jog, which is a standard exercise test (ACSM, 2014), it is hypothesized that exercisers will differ in reported psychological, physiological, and performance measures. Based on the reviewed literature, it is hypothesized that:

Hypothesis 1: If runners use dissociative techniques, they will show greater state exercise enjoyment measured before and after a 1.5-mile jog than when using associative techniques.

Hypothesis 2: If runners use dissociative techniques, they will report greater mood benefits measured before and after a 1.5-mile jog than when using associative techniques.
Hypothesis 3: Runners using dissociative techniques will finish the 1.5-mile jog at a slower speed than when using the associative technique (i.e. time to completion).

Hypothesis 4: Runners using dissociative techniques will be working at a lower perceived exertion than when using the associative technique (i.e. RPE).

Hypothesis 5: There will be no differences in Heart Rate between the association and dissociation strategy as it will be controlled by limiting HR\textsubscript{max} to 60% of HRR.

Hypothesis 6: There will be no changes in self-efficacy measures before or after the 1.5-mile jog when using association or dissociation cognitive strategies. The null hypothesis is used because self-efficacy has not been examined in relation to cognitive strategies and a significant result may be missed if wrongly hypothesized.
CHAPTER II: REVIEW OF LITERATURE

Association and dissociation are cognitive strategies that have been used over the centuries when running (Morgan, 1978) and recently have been implemented in a variety of other types of exercises such as rowing (Tenenbaum & Connolly, 2008), swimming (Wulf, 2013), and sit-ups (Neumann & Brown, 2013) for the purpose of enhancing performance outcomes and psychological well-being. Morgan (1978) reported that the Mahetangs Monks, were to have run 300 miles in 30 hours over rough terrain and cold weather in order to deliver a message. The Mahetangs would stare at distant object and repeat a sacred mantra over and over again, now today classified as a method of dissociation because of its nature of focusing away from the task at hand. Due to its influence on exercise-related factors such as psychological and performance outcomes, the specialty area of cognitive strategies has expanded and warrants further investigation for the strategies of association and dissociation. The effect association and dissociation (A/D) strategies have on self-efficacy, mood, enjoyment, ratings of perceived exertion (RPE), and heart rate are important because these could influence exercise adherence. In turn, this review of literature will set a foundation for the proposed study which focuses on A/D strategies and their possible influence on self-efficacy, performance, mood alteration, and enjoyment.

Association and dissociation attentional focus techniques have been researched because of their influences on both physiological outcomes such as heart rate and muscle recruitment and psychological outcomes such as mood, enjoyment, and satisfaction. In fact, over 112 studies relating to attentional focus in anaerobic or aerobic exercise supported themes of increased effort perception under associative conditions as well as enhanced muscular endurance under dissociation and some external association (Brick et al., 2014). Despite the accumulating
research and efforts to understand attentional strategies, there still remains uncertainty in the
effects A/D strategies have on RPE, HR, and general performance (Lind, Welch, & Ekkekakis,
2009; Salmon et al., 2010). Some of the variability in previous results comes from key issues
such as improper definitions and classifications of association and dissociation (Brick et al. 2014;
Salmon et al. 2010). Researchers have argued that investigators need to redefine these cognitive
strategies and to consider other interventions such as mindfulness techniques which accounts for
all surroundings and feelings in an unbiased manner (Brick et al., 2014; Salmon et al., 2010).

Researchers agree that the cognitive strategy of association promotes concentration
toward the task at hand while dissociation supports distraction from it (Goode & Roth, 1993;
Hutchinson & Tenenbaum, 2007; LaCaille et al., 2004; Lind et al., 2009; Morgan, 1978; Masters
& Ogles, 1998a; Neumann & Brown, 2013; Razon et al., 2009; Stevinson & Biddle, 1998).
Association and dissociation also may contain both internal and external dimensions (Stevinson
& Biddle, 1998). A runner may associate or dissociate, but within each of these strategies, the
focus may be internal within themselves or external to surrounding stimuli. Table 1 represents
the possible classifications developed by Stanley et al. (2007) that are based on Stevinson and
Biddle’s (1998) model. The model is important as it suggests that different benefits can come
from direction of focus, which is important in assigning a strategy and not having an unrefined
focus of association or dissociation. The current study will use both internal and external
directions under association by having runners focus on running form and breathing as well as
focusing on distance covered, and pacing strategies. However, runners in the dissociation
condition will focus only internally on problem solving and daydreaming as the external
direction, such as environment, will be controlled for.
Table 1

Stevinson and Biddle’s (1998) Classification of A/D Strategies

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<th>Internal</th>
<th>External</th>
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<tr>
<td>Association</td>
<td>-Running form, breathing</td>
<td>-Performance strategy, distance covered</td>
</tr>
<tr>
<td>Dissociation</td>
<td>-Problem solving, daydreaming</td>
<td>-Attention to environment</td>
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Due to the wide array of thought patterns taking place within association and dissociation strategies, internal and external directions were seen as necessary parts of classifying thoughts (Masters & Ogles, 1998a). To some researchers, however, association was solely an inward and internal focus and dissociation was an outward and external focus (Hutchinson & Tenenbaum, 2007; Razon et al., 2009; Tenenbaum & Connolly, 2008). Therefore, the disparate findings for research studies of cognitive strategies used during exercise may be caused by the definitions and classifications used for association and dissociation. Despite contrasting classifications and definitions of A/D strategies, the general moderating effect that intensity has on association and dissociation has been one of the most consistent findings throughout the literature.

Running Skill Level, Intensity, and A/D Strategies

It was believed by Morgan (1978) that skill level influenced the amount and type of A/D strategies used. Researchers have noted that elite runners used more association strategies, and that the “average” runner used more dissociation strategies (Morgan and Pollock, 1977; Tenenbaum, 2001). This remains an accurate observation, but Schomer (1986) found the underlying cause of these thought processes were dependent on the intensity of exercise, and not solely on the skill level of the exercisers. Thus, elite runners were forced to use more association strategies because they were exercising at higher \%VO_2\text{max} compared to the non-elite individuals. However, when intensity is low and thought processes can be controlled, the elite
runner may tend to use dissociation strategies during practice and association strategies during an actual race in order to monitor pace and physical sensations to achieve their best performance and avoid injury (Morgan & Pollock, 1977). The following section provides examples as to the cognitive strategies used by elite and non-elite runners.

In an early study of cognitive strategies, Morgan and Pollock (1977) investigated the psychological characteristics of elite runners to determine if they held a consistent and different psychological profile and to understand the cognitive strategies employed by both the elite and non-elite runners. A group of world class athletes ($n = 19$) and a group of college middle distance runners ($n = 8$) were recruited to compare the differences in psychological profiles, physiological characteristics, thoughts during running, and overall involvement for running. After separating the world class athletes ($n = 19$) into groups of middle-long distance ($n = 11$) and marathon runners ($n = 8$), all runners, including the college middle distance runners, were told to complete a submaximal and maximal exercise test. The submaximal test was a treadmill run at 10 mph for seven minutes and 12 mph for an additional four minutes; details for the maximal test were not provided. All runners were asked “Describe what you think about during a long distance run or marathon. What sort of thought processes take place as a run progresses?” (Morgan & Pollock, 1977). It was found that dissociation was not the prominent strategy and in fact, the associative strategy was much more prevalent (Morgan & Pollock, 1977). This contrasted findings that marathon runners attempt to dissociate sensory input rather than associate (Morgan, 1978). Some of the major themes reported by runners were that they identified others runners to stay in stride with, paid attention to their bodily sensations and feelings, paid attention to time elapsed, and constantly reminded themselves to relax. It was concluded that the non-elite employ dissociative
strategies while the elite employ associative strategies to read their body and alter pace (Morgan & Pollock, 1977).

While this study was important in recognizing the thought processes of elite and non-elite athletes, there still remained questions of validity. In terms of the methods, Morgan and Pollock (1977) failed to state whether the interview of thoughts during the run took place before or after the race. By means of classification, the non-elite runners were not truly defined and may seem non-elite in comparison to the world class athletes, but elite in comparison to the general population. Data for the non-elite runners included were from previous interviews and no operational definitions of association and dissociation were provided to ensure the correct classification of each. The results of the study provided insight into the mind of the marathoner and differences between elite and “non-elite” runners in using cognitive strategies.

**Exercise intensity shifts cognitions.** Taking Morgan and Pollock’s (1977) study further, Schomer (1986) hypothesized that associative thinking was directly related to an increase in intensity rather than the “status” (elite/non-elite) of athlete. In essence, elite athletes did not associate because they were elite, but instead they associated because they worked at a higher intensity. In order to test this, it was necessary to not only record thoughts and classify into A/D strategies, but to also correctly identify the differences in thoughts as either association or dissociation. In previous studies where researchers interviewed runners after the run, Schomer (1986) was one of the first to measure thought flow during the run and then subsequently categorize the thoughts into subcategories.

In order to document types of thoughts during the run, three groups of runners with differing skill levels were fitted with a transportable tape recorder. The device was used by each individual during four training times at monthly intervals preceding a marathon. Perceived
exertion was also recorded to measure effort. The runners were told to say aloud whatever came to mind no matter how relevant or irrelevant they think it might be. After all recordings were complete, a total of 62 recordings were used for data analysis. These included runners in the following categories: novice = 24, average = 20, and superior = 18 (Schomer, 1986).

After recordings were transcribed, the author classified thought subcategories: A (feeling and affect), B (body monitoring), C (command and instruction), and P (pace monitoring) into the task-related, associative strategy. Other subcategories: R (reflective introspection), S (problem solving), W (work, career management), E (Environmental feedback), I (course information), and T (conversational chatter) were categorized into the task-unrelated, dissociative strategy. Results indicated that the superior runners showed no statistical difference for using more of an associative strategy than the novice runners which contrasts with the findings presented by Morgan and Pollock (1977). In fact, it was found that a strong relationship between training intensity and associative thinking existed, supporting the hypothesis. As the perceived intensity of the exercise increased, associative thoughts such as subcategories of A, B, C, and P increased. Associative thoughts becoming prominent as intensity increases allows for the runner, elite or non-elite, to modulate pace and effort sense which in turn may optimize performance over dissociative thinking, although runners should not expect dramatic performance increases as suggested by Schomer (1986). Even though constantly reporting thoughts may attribute to an associative nature, this study has become a cornerstone for future studies of intensity and mental strategies in both aerobic and anaerobic exercise.

Tenenbaum (2001) came to three conclusions on mental states and exertion tolerance after reviewing multiple studies. First and most understandably, is that the perception of effort (RPE) increases with an increase in workload. Second, the exerciser’s attentional capacity
narrow as intensity increases. Third, and finally, during low physical loads dissociative strategies are more prominent and under heavy loads, association strategies become dominant and possibly, as Tenenbaum (2001) suggests, unavoidable.

In a form of physical activity different from running, Hutchinson and Tenenbaum (2007) measured association and dissociation by means of a hand-grip test (strength test) and cycling test (aerobic). It was hypothesized that the participant’s attention would shift from dissociative thoughts to associative thoughts as intensity increased. In the hand-grip study, 35 moderately active (three times a week for 30 minutes at moderate intensity) university students were asked to squeeze the dynamometer for as long as they could at 25% of their maximum voluntary contraction with five minutes in between each of the three squeezes. During the squeeze, the participants were asked to report aloud their thoughts in words or phrases, with the statement being written down by the examiner administering the test. To specify the differences between thoughts as associative or dissociative, Schomer’s (1986) classification was used.

A manipulation test determined the individuals were committed and dedicated to the task and the mean grip time was 1:58 minutes:sec. In assessing the participant’s thoughts, it was found that associative thoughts accounted for 94% of the total thoughts during the final stage of the grip test which was significantly greater than the amount of dissociative thoughts at the initial stage. Dissociative thoughts were more prominent at the initial stage, accounting for 71% of total thoughts (Hutchinson & Tenenbaum, 2007). As expected, during the middle stage, the shift from dissociative to associative thoughts occurred with 64% of the total thoughts being associative.

In a second study by Hutchinson and Tenenbaum (2007), 13 moderately active, undergraduate and graduate students were asked to complete a VO₂ max test on a cycle ergometer. One week later, the same participants were asked to cycle at 50% of VO₂ max for five
minutes, then 70% of VO2max for five minutes, followed by cycling to volitional exhaustion at 90% of VO2max. The participants were asked to express aloud their thoughts in words or phrases while the examiner wrote them down.

Again, the manipulation test determined the participants were committed and dedicated to the task. Descriptive statistics also reported that the VO2max results supported the classification that these participants were of average cardiorespiratory fitness and that mean time to exhaustion was 8:52 minutes:sec. The findings were similar to the handgrip study revealing that under the low intensity, 78% of the thoughts were dissociative and at a moderate intensity, 61% of the thoughts were associative. At the highest intensity, 93% of the thoughts were associative (Hutchinson & Tenenbaum, 2007). The results were similar to the results of the handgrip task and were in agreement with the findings of Schomer (1986) and the model posed by Tenenbaum (2001) which concludes that thoughts of association and dissociation are not specified to athlete status, elite or non-elite, but are dependent on intensity and duration of exercise.

Further investigating A/D strategies outside of the running world, Tenenbaum and Connolly (2008) examined effort perceptions between novice and experienced rowers, and gender differences. Of the 60 participants, 15 experienced men and 15 experienced women (at least three years of rowing) and 15 novice men and 15 women (less than one year of rowing) were included. The participants were instructed to row for five minutes for a warm-up, proceed to three minutes of a steady-state moderate intensity, and then increase 20 Watts at the end of each following minute until exhaustion. To measure attention, Tenenbaum and Connolly (2008) used a 10-point continuum, designed by Tammen (1996) ranging from 0 (external thoughts, daydreaming) to 10 (internal thoughts, body feeling) which Tammen (1996) deemed a valid one-question measurement of attention allocation. Every 60 seconds, participants were to say aloud
the number closest to their attentional thoughts along with a rating for RPE on a 10 point scale from 0 to 10 (nothing to extremely strong, respectively). After completion of the rowing set participants wrote the thoughts during the rowing which were later classified using Schomer’s (1986) classifications. On a separate day, the rowers were asked to row at 30%, 50%, and 70% relative to maximal power outputs for 10 minutes as determined by the initial testing and correlating with RPE ratings of three (moderate), five (strong), and seven (very strong). The order in which each stage was performed was counterbalanced with a 15-minute rest in between each stage. The same procedures were used to measure attention during and after and RPE during the exercise. Heart rate (HR) was also measured for each stage at every 60-second interval.

As expected, RPE, attention, and HR all increased as workload increased (Tenenbaum & Connolly, 2008). Although males worked at greater wattage and lower RPE, no gender differences were found and no differences due to rowing experience were found. Significant changes in attention allocation were found across each group at varying intensities. At 30% power output, the participants recorded dissociative thoughts. At 50% of power output, participant’s thoughts began to shift from dissociative to associative thoughts (50% each way). Consequently, at the highest intensity of power output (70%), 75% of the total thoughts remained associative. Interestingly, novice women reported more associative thoughts at each 60-second interval than all other groups. Despite an overall finding that no significant differences occurred in attentional allocation, a shift occurred from dissociative to associative thoughts as intensity increased (Tenenbaum & Connolly, 2008).

Noting the consistent finding of a shift from dissociative to associative thoughts with increasing intensity, Drylund and Wininger (2008) took a different approach to measuring
association and dissociation along with enjoyment by accounting for the type of music listened to (preferred and non-preferred) during a treadmill exercise session. It was hypothesized that if the music played was cognitively appealing, it would be processed over the physical sensation. Therein, it was hypothesized that, in accordance with the shift of attention from dissociation to association with increasing intensity, under a lower intensity the music would overpower pain and at higher intensity the pain would overpower the music.

To test the hypotheses, 200 participants (126 females and 74 males, $M_{age} = 20$ years) were asked to complete a music preference questionnaire that ranked 6 types of music on a 7-point scale of most preferred to least preferred (Drylund & Wininger, 2008). The participants were instructed to run on a treadmill for 20 minutes at 30%, 50%, or 70% of their predicted VO$_{2\text{max}}$ (calculated from BMI, height and weight) in either the most preferred music, least preferred music, or no music condition. RPE was recorded at the 10 and 20-minute intervals (Drylund & Wininger, 2008). In order to measure attention post-run, participants completed the Attentional Focus Questionnaire (AFQ), a 31-item, seven point Likert scale (one, “did not do at all”, to seven, “did a lot”) assessing the amount of time spent with differing associative or dissociative thoughts. Results revealed that RPE was significantly higher in each ascending VO$_{2\text{max}}$ condition and that no main effect of music was found. Despite failure to support the hypothesis that there would be significant differences in the amount of association thoughts across music conditions, there were still findings that revealed participants associated significantly less frequently under the low intensity condition and significantly more under the moderate and high intensity conditions. Although limitations of the study suggest that participants may not have intentionally processed the music, findings still supported a shift to associative thoughts under high intensity conditions (Drylund & Wininger, 2008).
Music may be a beneficial dissociation strategy when exercising (Razon et al., 2009). Manipulating visual and auditory conditions to assess perception of exertion and attention allocation, it was hypothesized that with occlusion of vision (blindfolded) and deprivation of auditory stimuli, the shift from dissociative thoughts to associative thoughts would occur sooner. In addition, it was also hypothesized that with the deprivation of visual stimuli but presence of auditory stimuli, the shift from dissociation to association would be delayed.

Using a hand grip task, 60 active participants (exercising 4 days a week at 75min/day) were asked to squeeze the handgrip with their dominant hand at 30% maximal effort (previously calculated) under one of four conditions for as long as they could; control (full vision, no music), occluded only (blindfolded, no music), music only (full vision, music), and occlusion and music (blindfolded, music). Prior to the test, the task-specific self-efficacy (TSSE) questionnaire, a 3-item, 10 point scale (1=low, 10 =high) was completed which measures one’s belief about physical capabilities to tolerate exertion. During the test, attentional thoughts were rated on the 10 point scaled designed by Tammen (1996) every 30 seconds along with RPE ratings on the 10 point scale (Razon et al., 2009). Results indicated that as grip duration increased, the participants were more likely to have an associative focus. In relation to the hypothesis established, it was found that those with vision and music stayed longer in dissociative attention patterns than the full vision and no music group and that alteration of visual feedback revealed significant differences in the shift of A/D thoughts. Razon et al. (2009) concluded that along low to moderate intensities, manipulation of attention may lower RPE, and therefore, lead to a longer duration of the task.

Looking directly at the inner dialogue of runners and the use of associative and dissociative strategies, Aitchison, Turner, Ansley, Thompson, Micklewright, and Gibson (2013)
measured the relationship between A/D strategies and RPE. Aitchison et al. (2013) hypothesized under low intensity exercise, runners will have more dissociative thoughts and under high intensity, runners will have more associative thoughts. Also hypothesized was that at a higher RPE, thoughts will be specifically directed toward fatigue, pacing, and self-talk to complete the run.

Participants included five men and three women who were healthy and active. The eight participants were asked to meet for four times, at three days apart. On the first day, participants completed an incremental treadmill exercise test to measure peak running speed. On following separate days, participants completed a 40-minute run at 50% (low) intensity and at 70% (high) intensity while self-categorizing their thoughts every three to five minutes. The last session required the participants to self-report exact thoughts every four minutes during the 40-minute run at 70% (high) intensity. This was done to ensure validity of the first two, self-categorized runs (Aitchison et al., 2013). RPE, on a scale of 6 (low) to 20 (high), was recorded after every categorization and all thoughts were classified using Schomer’s (1986) classifications.

Findings revealed that the hypothesis of a shift from dissociative to associative thoughts with increasing intensity (50% to 70%) was supported. Specifically, it was found that significantly more thoughts reflected conversational chatter and personal problem solving at 50% than at 70% and significantly more thoughts reflected affect, command, and instruction at 70% than at 50%. Interestingly, when comparing thoughts to RPE, a score of 16-20 showed significantly higher associative thoughts and a score of 6-10 showed significantly higher dissociative thoughts. Although it is unclear if the results were dependent on the amount of time spent exercising, Aitchison et al. (2013) suggest that at an RPE greater than 15, runner’s thoughts shift from dissociative to associative.
Summary of running skill level, intensity, and A/D strategies. When intensity increases, the exerciser’s cognitions shift from dissociative thoughts to associative thoughts (Aitchison et al., 2013; Drylund and Wininger, 2008; Hutchinson & Tenenbaum, 2007; Razon et al., 2009; Schomer, 1986; Tenenbaum, 2001; Tenenbaum & Connolly, 2008). This indicates that A/D strategies are not solely dependent on exerciser status, elite or non-elite (Morgan & Pollock, 1977). The most supported theory behind the shift is described by Tenenbaum’s (2001) effort-related model, adapted from Rejeski’s (1985) parallel processing model. Rejeski (1985) stated that emotions and sensory information can be processed together unless, however, the situation is cognitively or physically demanding in which case the most important information must appraised. Tenenbaum (2001) further noted that under demanding workloads, thoughts must remain internal and narrow as where under low workloads, thoughts are free to roam from internal to external and narrow to broad. As it seems clear and consistent in the literature that exercise intensity affects attention allocation, these findings may not be as consistent when examining other variables such as HR and RPE.

A/D: Ratings of Perceived Exertion (RPE)

It has long been established that increases in intensity result in increased effort perception (Borg, 1982), although effort perception may be lower for superior athletes compared to novice athletes due to working at a lower relative intensity of exercise (Morgan & Pollock, 1977). Borg (1982) created a scale in which to measure the increase in perceived exertion on a 10 point scale (from zero to 10) and a 15 point scale (from six to 20) with the higher numbers indicating a higher level of perceived exertion. As established through multiple reviews, the increase in intensity leads to more associative thoughts (Aitchison et al., 2013; Drylund and Wininger, 2008; Hutchinson & Tenenbaum, 2007; Razon et al., 2009; Schomer, 1986; Tenenbaum, 2001;
Tenenbaum & Connolly, 2008). However, it is unclear as to whether associative thoughts
directly influence higher ratings of perceive exertion and dissociative thoughts directly influence
lower ratings of perceived exertion. With the consideration of previous findings, RPE and A/D
strategies will be investigated specifically to see if a consistent outcome exists.

**RPE increases with intensity.** Thoughts of runners as well as ratings of perceived
exertion were measured during a 30-minute run by means of a tape recorder (Schomer, 1986).
Findings revealed that between association and RPE, a strong positive relationship existed which
held true across all groups of different running experience. Within this conclusion, specific
thoughts were revealed as to having greater impact on perceived exertion. Among the novice
group, pace monitoring (P), command and instruction (C), and feelings and affect (A)
contributed to the higher ratings of perceived exertion. In the average group, it was found that
body monitoring (B), in addition to A, C, and P, influenced a higher perceived exertion.
Perceived exertion was influenced in the superior group similar to that of the average group with
the absence of thoughts of feelings and affect (A). It still may not necessarily be conclusive that
these specific associative thoughts increased effort perception or that the thoughts were directly
mediated by task intensity itself.

The hypothesis of an increasing RPE mirroring an increase in task intensity was
confirmed by Tenenbaum and Connolly (2008). In a study of 60 rowers, rowing at 30%, 50%
and 70%, it was found that attention shifted from dissociation to association and that RPE
increased in each stage. Novice rowers demonstrated an overall higher RPE than the experienced
rowers, coinciding with findings of Morgan and Pollock (1977). Significantly, among all rowers,
novice women recorded higher associative thoughts at each minute of every 10 minute session.
In turn, novice women consistently reported the highest RPE over novice men and experienced
women (Tenenbaum & Connolly, 2008). Again, it cannot be determined that associative thoughts directly moderate higher RPE ratings.

In agreement with Tenenbaum and Connolly (2008) and Schomer (1986), Drylund and Wininger (2008) found similar results. When studying the effect of music preference and exercise intensity had on perceived exertion during treadmill running/walking, it was concluded that participants in the higher intensity groups reported higher RPE than those in the moderate and low intensity groups. In addition, the low intensity group associated significantly less than those in the high and moderate groups, revealing similar findings and influences RPE may have on association.

Using music as well as visuals to influence attention and perceived exertion, Razon et al. (2009) measured hand grip times for 60 participants under four different conditions as described previously. Despite presence or absence of vision and music, associative thoughts and ratings of perceived exertion increased under increases in duration of grip, or increasing intensity. Still, consistent with previous findings, along with the linear increase in perceived exertion, the shift from dissociative to associative thoughts occurred (Drylund & Wininger, 2008; Razon et al., 2009; Schomer, 1986; Tenenbaum & Connolly, 2008). However, Razon et al. (2009) importantly noted that under lower and moderate intensities, a focus of attention was effective in manipulating RPE. Specifically, external dissociation lowered RPE, leading to longer grip time.

Providing great insight into the effect intensity has on RPE and intensity has on attention allocation, Aitchison et al. (2013) reported an increase in associative thoughts with increasing intensities (50% to 70% of maximum treadmill speed). Through this study, Aitchison et al. (2013) provided an outline for explaining when associative thoughts would occur and when dissociative thoughts would occur. It was found that from an RPE of 16-20, associative thoughts
would occur and from an RPE of 6-10, dissociative thoughts would occur. It was still unclear if
the shift from dissociative to associative thoughts was time dependent (Aitchison et al., 2013).
They also provided no clear conclusion that association will lead to an automatic RPE of 16 to
20. The duration involved in the exercise and the exercise intensity still remain important factors
to the individual’s perceived intensity rating.

It is consistent that an increase in exercise intensity leads to a higher RPE (Aitchison,
2013; Drylund & Wininger, 2008; Razon et al., 2009; Schomer, 1986; Tenenbaum & Connolly,
2008) and a greater shift towards associative thoughts (Aitchison et al., 2013; Drylund and
Wininger, 2008; Hutchinson & Tenenbaum, 2007; Razon et al., 2009; Schomer, 1986;
Tenenbaum, 2001; Tenenbaum & Connolly, 2008). Masters and Ogles (1998a) reviewed
perceived exertion and found that dissociation strategies relate to increased tolerance of pain, and
in turn, lowered perception of exertion. It was specifically noted that a lowered perceived
exertion and raised pain tolerance were only possible under low and moderate conditions rather
than high intensity exercise conditions (Masters & Ogles, 1998a). In a more recent review, Lind
and colleagues (2009) noted the inconsistent nature when measuring RPE and attention
allocation. It was generalized that an association focus would enhance physical sensations
including pain and that dissociation would diminish physical sensations, raising and lowering
RPE respectively. However, Lind et al. (2009) offers that both association and dissociation can
raise RPE, differing from the conclusion provided by Masters and Ogles (1998a).

**Uncertain influence of A/D strategies on RPE.** To further understand the inconsistent
nature A/D strategies have on RPE, the methods and results of A/D strategies as independent
variables will be reviewed. LaCaille et al. (2004) gathered 60 participants who ran at least 15
times a week. To test how cognitive strategies influenced running performance, RPE, affect, and
satisfaction, the participants were categorized into either the association group or dissociation group and were asked to run five kilometers at a self-selected pace on either a treadmill, and indoor track, or an outdoor route.

In the association group, participants were asked to monitor heart rate via Polar HR monitor that beeped every 30 seconds. In this time, participants were told to reflect on the feedback as it would relate a marker of pace and effort. The dissociation group was asked to listen to music and pay no attention to the HR monitors (LaCaille et al., 2004). At the completion of the run, participants in the dissociation group were asked to report the number of songs listened to. At the completion of the run, all participants were asked to complete the Thoughts during Running Scale (TDRS), a 38-item inventory measuring the extent to which various dissociative and associative thoughts occurred on a 5-point scale (0=never to 4=very often). Ratings of perceived of exertion, from 16-20, were also measured after completion of the run (LaCaille et al., 2004).

Participants in the association condition did not report significantly higher RPE ratings than those runners in the dissociative group when running at nearly the same speed and finishing close to the same time (LaCaille et al., 2004). It was suggested that the lack of change in RPE between groups was due to the type of attention. Monitoring heart rate is considered an associative strategy but requires active attention. Listening to music can be considered dissociative, but is more passive in nature and not requiring a lot of focus. Therein, it is suggested that a more active dissociative strategy may lower RPE (LaCaille et al., 2004).

Participants were recruited by Stanley and colleagues (2007) from a cycling class, ensuring cycling experience, to test the effects of attentional strategies on perceived exertion. Thirteen female participants were instructed on four instructional sets of attentional strategies to
use, one for each of the four total sessions. Participants were asked to cycle at moderate level of resistance, 75-80 watts, for 10 minutes and to pedal at a pace that maintained a pre-established HR as determined by a previous max test. Participants were divided into groups of internal association, external association, internal dissociation, and external dissociation using Stevinson and Biddle’s (1998) classification (Stanley et al., 2007). The internal association group was asked to focus on heart rate, respiration, and muscle feeling. The internal dissociation group was asked to watch a video of choice and then answer questions in regard to the video at the completion of the test. The external association group was instructed to pay attention to the digital screen in front of them that displayed distance covered, calories burned, and duration. The external dissociation group was asked to observe the entrance of the gym and count the number of females and males that entered. At one-minute intervals, measures of HR and RPE were taken by the instructor.

From the intervention, Stanley et al. (2007) found that all four sessions required the same physical effort and also interestingly that internal and external association revealed similar thought processes. In light of Masters and Ogles (1998a) previous mentioning of manipulating RPE under low intensity, it was reported that the dissociative coping strategy, internal and external, reported lower perceived exertion than when using the internal and external associative strategies because of the physical effort being tolerable (Stanley et al., 2007). Despite conclusion of a change in RPE when using differing attention strategies, Stanley et al. (2007) noted that the findings may only be relevant to shorter resistance tasks and not long endurance tasks.

**Overview of A/D: Ratings of perceived exertion (RPE).** It is concluded consistently that as intensity increases, RPE increases (Aitchison, 2013; Drylund & Wininger, 2008; Razon et al., 2009; Schomer, 1986; Tenenbaum & Connolly, 2008) and a shift from dissociation to
association occurs (Aitchison et al., 2013; Drylund and Wininger, 2008; Hutchinson & Tenenbaum, 2007; Razon et al., 2009; Schomer, 1986; Tenenbaum, 2001; Tenenbaum & Connolly, 2008). Unfortunately, the influence association and dissociation have on effort perception is not yet solidified (Lind et al., 2009; Masters and Ogles, 1998a) and may further be influenced by the type of association and dissociation strategies used (LaCaille et al., 2004). Whereas for endurance runners, attentional strategies showed no significant changes in RPE (LaCaille et al., 2004), significant changes of RPE did exist in short term resistance cycling (Stanley et al., 2007). In conclusion, more research is needed with specific attentional strategies and specific exercise mode and duration to determine if type of attentional strategy has a consistent, moderating effect on RPE.

A/D: Physiological and Performance Outcomes

Association and dissociation strategies effects on physiological outcomes, such as HR, EMG activity, and RER, along with performance outcomes such as the duration of task and distance covered have been researched broadly over the past three decades. Researchers have performed studies measuring the effect attentional strategies have on swimming, running, cycling, rowing, and even sit-ups demonstrating the wide, and almost endless, possibilities different cognitive strategies have on performance. In this section, a close look will be placed on physiological and performance outcomes.

Physiological outcomes. When observing HR and blood pressure (BP), Lind et al. (2009) reported no consistent significant differences between using an association or a dissociation strategy. They reported that dissociation both lowered (Couture, Singh, Lee, et al., 1994; Franks & Myers, 1984) and raised (Smith, Gill, Crews, Hopewell, & Morgan, 1995) HR with causes of this remaining unknown. When measuring oxygen consumption, it was
predominantly found that A/D strategies revealed no significant changes in max. However, some findings reported using an associative strategy, for the most part, led to lower minute ventilation and respiration rate. Similar oxygen consumption (VO₂), the respiratory exchange ratio (RER) was found to be predominantly lower; more fat burning than carbohydrate burning under associative thinking (Hatfield et al., 1992).

Electromyographic (EMG) activity, a factor related to exercise economy, determines the amount of muscles that are being recruited to perform a task or activity (Wulf, 2013). A lowered EMG activity would indicate the most efficient movement outcome. When comparing association and dissociation strategies, the benefits of a dissociative strategy include lowering EMG activity. In a review by Wulf (2013), an external focus is said to release the body’s degrees of freedom, or ease of movement, and allow for the highest possible movement efficiency. Therefore, running performance may increase as less strain is put on muscles that aren’t necessarily needed to move.

While reviews are important to get an overall understanding of A/D strategies on exercise economy and other physiological responses, specific studies which include detailed methods and results better encapsulate the direct effect. Neumann and Brown (2013) studied physiological and motor performance during sit-ups. Twenty three, active to semi-active, female students (Mage = 21.4) completed eight sets of 12 sit-ups under four different conditions (two sets in each condition). Each sit-up was regulated by a monitor, with a cadence set to have the participants in the starting position for three seconds to the seated position for three seconds. Participants were hooked up to multiple EMG sensors to measure trunk contraction and bending of the waist. Along with this, HR response was measured throughout the duration of the activity. Using attentional strategies as the independent variable, four conditions were used. In the internal
association condition, participants watched a recording of fitness trainer instructing them to focus on the tension and contraction of the stomach muscles. Participants in the external association group watched the same fitness training video but instead were given cues to focus on the smoothness and flow of movements rather than specific attention to the muscles operating. In the internal dissociation group, participants were shown arithmetic calculations every 3 seconds in which they had to solve. Lastly, in the external dissociation, participants were instructed to watch two separate netball matches with commentary (Neumann & Brown, 2013).

Mean raw EMG activity was found to be higher in the association conditions than the dissociation conditions (Neumann & Brown, 2013) which is parallel to the findings reported by Marchant et al. (2009). Specifically, EMG activity was significantly lower in the external association group than the internal association group. However, in terms of dissociation, EMG activity was lower, but not significant, for the internal dissociation group as compared to the external dissociation group. When looking at significant findings, the results indicated that more efficient muscle recruitment is produced under the external association condition. Heart rate response was also measured and it was found that when comparing an external focus to an internal focus using association, HR was lower, similar to the EMG response.

Psychological and physiological responses of attentional strategies have also been studied in running (Neumann and Piercy, 2013). Twenty participants reported exercising each week anywhere from less than two to six hours a week. Prior to testing, all participants performed a maximum velocity ($V_{\text{max}}$) test to determine experimental condition speed which was set at 70% of $V_{\text{max}}$ for each individual, with all thoughts recorded after this test. Five minutes after the maximum velocity test, the participants were asked to run for four sessions of six minutes separated by a five minute break. Each session held a different attentional strategy and
participants were reminded every 30 seconds to use the designated strategy. All participants were hooked up to machines to measure EMG, electrocardiogram (ECG), and gas exchange.

In manipulating association and dissociation conditions, four different conditions existed. In the distance focus condition, participants were instructed to focus on the increase in distance covered on the monitor in front of them while all other information on the monitor was covered. For all other conditions, the entire display was covered. Participants in the movement focus condition were asked to focus on the movement and stepping forward of their legs. In the breathing condition, participants were asked to concentrate on the breaths going in and out. Lastly, the control condition had all participants focus on what they thought about during the maximum velocity test. All four sessions were counterbalanced to ensure accuracy among attentional strategies without attribution to order (Neumann & Piercy, 2013).

When comparing respiration rate (RR), results showed that RR was significantly lower for the distance focus group than the breathing focus and control group. In terms of oxygen consumption, was lower for the movement focus than the breathing focus with no differences in comparison to the distance and control group. These results are in disagreement with the review findings of Lind et al. (2009) who reported no significant changes in oxygen consumption. Interestingly, no statistical significant difference was found when comparing EMG activity in each condition (Neumann & Piercy, 2013).

The findings reported by Wulf (2013) that EMG activity can be lowered using dissociative strategies were confirmed by Neumann and Brown (2013). In the study by Neumann and Piercy (2013), however, it was found that there existed no differences in EMG activity between groups. This might be due to the difference in exercise mode, a short-term strength exercise in comparison to a more endurance-based exercise. Also, association and dissociation
strategies in Neumann and Brown (2013) were very defined and specified where in Neumann and Piercy’s (2013) these were not. Nonetheless, it is noted that association and dissociation strategies may influence muscle recruitment and exercise economy, such as lowering heart rate (Neumann & Brown, 2013) and oxygen consumption and respiration rate (Neumann & Piercy, 2013). Lind et al. (2009) earlier contrasted such findings noting that no major differences in HR and oxygen consumption took place. In consideration of these findings, and in application to the running world, certain physical limitations along with mental limitations have contributed to a running term known as “hitting the wall.” In the next section it is important to discuss “hitting the wall” because it may have relevance to the physiological processes that take place and the dissociative or associative monitoring of these processes.

**Hitting the wall: Does it always occur?**. “Hitting the wall” is a process in which the body begins to shut down, an effect caused by glycogen depletion and lowering of blood volume (Morgan, 1978). As physiological as it seems, it can also be manipulated by the runner’s cognitions. Some runners acknowledge a “wall” exists and hit it more than once in a marathon, while other runners believe the wall to be a myth (Morgan, 1978). Morgan (1978) reported that those who associate are able to monitor incoming physiological sensations and adjust pace and workload accordingly to potentially avoid “hitting the wall.” Other runners, who may dissociate, distract themselves for so long that eventually the pain becomes unbearable, and “the wall” is hit. Lind et al. (2009) reported overall that those who maintained an internal, task-irrelevant focus “hit the wall” sooner than other focus groups, but nonetheless, all groups “hit the wall,” whether using association or dissociation. The differences in these findings may be in relation to the status of the elite, with elite athletes having more practice and experience at attending to and monitoring physical sensations.
To directly study the cognitive orientations of runners and their perceptions of “hitting the wall,” 66 participants, entrants of the London marathon, were recruited for a study (Stevinson & Biddle, 1998). The sample of runners included 35 first time runners and all runners were classified as non-elite marathoners. Participant’s received questionnaires before the race to be completed after the race. The questionnaire included a statement about how people think about different things and were asked to list (from zero to eight) how much of their thoughts existed in each category of internal association, internal dissociation, external association, and external dissociation with a total score from all four groups equaling eight. Along with the thoughts during the run, time to completion of the marathon and time to “hitting the wall” were recorded.

The questionnaires returned revealed that 53% (35 runners) reported “hitting the wall” while 47% (31 runners) did not (Stevinson & Biddle, 1978). A relation existed between cognitive strategies and “hitting the wall.” It was found that those who “hit the wall” had greater inward distraction scores and “hit the wall” sooner and for a longer duration of time. These findings relate to the findings of Morgan (1978) in two ways. First, not every runner “hits the wall” (Stevinson & Biddle, 1998; Morgan, 1978). Secondly, association does not always avoid “hitting the wall” as suggested by Morgan (1978). In fact, association runners “hit the wall” just as much as dissociation runners. In comparison, Stevinson and Biddle’s (1998) study used non-elite runners while Morgan (1978) focused on more elite runners who may have far more experience with managing physical sensations and pace to accommodate fatigue. Overall, findings revealed that outside of physiology, associative and dissociative thoughts influence performance and fatigue, no matter the status of the exerciser or ability.

**Performance outcomes.** While physiological outcomes are changes that take place internally, performance outcomes can be described as external changes that take place as a result
of the changes from internal processes. As exercise economy factors change, so does time to completion, duration, and distance covered. Lower heart rate, RER, respiration rate, and EMG activity from differing attentional strategies may lead to better performance outcomes (Morgan, 1978). This section takes a look into further performance outcomes such as running speed, running distance, and duration.

Dissociation has been an optimal strategy to lower RPE and HR along with occasional reductions in minute ventilation (Wulf, 2013) and increases in pain tolerance (Johnson & Siegel, 1992). The distraction however, may overlap into performance too far and become an antecedent to slower running times when compared to associative thoughts (Masters & Lambert, 1989; Saintsing, Richman, & Bergey, 1988). Connolly and Janelle (2003) found that self-controlled pacing, an associative strategy, yielded performance improvements including greater VO$_2$max values (Mauger & Sculthorpe, 2012). In opposition, it was revealed that with an external focus movement speed can increase in short movement tasks (Fasoli, Trombly, Tickle-Degnen, & Verfaellie, 2002) and time to complete running tasks is reduced (Porter, Nolan, Ostrowski, & Wulf, 2010).

Running performance has been studied with the use of cognitive strategies (LaCaille et al., 2004). With further details described previously in this chapter, it is important to note again that 60 participants, who run at least 15 miles a week, were split into an associative or dissociative group and asked to run for five kilometers at a self-selected pace on a treadmill, indoor track, and outdoor route (LaCaille et al., 2004). A main effect of cognitive strategy on performance time was reported (LaCaille et al., 2004). Under the association focus group, participants ran faster than the dissociation group. This result is in agreement with Masters and Ogles (1998a) and Connolly and Janelle (2003), but in disagreement with the findings of Porter.
LaCaille et al. (2004) noted that perhaps the association group monitored their pace constantly, which is also consistent with their capability, and was less likely to fluctuate than the dissociative group.

In another study measuring RPE and task intensity, Razon et al. (2009) measured performance time in relation to the cognitive strategy used. Sixty participants completed a hand grip task under 4 different conditions with each condition reflecting a different dimension of association and dissociation indirectly; no vision and no music, music and vision, vision and no music, and no vision and music.

Under the two conditions with music, it was reported that participants held the grip longer than the no music groups (Razon et al., 2009). In essence, a dissociative strategy of listening to music helped to improve the time on task. While it is not an endurance task, better performance outcomes appear to be reflective of dissociative strategies. This finding reflected the increased pain tolerance temporarily allotted by dissociation (Johnson & Siegel, 1992). An underlying theme provided by Wulf (2013) suggests that “an external focus on the intended movement allows for a functional vulnerability, such that the motor systems automatically adjust the various degrees of freedom to achieve the effect” (p. 89). In result, muscular activity is reduced because of the increase in movement efficiency, thus influencing performance outcome.

**Overview of A/D: Physiological and performance outcomes.** It appears as though results still remain inconclusive about the effects of attentional strategies have on physiological and performance outcomes. Heart rate may increase or decrease using dissociation (Neumann & Brown, 2013) or may not even change at all (Baden, McLean, Tucker, Noakes, & St Clair Gibson, 2005; Hatfield et al., 1992). Lind et al. (2009) supported no changes in using differing attentional strategies, but oxygen consumption was found to decrease under a dissociation focus.
according to Neumann and Piercy (2013). At times, a dissociation focus led to a decrease in EMG activity (Wulf, 2013; Neumann and Brown, 2013) and resulted in a better time on task duration (Razon et al., 2009). Other performance increases still question which attentional strategy to use as Porter et al. (2010) provided support for dissociation while Mauger and Sculthorpe (2012) and Masters and Ogles (1998) provide support for association. In conclusion, this inconsistency allows for further investigations to determine how cognitive strategies potentially moderate performance and physiological outcomes.

**A/D: Psychological Outcomes**

Measures of RPE, intensity, HR, and EMG activity have been studied extensively in the literature surrounding association and dissociation attentional focus strategies. Affect, enjoyment, mood states, satisfaction, anxiety, and self-efficacy have been studied minimally. Salmon et al. (2010) reviewed more than 50 studies about cognitive strategies and it was noted that only two studies measured affect. Morgan et al. (1998) has stated that psychological factors are important in running performance and that as a result, the intrinsic rewards that influence the engagement of exercise become the factors most attributed to increased exercise adherence. If enjoyment and mood factors are important in exercise and exercise adherence, it is important to investigate other underlying extrinsic and intrinsic rewards, such as satisfaction and enjoyment, due to the influence on exercise adherence (Morgan & Pollock, 1977). From the few studies that have been done, results confirm the benefits that exist when using attentional strategies, but overall findings remain inconclusive and unsolidified to proving a definitive cognitive strategy that is best. This section details the differing psychological outcomes resulting from differing cognitive strategies. Goode and Roth (1993) set out to understand the thoughts of a runner during his or her run and the potential mood benefits in light of each thought process. Along with their
review and recent findings, they suggested that if runners used associative thinking or significant cognitive effort in dissociative thinking, they would not experience all of the mood benefits possible from the run.

**More psychological benefits using dissociation.** One hundred and fifty runners with at least seven years of regular running (ages ranging from 17-58 years) were included for participation in a study by Goode and Roth (1993). Runners who were preparing to run their own personal running session (no set distance or time) were asked to participate in the study. Upon acceptance, the runners completed the *Profile of Mood States* (POMS) before the run and after the run. After the run, participants were also asked to complete a 38-item version of the *Thoughts During Running Scale* (TDRS), which measured how much they thought about certain items on a 5-point scale (0=never to 4=very often) (Goode & Roth, 1993).

It was found that when comparing scores of the POMS to the TDRS, only the thought domain of interpersonal relationships significantly decreased Tension. Vigor was shown to significantly increase when runners focused on external surroundings, interpersonal relationships, and daily events which were dissociative thoughts (Goode & Roth, 1993). Not significant, but still important to note, was the finding that associative thoughts were related to increases in fatigue while dissociative thoughts showed decreases in fatigue, supporting the findings of Masters and Ogles (1998) and Tenenbaum (2001). Besides spiritual reflection, all dissociative factors reflected significant increases in Vigor. In light of the previous statement, increasing dissociation through a designed intervention has been found to increase running performance. While the results may show benefits, it is to be noted that run intensity and run duration were not held constant. This may provide evidence for choosing a self-selected pace and
distance to increase performance, but this remains to be investigated with runners who are forced to run under a non-self-selected pace and distance (Goode & Roth, 1993).

In a study by LaCaille et al. (2004), the Exercise-Induced Feeling Inventory (EFI) along with course satisfaction and the TDRS were measured under six separate conditions which included groups using either an associative or dissociative strategy on an outdoor route, an indoor track, or on a treadmill. The EFI specifically measures feeling states and the degree to which feelings occur, on a 5-point scale (0=do not feel to 4=very strong), during a single bout of exercise. LaCaille et al. (2004) recruited 60 individuals to run at a self-selected pace for five kilometers; details of the study have been described previously. Along with EFI measures, course satisfaction scores and TDRS scores were recorded by the runners immediately following the completion of the study.

Results indicated that cognitive strategy and exercise setting were significantly related, as only tranquility was found to be greater in the dissociation group and no significant findings existed between cognitive strategies and satisfaction. It was therein revealed that in the exercise setting, the outdoor route produced lowered exhaustion and more positive affect in comparison to running on the track and treadmill, with the indoor track being in the middle. These findings are important when measuring affect because most studies have either used treadmills, which produce lower satisfaction ratings and higher RPE (LaCaille et al. (2004), or indoor tracks (Goode & Roth, 1993). With the main focus being psychological outcomes, no differences were found in satisfaction when using association or dissociation (LaCaille et al., 2004).

Music, a possible form of dissociation, has been studied as well when measuring psychological outcomes and attentional strategies. Drylund and Wininger (2008) studied the effects music has on psychological variables. With major details described in previous sections
of this review of literature, 200 participants were recruited and asked to complete a music preference questionnaire followed by a music satisfaction questionnaire after the test. After being placed into one of 3 music conditions (most preferred, least preferred, none) and 3 exercise conditions (low, moderate, high intensity), participants were told to run for 20 minutes at the assigned intensity. The AFQ, music satisfaction, and enjoyment questionnaire were completed after the test. Enjoyment was measured by the *Interest/Enjoyment Scale* from the *Intrinsic Motivation Inventory* (IMI). The specific *Interest/Enjoyment Scale* is a self-report measuring intrinsic motivation and uses a 7-point Likert scale (1=strongly disagree to 7=strongly agree).

Results remained rather inconclusive but supported the theory by Tenenbaum (2001) that noted only under low or moderate intensities are dissociative strategies useful. Drylund and Wininger (2008) indicated that music, a dissociative focus, can have an effect on exercise enjoyment. In order for this to occur, the music has to be salient enough to overpower the intensity of the exercise, which is more common under low and sometimes moderate intensities. Although it was not significant, it was also found that when exercising under the moderate intensity condition, participants reported the highest levels of enjoyment (Drylund and Wininger, 2008). In combination with effects of cognitive strategies, and with no significant findings revealed, the dissociation strategy of listening to music may have the potential to increase exercise enjoyment under low and moderate intensity exercise.

Another important finding is the effect the differing cognitive strategies had on satisfaction (Neumann and Brown, 2013). Twenty-three females were recorded to do eight sets of sit ups under four different attentional conditions (two sets each). The conditions consisted of internal and external dissociation and internal and external association. Participants were asked to subjectively rate on a scale from one (very low) to seven (very high) on how satisfied they felt
with their effort. When using the dissociation method, participants were more satisfied with an external focus than an internal focus. They reported that not only was the internal focus the least satisfying, but it was the less likely method they would ever perform the task. When comparing association strategies, no differences existed between external and internal foci. Altogether, no differences existed between cognitive strategies of association or dissociation on satisfaction (Neumann & Brown, 2013). No conclusive findings can be revealed in support of one attentional focus strategy or the other, but it is important to note than when using a dissociative strategy, an internal focus may be the least satisfying.

Measuring psychological changes using differing cognitive strategies, Neumann and Piercy (2013) measured satisfaction in a running task. After a maximum velocity task, 21 participants were asked to run at 70% of their $V_{\text{max}}$ speed for four, six-minute running blocks separated by five minute breaks. Each running block consisted of a different instruction of focus as detailed previously. Upon completion of each test, participants were asked to complete the POMS (also done before), a single-item Exercise Satisfaction Scale, and the Physical Activity Enjoyment Scale (PACES). The single-item Exercise Satisfaction Scale had participants rate on a 5-point scale (1=low to 5= high) how well they were satisfied with their effort. The PACES is a 16 item form used to measure enjoyment. No significant differences were found across any conditions. All participants were moderately satisfied and moderately enjoyed the run.

**Self-efficacy and exercise.** In relation to cognitive strategies, association and dissociation, exercise, psychological and performance outcomes, the measurement of self-efficacy was not a main focus of study. Self-efficacy has been studied in its relation to exercise and through the intervention of an exercise program to adherence, but has little to any information about the effect cognitive strategies may have on self-efficacy. Razon et al. (2009)
used self-efficacy to determine similarities in confidence between groups, but did not measure self-efficacy to determine if changes occurred before and after.

Self-efficacy was defined by Bandura (2006) as the beliefs one has in their capabilities to reach a certain goal or fulfill a set of achievement standards. In regards to exercise, self-efficacy may play a large role in the adherence to a daily routine or regular exercise patterns. If one cannot reach goals on a continual basis, whether goals are too high or too broad, or there exists a disconnection between the enjoyment and goals one has, then self-efficacy may become lowered. It is the intent of the present investigation, however, to measure self-efficacy before and after an exercise intervention to determine if one cognitive strategy can play a larger role than the other in increasing self-efficacy.

In a study of 58 women completing a 12-week strength training program, Rodgers, Wilson, Hall, Fraser, and Murray (2008) assessed participants’ self-efficacy using the Multidimensional Self-Efficacy for Exercise Scale at three time periods (the first week, week six, and week 12). As this self-efficacy scale is designed to measure task, coping, and scheduling self-efficacy, Rodgers et al. (2008) found that scheduling and coping self-efficacy increased overtime, whereas task self-efficacy did not. Additionally, coping self-efficacy increased from week one to week six and from week six to week 12 while scheduling self-efficacy only increased from week one to week six. This questionnaire, along with an intervention of cognitive strategies, may provide further information of how self-efficacy has the likelihood to produce long term increases, and in relation to the current study, possible short term increases.

Solely investigating the relationship exercise has to self-efficacy, in validating Bandura’s (2006) exercise self-efficacy questionnaire which measures barrier self-efficacy, Shin and colleagues (2001) found that adults who exercised regularly and more frequently had higher
exercise self-efficacy (ESE) than those who never exercised or exercised intermittently and those who exercised less frequently.

In another validation study, ESE was measured in cardiac rehab patients performing 6-minute walk tests during a 6-week intervention program (Everett et al., 2009). It was found that during this time, the group walking the most (more than 500m at baseline) reported higher measures of ESE than those who reported walking less (up to 400m at baseline). In application of these findings, exercise self-efficacy was able to increase with the implementation of an exercise program. Everett et al. (2009) concluded that self-efficacy improvement may in turn increase regular physical activity in chronic rehabilitation patients, and even in the general population.

Measuring the mechanisms that related self-efficacy to exercise adherence and other factors such as health-related quality of life, Ikuyo, Alfano, Mason, Chiachi, Liren, et al. (2013) had participants exercise at 60% to 85% of their max for 60 minutes a day, six days/week, for 12 months. Control participants were asked to not change their exercise and diet habits, but were given the opportunity to take an exercise class for two months. After the 12 month period, the participants in the intervention program who had greater increases in cardiopulmonary fitness showed larger increases in general health, physical functioning, and importantly exercise self-efficacy. Overall, higher self-efficacy and quality of life were associated with increases in exercise adherence and cardiopulmonary fitness (Ikuyo et al., 2013). The results of this study, along with previous results (Everett et al., 2009; Shin et al., 2001) suggested that exercise self-efficacy can be improved and improved by means of intervention. Unfortunately, changes in self-efficacy usually are measured by intervention programs lasting more than one week, and not in an acute episode (e.g., 10-15 minutes of exercise).
**Overview of A/D: Psychological outcomes.** Psychological outcomes still remain limited and inconclusive among the cognitive strategy and exercise literature, finding more often than not that significant differences existed between cognitive strategies used during exercise (Drylund & Wininger; 2008; LaCaille et al., 2004; Neumann & Brown, 2013; Neumann & Piercy, 2013). Limited findings revealed that dissociation had a possibility of increasing enjoyment under moderate intensity (Drylund & Wininger, 2008) and raising levels of tranquility (LaCaille et al., 2004). With minor support of dissociation as beneficial, it is also important to note that specifically an internal focus may lower satisfaction (Neumann & Brown, 2013). The most differences in findings when comparing cognitive strategies came from Goode and Roth (1993). They reported that Tension decreased significantly when thinking about interpersonal relationships and that Vigor increased the most with a focus on daily events, interpersonal relationships, and external surroundings; all of which can be classified as dissociative strategies. Exercise self-efficacy also has the potential to be influenced by integrating exercise into daily life through different interventions (Everett et al., 2009; Ikuyo et al., 2013; Shin et al., 2001). The amount of time and interventions for these changes to take place using cognitive strategies remains undefined. Therefore, when assessing psychological outcomes in the current study, hypotheses should be directional, supporting dissociation as a more beneficial strategy.

**Summary of Literature Review**

Overall benefits exist in terms of dissociation for lowering EMG activity (Neumann and Brown, 2013; Wulf, Dufek, Lozano, & Pettigrew, 2010) and RPE (Razon et al., 2009; Stanley et al., 2007; Wulf, 2013) when dissociation is able to be manipulated under low to moderate intensity conditions (Masters and Ogles, 1998b; Rejeski, 1985; Tenenbaum, 2001). When assessing psychological benefits during exercise such as mood and affect, cognitive strategies do
not always significantly differ (Drylund & Wininger; 2008; LaCaille et al., 2004; Neumann & Brown, 2013; Neumann & Piercy, 2013) but researchers have reported results in favor of dissociation (Drylund & Wininger, 2008; Goode and Roth, 1993; LaCaille et al., 2004; Neumann & Brown, 2013). The only problem with a dissociation method is that it might slow down the runner (Saintsing et al., 1988) and influence “hitting the wall” sooner and for longer when running (Lind et al., 2009; Stevinson & Biddle, 1998). Other positive aspects of dissociation reveal contradictory findings in performance outcomes such as better times when running (LaCaille et al., 2004; Porter et al., 2010) and longer durations of exercise (Razon et al., 2009). Still, even though it is uncertain as to which cognitive strategy is better than another, there always exists the fact that after a certain intensity, all thoughts will be shifted towards associative ones (Aitchison et al., 2013; Drylund & Wininger, 2008; Hutchinson & Tenenbaum, 2007; Razon et al., 2009; Schomer, 1986; Tenenbaum, 2001; Tenenbaum & Connolly, 2008) and perceptions of effort will be raised (Aitchison, 2013; Drylund & Wininger, 2008; Razon et al., 2009; Schomer, 1986; Tenenbaum & Connolly, 2008). There still remains a personal preference of focus, but it is necessary to continue examination on the effects of each cognitive strategy during running. In light of all findings and with directions towards further investigations, it is important to design a study that properly defines association and dissociation, accounts for the methods of recent studies, and expands on the points of measures. The next chapter will provide further details into how the investigation of differing cognitive strategies as the independent variable will influence performance, physiological, and psychological outcomes.

The Current Study

The classification proposed by Stevinson and Biddle (1998) was used to design the intervention instructions, specifically instructing participants on what to focus on (See Table 1
for a summary). Although Brick et al. (2014) proposed highly specified examples and definitions, the current study attempts to understand how an internal or external associative or internal dissociation strategy can influence behavioral and personal outcomes.

Although males and females have been used to study the effects of A/D strategies, the current study will only sample males. This sample of the population is considered because females tend to report higher RPE’s than males working at the same intensity (Tenenbaum & Connolly, 2008) and consequently, higher RPE’s correlate to more associative thoughts (Thompson & Micklewright, 2013).

The purpose of the current study is to attempt to understand how cognitive strategies influence psychological, physiological, and performance outcomes of recreational male exercisers during a 1.5-mile run. As extensively reported in the literature, it is hypothesized that the dissociation intervention will support enhanced positive psychological outcomes such as enjoyment, mood, and self-efficacy benefits and that the association intervention will support increases in performance outcomes such as time to completion. Findings should then recognize that using cognitive strategies is a very possible way to enhance these outcomes and allow all exercisers, elite or non-elite, to achieve the benefits they desire most.
CHAPTER III: METHOD

Participants

Participants \((N = 22)\) were recruited from a northwest Ohio public university via classroom visits and handouts. Following the completion of eligibility questionnaires one participant was removed from the study for a high social desirability (see Instrumentation). Therefore, the final number of participants was 21. All participants were males and required to have participated in regular exercise of at least 150 minutes/week for the past month. The purpose of having participants in this fitness level was to differentiate them from an elite running population and thus, be comparable to a recreational exercising population that was able to run continuously for 1.5 miles. Additionally, all participants selected were classified as healthy based on responses to classifications of the Medical History Questionnaire (Appendix A) and according to ACSM (2014).

The characteristics of participants are shown in Table 2 and show that the population consisted of regular exercisers that did and did not run habitually, but still maintained 120 minutes/week of exercise whether it be resistance or cardiovascular or a combination of both. The majority of participants were graduate students \((n = 11)\) and juniors \((n = 5)\). European Americans \((n = 16)\) were among the highest frequency followed by Asian/Pacific Islanders \((n = 2)\) and Hispanic/Latino \((n = 2)\). In relation to preferred attentional focus strategy, participants were evenly distributed among preferences to associate \((n = 5)\), dissociate \((n = 8)\), and to do both \((n = 8)\). It should be noted that a \(Mean\) BMI of 25.47 kg/m\(^2\) classified the participants as overweight, even though all participants were regular exercisers. The BMI findings were undoubtedly skewed by not accounting for muscle mass.
Table 2

Participants Characteristics

<table>
<thead>
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<th>Variable</th>
<th>Mean</th>
<th>Std. Deviation</th>
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<th>Maximum</th>
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<tr>
<td>Exercise Days</td>
<td>5.1</td>
<td>1.2</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Exercise (minutes/days)</td>
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<td>25.4</td>
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<td>5</td>
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<tr>
<td>Miles/Session</td>
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<td>2.0</td>
<td>0</td>
<td>7</td>
</tr>
</tbody>
</table>

*Note. Participants (N = 21) individually participated in more than 150 minutes/week of exercise and were classified as healthy based on the medical history questionnaire.*

Instruments

**Personal, medical, and exercise history questionnaires.** A medical questionnaire was used to determine eligibility by assessing physical capability and health liabilities (See Appendix A). Personal data measurements included age, weight, height, ethnicity, and education level (See Appendix B). Exercise mode, duration, and frequency were included in Appendix C. A specific running question asked participants to record the average number of miles they ran per session per week as well as commonly used cognitive processes used. Any individual exercising less than the 150 minutes/week were excluded from the study in order to maintain a consistent fitness level across all groups as well as meet qualifications for exercise testing which stated that a 10-minute exercise bout was acceptable as long as the exerciser accumulated 20 to 60 minutes of daily exercise (ACSM, 2014).

**Reynolds Short Form of the Marlowe-Crowne Social Desirability Scale.** The Reynolds Short Form of the Marlowe-Crowne Social Desirability Scale (RSF-MCSDS; Reynolds, 1982) is an 11-item scale that utilizes a true/false response to assess a participant’s social desirability when completing self-report measures. Without reading too much into the statements, participants answered the statements as true or false based on their own personality.
traits (e.g., *No matter who I’m talking to, I’m always a good listener, I’m always willing to admit it when I make a mistake*, etc.). Participants with high social desirability ($M_{score} \geq 9$) were excluded from the study. Nine was chosen as the cutoff point as it represents the top 75th percentile of social desirability scores out of 11. Studies of the MCSDS do not use cut-off scores, but report that high defensiveness scores, similar to denying faults, are near the top 1/3 and 1/4 of scores (LaRowe, Kline, & Patrick, 2004). Because the short form was used, the top 1/4 (75%) was used as the cut-off point for eligibility in the study.

This short form was derived from the original 33-item scale by a factor analysis, using a .40 or greater factor loading criteria (Reynolds, 1982). An 11-item, 12-item, and 13-item version of the scale was developed from the original scale. Concurrent validity of these short forms is demonstrated with a correlation coefficient of .91, .92, and .93 respectively. While the 13-item scale holds the highest correlation coefficient, the 11-item scale represents more than adequate reliability in assessing social-desirability (Reynolds, 1982). See Appendix D for a copy of the inventory.

**Multidimensional Self-Efficacy for Exercise Scale.** The Multidimensional Self-Efficacy for Exercise Scale (MSES; Rodgers et al., 2008) is a 9-item questionnaire, three questions per subscale, of exercise intentions and behaviors that rates the degree of confidence one has in their ability to do the exercise correctly (task), doing so under hard circumstances (coping), and doing so despite scheduling constraints (scheduling). Examples include the following: *“follow directions to complete the exercise,” “exercise when you lack energy,” and “consistently exercise three times per week.”* Items are rated on a 10-interval, 100-point scale which ranges from 0 (cannot do at all) to 50 (moderately can do) to 100 (highly certain can do). All items are unipolar concluding that higher numbers indicate higher overall self-efficacy.
The MSES contains valid measures of task self-efficacy (r = .78), coping efficacy (r = .83), and scheduling efficacy (r = .80) and a high internal consistency rating of 0.85, .89, and .91 respectively (Rodgers et al., 2008). The MSES was also found to maintain internal consistency with Cronbach alphas ranging from .76 to .95 across a 12-week program (Rodgers et al., 2008). Altogether, the MSES has been found to be a reliable and valid measure of exercise self-efficacy beliefs including the changes of beliefs over time. (See Appendix E).

**Profile of Mood States.** The Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 2003) is a 65-item self-report scale that measures transient feelings and long-lasting affective states. The POMS measures overall mood disturbance and includes six subscales of Tension, Depression, Vigor, Fatigue, Confusion, and Anger. Each item of the POMS is measured on a 5-point Likert scale, ranging from 0 (not at all) to 4 (extremely) of how a person feels at that exact moment. The POMS is ideally used in clinical, athletic, and medical research because of its ability to assess changes in mood pre- and post-treatment (Berger & Motl, 2000). Bourgeois, LeUnes, and Meyers (2010) reported high internal consistency of the POMS with subscales ranging from .79 (Confusion) to .93 (Depression). (See Appendix F)

**Physical Activity Enjoyment Scale.** The Physical Activity Enjoyment Scale (PACES; Kendzierski & DeCarlo, 1991) is a bipolar, 18-item inventory that measures the feelings an individual has towards an activity. Items such as “I find it pleasurable” or “I find it unpleasurable” are to be ranked subjectively from 1 to 7 with each rating on each end of the spectrum. When recording scores, some questions are reverse scored giving lower numbers to a higher reported scores (7 =1, 6=2, etc.) and higher numbers to lower reported scores (1 =7, 2=6, etc.). A higher overall score represents more enjoyment for the specific activity. The PACES can also be measured either as a state (e.g. “rate the activity you just completed”) or as a trait
measure (e.g. “rate how you feel about general exercise for most of the time”). The PACES has been validated to effectively measure enjoyment in different groups of individuals (Crocker, Bouffard, & Gessaroli, 1995; Kendzierski & DeCarlo, 1991; Motl et al. (2001). [See Appendix G (Trait measure) and Appendix H (State measure)].

Attentional Focus Questionnaire. The Attentional Focus Questionnaire (AFQ; Brewer, Van Raalte, & Linder, 1996) assesses how often individuals think about certain activities during a maximal or submaximal effort run. The AFQ includes three subscales: association (how much the runner thinks about performance variables and bodily sensations), dissociation (how often the runner lets their mind wander and think about problem solving and relationships, and distress (how much the runner thinks about quitting and the pain being experienced). The 30-item AFQ rates items on a scale of 1 to 7 (I do not do this at all to I do this all the time, respectively). Sample scale items include examples of association [“monitoring specific body sensations (e.g., leg tension, breathing rate”)], dissociation (“thinking about pleasant images” or “singing a song in your head”), and distress (“wishing the run would end”).

The AFQ has been reported to be a reliable measure of attentional focus measurements: α = .77 and .66 for the dissociation measurement, .79 and .66 for association measurements, and .85 and .88 for the distress measurements. The AFQ also achieves a moderate to high level of internal consistency (.66 - .82) (Brewer et al., 1996). Masters and Ogles (1998b) reported that the AFQ allowed runners to score high or low on both scales of association and dissociation. Thus, association items and dissociation items were added and compared to determine if participants maintained one focus of the other. Additionally, distress scores were compared, but not included when determining the participants focus on either associative or dissociative scores. Distress scores were analyzed separately (See Appendix I).
**Rating of perceived exertion.** The Rating of Perceived Exertion scale (RPE; Borg, 1982) subjectively measures perceived effort of physical strain. The scale ranges from 6 “no exertion at all” to 20 “maximal exertion”. RPE is a measurement that allows participants to account for personal fitness level and general fatigue in the subjective rating of their feelings (ACSM, 2014). Borg (1982) developed the RPE scale to be associated with heart rate (See Appendix J).

Confirming the correlation of HR in a meta-analysis for RPE, Chen, Fan, and Moe (2002) found that in active participants, the correlation between HR and RPE (r) of .65 was reported with 95% confidence interval (CI) of 0.624 - 0.628. Using the 15 point RPE scale (6-20), Chen et al. (2002) reported an r = .63 with a 95% CI of 0.616 - 0.651. For submaximal exertion and HR, a physical steady state workload for a period of time, r = .61 with a 95% CI of 0.661 – 0.704 was reported. In a study of 2,560 Caucasian participants exercising to exhaustion during an incremental treadmill test, Scherr, Wolfarth, Christie, Pressler, Wagenpfeil, and Halle (2013) reported a moderate to high significant correlation between RPE and HR (r = .74, p < .001). The use of HR and RPE for the current study is supported also by Chen et al.’s (2002) submaximal exertion correlation (r = .61; Chen et al., 2002).

**Heart rate.** To measure physiological intensity of the exercise sessions, heart rate was measured by means of a telemetered heart rate monitor (Polar Inc., Port Washington, New York, USA) that was fixed around the torso of the runner. To measure physiological intensity, target heart rate (THR) was calculated as follows using the Karvonen and Vuorimaa (1988) method:

\[
\text{THR} = ((\text{HR}_{\text{max}} - \text{HR}_{\text{rest}}) \times \% \text{ intensity}) + \text{HR}_{\text{rest}}
\]

Recording RPE and HR provides two representations of the effort exerted during the exercise run.
Running performance. Performance was measured by the total time required to complete two low to moderate pace 1.5-mile runs, a commonly used exercise field test (ACSM, 2014) using a stopwatch. To confirm reliability, the tester recorded the time for all participants to maintain consistency.

Commitment check. To ensure participants committed to the exercise and used the intervention instructions that were read to them pre-exercise, participants were asked to rate on a self-created scale of 1 (none of the time) to 7 (all of the time) of how much they used the intervention.

Procedure

After receiving approval from the Human Subjects Review Board at Bowling Green State University, undergraduate and graduate students were recruited from the university’s local recreation center, buildings, and classrooms via personal recruitment, classroom visits, and handouts with information describing the study (See Appendix K). Students who were interested in the study phoned or emailed the primary investigator to set up a meeting time.

Meeting 1: During the first meeting, participants individually reported to a 111 meter indoor track to complete the consent form with details of the study explained. Post-consent, the participant then completed the personal data questionnaire, medical history form, the exercise history inventory, and the social desirability scale. For the participant who was eligible for inclusion (N = 21), based on medical, exercise history, and social desirability, the researcher scheduled two additional exercise times, at least two days apart within a week, to begin data collection. In the meantime, the participant was asked to maintain their current exercise behaviors and to abstain from drinking caffeine, smoking, and eating two to three hours prior to testing.
After meeting times were scheduled, the participant was informed about the RPE measure and how to rate it. The participant also were fitted with a heart rate monitor and jogged at a leisurely pace for 4 practice laps around the track. The participants reported RPE and HR at the turn of each lap, where an RPE scale was placed in order to correctly identify the ranking system. The entire first meeting was completed in order for participants to familiarize themselves with the setting, use the HR monitors, and practice reporting RPE.

**Meeting 2:** In the second meeting, the participant completed the POMS, the MSES, and trait version of the PACES. The participant was fitted with a Polar Heart Monitor to measure HR during the run. The procedure for reporting RPE was again explained in the form of a poster in order to re-familiarize the participants with the rankings (See Appendix J). The participant was reminded that he would be reporting RPE and HR every fourth lap until conclusion of the 1.5-mile run (22 laps), with RPE first followed by HR. Heart Rate and RPE were recorded every fourth lap to ensure that participants running under the dissociation condition had time between laps to maintain a focus away from the exercise. The participant was asked to be honest about HR and RPE throughout the entire process. Since reporting RPE and HR are associative thoughts, participants in the dissociation group were asked to quickly report RPE and HR and then immediately transition back into the previous train of thought or start a new one. The participant was instructed to jog with a THR between 40% and 60% of his HRR, which is classified as a moderate intensity (ACSM, 2014).

Following completion of the questionnaires and re-familiarization of RPE, the participant was randomly assigned to run under one of two interventions when running the 1.5-mile distance. In order to randomly assign interventions, participants selected a number from one through 10, where an even number represented the association intervention and an odd number
represented the dissociation intervention. In the associative intervention, participants were asked to monitor their heart rate and respiration rate, and to focus on their muscles and feet pushing off of the ground. In the dissociation intervention, participants were encouraged to focus on reflective thoughts, daydreams unrelated to the run, scheduling events, and imagining music. Specific instructions for each intervention can be found on Appendices L and M. Participants completed the 1.5-mile run two times under each intervention (association, dissociation) with assignment of the interventions randomized.

Each participant completed a 1.5-mile run at a low to moderate intensity on an indoor track with RPE and HR recorded every four laps. The runner was asked to keep a pace in the moderate intensity range in order to manipulate the direction of attention. As noted previously, under a moderate or low intensity, attention is able to be manipulated (Schomer, 1986; Tenenbaum, 2001). Heart rate and RPE were recorded to measure the intensity of each run under each condition. An indoor track was chosen for its consistent nature and open space. Although an outdoor running route may yield great changes in positive affect, the testing was done over separate days and changes in weather could easily have manipulated levels of affect and enjoyment (LaCaille et al., 2004). Although a treadmill is highly controlled for pace, effects on affect and mood and enjoyment have been found to be minimal (LaCaille et al., 2004). Thus, the indoor track showed a moderation of both controlled pace and levels of enjoyment.

Time to complete the test was immediately recorded upon conclusion of the 1.5-mile run and the participant was instructed to walk two laps to cool down. Immediately after the cool down walk, the participant was asked to complete the AFQ, POMS, MSES, and state version of the PACES seated at a table near beside. At this time, participants were asked to report verbally how they felt about the testing as to offer advice for future testing. Finally, the participant made
an appointment to return in two days to complete the last session under the remaining, opposite intervention. The same process was consistent throughout Meeting 3. All participants completed 1.5-mile runs under each assigned intervention. See Table 3 for the exercise testing protocol.

Table 3

*Testing Protocol*

<table>
<thead>
<tr>
<th>Meetings</th>
<th>Activities and Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meeting 1:</strong></td>
<td>Discussed purpose of study and completed Consent Form.</td>
</tr>
<tr>
<td>Met at indoor track</td>
<td>Completed Medical and Exercise History, Social Desirability Scale</td>
</tr>
<tr>
<td>Tested for eligibility</td>
<td>Fit participant with calibrated HR monitor and describe RPE</td>
</tr>
<tr>
<td>Exercise at 40-60% HRR</td>
<td>Participants completed 4 laps, reporting HR and RPE every lap</td>
</tr>
<tr>
<td></td>
<td>Established 2 new meeting times; Instructed to avoid caffeine, alcohol, and tobacco</td>
</tr>
</tbody>
</table>

| **Meeting 2:** | |
| A.) Testing completed seated at table beside the track. One participant tested at a time | Participants completed: POMS, MSES, and PACES-T<sup>a</sup> |
| | Reviewed RPE and HR procedure |
| B.) Exercised between 40-60% HRR using assigned intervention | Randomly assigned intervention: Association or dissociation |
| | Participants jogged for 1.5 miles under the assigned intervention |
| | Participants reported RPE and HR every four laps |
| | Time to completion recorded via stopwatch |
| C.) Testing completed seated at table beside the track. One participant tested at a time. | Participants completed tests in order: AFQ, POMS, MSES, PACES-S |
| | Participants instructed to relax for day in-between testing |

| **Meeting 3:** | Administer the other intervention (association or dissociation). |
| Meeting 3 is the same as Meeting 2 | Same exact sequence as in Meeting 2. |

Note. All participants completed the same testing protocol.

HR = heart rate; RPE = rating of perceived exertion; PACES-T (S) = physical activity enjoyment scale trait (state); POMS = profile of mood states; AFQ = attentional focus questionnaire; MSES = multidimensional self-efficacy for exercise scale

<sup>a</sup>PACES-T is only completed before the first exercise session
Statistical Analyses

The purpose of the study was to examine the effects that the independent variables of time, order, and cognitive strategy (association, dissociation) while running has on the dependent variables of self-efficacy, enjoyment, mood, performance, heart rate and RPE. The Statistical Package for the Social Sciences (IBM SPSS Statistics, Chicago, IL, USA) version 20 was used to test statistics for the following hypotheses. All preliminary analyses were performed with $\alpha = 0.05$. An a priori power analysis indicated a minimum of 18-22 participants were needed in order to reach a desired power of .80 at $\alpha < .05$. This sample was conservative as only a .70-.75 correlation was used in the a priori analysis, while the Profile of Mood States has a reported .80-.90 correlation coefficient among repeated measures. Following eligibility, the final number of participants was 21.

A 2 (Intervention) x 2 (Order) multivariate analysis of variance (MANOVA) on the factor of two responses (association or dissociation) was used to determine if the independent variable (intervention) was significant in creating two different groups of responses and included a factor of Order to determine if responses were influenced by the Order of intervention. Additionally, all hypothesis and analyses included order as a between subjects factors.

Hypothesis 1: If runners use dissociative techniques, they will show greater state exercise enjoyment measured after a 1.5-mile jog than when using associative techniques. To assess differences in enjoyment between cognitive strategies, a 2 (Intervention) x 2 (Order) ANOVA with repeated measures on Intervention factor was used.

Hypothesis 2: If runners use dissociative techniques, they will report greater mood benefits measured before and after a 1.5-mile jog than when using associative techniques. A 2 (Time) x 2 (Intervention) x 2 (Order) MANOVA on the vector of the six POMS subscales with
repeated measures on the two factors of time and intervention was performed to assess changes in mood states before and after the jog and between the two cognitive strategies of association and dissociation.

Hypothesis 3: Runners using dissociative techniques will finish the 1.5-mile jog at a slower speed than when using the associative technique (i.e. time to completion). A 2 (Intervention) x 2 (Order) ANOVA with repeated measures on Intervention was used to analyze the differences in time to completion between associative and dissociative strategies.

Hypothesis 4: Runners using dissociative techniques will report a lower perceived exertion than when using the associative technique (i.e. RPE). A 2 (Intervention) x 6 (Laps) x 2 (Order) analysis of variance (ANOVA) with repeated measures on Laps was used to analyzed RPE differences between cognitive strategies every four laps.

Hypothesis 5: There will be no differences in Heart Rate between the association and dissociation strategy as it will be controlled by limiting max HR to 60% of HRR. A 2 (Intervention) x 6 (Laps) x 2 (Order) analysis of variance (ANOVA) with repeated measures on Laps was used to analyzed HR differences between cognitive strategies every four laps.

Hypothesis 6: There will be no changes in self-efficacy measures before or after the 1.5-mile jog when using association or dissociation cognitive strategies. To assess differences in the three subscales of the MSES, a 2 (Time) x 2 (Intervention) x 2 (Order) MANOVA on the vector of the three exercise self-efficacy subscales with repeated measures on time and intervention was used.
CHAPTER IV: RESULTS

In order to establish a relationship between the cognitive strategy interventions and the dependent variables, it was first and foremost important to determine if the participants’ reported thoughts from the Attentional Focus Questionnaire aligned with the paralleled intervention instructions (i.e. associative thoughts in the association intervention and dissociative thoughts in the dissociative intervention). Overall, participants did attend to their appropriated instructions and further analysis of the results can be found in the attentional manipulation section.

Additionally, because of an “Order” factor, it was also necessary to ensure that participants using the association intervention first (N = 10) reported similar descriptive statistics as the participants using the dissociation intervention first (N = 11). In multiple mean comparison analyses, there were no significant differences in age, ethnicity, school level, cognitive preference, miles/week, running sessions/week, and exercise sessions/week between the two groups (all p’s > .05). Therefore, any differences found in relation to order can be fully attributed to the order of the intervention and not the differences among the participants.

Attention Manipulation

To assess whether the interventions of association and dissociation created an effective manipulation of attention, a 2 (Intervention) x 2 (Order) MANOVA analyzed the participants’ types of responses (association and/or dissociation) during the run as measured by the Attentional Focus Questionnaire. Within subjects tests revealed a non-significant interaction between the Order and the Intervention (F_{2,18} = 3.187; \( p = .065; \eta^2 = .262; \) N-B = .536) but a significant difference between the Interventions (F_{2,18} = 61.414; \( p < .001; \eta^2 = .872; \) N-B = 1.00).

Between subjects tests revealed a significant difference between the order of the interventions (F_{2,18} = 4.498; \( p = .026; \eta^2 = .33; \) N-B = .693).
A follow up ANOVA of the significant difference between the Interventions revealed that participants in the association intervention had significantly more association thoughts than dissociation thoughts (50.85 ± 1.88 vs 21.8 ± 1.60 respectively; \( p < .001 \)) and that participants in the dissociation intervention had significantly more dissociation thoughts than dissociation thoughts (45.11 ± 1.98 vs 25.10 ± 2.23 respectively; \( p < .001 \)).

Follow up pairwise comparisons of the significant difference between the Order of the interventions revealed that there was no overall significant difference of association thoughts whether participants completed the association intervention or the dissociation intervention first (35.45 ± 2.15 vs 40.50 ± 2.05 respectively; \( p = .105 \)) and no overall significant difference of dissociation thoughts whether participants completed the dissociation intervention first or the association intervention first (31.91 ± 2.01 vs 35.00 ± 2.11, respectively; \( p = .301 \)).

Overall, participants followed instructions, reporting more association thoughts than dissociation thoughts using the association intervention and more dissociation thoughts than association thoughts using the dissociation intervention. The order in which the interventions were received did not influence the types of reported thoughts as there was no significant interaction.

**Manipulation check.** Ensuring that participants spent similar time and effort following the intervention instruction, results of the manipulation check confirmed that participants spent equal time attending to the intervention. On a scale of 1 (not at all) to 7 (all of the time), participants’ reported a mean of 6.0 ± .71 in the association intervention and a mean of 5.7 ± .96 in the dissociation intervention. A mean score of six indicated that participants’ reported spending the majority of the time thinking about what they were instructed to think about during
the 1.5 mile run. These means are not significantly different from one another ($t_{20} = 1.2; p = .229$), and verify that participant’s spent similar time thinking about the intervention instructions.

**Distressful Thoughts**

Since participants exercising in association conditions tend to “hit a wall” and fatigue sooner than those who dissociate, the comparison of the exercisers’ reported distressful thoughts from the AFQ were evaluated. A 2 (Intervention) x 2 (Order) repeated measures ANOVA on distressful thoughts revealed no significant interaction between the Intervention and the Order of the intervention on distress scores ($F_{1,19} = .112; p = .741; \eta^2 = .006; N-B = .062$). There was a significant difference in distress scores between the Interventions without order contributing to the differences ($F_{1,19} = 6.171; p = .022; \eta^2 = .245; N-B = .654$). Participants reported more distressful thoughts when using the association intervention ($11.92 \pm 1.03$) than when using the dissociation intervention ($9.19 \pm .62$). See Figure 1 below for differences of distressful thoughts between the interventions.

![Figure 1. Distressful thoughts between interventions without the order effect. * indicates significant differences between thoughts ($p < .05$). Standard error bars included.](image)

**Exercise State Enjoyment**

The first hypothesis in determining if participants using the dissociation intervention would report greater state enjoyment scores than participants using the association condition was
not supported. A 2 (Intervention) x 2 (Order) ANOVA indicated a significant interaction between the Interventions and the Order of the intervention on state enjoyment \( (F_{1,19} = 4.849; p = .040; \eta^2 = .203; N-B = .552) \). Simple effects analyses revealed no significant differences in state enjoyment scores when the association intervention was completed first \( (F_{1,19} = 2.366; p = .158; \eta^2 = .208; N-B = .280) \), or when the dissociation intervention was completed first \( (F_{1,19} = 3.083; p = .110; \eta^2 = .236; N-B = .355) \). Overall, there was no evidence that state enjoyment scores significantly differed between the two cognitive strategy interventions, but the Intervention × Order interaction figure revealed that state enjoyment was higher in the intervention completed first than the other intervention if it was completed second (See Figure 2). Specifically, when the association intervention was completed first, participants’ enjoyment was higher in the association intervention \( (91.5 \pm 4.95) \) than the dissociation intervention \( (81.4 \pm 5.25) \). When the dissociation intervention was completed first, participants’ enjoyment was higher in the dissociation intervention \( (101.54 \pm 5.0) \) than the association intervention \( (96.18 \pm 4.72) \).

![Figure 2. Interaction of order of intervention on state enjoyment scores (p = .040)](image)

**Trait Enjoyment**

After participants completed the jogging session, they described the exercise session and running pace to the tester as one they did not prefer to engage in. Noting that preferred intensity
may be related to the enjoyment of the exercise (Morgan, 1997), state enjoyment scores were compared to trait enjoyment scores of exercise. Specifically, post-hoc analyses were conducted in order to examine participants’ enjoyment of the specific, designed exercise in relation to their trait enjoyment of most exercises. Participant’s state enjoyment of each condition was compared to trait enjoyment of exercise using paired samples t-tests and can be seen in Figure 3.

Participants’ state enjoyment in the association condition was significantly lower than their reported trait enjoyment (94 ± 15.45 vs 110.52 ± 10.43 respectively; $t_{20} = 5.42; p < .001$) and participant’s state enjoyment in the dissociation condition was also significantly lower than their reported trait enjoyment (92 ± 19.18 vs 110.52 ± 10.43 respectively; $t_{20} = 4.22; p < .001$). In summary, participants enjoyed the 1.5-mile run at a moderate intensity significantly less than they enjoyed exercise in general.

Figure 3. Comparison of state and trait enjoyment between interventions
* indicates significant differences between the enjoyment scores ($p < .05$). Standard deviation bars included. Trait enjoyment scores measured one time prior to all testing.

Mood

Raw scores on the POMS subscales were converted to t-scores based on normative college student sample means and standard deviations (McNair et al., 2003). To test the
hypothesis that participants exercising in the dissociation intervention would report greater mood benefits when measured before and after the 1.5-mile jog, a 2 (Time) x 2 (Intervention) x 2 (Order) MANOVA on the vector of the six POMS subscales with repeated measures on the two factors of Time and Intervention was performed. There was a significant three-way interaction for Intervention × Time × Order ($F_{6,14} = .2.878; p = .048; \eta^2 = .552; N-B = .710$). Therefore, follow up MANOVAs were conducted to assess the interaction.

**Order – Association intervention first.** Testing for an order effect, a 2 (Time) x 2 (Intervention) follow up MANOVA revealed that when participants exercised using the association intervention first, there was no significant Intervention × Time interaction ($F_{6,4} = 1.693; p = .318; \eta^2 = .718; N-B = .221$) and no significant main effect of Intervention ($F_{6,4} = .632; p = .707; \eta^2 = .487; N-B = .108$). However, there was a trend towards significance when measuring mood pre- to post exercise ($F_{6,4} = 5.30; p = .064; \eta^2 = .881; N-B = .581$). Although the multivariate ANOVA did not reach a significant main effect for Time, the trend towards significance implicated that something was happening at the univariate level.

The POMS consists of six subscales that measures an individual’s overall mood, with each subscale individually assessing different and distinct mood states, such that an individual’s level of anger may be entirely different than an individual’s level of fatigue. Therefore, because of the trend towards significance of pre- and post-measures and the different nature of each subscale, univariate analyses were examined but should still be interpreted cautiously because of the high likelihood of Type I errors due to the number of tests performed.

The 2 (Time) x 2 (Intervention) univariate analyses revealed a significant interaction between association and dissociation strategies on the subscale of Tension when participants used the association intervention first ($F_{1,9} = 8.288; p = .018; \eta^2 = .479; N-B = .727$) and is
shown in Figure 4. Note from the figure that Tension is shown to decrease in the association intervention (first) but increase in the dissociation intervention (second).

*Figure 4. Association intervention first. Interaction between intervention and time on Tension ($p = .018$)*

When participants used the association intervention first, simple, simple effects revealed that there was no significant main effect of time on Tension in the association intervention ($F_{1,9} = 2.307; p = .163; \eta^2 = .204; N-B = .275$) (See Figure 5) or the dissociation intervention ($F_{1,9} = .966; p = .351; \eta^2 = .097; N-B = .143$) (See Figure 6). Even though each intervention had no significant difference in Tension scores pre- to post-exercise, the overall interaction is most likely a result of the non-significant increase in Tension in the dissociation intervention when completed second (See Figure 4).

*Figure 5. Association intervention mood changes when used first
* indicates significant differences between the subscale t-scores ($p < .05$). Standard error bars included.*
The 2 (Time) x 2 (Intervention) univariate analyses also revealed a significant main effect for time on the subscale of Confusion when participants exercised using the association intervention first ($F_{1,9} = 17.347; p = .002; \eta^2 = .658; N-B = .958$). Pairwise comparisons indicated that participants’ exercise Confusion scores significantly decreased from pre- to post-exercise when using the association intervention first ($42.308 \pm 2.51$ to $38.860 \pm 2.50; p = .002$). Simple, simple effects revealed that Confusion scores only decreased when using the association intervention first ($p = .004$) (Figure 5) and not when using the dissociation intervention second ($p = .157$) (Figure 6).

![Figure 6. Dissociation intervention mood changes when used second](image)

No significant differences between the subscale t-scores ($p > .05$). Standard error bars included.

In summary, the hypothesis of greater mood benefits using dissociation was not supported. However, pre- to post-exercise mood benefits were found when participants exercised using the association condition first, reporting significant decreases in Confusion scores pre- to post-exercise. When using the dissociation intervention second, participants reported no significant changes in Confusion pre- to post-exercise. All other mood scales of Depression,
Anger, Vigor, and Fatigue had no significant changes dependent on the Intervention, Time, and Order of the interventions (all p’s > .05).

**Order – Dissociation intervention first.** When participants exercised using the dissociation intervention first, a 2 (Time) x 2 (Intervention) follow up MANOVA revealed no significant Intervention × Time interaction ($F_{6,5} = 1.188; p = .434; \eta^2 = .588; N-B = .192$), no significant main effect of Intervention ($F_{6,5} = 2.773; p = .141; \eta^2 = .769; N-B = .408$) and no significant main effect of Time ($F_{6,5} = 1.871; p = .254; \eta^2 = .692; N-B = .286$). Even though no significant interactions or main effects were found from the multivariate analyses, the same justification was used to analyze the univariate analyses, and the following results should be interpreted carefully.

![Figure 7. Dissociation intervention first. Interaction between intervention and time on Tension (p = .022)](image)

Simple effects from the 2 (Time) x 2 (Intervention) univariate analyses revealed a significant interaction on the subscale of Tension ($F_{1,10} = 7.327; p = .022; \eta^2 = .423; N-B = .685$) when participants used the dissociation intervention first (See Figure 7). Simple, simple effects revealed that when using the dissociation intervention first, there was no significant main effect of Time on the subscale of Tension in the association intervention ($F_{1,10} = .256; p = .624; \eta^2 = $)
.025; N-B = .075) (Figure 9), but a significant main effect of Time on the subscale of Tension in the dissociation intervention \((F_{1,10} = 5.347; p = .043; \eta^2 = .348; N-B = .551)\) (Figure 8). Pairwise comparisons reveal that Tension significantly decreased pre- to post exercise in the dissociation intervention \((42.13 \pm 1.54 \text{ vs } 37.73 \pm 1.73; p = .043)\) as seen in Figure 8. Even though not significant and as seen in Figure 9, Tension scores decreased for participants in the association intervention pre- to post-exercise \((38.25 \pm .852 \text{ vs } 37.36 \pm 1.613; p = .624)\).

**Figure 8.** Dissociation intervention mood changes when used first
* indicates significant differences between the subscale t-scores \((p < .05)\). Standard error bars included.

Simple effects from the 2 (Time) x 2 (Intervention) univariate analyses revealed a significant main effect of time only on the subscales of Depression \((F_{1,10} = 9.199; p = .013; \eta^2 = .479; N-B = .780)\) and Confusion \((F_{1,10} = 12.124; p = .006; \eta^2 = .548; N-B = .880)\) when participants used the dissociation intervention first. Pairwise comparisons revealed that when using the dissociation intervention first, participant’s reported a decrease in Depression pre- to post-exercise \((40.03 \pm .784 \text{ vs } 38.61 \pm .792; p = .013)\) and a decrease in Confusion pre- to post-exercise \((40.17 \pm 1.65 \text{ vs } 35.06 \pm 1.17; p = .006)\). Simple, simple effects reveal that significant changes in Depression were only reported in the dissociation intervention \((p = .014)\) (Figure 8).
and not the association intervention ($p = .053$) (Figure 9), while significant changes in Confusion were reported in both dissociation ($p = .008$) (Figure 8) and association ($p = .016$) (Figure 9) interventions.

![Figure 9. Association intervention mood changes when used second](image)

* indicates significant differences between the subscale t-scores ($p < .05$). Standard error bars included.

In summary, the hypothesis of greater mood benefits using dissociation was not supported. However, pre- to post-exercise mood benefits were found when participants used the dissociation intervention first, reporting significant decreases in Depression and Confusion pre- to post-exercise. Additionally, participants also reported significant decreases in Tension under the dissociation condition but non-significant decreases in Tension under the association condition. All other mood scales of Anger, Vigor, and Fatigue had no significant changes dependent on the Intervention, Time, and Order of the interventions (all $p$’s > .05). All pre- to post-exercise mood scores can be seen in Table 4.
Table 4

All Mood Subscales T-scores

<table>
<thead>
<tr>
<th>Association</th>
<th>First Condition</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
<th>Dissociation</th>
<th>First Condition</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tension</td>
<td>Association</td>
<td>43.6765</td>
<td>8.99079</td>
<td>10</td>
<td>Dissociation</td>
<td>42.1257</td>
<td>5.10968</td>
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<tr>
<td></td>
<td>Dissociation</td>
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<td>Total</td>
<td>40.8333</td>
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<tr>
<td></td>
<td>Total</td>
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<tr>
<td>Depression</td>
<td>Association</td>
<td>37.3587</td>
<td>5.34984</td>
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</table>
Pre-to post-exercise scores closely represent iceberg profile with Vigor at or above 50th percentile and negative mood states below 50th percentile. Changes in subscales follow hypothesized direction except in Tension (Dissociation Intervention, Association First).

**Performance (Time to complete 1.5-mile run)**

It was hypothesized that runners using dissociative strategies would take longer to complete the 1.5-mile run than when running using associative strategies. Results from the 2 (Intervention) x 2 (Order) analyses revealed no significant interaction between the order of the intervention and the time to completion of each intervention ($F_{1,19} = 2.504; p = .130; \eta^2 = .116; N-B = .324$). Without Order being a significant factor, there were no differences in time to completion between association and dissociation interventions ($F_{1,19} = .115; p = .738; \eta^2 = .006; N-B = .062$) and therefore, the hypothesis was rejected. Mean time to completion and standard deviations of the two interventions are displayed in Table 4.

Table 5

<table>
<thead>
<tr>
<th>Interventions</th>
<th>Mean time to completion (min)</th>
<th>SD</th>
<th>Ranges (min)</th>
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<td>13.3-24.3</td>
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<tr>
<td>Dissociation</td>
<td>18.64</td>
<td>2.91</td>
<td>12.3-25.3</td>
</tr>
</tbody>
</table>

Note. Results displayed from 1.5-mile jog ($N = 21$); min = minutes, SD = standard deviations

**Heart Rate**

A 2 (Intervention) x 6 (Laps) x 2 (Order) ANOVA with repeated measures on laps was used to test the hypothesis that there would be no differences between interventions on reported
exercising HR since a moderate intensity HR was a treatment condition for both interventions. Since all tests violated the assumption of sphericity, a Huynh-Feldt correction was applied. There was not a significant three way interaction among the Intervention, Laps, and Order of the intervention \( (F_{1.718,32.651} = 1.326; p = .277; \eta^2 = .065; N-B = .249) \). There was no significant Lap \( \times \) Intervention interaction \( (F_{1.718,32.651} = .1.326; p = .276; \eta^2 = .065; N-B = .249) \), no Order \( \times \) Intervention interaction \( (F_{1.19} = 2.158; p = .158; \eta^2 = .102; N-B = .286) \), and no Order \( \times \) Lap interaction \( (F_{2.487,47.26} = 1.552; p = .219; \eta^2 = .076; N-B = .348) \). There was also no significant main effect of Intervention \( (F_{1,19} = 2.158; p = .698; \eta^2 = .008; N-B = .066) \), no significant main effect of Lap \( (F_{2.487,47.26} = 1.678; p = .192; \eta^2 = .081; N-B = .374) \), and no significant main effect of order \( (F_{1,19} = 2.385; p = .139; \eta^2 = .112; N-B = .311) \). Therefore, the hypothesis was supported. Mean exercising heart rate and standard deviation of each intervention are displayed in Table 5.

Table 6

Comparison of Exercising Heart Rate

<table>
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<tr>
<th>Intervention</th>
<th>Exercising HR</th>
<th>SE of HR</th>
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<tr>
<td>Association</td>
<td>139.06</td>
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<tr>
<td>Dissociation</td>
<td>138.64</td>
<td>2.41</td>
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</table>

Note. Participant’s \( (N = 21) \) mean HRmax (196.29 ± 3.15) and mean HRrest (64.33 ± 9.07) was used to establish a moderate exercise intensity that was between 40% HRR (117) and 60% HRR (143); HRmax = Heart Rate max, HRR = Heart Rate Reserve, SE = Standard Error

Ratings of Perceived Exertion

Using a 2 (Interventions) \( \times \) 6 (Laps) \( \times \) 2 (Order) analysis of variance (ANOVA) with repeated measures on Laps, the hypothesis that participants running under the dissociation condition would report lower perceived exertion was not supported. Following Mauchly’s Test of Sphericity, a Huynh-Feldt correction was used \( (p < .05) \). There was not a significant three-
way interaction among the Intervention, the Laps, and the Order of the intervention \( (F_{4.073,77.384} = 1.051; p = .387; \eta^2 = .052; N-B = .320) \). Therefore, there was no Intervention × Lap interaction \( (F_{4.073,77.384,19} = .159; p = .960; \eta^2 = .008; N-B = .082) \), no Intervention × Order interaction \( (F_{1.19} = .055; p = .816; \eta^2 = .003; N-B = .056) \), and no Lap × Order interaction \( (F_{1.56,29.644} = .628; p = .502; \eta^2 = .032; N-B = .135) \). There was no significant main effect for Order \( (F_{1,19} = 1.412; p = .249; \eta^2 = .069; N-B = .204) \) and no significant main effect for the Intervention \( (F_{1,19} = 1.716; p = .206; \eta^2 = .083; N-B = .238) \) as shown in Figure 10. However, there was a significant main effect for Laps \( (F_{1.56,29.644} = .30.838; p < .001; \eta^2 = .619; N-B = 1.0) \) as shown in Figure 11.

![Figure 10](image-url)  
*Figure 10.* RPE scores between interventions without the order effect.  
No significant differences (all p’s > .05). Standard error bars included.

Following up the significant main effect of Laps on RPE, pairwise comparisons indicated that RPE increased as the number of laps completed increased, starting with the first recording of RPE at lap four and intermittently recorded every four laps. More specifically, and shown in Figure 8, RPE increased from Lap 4 to Lap 8 \((8.77 \pm .41 \text{ vs } 9.50 \pm .38; p = .001)\), Lap 8 to Lap
12 (9.50 ± .38 vs 10.19 ± .41; \( p = .001 \)), and Lap 16 to Lap 20 (10.64 ± .42 vs 11.02 ± .45; \( p = .029 \)).

**Figure 11.** Main effect of laps on perceived exertion without the order effect. * indicates significant difference between recordings (\( p < .05 \)). Standard error bars included.

**Exercise Self-Efficacy**

The sixth hypothesis was to determine if participants’ reported differences in self-efficacy pre- to post-exercise and between the interventions. With little literature surrounding cognitive strategies’ influence on self-efficacy, the null hypothesis was used. Participants were hypothesized to report no differences in self-efficacy as measured by three subscales both before and after each exercise session when using associative or dissociative interventions. The Exercise Self-Efficacy measure included three subscales: coping, task, and scheduling self-efficacy. Therefore, a 2 (Intervention) x 2 (Time) x 2 (Order) MANOVA on the vector of the three exercise self-efficacy subscales with repeated measures on Time and Intervention was used. There was no significant three way interaction among the Intervention, Time, and Order of the intervention (\( F_{3,17} = .962; p = .433 \); \( \eta^2 = .145 \); N-B = .218). Additionally, there was no Intervention \( \times \) Time interaction (\( F_{3,17} = .574; p = .640 \); \( \eta^2 = .092 \); N-B = .144), and no Time \( \times \) Order interaction (\( F_{3,17} = .355; p = .800 \); \( \eta^2 = .056 \); N-B = .102), but there was an Intervention \( \times \) Order interaction (\( F_{3,17} = 3.76; p = .031 \); \( \eta^2 = .399 \); N-B = .711). Follow up analysis showed no
differences between the interventions whether participants completed the association intervention first \((p = .116)\) or the dissociation first \((p = .099)\).

There was also no significant main effect for Order \((F_{3,17} = 2.86; p = .068; \eta^2 = .336; N-B = .578)\), Intervention \((F_{3,17} = 1.224; p = .331; \eta^2 = .178; N-B = .269)\) or Time \((F_{3,17} = 1.901; p = .168; \eta^2 = .251; N-B = .404)\).

While three subscales make up the entire self-efficacy construct, each subscale may represent different aspects of the self-efficacy construct. Therefore, being that there was a significant interaction between the Intervention and Order of the interventions, all interactions and main effects were assessed at the univariate level. Doing so allowed for interpretation of the significant Intervention \(\times\) Order interaction that revealed no differences between the interventions when controlling for order of the interventions.

**Coping self-efficacy.** Using a 2 (Intervention) \(\times\) 2 (Time) \(\times\) 2 (Order) ANOVA, results showed no significant three way Intervention \(\times\) Time \(\times\) Order interaction for coping self-efficacy \((F_{1,19} = .015; p = .903; \eta^2 = .001; N-B = .052)\), no two-way Intervention \(\times\) Time interaction \((F_{1,19} = .264; p = .613; \eta^2 = .014; N-B = .078)\), and no Time \(\times\) Order interaction \((F_{1,19} = .565; p = .462; \eta^2 = .029; N-B = .110)\). There was a significant two-way Intervention \(\times\) Order interaction on coping self-efficacy \((F_{1,19} = 9.615; p = .006; \eta^2 = .336; N-B = .837)\) and is shown in Figure 12.

![Figure 12. Interaction between order and intervention on coping self-efficacy](image)
The Intervention × Order interaction revealed that there was no significant main effect of coping self-efficacy scores between the interventions when participants exercised using the association intervention first \((F_{1,9} = 4.663; p = .059; \eta^2 = .341; \text{N-B} = .487)\), but a significant main effect of coping self-efficacy scores when participants exercised using the dissociation intervention first \((F_{1,10} = 6.686; p = .027; \eta^2 = .401; \text{N-B} = .645)\). Pairwise comparisons indicate that when using the dissociation intervention first, participants reported a significantly greater coping self-efficacy score in the association intervention than the dissociation intervention \((206.59 \pm 18.32 \text{ vs } 190.00 \pm 20.35; p = .027)\).

There was no significant main effect of Order \((F_{1,19} = 3.176; p = .091; \eta^2 = .143; \text{N-B} = .395)\) or Intervention \((F_{1,19} = 2.264; p = .149; \eta^2 = .106; \text{N-B} = .298)\), but there was a significant main effect of Time on coping self-efficacy \((F_{1,19} = 5.90; p = .025; \eta^2 = .237; \text{N-B} = .635)\). Pairwise comparisons indicated that participants’ coping self-efficacy significantly increased from pre- to post-exercise \((215.00 \pm 13.08 \text{ vs } 227.67 \pm 13.29; p = .025)\) and are shown in Figure 13.

![Figure 13](image-url)

* indicates significantly higher post self-efficacy than pre self-efficacy score \((p < .05)\). Standard error bars included.
Overall, coping self-efficacy was significantly higher in the association intervention when completed second but not significantly higher in the dissociation condition when completed second. This finding supported that coping self-efficacy did not increase from session to session, but instead increased significantly only when associating second which partially rejects the original hypothesis that there would be no differences between interventions.

**Task Self-Efficacy.** A 2 (Intervention) x 2 (Time) x 2 (Order) ANOVA revealed that there was no three-way Intervention × Time × Order interaction ($F_{1,19} = 1.679; p = .211; \eta^2 = .081; N-B = .234$) and subsequently no Intervention × Time interaction ($F_{1,19} = 1.834; p = .192; \eta^2 = .088; N-B = .251$), no Intervention × Order interaction ($F_{1,19} = 4.075; p = .058; \eta^2 = .177; N-B = .483$) and no significant Time × Order interaction ($F_{1,19} = .004; p = .948; \eta^2 = .00; N-B = .05$). There was also no significant main effect of Intervention on task self-efficacy ($F_{1,19} = 2.620; p = .122; \eta^2 = .121; N-B = .336$) which is in support of the null hypothesis.

There was a significant main effect of Time on task self-efficacy ($F_{1,19} = 4.623; p = .045; \eta^2 = .196; N-B = .532$). Pairwise comparisons of the follow up ANOVA revealed that participants’ task self-efficacy significantly increased from pre- to post-exercise (271.90 ± 3.87 to 276.75 ± 4.37; $p = .045$) without the order of the interventions influencing the participant’s scores. See Figure 13.

There was also a significant main effect of Order on task self-efficacy ($F_{1,19} = 7.56; p = .013; \eta^2 = .285; N-B = .742$). Pairwise comparisons of the follow up ANOVA revealed that participants’ task self-efficacy was significantly higher when the association intervention was completed first than if the dissociation intervention was completed first (285.25 ± 5.75 vs 263 ± 5.48; $p = .013$).
Overall, participants’ task self-efficacy increases pre-to post-exercise and was ultimately higher when running using the association intervention first. Because there is no difference between the Interventions on task self-efficacy, it cannot be interpreted that association is better than dissociation or vice versa.

**Scheduling self-efficacy.** There was no three way Intervention × Time × Order interaction ($F_{1,19} = .755; p = .396; \eta^2 = .038; N-B = .131$), no Intervention × Time interaction ($F_{1,19} = .182; p = .674; \eta^2 = .010; N-B = .069$), no Intervention × Order interaction ($F_{1,19} = .160; p = .694; \eta^2 = .008; N-B = .067$), and no Time × Order interaction ($F_{1,19} = .616; p = .442; \eta^2 = .031; N-B = .116$) when measuring participants’ scheduling self-efficacy. In support of the null hypothesis, there was no significant main effect of Order ($F_{1,19} = .409; p = .530; \eta^2 = .021; N-B = .093$), Intervention ($F_{1,19} = .022; p = .882; \eta^2 = .001; N-B = .052$), and Time ($F_{1,19} = 1.839; p = .191; \eta^2 = .088; N-B = .251$) on scheduling self-efficacy. In summary, participants’ scheduling self-efficacy scores did not differ from pre to post exercise and did not differ between the interventions as shown in Figure 13.
CHAPTER V: DISCUSSION

In the current study it was hypothesized that a relationship would exist between different cognitive strategies, specifically association and dissociation, and exercisers’ psychological, physiological, and performance outcomes. The main purpose of the study was to examine whether one cognitive strategy was better than another at achieving these specific outcomes and to what extent can these varying outcomes be applied to individual, college-aged, recreational exercisers. The results did not entirely support a difference between strategies when measuring performance (time to completion), state enjoyment, mood, ratings of perceived exertion, and self-efficacy. However, there were significant changes in the subscales of coping and task self-efficacy, and mood subscales of Confusion. Changes in Tension and Depression were also found but depended on the order in which the participants completed the interventions. Nonetheless, results suggest that even though the exercise completed was less enjoyable than the participants’ trait enjoyment for exercise in general, coping and task self-efficacy was able to increase and mood states were improved.

Attention Manipulation

To determine whether the results could be attributed to the cognitive strategies employed while exercising (association or dissociation), it was necessary to create two separate interventions. In order to create reliable intervention instructions, and as previously mentioned in Chapters 2 and 3, the intervention instructions were based on Stevinson & Biddle (1998) and Brick and colleagues (2014) research and outlines. Based on the instructions and attentional cues, participants had a majority of dissociative or associative thoughts in their respective conditions without being influenced by opposing cognitions. Thus, participants were successful at exercising using two different cognitive strategies.
Order did not have a significant influence on participants’ thoughts, and the participants maintained a thought pattern appropriate to the designed intervention. Minor findings show that when using the association intervention first and dissociation intervention second, participants had no problem attending to the proper cues as shown in the results. When participants completed the exercise using the dissociation intervention first and the association intervention second, they were still able to correctly focus their attention, but slightly less successfully with higher associative scores. Possible reasons for this are that when participants used the dissociation intervention first, they may have had to spend more time attending to their pace and making sure their heart rate fell within the target. This would differ from the participants using the association intervention first because one of their main objectives was to focus on heart rate. Thus, establishing a pace seemed to be easier and more appropriate to do with the association intervention first and harder to do with the dissociation intervention first.

A manipulation check was conducted to ensure that participants were focusing on the instructions and directing their thoughts toward the intended intervention. Results supported the conclusion that participants spent similar time focusing on the instructions in each assigned condition and align with findings from Attentional Focus Questionnaire. In essence, participants spent the majority of the run thinking about associative thoughts when instructed to use the association intervention and similarly spent the majority of run thinking about dissociative thoughts when instructed to use the dissociation intervention.

Results suggest that participants in the association intervention reported more distressful thoughts when running than when using the dissociation intervention with the order of the interventions being a non-significant factor. This is in agreement with previous literature which supports an increased pain tolerance under dissociation (Johnson & Siegel, 1992). This also
compares to studies of elite exercisers in that running under association caused exercisers to monitor physical sensations more (Morgan & Pollock, 1977) and lead to increases in fatigue (Goode & Roth, 1993) and “hitting the wall” sooner (Lind et al., 2009; Stevinson & Biddle, 1998).

**Exercise Enjoyment**

The first hypothesis was to test the possibility that state enjoyment scores would be higher in the dissociation intervention than the association intervention. While the hypothesis was based on literature in favor of dissociation for higher state enjoyment scores when studying elite runners (Goode & Roth, 1993) and when studying music preference of regular exercisers (Drylund & Wininger, 2008; Salmon et al., 2010), it was found that participants reported similar state enjoyment scores after both exercise sessions. When factoring the order in which the interventions were used, no significant differences were found but a trend revealed that state enjoyment was higher in the first exercise session. Specifically, if participants completed the association intervention first, enjoyment was higher in the association intervention than the dissociation intervention and if participants completed the dissociation intervention first, enjoyment was higher in the dissociation enjoyment than the association enjoyment. These differences were not significant and disagrees with the initial hypothesis and literature, but agrees with some research that has noted a similarity of state enjoyment scores despite cognitive interventions (Fillingim & Fine, 1986; Pennebaker & Lightner, 1980). Although the literature is divided on the effects of cognitive strategies on enjoyment, the current findings of the exercisers’ state enjoyment do not provide any more clarity and further work is needed.

An important finding was that participants reported the running session to be significantly less enjoyable than their trait enjoyment of exercise which was reported before all exercise
sessions. The scores from the current study can be related to the validation study of the PACES (Kendzierski & DeCarlo, 1991). In their study, Kendzierski and DeCarlo (1991) instructed participants to cycle with and without music and to complete the PACES and a scale that measured boredom. In the condition without music, found to be boring, participants reported mean scores of 81 on the PACES while participants in the experimental condition of listening to music, and not boring, reported means scores of 96. These results align with the current findings and should be noted that although the mean scores of both conditions ranged from 92 to 94, some individuals did rate the activity as less enjoyable than exercise in general with standard deviations placing scores near 72 to 78 in both interventions. Thus, it should be continued to be emphasized that in some modes, durations, and intensities of exercise, enjoyment may actually decrease or be less than what is typically achieved by the exerciser.

Furthermore, and not yet tested, the exerciser’s preference for a specific cognitive strategy may influence the enjoyment of the exercise session. However, because all participants in the present study exercised under each of the two cognitive strategies and their enjoyment scores in each of intervention remained similar, we can reject this statement and attribute the lowered enjoyment of the exercise to the qualities of the exercise session, perhaps the duration, intensity, and/or mode.

In future studies, researchers should attempt to have the participants self-select the exercise intensity as it has been shown to have the greatest increases in mood (Morgan, 1997) and possibly enjoyment outcomes. As a result of the lowered state enjoyment from the exercise session and both interventions, and noted from here on, any of the psychological and physiological changes pre-to post-exercise should be compared to the enjoyment of the exercise session in relation to the exercisers’ typical trait enjoyment of exercise.


**Mood Alteration with Exercise**

In establishing a directional hypothesis, and based on previous findings of increases in vigor and decreases in tension (Berger & Owen, 1998) and specifically while dissociating (Goode & Roth, 1993), it was hypothesized that participants in the current study would report greater increases in positive mood states and decreases in negative mood states when using the dissociation intervention rather than the association intervention. An interaction existed between the order of the interventions, the interventions, and time but further analyses offered no substantial evidence for changes in mood when considering mood as a whole construct. Therefore, separate analyses were conducted on the individual subscales of mood while accounting for the order of the interventions. These results and interpretation should be examined carefully because of the multiple tests and comparisons performed.

**Association intervention first.** When participants used the association intervention first, participants’ levels of Confusion decreased pre- to post-exercise. The finding of mood changes pre- to post-exercise has been commonly reported in the literature by Berger and colleagues (Berger, 2004; Berger et al., 2007, p. 107) but in this study was more specifically found in the subscale of Confusion. Additionally, when participants used the association intervention, there was an interaction between the Intervention and Time on the subscale of Tension. Tension scores did not differ between pre- to post-exercise measurements, but the interaction was most likely significant due to the fact that Tension increased when using the dissociation intervention and decreased using the association intervention. An explanation for this may be that when using the dissociation intervention second, participants reported increases in Tension as a result of trying to stay within the heart rate range and keep a pace similar to that of the first, association intervention. If this is accurate, it may or not be reflected when the dissociation intervention was used first. Using the dissociation first wouldn’t force participants to maintain a pace similar to...
the association intervention, because it would be the first intervention. Using the association intervention second, participants could actively monitor pace and keep it consistent with the pace from the first intervention without violating their appropriated thought patterns.

**Dissociation intervention first.** When participants exercised using the dissociation intervention first, they reported significant decreases in Confusion and Depression pre- to post-exercise. The decrease in Confusion was observed in both interventions, but the decrease in Depression was only found when the dissociation intervention was first. A reason that a change in Depression scores occurred when the dissociation was used first and not the association intervention was that participants did not have to worry about keeping a certain pace in the first running session. Using the dissociation intervention first, participants were able to set a pace in the first few laps and then begin to distract themselves. When using the association intervention second, participants had to appropriately focus on the pace without violating the designed thought pattern and therefore, did not allow them to relax and achieve the possible mood benefits.

As a Time by Intervention interaction was found on the subscale of Tension when the association intervention was first, a similar finding was revealed when the dissociation intervention was completed first. Controlling for the intervention then, it was revealed that when participants exercised using the dissociation intervention, their levels of Tension significantly decreased pre- to post-exercise but did not significantly decrease when using the association intervention. As previously suggested, when participants used the dissociation intervention first, they were able to set their own pace without worrying about their pace as they may have done when the dissociation intervention was second. This allowed for decreases in Tension pre- to post-exercise. When using the association intervention second, participants were able to
appropriately focus on matching the pace without violating the intervention instructions and the
decreases in Tension were apparent and similar to recent literature that supports desirable mood
changes pre- to post-exercise (Berger, 2004; Berger et al., 2007, p. 107).

These mood benefits have been noted to be reported after just 20-minute exercise
sessions of low to moderate intensities in college joggers (Berger and Owen, 1998). These mood
benefits relate to the findings of the current study of significant mood changes of Depression and
Confusion and possibly in Tension after approximately 20 minutes of exercise in college-aged
recreational exercisers, but may depend on order of the interventions.

Participants reported mostly decreases in negative mood states and increases in positive
mood states despite the enjoyment of the exercise. Thus, despite the lowered enjoyment of the
exercise sessions, in each intervention participants nearly achieved the Iceberg Profile as
classified by Morgan (1980) when Vigor is above the 50th t score percentile and the rest of
the negative mood scores are below the 50th percentile (See Figures 5 – 9 and Table 4). This can
be compared to previous literature that states that mood and enjoyment may or may not be
related. To investigate the conflicting findings of the mood and exercise enjoyment relationship,
Motl, Berger, and Leuschen (2000) reported that enjoyment mediated changes in mood with a
strong effect on total mood disturbance when studying types of distractions used by college
exercisers, Raedeke (2007) reported that enjoyment was related to changes in vigor and fatigue
in college age females, and Berger, Darby, Owen, and Carels (2010) reported no relationship
between the two when studying obese exercisers in a weight loss program concluding that
enjoyment was independent of mood enhancement. Altogether, there is no clear relationship of
mood and exercise enjoyment and positive mood states can still increase despite performing a
less enjoyable activity.
Performance (Time to completion)

In continuing to measure the benefits of association and dissociation cognitive strategies, time to completion was measured after the participants completed the 1.5-mile jogging session. Literature has supported a trend towards faster running while running under association (Connolly & Janelle, 2003; Wulf, 2013), but the current study found no difference in time to completion between the interventions with or without order as a factor. These results do not support the hypothesis that an associative focus will increase running speed due to the participants’ abilities to constantly monitor and modulate pace as found when studying rowers (Connolly & Janelle, 2003) and when studying exercise setting (LaCaille et al., 2004).

However, one of the main limitations as to why no differences existed between interventions was that all participants had to maintain a specific exercising heart rate and thus, were restricted in their speed. A ceiling effect was created as all participants had to maintain an exercising heart rate between 40% and 60% of their HRR, with all exercisers choosing to run close to the latter.

Exertion

Participants in the association and dissociation interventions did not report any differences in ratings of perceived exertion with and without an order factor. This finding did not support the hypothesis of lowered exertion under dissociation and differs from the literature that supports lowered RPE under dissociation when cycling at 70% HRmax (Stanley et al., 2007). However, findings of LaCaille et al. (2004) when studying exercise setting support the current findings of no differences in RPE between attentional strategies. The literature surrounding cognitive strategies and ratings of perceived exertion still remains unclear, but this was an opportunity to assess RPE as heart rate or intensity is controlled.
Wherein previous studies participants ran at a self-selected pace (LaCaille et al., 2004) and reported RPE, participants were given the opportunity to run at an intensity of their choice. As the intensity of the exercise was not controlled in the LaCaille et al. (2004) study, the increases in RPE may have reflected the positive linear relationship with HR (Borg, 1982). In the current study, however, intensity (heart rate) was controlled for and RPE still increased. Therefore, any change in RPE in the current study should have been a direct effect of the strategy and not the exercise intensity, mode, or duration. Because the current study found no differences in RPE, it can be concluded that there was little or no influence of the association and dissociation interventions on perceived exertion.

Not surprisingly, RPE did increase over time within the running session, which is a consistent finding within the literature (Borg, 1982) of both novice and experienced exercisers (Drylund & Wininger, 2008; Schomer, 1986; Tenenbaum & Connolly, 2008). Even though RPE increased over time, the thoughts of participants did not shift from dissociative to associative thoughts, which may occur under high intensities (Tenenbaum, 2001). This is mainly because the mean highest reported RPE was 11 which is classified as a “light” exertion (Borg, 1982) and was not high enough for thoughts to be forced to associative thoughts. As suggested in the guidelines of the current study and confirmed with the results, the intent of having participants exercise at a moderate intensity and moderate perceived exertion in order for thoughts to be manipulated was successful.

**Heart Rate**

Participants had no heart rate differences between the interventions with and without an order factor, and can be said that all participants exercised at a consistent pace between interventions and within each intervention which follows the suggested guidelines of the current
study. These findings are in agreement with previous findings that support no change in heart rate between cognitive strategies (Lind et al., 2009), but should be considered tentatively as maximum heart rate was controlled. When not controlling for heart rate, other studies have suggested some heart rate differences with both decreases in HR in military members during endurance tasks (Couture et al., 1994) and increases in HR in long distance runners (Smith et al., 1995) under dissociation.

**Self-Efficacy**

To add to the cognitive strategy literature, self-efficacy was measured pre- and post-exercise session of each cognitive strategy intervention. Since there was no recent literature surrounding exercise self-efficacy and cognitive strategies, the null hypothesis tested that there would be no differences in self-efficacy between cognitive strategies before and after exercise. After running two, 1.5 mile sessions, participants’ pre- and post-exercise self-efficacy scores were compared and no differences were reported between the association and dissociation intervention when controlling for the order in which the interventions were completed.

When determining the differences in exercise self-efficacy, all subscales were considered to measure the same construct of self-efficacy and thus only a significant result of the Order by Interaction were revealed. Within this interaction, no differences were revealed between the interventions when controlling for order. However, because of the existing interaction, as well as concluding that each subscale of the exercise self-efficacy construct could be influenced differently, univariate tests were examined. Findings of Rodgers and colleagues (2008) also advocate that these measures be looked at separately, as they found increases in scheduling and coping self-efficacy but no changes in task self-efficacy following six-week intervals of a 12-week intervention.
**Coping self-efficacy.** Participants reported an increase in coping self-efficacy pre- to post-exercise without order contributing to the differences. The increase in coping self-efficacy demonstrates that following the exercise session, participants felt more confident to pursue and complete a task in the face of adversity such as exercising when not feeling well and lacking energy. Also revealed within the results was that the intervention influenced participants’ coping self-efficacy, but only by the order in which the interventions were completed. Specifically, coping self-efficacy was higher in the association intervention when completed second. This finding may advocate that after experience with an exercise, using an associative focus may enhance coping self-efficacy. Similarly, as experience with exercised increased, Rodgers et al., (2008) found that participants coping self-efficacy increased after 6 weeks of a 12-week trial, while the current study found increases in coping self-efficacy after one exercise session.

**Task self-efficacy.** The order of the intervention and the interventions did not influence the participants’ task self-efficacy, but task-self efficacy did increase pre- to post-exercise in both interventions. The increase in task self-efficacy demonstrates that participants were more confident to perform an exercise correctly and follow directions to complete an exercise after each exercise than before each exercise session. Thus, exercise should be able to influence task self-efficacy in just 20 minutes of exercise without the use of a specific cognitive strategy.

**Scheduling self-efficacy.** Participant’s scheduling self-efficacy was not directly influenced pre- to post-exercise, by the order of the interventions, or the intervention itself. While this result contrasts with the results of the Rodgers et al. (2008) study that reported changes in scheduling self-efficacy, it is most likely due to the length of study. A longitudinal study, such as Rodgers et al. (2008) 12-week trial, may produce differences in scheduling self-efficacy and between various cognitive strategies. The current study, two sessions, may not be
enough time for participants to develop an exercise routine or sense of obligation/adherence to exercise.

**Self-efficacy summary.** Altogether, there are two important key conclusions from the self-efficacy measurements. The first key conclusion is that after just one exercise session, participants showed increases in their beliefs and confidence to cope with resisting factors of exercise such as sickness or tiredness, and similarly showed increases in their confidence and beliefs to perform an exercise task well such as following directions and performing the correct movements. Most studies on self-efficacy have been longitudinal studies with some finding differences in self-efficacy after 6 weeks (Everett et al., 2009), 12 weeks (Rodgers et al., 2008), and even 12 months (Ikuyo et al., 2013). This study provides new and important information to the literature in relation to the duration and frequency needed to see changes in exercise self-efficacy.

Participants did not show increases in scheduling self-efficacy which may be considered as most important in determining an exerciser’s adherence beliefs. Reasons that exercisers’ perceptions of scheduling self-efficacy may not have increased is that most exercisers were already high on scheduling self-efficacy, however this does not explain the significant increase in task self-efficacy (See Figure 13). To be eligible for the study, participants had to have an exercise routine that included exercising for 150 minutes/week. Moreover, the exercise preformed may not have been enjoyable and scores on scheduling self-efficacy could have be in relation to never or rarely doing that specific exercise mode or intensity.

While a major concern of self-efficacy in relation to exercise adherence is still being researched with a more established positive relationship (Everett et al., 2009; Higgins et al., 2014), the current study does offer important insight into various types of self-efficacy and how
they might increase despite accumulating lower enjoyment benefits than typically received. If true, and should further be tested, one may advocate enrolling in various modes and intensities of exercise in order to enhance various types of self-efficacy, specifically coping and task.

**Limitations**

The current research experiment included a limitation of exercise intensity and order. By limiting the exercise to such a moderate intensity as signified by HR, the results may only be applied to that intensity. Additionally, by adding an order factor, the already limited sample size was reduced further and differences in outcome variables may have been harder to detect with less power behind the findings. Therefore, future studies should include a larger sample size. Another limitation was that non-habitual runners were asked to perform a running experiment. Even though most participants had some running experience, it may have been more appropriate to examine how cognitive strategies influence each participant’s favorite or preferred mode of exercise. Lastly, while association and dissociation strategies are the most common, another strategy such as mindfulness may differentially influence performance, physiological, and psychological outcomes. Association and dissociation distinctly focus on two separate directions of attention while mindfulness focuses on having a non-judgmental bias towards factors that can be considered both associative and/or dissociative.

Some other demographic limitations of the study include the population in which the results were derived from. Only male exercisers were tested and any findings may not be directly applied to female exercises. Moreover, the sample population tested was primarily European American and results may not be directly identifiable to minority populations. Additionally, only college student recreational exercisers were investigated and therefore, the results may not be
applicable to elite exercisers or sedentary individuals who are younger or above the age of 30. Future studies should attempt to include a more diverse population.

**Suggestions for Future Research**

When investigating the differences in performance, psychological, and physiological outcomes, few benefits were reported by the college-age male recreational exercisers as a direct result of the cognitive strategy intervention. In order to potentially achieve significant effects, future studies should include increasing the exercise intensity or offering a self-selected pace (Dishman et al., 1987; Morgan, 1997) as well as including very specific outlines for cognitive strategies to create more than just two conditions as proposed by Brick et al. (2014). As many previous studies including the current one, have looked at aerobic exercises, future research should include examination of high intensity exercises and various modes of exercise the exerciser enjoys other than running or cycling. Some examples would include CrossFit, high intensity interval training, volitional exhaustion tests, and long distance rowing.

Additionally, the current study was limited to only measuring very surface level physiological data of heart rate and RPE. Physiological measures such as blood pressure (Lind et al., 2009), respiratory exchange ratio, oxygen consumption (Hatfield et al., 1992), and EMG activity (Wulf, 2013) may provide more information on the direct influence of cognitive strategies on physiological responses. Taking lactate accumulation at various times in the exercise may also provide additional physiological information.

A final suggestion for future research would be to assess how different cognitive strategies influence exercise adherence and participation over time. Understanding the long term effect of cognitive strategies may help to advance the understanding of why the obesity rate
increases post-secondary education (Centers for Disease Control, 2014), and what factors can be focused on to slow down this unhealthy trend.

**Conclusion**

Exercise has been known to increase positive mood states and decrease negative mood states following just 20 minutes of low to moderate intensity exercise (Berger & Motl, 2000). In the current study, Confusion was shown to decrease pre- to post-exercise and Depression decreased when participants used the dissociation intervention first. Surprisingly, Tension decreased when using the dissociation intervention first and increased when using the dissociation intervention second. Furthermore, different dimensions of an exerciser’s self-efficacy including task and coping self-efficacy showed acute increases from just two exercise sessions. Although cognitive strategies did not appear to have any effect on various measures of performance, psychological, and physiological outcomes, previous literature has been in support of dissociation strategies for psychological benefits (Neumann & Piercy, 2013; Drylund & Wininger, 2008) and association strategies for physiological (Connolly & Janelle, 2003) and performance benefits (LaCaille et al., 2004). Finally, it was found that participants had more distressful thoughts in the association condition, RPE increased over time, negative mood states decreased pre- to post-exercise, and that coping and task self-efficacy increased pre- to post-exercise.

In conclusion, recreational exercisers were able to achieve increases in self-efficacy and mood benefits independent of the interventions following just a short, 1.5-mile run at a moderate intensity. As college male exercisers begin to exercise, they should continue to use their preferred cognitive strategy for now until cognitive strategy findings are more definitive. Until then, the results of the current study support that a moderate intensity exercise session lasting at
least 20 minutes will enable an exerciser to enhance their self-efficacy and attain positive mood enhancement benefits.
REFERENCES


APPENDIX A: MEDICAL HISTORY QUESTIONNAIRE

EXERCISE PHYSIOLOGY LABORATORY
124 EPLLER SOUTH, SCHOOL OF HMSLS
BOWLING GREEN STATE UNIVERSITY

All information given is personal and confidential. It will enable us to better understand you and your health and fitness habits. In addition, we will use this information to classify your health status according to the American College of Sport Medicine (ACSM) recommendations for risk stratification (ACSM, 2014). Please let us know if and when you have changed your medication (dose & type), diet, exercise or sleeping habits within the past 24 or 48 hours. It is very important for you to provide us with this information.

NAME________________________ AGE___________________DATE___________________

OCCUPATION_________________________________________________________________

1. *FAMILY HISTORY

Check each as it applies to a blood relative:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>No</th>
<th>Unsure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Attack</td>
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<tr>
<td>Sudden Death</td>
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<tr>
<td>Coronary Revascularization</td>
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<td>Tuberculosis</td>
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<tr>
<td>Stroke</td>
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<tr>
<td>Asthma</td>
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<tr>
<td>High BP</td>
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<tr>
<td>Circ Disorder</td>
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<tr>
<td>Heart Disease</td>
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</tbody>
</table>

Father’s Age: Deceased: Age at death: (Before 55 yr. in father or first-degree male relative)

Mother’s Age: Deceased: Age at death: (Before 65 yr. in mother or first-degree female relative)

2. PERSONAL HISTORY

Check each as it applies to you:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>No</th>
<th>Unsure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (men ≥ 45 yr; women≥ 55 yr)</td>
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<tr>
<td>Current Cigarette Smoking</td>
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<tr>
<td>Sedentary Lifestyle</td>
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<tr>
<td>Obesity – BMI &gt;30 kg•m</td>
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<tr>
<td>High Blood Pressure</td>
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<tr>
<td>Dyslipidemia</td>
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<tr>
<td>PreDiabetes</td>
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<tr>
<td>Negative Risk Factor</td>
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<tr>
<td>Tuberculosis</td>
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<td>Stroke</td>
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<td>Asthma</td>
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<td>Heart Attack</td>
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<tr>
<td>Angina</td>
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<tr>
<td>EKG Abnormal</td>
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<tr>
<td>Emphysema</td>
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<td>Surgery</td>
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<td>Stroke</td>
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<td>Severe Illness</td>
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<td>Hospitalized</td>
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<td>Black Outs</td>
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<td>Gout</td>
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<td>Nervousness</td>
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<td>Joint Problems</td>
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<td>Allergy</td>
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<tr>
<td>Depression</td>
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<td>Chest Pain</td>
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<td>Arm Pain</td>
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<tr>
<td>Short of Breath</td>
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<td>Indigestion</td>
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<td>Ulcers</td>
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<tr>
<td>Overweight</td>
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<tr>
<td>Hernia</td>
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<tr>
<td>Back Pain</td>
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<tr>
<td>Leg Cramps</td>
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<td>Low Blood Press</td>
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<tr>
<td>Insomnia</td>
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</table>

Have you ever had:

- Diabetes
- Tuberculosis
- Heart Attack
- Angina
- EKG Abnormal
- Asthma
- Emphysema
- Surgery
- Stroke
- Severe Illness
- Hospitalized
- Black Outs
- Gout
- Nervousness
- Joint Problems
- Allergy
- Depression
- Chest Pain
- Arm Pain
- Short of Breath
- Indigestion
- Ulcers
- Overweight
- Hernia
- Back Pain
- Leg Cramps
- Low Blood Press
- Insomnia

For Office Use Only:

Sum of positive and negative *CVD risk factors* (according to Table 2.2. ACSM (2014))

NOTE: All risk factors are explained verbally to each person completing the questionnaire.

Classify according to ACSM (2014, p. 26) (check one): Low risk < 2; Moderate risk > 2; High risk (known disease)
3. MEDICAL HISTORY

Name of your physician______________________________________________________________

Date of your most recent physical examination_________________________________________

What did the physical examination include?________________________________________________________________________________________________________

Have you ever had an exercise EKG? Yes_______ No________

Are you presently taking any medications? Yes_______ No_______ List name and dosage____________
(Including over-the-counter medications and/or herbs)

Have you ever taken:

<table>
<thead>
<tr>
<th>Medication</th>
<th>Yes____</th>
<th>No____</th>
<th>Unsure____</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digitalis</td>
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<td>Nitroglycerin</td>
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<td>High Blood Pres</td>
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<td>Sedatives</td>
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<td>Inderal</td>
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<td>Insulin</td>
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<td>Pronestyl</td>
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<tr>
<td>Vasodilators</td>
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<tr>
<td>Other</td>
<td>_______</td>
<td>_______</td>
<td>_______</td>
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</tbody>
</table>

If yes, list medications:______________________________________________________________

4. EXERCISE HISTORY

Do you exercise? Yes_______ No_______ What activity__________________________________________

How long have you been exercising?__________________________________________________________________

How many days do you exercise?______ How many minutes per day?______

What kinds of shoes do you work out in?____________________________________________________________

Where do you usually exercise?___________________________________________________________________

Do you monitor your pulse during your workout?______________________________________________________

Additional information from client interview to further assess health/coronary risk status:
_____________________________________________________________________________________________
_____________________________________________________________________________________________
_____________________________________________________________________________________________
_____________________________________________________________________________________________

Signature of Tester __________________________ Date ___________________________
APPENDIX B: PERSONAL DATA QUESTIONNAIRE

ID: __________

Instructions: Read each of the following questions carefully and indicate the BEST response.

Be sure to respond to each item.

1. Birthday (mm/dd/yyyy) ________

2. My weight is _________ pounds; my height is ________ inches.

3. I am a (circle one)
   a.) Freshman
   b.) Sophomore
   c.) Junior
   d.) Senior
   e.) Graduate Student

4. My ethnicity is (circle one)
   a.) Caucasian/European
   b.) Asia/Pacific Islander
   c.) African-American
   d.) Middle-Eastern
   e.) Latino/Hispanic
   f.) American Indian/Alaskan Native/ Hawaii Native
   g.) Other _________
APPENDIX C: EXERCISE HISTORY QUESTIONNAIRE

Date: __________________       ID:___________

1. Do you exercise?   Yes_____ No_______

2. For the past month, list the top 3 activities/exercises you have participated in, the
days/week you have participated in them, and the min/session:
   Activity #1. _______________ days/week ____________ min/session____________
   Activity #2. _______________ days/week ____________ min/session____________
   Activity #3. _______________ days/week ____________ min/session____________

3. Do you run for cardiovascular training/conditioning?  Yes_______ No_______

4. If yes, how many sessions a week? ___________________

5. Approximate number of miles for an average session? _________________

When exercising, do you prefer to (check all that apply):

☐ Distract yourself from focusing on the exercise (listen to music, think about things you
   have to do, think about the past, etc.)

   AND/OR

☐ Pay attention to the exercise and your body (control your breathing, monitor your heart
   rate and muscle fatigue, think about time remaining to pace yourself, etc.)
APPENDIX D: REYNOLDS SHORT FORM OF THE MARLOWE-CROWNE SOCIAL DESIRABILITY SCALE

Below are a brief series of statements on certain attitudes and personal traits. Read them all and respond with T (true) or F (false), circling a response for each question. It is advisable not to read too much into each statement, but to give the first answer that comes to mind.

1. It is sometimes hard for me to go on with my work if I am not encouraged. T F
2. I sometimes feel resentful when I don’t get my way. T F
3. No matter who I’m talking to, I’m always a good listener. T F
4. There have been occasions when I took advantage of someone. T F
5. I’m always willing to admit it when I make a mistake. T F
6. I sometimes try to get even rather than forgive and forget. T F
7. I am always courteous, even to people who are disagreeable. T F
8. I have never been irked when people expressed ideas very different from my own. T F
9. There have times when I was quite jealous of the good fortune of others. T F
10. I am sometimes irritated by people who ask favors of me. T F
11. I have never deliberately said something that hurt someone’s feelings. T F

APPENDIX E: MULTIDIMENSIONAL SELF-EFFICACY FOR EXERCISE SCALE

Please rate how confident you are for each of the following items. Rate your degree of confidence by recording a number from 0 to 100 using the scale given below:

<table>
<thead>
<tr>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot do at all</td>
<td>Moderately can do</td>
<td>Highly confident can do</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In general how confident are you that you can:

1. Follow directions to complete exercise
2. Consistently exercise three times per week
3. Exercise when you lack energy
4. Arrange your schedule to include regular exercise
5. Complete exercise using proper technique
6. Exercise when you don’t feel well
7. Perform all of the required movements
8. Include exercise in your daily routine
9. Exercise when you feel discomfort

Confidence (0-100)

**APPENDIX F: PROFILE OF MOOD STATES**

How Do You Feel Right Now?

**DIRECTIONS:** Below is a list of words a describe feelings people have. Please read each one carefully. Then fill in ONE circle under the answer to the right which best describes **HOW YOU FEEL RIGHT NOW.**

The numbers refer to these phrases:

- ∅ = Not at all
- 1 = A little
- 2 = Moderately
- 3 = Quite a bit
- 4 = Extremely

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>D</td>
<td>A</td>
<td>V</td>
<td>F</td>
<td>C</td>
<td>∅</td>
</tr>
</tbody>
</table>

**MAKE SURE YOU HAVE ANSWERED EVERY ITEM.**

- T
- D
- A
- V
- F
- C
APPENDIX G: PHYSICAL ACTIVITY ENJOYMENT – TRAIT

Please rate how you feel about most types of physical activity in general, most of the time.

Circle your response to each of the following items.

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I enjoy it</td>
<td>1 2 3 4 5 6 7</td>
<td>I hate it</td>
</tr>
<tr>
<td>2. I feel bored</td>
<td>1 2 3 4 5 6 7</td>
<td>I feel interested</td>
</tr>
<tr>
<td>3. I dislike it</td>
<td>1 2 3 4 5 6 7</td>
<td>I like it</td>
</tr>
<tr>
<td>4. I find it pleasurable</td>
<td>1 2 3 4 5 6 7</td>
<td>I find it unpleasurable</td>
</tr>
<tr>
<td>5. I’m very absorbed in this activity</td>
<td>1 2 3 4 5 6 7</td>
<td>I’m not at all absorbed in this activity</td>
</tr>
<tr>
<td>6. It’s not fun at all</td>
<td>1 2 3 4 5 6 7</td>
<td>It’s a lot of fun</td>
</tr>
<tr>
<td>7. I find it energizing</td>
<td>1 2 3 4 5 6 7</td>
<td>I find it tiring</td>
</tr>
<tr>
<td>8. It makes me depressed</td>
<td>1 2 3 4 5 6 7</td>
<td>It makes me happy</td>
</tr>
<tr>
<td>9. It’s very pleasant</td>
<td>1 2 3 4 5 6 7</td>
<td>It’s unpleasant</td>
</tr>
<tr>
<td>10. I feel good physically while doing it</td>
<td>1 2 3 4 5 6 7</td>
<td>I feel bad physically doing it</td>
</tr>
<tr>
<td>11. It’s very invigorating</td>
<td>1 2 3 4 5 6 7</td>
<td>It’s not at all invigorating</td>
</tr>
<tr>
<td>12. I’m very frustrated</td>
<td>1 2 3 4 5 6 7</td>
<td>I’m not at all frustrated</td>
</tr>
<tr>
<td>13. It’s very gratifying</td>
<td>1 2 3 4 5 6 7</td>
<td>It’s not at all gratifying</td>
</tr>
<tr>
<td>14. It’s very exhilarating</td>
<td>1 2 3 4 5 6 7</td>
<td>It’s not at all exhilarating</td>
</tr>
<tr>
<td>15. It’s not at all stimulating</td>
<td>1 2 3 4 5 6 7</td>
<td>It’s very stimulation</td>
</tr>
<tr>
<td>16. It give me a strong sense of accomplishment</td>
<td>1 2 3 4 5 6 7</td>
<td>It does not give me any sense of accomplishment</td>
</tr>
<tr>
<td>17. It’s very refreshing</td>
<td>1 2 3 4 5 6 7</td>
<td>It’s not all at refreshing</td>
</tr>
<tr>
<td>18. I felt as though I would rather be doing something else</td>
<td>1 2 3 4 5 6 7</td>
<td>I felt as though there was nothing else I would rather be doing</td>
</tr>
</tbody>
</table>


*Journal of Sport and Exercise Psychology, 13, 50-64.*
APPENDIX H: PHYSICAL ACTIVITY ENJOYMENT – STATE

Please rate how you feel at this moment about the physical activity you have just completed. Circle your response to each of the following items.

1. I enjoy it 1 2 3 4 5 6 7 I hate it
2. I feel bored 1 2 3 4 5 6 7 I feel interested
3. I dislike it 1 2 3 4 5 6 7 I like it
4. I find it pleasurable 1 2 3 4 5 6 7 I find it unpleasurable
5. I’m very absorbed in this activity 1 2 3 4 5 6 7 I’m not at all absorbed in this activity
6. It’s not fun at all 1 2 3 4 5 6 7 It’s a lot of fun
7. I find it energizing 1 2 3 4 5 6 7 I find it tiring
8. It makes me depressed 1 2 3 4 5 6 7 It makes me happy
9. It’s very pleasant 1 2 3 4 5 6 7 It’s unpleasant
10. I feel good physically while doing it 1 2 3 4 5 6 7 I feel bad physically while doing it
11. It’s very invigorating 1 2 3 4 5 6 7 It’s not at all invigorating
12. I’m very frustrated 1 2 3 4 5 6 7 I’m not at all frustrated
13. It’s very gratifying 1 2 3 4 5 6 7 It’s not at all gratifying
14. It’s very exhilarating 1 2 3 4 5 6 7 It’s not at all exhilarating
15. It’s not at all stimulating 1 2 3 4 5 6 7 It’s very stimulation
16. It give me a strong sense of accomplishment 1 2 3 4 5 6 7 It does not give me any sense of accomplishment
17. It’s very refreshing 1 2 3 4 5 6 7 It’s not all at refreshing
18. I felt as though I would rather be doing something else 1 2 3 4 5 6 7 I felt as though there was nothing else I would rather be doing

APPENDIX I: ATTENTIONAL FOCUS QUESTIONNAIRE

Following the completion of a 1.5 mile run, please rate on a 1 to 7 scale how much you engaged in the following activities **during the previous run.**

1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7
I did not do this at all                      I did this all the time

_____ 1. Letting your mind wander
_____ 2. Monitoring specific body sensations (e.g., tension, breathing rate)
_____ 3. Trying to solve problems in your life
_____ 4. Paying attention to your general level of fatigue
_____ 5. Focusing on how much you are suffering
_____ 6. Singing a song in your head
_____ 7. Focusing on staying loose and relaxed
_____ 8. Wishing the run would end
_____ 9. Thinking about school, work, social relationships, etc.
_____ 10. Focusing on your performance goal
_____ 11. Wondering why you are even running in the first place
_____ 12. Making plans for the future (e.g., grocery list)
_____ 13. Getting frustrated with yourself over your performance
_____ 14. Writing a letter or paper in your head
_____ 15. Paying attention to your form or technique
_____ 16. Reflecting on past experience
APPENDIX I (continued)

Attentional Focus Questionnaire – Post-Run

____ 17. Paying attention to your rhythm
____ 18. Thinking about how much you want to quit
____ 19. Focusing on the environment (e.g. scenery)
____ 20. Thinking about cognitive strategy or tactics
____ 21. Counting (e.g. objects in the environment)
____ 22. Monitoring your pace
____ 23. Thinking about how much the rest of the run will hurt
____ 24. Meditating (focusing on a mantra)
____ 25. Encouraging yourself to run fast
____ 26. Trying to ignore all physical sensations
____ 27. Concentrating on the run
____ 28. Wondering whether you will be able to finish the run
____ 29. Thinking about pleasant images
____ 30. Monitoring the time of the run
____ 31. Other ____________________________

Finish time of 1.5 mile run: ________________

Session number of the run: ____

APPENDIX J: RATING OF PERCEIVED EXERTION

Every four laps I will ask you how hard you are working on a scale from 6- to 20 as described below. Try not to let one single factor influence your rating but rather choose a rating that includes all aspects of your work rate. Be as honest as possible and try not to overestimate or underestimate. Each number can be used more than once and not every number has to be used.

Choose the number that best describes your level of exertion.

6. No exertion at all                     LOW INTENSITY
7. Extremely light
8.
9. Very light
10.
11. Light
12. MODERATE INTENSITY
13. Somewhat hard
14.
15. Hard (heavy)
16.
17. Very hard
18. HIGH INTENSITY
19. Extremely hard
20. Maximal exertion

A Master’s student from Bowling Green State University is seeking physically fit exercisers and/or runners to participate in a research study. As a member of the study, you will be given the chance to discover new mental processes you can use during your typical exercise or run. The study will take place during a one-week period and requires you to run at a pace of your choice on the track in the Eppler South Gymnasium.

To qualify for the study:
1. You must be an undergraduate or graduate student at BGSU,
2. You must have participated in cardiovascular exercise for the past month for at least 150 minutes a week (20-60 minutes daily), and
3. You must have no recent injuries or illnesses.

If you are interested in learning more about this study, please contact:

Matt Jones
Phone: (814) 418-2163
Email: jonesms@bgsu.edu
APPENDIX L: ASSOCIATION - INTERVENTION INSTRUCTIONS

Script Read to Each Participant

“Runners often use mental strategies while running to ensure that they are keeping a consistent pace and working to their full potential. One of these strategies is called “association”.

For the entire jogging session, do your best to focus on information immediately relevant to the run. This includes:

- heart rate,
- breathing rate,
- muscle movement and fatigue,
- soreness, and
- keeping a cadence for pace.

For this exercise session, you are instructed to run/jog at a low to moderate intensity for 1.5 miles at a pace of your choice. Keep in mind you will run/jog a similar pace for the next session. For the 1.5 mile jog, you are asked to focus on monitoring your body to control your heart rate, breathing, and pace. During this time, anything that relates specifically to the run is okay to think about.

Avoid thinking about irrelevant thoughts and/or daydreams.

Every four laps I will ask you for your RPE as described earlier then followed by your heart rate.”
“Runners often use mental strategies while running to ensure that they are keeping a consistent pace and working to their full potential. One of these strategies is called “dissociation.” For the entire jogging session, do your best to focus on information irrelevant to the run/jog to distract yourself. You might choose to think about:

- past relationships,
- recalling memories throughout your life,
- thoughts of friends and family,
- imagining music,
- spiritual reflection, and
- solving mental problems.

For this exercise session, you are instructed to run/jog for 1.5 miles at a low to moderate intensity at a pace of your choice. Keep in mind you will run this pace for the next test. For the 1.5 mile jog, you are asked to focus on similar thoughts of imagining music, recalling specific memories, relevant past events, and reflecting on relationships with friends and family. Be sure to focus on your personal life and events.

Avoid thinking about bodily sensation, fatigue, and heart rate. Every four laps I will ask you for your RPE as described earlier then followed by your heart rate.

Immediately after reporting to me your RPE and HR, you are to transition back into the same thought process or start a new one that remains relevant to your personal life and events.”
APPENDIX N: INFORMED CONSENT FORM

Thesis Title: Use of Cognitive Strategies during Running
Primary Investigator: Matthew Jones, Graduate Student, Developmental Kinesiology
Advisor: Dr. Bonnie Berger, Professor, School of HMSLS
Committee: Dr. Lyn Darby, Professor, School of HMSLS
D. David Tobar, Assistant Professor, School of HMSLS

Matthew Jones, a graduate student, and his advisor Dr. Bonnie Berger of the Department of Human Movement, Sport, and Leisure Students at Bowling Green State University are examining how exercisers feel after a run when they think about different things during a run. I have contacted these investigators because I am a male recreational exerciser who would like to participate in this study.

I have been informed that there is minimal, if any risk, associated with the exercise, and that a purpose of this study is to assess how I feel in relation to exercise and the use of cognitive strategies. I also have been informed that potential benefits of the study include learning about jogging and attentional focus.

My involvement in this study includes jogging four laps to practice data collection, and then on two other days, I will jog 1.5-miles and complete several questionnaires before and after jogging. Completion of the questionnaires will require approximately 20 minutes before and after jogging, with participation lasting approximately 1 hour each day. If I experience an injury during the exercise, researchers may call emergency services for transportation to the hospital. If I experience any adverse effects in the days that follow, I should seek medical attention on my own. I have been informed that if I do sustain an injury during participation, I am fully responsible for the cost of treatment.

All data that I provide will be kept locked in a file cabinet to protect the confidentiality of my identity, and only the researchers will see the data that I have provided. When the study has been completed, the data will be secured in a locked file cabinet in the Exercise Psychology Laboratory at Bowling Green State University. It has been explained to me that any identifying feature of my identity will be coded during the data analysis and publication of the results.

If I have any questions about this study, I may contact Matthew Jones, 814-418-2163 or jonesms@bgsu.edu as well as Bonnie Berger, 419-308-1633 or bberger@bgsu.edu. I may also contact the Chair, Bowling Green State University’s Human Subjects Review Board, 419-372-7716 or hsrb@bgsu.edu, with questions or concerns about my right as a research participant.

I willfully provide my consent to participate in the research study examining how cognitive strategies influence my feelings. My signature below indicates I have been informed of the following:

- I must be over the age of 18 in order to participate in this study
- All of my information that I provide will be confidential.

BGSU HSRB - APPROVED FOR USE
IRBNet ID # 701365
EFFECTIVE 02/19/2015
EXPIRES 02/03/2016
• My decision to participate is entirely voluntary and will have no impact on my relationship to Bowling Green State University
• I will be not offered direct benefits such as a monetary reward for my participation
• I may withdraw consent and terminate participation at any time during the study
• I have been informed of the procedures that will be requested of me
• a copy of this informed consent form will be provided to me, and
• upon request, I will receive a summary of findings of this study

__________________________  ______________________  ___________________
Name                          Date                Signature

Phone Number: __________________________