

THE FLORIDA STATE UNIVERSITY

COLLEGE OF EDUCATION

A COMPARISON OF COPING STRATEGIES: EFFECTS UPON PERCEIVED

EXERTION IN A CYCLING TASK

By

CHRISTOPHER T. STANLEY

A Thesis submitted to the  
Department of Educational Psychology and Learning Systems  
in partial fulfillment of the  
requirements for the degree of  
Master of Science

Degree Awarded:  
Spring Semester, 2004

The members of the Committee approve the thesis of Christopher T. Stanley defended on  
March 25<sup>th</sup>, 2004

---

David Pargman  
Professor Directing Thesis

---

Gershon Tenenbaum  
Committee Member

---

Akihito Kamata  
Committee Member

Approved:

---

Frances Prevatt, Chair, Department of Educational Psychology and Learning Systems

The Office of Graduate Studies has verified and approved the above named committee members.

## TABLE OF CONTENTS

LIST OF TABLES.....	v
LIST OF FIGURES.....	vi
ABSTRACT.....	vii
1 INTRODUCTION.....	1
Definition of main terms.....	1
2 LITERATURE REVIEW.....	3
Theories of Attention and Effort.....	3
A Model.....	5
Coping Strategies: Linking Perceived Exertion and Attention.....	6
Studies examining perceived exertion and coping strategies.....	7
Attention and intensity.....	8
Elite athletes (runners).....	10
Novice athletes.....	11
Measurement of attention and perceived exertion.....	14
Purpose of the study.....	16
Hypotheses.....	17
3 METHOD.....	18
Participants.....	18
Instrumentation.....	18
Apparatus and materials.....	19
Physical Task.....	19
Attention manipulation.....	19
Procedure.....	22
Statistical Analyses.....	22
4 RESULTS.....	23
Effects for treatment on heart rate .....	23
Qualitative Analysis.....	25
Effect for treatment of perceived exertion.....	26
Differences between associative and dissociative treatments.....	32

5	DISCUSSION.....	34
	Limitations and future directions.....	37
	APPENDIX A.....	40
	APPENDIX B.....	41
	APPENDIX C.....	42
	APPENDIX D.....	43
	APPENDIX E.....	44
	APPENDIX F.....	45
	APPENDIX G.....	46
	APPENDIX H.....	47
	APPENDIX I.....	48
	APPENDIX J.....	49
	REFERENCES.....	50
	BIOGRAPHICAL SKETCH.....	54

## LIST OF TABLES

1.	Attentional strategy model offered by Stevinson and Biddle (1999).....	7
2.	RM ANOVA results for Heart Rate.....	23
3.	Frequency table for reported thoughts during associative treatments.....	25
4.	RM ANOVA results for RPE.....	26
5.	t-test results for RPE of associative and dissociative treatments.....	29
6.	RM ANOVA results for RPE of combined treatments.....	30
7.	RM ANOVA results for RPE of Associative Treatments .....	32
8.	RM ANOVA results for RPE of Dissociative Treatments.....	33

## LIST OF FIGURES

1.	A social cognitive model offered by Tenenbaum (2001).....	5
2.	The cycle ergometer protocol.....	21
3.	Mean HR values under four treatment conditions across the 10 minutes.....	24
4.	Mean HR for the four treatments during the 10 minutes .....	24
5.	Mean RPE under four treatment conditions.....	27
6.	Means for the four treatments during the 10 minutes of cycling.....	28
7.	Interaction Effect of Treatment and Time for Combined Treatments.....	31

## ABSTRACT

The purpose of this study was to compare the effects of associative and dissociative intervention strategies upon perceived exertion in undergraduate and graduate female students ( $n = 13$ , 18 - 24 years of age) exercising on stationary bicycles. Participants had some experience with cycling, as they were recruited from physical education spinning classes at a large southeastern university. They were assigned to each treatment condition, and performed the same 10-minute cycling task for four consecutive weeks. The order of treatment was randomized to discourage order effects.

Interventions applied were derived from Stevinson and Biddle's (1999) two-dimensional coping strategy model. The first dimension was task relevance, comprised of associative (e.g. bodily sensations, pace) and dissociative (e.g. daydreams, environmental distractions) processes. The second dimension was direction of attention, i.e. internal or external. Therefore, the model yields four coping strategy types: internal association, external association, internal dissociation, and external dissociation. It was hypothesized that (1) participants in the internal and external dissociation conditions would report lower RPE than participants in the internal and external associative conditions, (2) there would no difference between the internal and external associative conditions, and (3) there would be no difference between the internal and external dissociative conditions.

The first session was the same for all participants, consisting of a sub maximal multiple-stage test aimed at assessing the participants  $VO_{2\max}$  and corresponding heart rates. The following four sessions each introduced a different intervention, but maintained an equivalent physical load. The task required the participants to ride an exercise bicycle for a total of 20-minutes during each session: comprised of a five-minute warm-up, a 10-minute physical task, and a five-minute cool down. The participants were asked to maintain a 75%  $HR_{\max}$  range throughout the 10-minute cycling task.

In order to examine the three hypotheses, a repeated measures ANOVA with one within subject factor (treatment condition) was used to analyze the data. The dependent

variable is RPE as reported by the participants. Two main effects were observed: treatment condition and time. One interaction effect was also found: treatment by time. Results yielded significant differences ( $p < .01$ ) between the associative and dissociative treatments. The associative treatments provided higher perceived exertion levels than the dissociative treatments for the same physical load. Therefore, task relevance may affect perceived exertion. However, the differences in perceived exertion were not significant between the internal association and external association ( $p = .22$ ) and the internal dissociation and external dissociation treatments ( $p = .99$ ). These findings suggest that the directional dimension of the model may not affect the perceived exertion of endurance tasks as much as task relevance.

## CHAPTER 1: INTRODUCTION

### *Definition of Main Terms*

Many terms have been used to describe the notion of perceived effort, including perceived exertion and exertion tolerance. These terms, however, deserve distinctions. Perceived exertion has been defined as “the subjective intensity of effort, strain, and/or discomfort that is experienced during exercise” (Robertson, Goss & Metz, 1998, p.183). Less empirical attention has been given to exertion tolerance, which is defined as the ability to sustain and cope with feelings of exertion for long periods of time (Tenenbaum, 2001). Borg (1962) originally highlighted a difference between perceived force and perceived fatigue/exertion. He suggested that the perceived force was related with short-term exercise, while perceived exertion was related with long-term exercise bouts. Borg went further to delineate between the terms of fatigue and exertion. Fatigue is often associated with high levels of exhaustion, tiredness, and decreases in physical performance. Fatigue, therefore, has a physiological basis. Perceived exertion is a much broader concept that takes into account physiological and psychological factors (e.g. coping strategies, motivation, and emotion).

Morgan & Pollack (1977) suggested that strategies for coping with perceived exertion can take two forms: active (association) and passive (dissociation). Moreover, active strategies may take on internal or external forms. Briefly, internal strategies are aimed at coping directly with feelings of overuse and exertion through “fighting” against them or other negative events (Tenenbaum, 2001). External strategies allow the performer to shift attention to external events to reduce perceptions of neural exertion signals coming from the muscles, joints, and cardiopulmonary systems. Alternatively, a passive coping strategy does not attempt to alleviate the sensations of pain, fatigue, and exhaustion.

Abundant research on the psychological factor-perceived exertion relationship has been compiled, exploring the influence that coping strategies have upon perceived exertion (e.g. Cymerman and Stokes, 1983; Fillingham & Fine, 1986; Padget and Hill,

1989; Pennebaker & Lightner, 1980; Morgan & Pollock, 1977; Russell & Weeks, 1994; Schomer, 1986). Studies have explored the coping strategy-perceived exertion relationship in many athletes, including runners, swimmers, rowers, and race walkers (Clingman & Hilliard, 1990; Couture, Jerome, & Tihanyi, 1999; Connolly & Janelle, 2003; Spink, 1988). Further, the relationship has often been examined within the expert-novice paradigm, attempting to determine the coping strategy preferences of elite and recreational athletes (Padget and Hill, 1989; Pennebaker & Lightner, 1980; Morgan & Pollack, 1977; Silva & Applebaum, 1989; Tammen, 1996; Ungerleider, Golding, Porter, & Foster, 1989; Wrisberg & Pein, 1990). More recently, however, researchers have argued that the use of coping strategies by athletes, whether expert or novice, can be better understood by considering the intensity of the physical load (Tenenbaum, 2001). The present study will expound upon the work of Padget and Hill (1989) by comparing the effectiveness of coping strategies upon perceived exertion in cyclists.

## CHAPTER 2: LITERATURE REVIEW

### *Theories Linking Effort and Attention*

Attention and perceived exertion are fundamental psychological processes of motor performance. It is difficult to imagine that there can be anything more important to the learning and performance of sport skills than paying attention to the task at hand (Abernethy, 1993). The consequences of poor attention skills may be concentration lapses, fundamental skill errors, and a decrease in overall performance. Sport psychology researchers and practitioners have devoted much effort to understanding attention, its implications in sport, and the implementation of attention control training.

Posner and Boise (1971) highlighted three major uses of the term attention: (1) attention as *alertness*, (2) attention as a *limited capacity* or resource, and (3) attention as *selectivity*. Briefly, attention as alertness focuses on the effects of arousal, activation, stress and anxiety on attention and performance. Attention may also be understood as a limited capacity or resource in the context of limited information processing, capacity and resources. Selective attention refers to the processes by which certain information is considered while other information is disregarded (Abernethy, Summers, & Ford, 2001). This section reviews some of the theories that may link physical effort and attention.

Easterbrook (1959) reviewed emotion (i.e. arousal) and its effect on cue utilization. Easterbrook argued that as arousal increases, the cue-utilization processes approach a most optimal level. However, after having reached the optimal level of arousal, any further increases in arousal will result in less desirable cue-utilization levels. According to Easterbrook, heightened arousal affects selectivity, causing an individual to narrow his/her attention

A common assumption is that the attentional processes of athletes undergo a “narrowing” effect as arousal increases above an optimal point. The attentional narrowing restricts the performer’s cue intake capabilities. Nideffer (1976) has offered the *Theory of Attentional Styles*, which divides attention into the two dimensions of “width” and “direction”. Width ranges from broad to narrow attentional focus, while

direction ranges from internal to external attentional focus. The theory assumes that arousal effects attention in predictable ways: High arousal levels lead to reduced attentional flexibility, a narrowing of attentional focus, and a predominantly internal orientation. This notion parallels Easterbrook's original assumption that heightened arousal effects selectivity, causing an individual to narrow his/her attention. Various studies have indicated emotional arousal does indeed limit a performer's peripheral visual field (Bacon, 1974; Landers 1980, 1981; Wachtel, 1967).

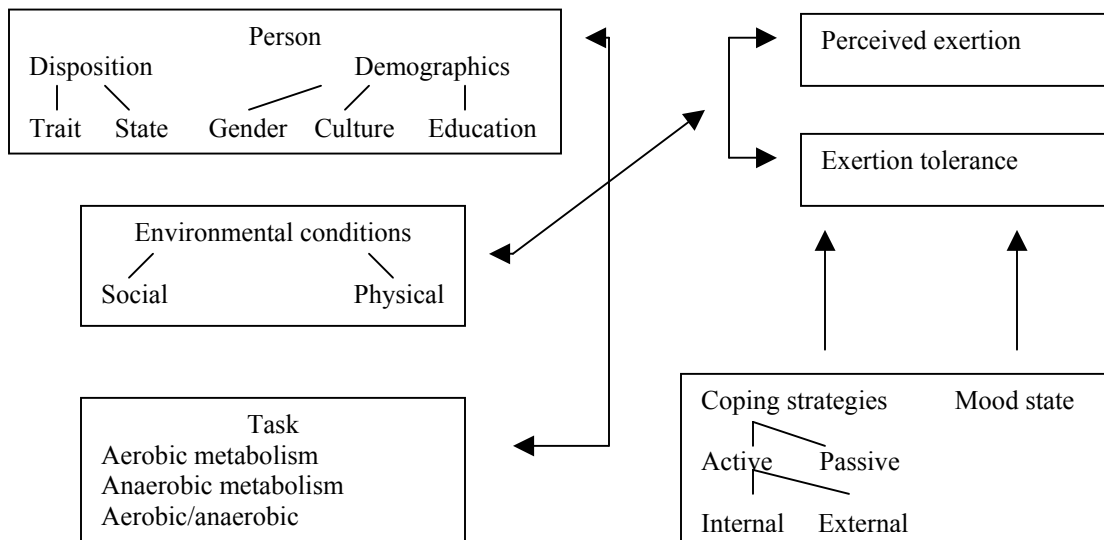
Kahneman (1973) argued that individuals maintain a *fixed cognitive capacity* of attention, and thusly, the capacity model was developed. Capacity theory assumes that there is a general limit on an individual's capacity to perform mental work. It also assumes that this limited capacity can be allocated with considerable freedom among concurrent activities (Moray, 1967). Different tasks require different attentional demands, and, as the difficulty of task increases, more attentional capacity is needed to meet these demands. According to capacity model, the number of cues that can be attended to is determined by the cognitive capacity that each requires. Should the capacity become full, task performance would subsequently decrease. Major contributions of Kahneman's model are the consideration of the effects of task difficulty upon performance, and the distribution of attention between more than one task.

The relationship between attention and perceived exertion can be understood within the parallel-processing model offered by Rejeski (1985). From a parallel processing perspective, one would hypothesize that dissociative strategies offer relief from fatigue by occupying limited channel capacity that is critical to bringing fatigue into awareness (p. 374). The model posits that if an internal cue is forced to compete with cues arising from the environment, then a portion of attentional capacity is needed to meet these demands. Conceptually, less attentional space may be available for physical exertion cues, thereby creating an "easier" feel. The parallel-processing model places importance upon the intensity of the physical load.

To summarize, the theories of attention describe the selective and fixed capacity aspects of attention. These theories place varying amounts of importance upon past experience, task difficulty, variability of physical load, and individual differences as mediators of attentional focus.

### *A Model*

Noble and Robertson (1996) maintained that perceived effort is influenced by three external factors: (1) the physical load and duration of the work, (2) the environmental conditions, and (3) task characteristics. More recent research, however, has demonstrated that internal factors also heavily influence perceptual exertion. A study examining perceived discomfort of distance runners showed that under moderate to high levels of intensity, the psychological mechanisms weighed more heavily upon the perceived exertion of the runners. Runners were more concerned with task completion and mental toughness strategies than the symptoms arising from pain. (Tenenbaum, Fogarty, Stewart, Calcagnini, Kirker, Thorne, & Christensen, 1999). Additional factors relating to perceived exertion may be task familiarity, experience level, and the physical conditioning status of the performer. It becomes apparent that perceived exertion is a complex phenomena that may be influenced by individual differences in disposition and demographics, task characteristics, intensity level, environmental conditions, and psychological components. Tenenbaum (2001) offered a social-cognitive model integrating all of these elements (see Figure 1).



*Figure 1.* A social cognitive model offered by Tenenbaum (2001).

One of the primary tenets of the social-cognitive model is that the intensity level influences perceived exertion. The model outlines the relationship between physiological symptoms and perceived exertion. As long as the intensity level remains light to

moderate, only effort symptoms such as perspiration, breathing and local pain are felt, while at very high levels of intensity, task completion, extreme fatigue and difficulty breathing are the most evident symptoms. Moreover, as long as the intensity remains light to moderate, the exerciser is able to shift from associative to dissociative strategies. As the intensity level increases, attention begins to narrow, and the exerciser is no longer free to shift voluntarily between associative and dissociative strategies. In addition, as the physical load increases, association will become the dominant strategy.

In summary, the model posits that individuals training at high levels of intensity, e.g. elite athletes, are unable to ignore the physiological sensations that accompany this training intensity, and therefore tend to adopt associative strategies. Novice and recreational athletes are able to shift between associative and dissociative strategies because they have to deal with less severe physiological symptoms. The model thusly provides an alternative explanation of the coping strategy use by elite and novice athletes. The following section will provide a review of the relevant literature linking perceived exertion and attention.

#### *Coping Strategies: Linking Perceived Exertion and Attention*

The conceptualization of coping strategies have varied considerably. Some researchers have dichotomized coping strategies into internal and external dimensions (Gill & Strom, 1985; Morgan & Pollack, 1977). In addition, Schomer (1986) introduced the idea of task related and task unrelated thoughts. Other scientists have argued that the term dissociation was too closely linked to the clinical term of dissociation (Masters & Ogles, 1998).

As a reaction to these criticisms, Stevinson and Biddle (1999) proposed a two-dimensional model of attention. The first dimension was task relevance, comprised of associative (e.g. bodily sensations, pace) and dissociative (e.g. daydreams, environmental distractions) processes. The second dimension was direction of attention, i.e. internal or external. According to this model, the four types of coping strategies are: internal association, external association, internal dissociation, and external dissociation (see Table 1).

Table 1

*Attentional strategy model offered by Stevinson and Biddle (1999).*

	<b>Internal</b>	<b>External</b>
<b>Task-relevant (association)</b>	Focus on form, breathing, perspiration, how muscles feel, relaxation <b>(Inward monitoring)</b>	Race strategy, time interval, distance completed, competitors <b>(Outward monitoring)</b>
<b>Task-irrelevant (dissociation)</b>	Day dreaming, problem solving <b>(Inward distraction)</b>	Environmental stimuli <b>(Outward distraction)</b>

*Studies Examining Perceived Exertion and Coping Strategies*

Numerous studies have explored the relationship between coping strategies and perceived exertion. To illustrate, Pennebaker and Lightner (1980) concluded that subjects hearing their own breathing (association) reported more fatigue and effort than those who heard distracting street sounds (dissociation). Fillingham and Fine (1986) found that joggers in a dissociative treatment factor reported less exercise symptoms than joggers in associative or control treatments. Padgett and Hill (1989) revealed that an external focus group reported less effort than the internal group. Cymerman and Stokes (1983) concluded that, despite very similar physiological levels, runners employing a dissociative strategy were able to sustain exercise for a significantly longer time than a control group.

A landmark study by Morgan and Pollack (1977) found differences in attentional focus preferences between elite and non-elite marathon runners. They determined that competitive marathon runners employed an associative strategy, while recreational runners favored a dissociative strategy. The researchers concluded that the major distinguishing psychological factor of the elite marathoner is in the employment of the associative strategy during competition.

Schomer (1986) corroborated these finding by concluding that: (1) distance runners reporting higher levels of associative thoughts also experienced higher RPE, and (2) an increase in training intensity caused runners to report more associative thoughts.

This finding was expanded by Russell and Weeks (1994), who claimed that cyclists who had performed under a dissociative condition reported significantly lower RPE when compared to an associative or control group. A characteristic feature in Schomer's study was a convergence of the increased associative thoughts with an increase in perceived effort.

Researchers exploring the attention-RPE relationship have concluded that association is related to higher ratings of RPE, while dissociation is characterized by lower ratings of RPE. Association has also been shown to relate to higher reported symptoms of fatigue, effort, and boredom (Padget and Hill, 1989). Thus, it appears likely that the relationship between RPE and reported symptoms of fatigue is positive.

#### *Attention and Intensity*

Schomer (1986) and Tenenbaum (2001) agree that exercise intensity is a primary determinant in perceived exertion. Accordingly, Tammen (1996) investigated the link between attention and exercise intensity. More specifically, he examined whether the pace of the run would influence the coping strategy used by middle and long distance runners. The runners were asked to run three to four trials of 1500 meters at a submaximal pace, and then run 2300 meters at a maximum pace. After the completion of the 2300-meter run, runners were instructed to indicate whether their thoughts were more associative or dissociative in nature. Tammen concluded that as pace increased, dissociation decreased: as pace increased the runners focused more on internal body sensations (association). This suggests that as the pace of the run becomes more like a "normal" run for the elite distance runners, associative coping is more evident.

Okwumabua, Meyers, Schlessler, and Cooke (1983) hypothesized that attention could be manipulated to result in higher training intensities and subsequent performance gains. They assigned participants to associative, dissociative, and relaxation treatment groups. Before, during, and after the five-week mental training sessions, subjects were asked to run a 1.5-mile race. Runners in the dissociation groups ran much slower than the other two conditions. Surprisingly, all runners reported more use of an associative strategy over trials, regardless of training condition. Findings revealed that runners who reported using more associative strategies showed greater improvement over trials relative to runners who reported dissociative use. The associative coping-performance

gain relationship was supported by a similar study in which an association condition improved running times compared to other conditions (Saintsing, Rishman & Bergey, 1988).

Similarly, Schomer (1987) trained marathon runners in the use of associative thinking; based on the notion that marathon running requires a high training intensity. The runners were instructed to associate during the 5 training sessions, and increase its use throughout the five sessions. Runners who had employed the associative strategies revealed improvements in the form of shortened race times, better training times, longer sustained training runs, higher training intensities, and minimized injury occurrence. This study concurs that association is related to performance gains in novice athletes.

In a study that yielded contradictory findings, Morgan, Horstman, Cymerman, and Stokes (1983) examined whether it was “possible to facilitate endurance performance by means of a cognitive strategy” (p. 262). Participants were delegated to a dissociative group or a control group. All participants were required to run on a treadmill to exhaustion at 80% of their maximal aerobic power. All participants maintained very similar physiological measures, however, the dissociative group showed significant performance gains over two trials. Morgan et al. concluded that “the distraction of sensory discomfort enabled the participants in the dissociation group to tolerate a greater amount of discomfort for a longer period of time” (p. 251).

The literature investigating the relation among effort, attention, and intensity corroborate Tenenbaum’s (2001) social-cognitive model. Tammen (1996) concluded that association is characteristic of higher exercise intensities in elite athletes. In addition, dissociation *and* associative coping strategies have been linked to endurance performance gains in novice athletes (Morgan et al., 1983; Okwumabua et al., 1983; Saintsing et al., 1988; Schomer, 1987).

### *Elite athletes*

Elite athletes have mastered physical and mental skills over many years of diligent practice and their physiological and psychological capabilities are likely to exceed the levels of amateur, novice and recreational athletes. They are deserving of attention in sport psychology research. Elite athletes have been shown to operate at relatively high intensity levels and typically adopt associative strategies in their training and competitive efforts.

Empirical inquiry into the coping strategy use of elite athletes began with the Morgan and Pollock (1977) study. Each marathon runner completed a battery of inventories that assessed physical, psychological, and personality-based variables. Researchers hypothesized that “dissociation would represent the principle cognitive strategy employed by the world-class distance runners during competition” (p. 385). Key contributions came from the finding that elite runners adopted an associative strategy during the run.

Silva and Applebaum (1989) examined the cognitive strategies used by 32 Olympic marathon trial contestants. The lower place finishers tended to adopt a dissociative strategy and maintained it throughout the run. The higher finishers, however, were able to shift from associative to dissociative strategies at the earlier stages and throughout the race. This notion led Silva and Applebaum to believe that marathon running requires an “adaptive flexible” strategy. The higher finishers were more aware of their physiological state, and prepared to make the appropriate adjustments. Similarly, Masters and Lambert (1989) explored a marathon sample, consisting of elite runners and their non-elite counterparts. Findings revealed an overall tendency to shift strategies during training runs; whereas the fastest marathon performances were shown to be related to association.

Tammen’s (1996) study examined an elite middle distance running sample. The runners were required to run several trials at a submaximal pace, and then run 2300-meters at a race simulation pace. Tammen concluded that as the pace approached increased to race-like intensities, dissociation decreased; as pace increased the runners focused more on internal body sensations (association). Additionally, runners reported that “the slower paces caused them to focus more on external things as listening to the

experimenters for encouragement and for monitoring of pace” (p. 7). These findings suggest that elite athletes adopt associative strategies during competition.

The literature thus far has examined the coping strategies employed by elite, middle and long-distance runners. Ungerleider, Golding, Porter, and Foster (1989) examined a sample of Master’s track and field athletes. Five hundred and eighty seven track athletes that had qualified for a national event filled out a questionnaire. Approximately 76% of the athletes reported using an associative strategy during competition.

Research with elite athletes is unequivocal, demonstrating that elite athletes prefer to associate during competition and that association increases according to intensity level, and the social-cognitive model is thusly supported. Morgan (1978) suggested that elite athletes associate more because of their experience and knowledge of how to monitor their bodies effectively.

#### *Novice Athletes.*

Novice and inexperienced athletes do not attain the same physiological and psychological prowess that elite athletes do. Rather, they maintain relatively lower levels of knowledge and experience, thereby unable to monitor their bodies as effectively. The social-cognitive perspective maintains that novice athletes maintain a lower relative intensity, and therefore, may shift between associative and dissociative strategies. Such athletes may also adopt more dissociative strategies than their elite counterparts because of a lower exercise intensity.

Wrisberg and Pein (1990) attempted to ascertain the types of thoughts and cues that recreational runners tended to during exercise. The purpose of the study was to compare experienced and inexperienced recreational runners coping strategy preferences. The results suggested that experienced runners tend to dissociate more than inexperienced runners do. The most inexperienced of runners tended to associate more. Consistent with other research (Fillingham & Fine, 1986; Padget & Hill, 1989; Pennebaker & Lightner, 1980), Wrisberg and Pein argue that the inexperienced runners were running at a higher relative intensity, which would encourage associative strategies.

Pennebaker and Lightner’s (1980) study compared novice treadmill runners to runners in open environments. Treadmill runners were assigned to one of two

interventions: one group heard an amplification of their own breathing, and a second that heard distracting sounds. The open environments groups ran on a 400-meter track or a cross-country course. The group hearing their own breathing (association) reported more fatigue and effort than the group that heard distracting sounds (dissociation).

Additionally, runners on the cross-country course (dissociation) maintained faster times than the 400-meter track group (association). Morgan, Horstman, Cymerman and Stokes (1983) elicited similar results when they compared novice running performances of a dissociative strategy group to a control group. The running task required subjects to run on a treadmill until fatigue at 80% of maximal aerobic capacity. This value is within the training sensitive zone, 70%  $HR_{max}$  to 90%  $HR_{max}$  that represents the heart rate threshold that will stimulate an aerobic response (McArdle, Katch, & Katch, 2000). They concluded that, despite very similar physiological levels, the dissociative group was able to perform for a significantly longer time than the control group. These findings suggested that dissociation is the preferred coping strategy for novice athletes to achieve performance gains.

Padgett and Hill (1989) concluded that dissociation is linked to better performance in novice runners. Their study also explored the differences and effectiveness of two external strategies, namely, external focus and dissociation. Padgett and Hill hypothesized that as distraction increased in the external focus treatment condition, the novice athletes would perform better in endurance based tasks. The study consisted of two experiments, the first of which assigned novice cyclists to either an external focus group or an internal focus (association) group. The cyclists in the external focus group completed a survey during the cycling task. The association group cyclists were instructed to “concentrate on body level, be aware of legs and thighs, and notice heart rate and perspiration levels.” (p. 334). The first experiment revealed that the external focus group reported less effort than the internal group. According to Padgett and Hill (1989) external focus appears to be the best cognitive strategy for increasing novice endurance performance.

Connolly and Janelle (2003) investigated the effectiveness of the associative and dissociative strategies on performance, heart rate and perceived exertion of collegiate rowers. In the first of two experiments, the rowers were subjected to associative and

dissociative conditions, and asked to row, or erg, for 20 minutes on an ergometer. The participants were asked to maintain a “steady state of about 75% pressure” (Connolly & Janelle, 2003). Results showed that rowers in the associative condition rowed significantly more meters and maintained higher heart rate and perceived exertion levels than the rowers in the dissociative conditions. The second experiment was aimed at evaluating the effectiveness of the Stevinson and Biddle (1999) coping strategy model on performance, heart rate and perceived exertion of collegiate rowers. The participants were asked to maintain a heart rate between 160 and 180 beats per minute throughout the exercise. As reported in the first experiment, rowers in the associative condition rowed significantly more meters and maintained higher heart rate and perceived exertion levels than the rowers in the dissociative conditions.

A major limitation of research with novice athletes, however, is that most failed to standardize the physical load (Fillingham & Fine, 1986; Padget & Hill, 1989; Pennebaker & Lightner, 1980). For instance, Padget and Hill noted the setting each student chose during the initial testing and monitored the students during both sessions, ensuring that the student maintained a constant rate during each session (p. 334). Connolly and Janelle (2003) to exert 75 % pressure and the first experiment and maintain a heart rate between 160 and 180 beats per minute in the second experiment. Heart rate has traditionally been used to ascertain work load, but more advanced methods of determining aerobic output are currently available (e.g. maximal and submaximal  $\text{VO}_2$ , and blood lactate tests). This lack of standardization of intensity severely limits the findings due to variable physical intensities. Athletes working at a higher relative intensity can not avoid but to dissociate.

In summary, dissociation seems related to greater endurance performance with novice athletes (Morgan et al., 1983; Pennebaker & Lightner, 1980; Padget & Hill, 1989). This relationship may be due to the notion that dissociation causes less perceived physical effort and symptoms of boredom. Conversely, research has shown that elite athletes prefer an associative coping strategy (Morgan & Pollack, 1977). Elite runners have been found to use predominantly associative strategies because their relative intensity levels are high. Recreational runners, on the other hand, shift between

associative and dissociative strategies due to a less intense physical load. The limitation described above warrants further research in this area.

#### *Measurement of Attentional Focus and Perceived Exertion*

Abernethy, Summers and Ford (2001) articulated that, “Although the broad omnipresent nature of attention makes it a critical concept for sport and exercise psychologists to understand, it is these very same characteristics that also generate the major problem in its accurate, reproducible, and objective measurement” (p. 173). Data collection on attention can be problematic due to the covert nature of cognitive processes. Additional problems arise from the fact that the cognitions of interest occur while the subject is engaged in a bout of exercise, although he/she may not be exercising when asked to record those cognitions. Masters and Ogles (1998) provided a comprehensive review of measurement and design issues on association-dissociation research. A similar review on measurement and method procedures aimed at assessing association and dissociation is provided in this section.

Morgan and Pollack (1977) originally assessed thought content via a post-race runner interview. Morgan, O’Connor, Ellickson, and Bradley (1988) and Morgan, O’Connor, Sparling, and Pate (1987) conducted similar interviews to gather information on participants thought content during exercise. Post-race interviews may gather large amounts of information in a non-obtrusive way. The interviews also allow the interviewee to share specific thought content. The thoughts are often then classified into associative or dissociative categories.

Several studies have used paper-pencil assessments of attention. Okwumabua, Meyers, Schleser, and Cooke (1983) presented participants with a list of possible cognitive topics and asked them to mark off the items that they had thought about while running. Each item carried an associative or dissociative value. Participants reported more use of an associative strategy, regardless of training condition. However, findings revealed that runners who reported using more associative strategies showed greater improvement over trials relative to runners who reported dissociative use. Another study provided definitions of association and dissociation to the runners, and subsequently asked them to provide an estimate of the time that had been devoted to those particular strategies during certain portions of the run (Okwumaba, Meyers & Santille, 1987).

Specifically, runners estimated the percentage of time that they utilized either strategy during each quarter of a 10-k race and for the entire race. This study also asked participants to elaborate upon their thoughts during the race through a free-response format. Results demonstrated that the higher finishers adopted more associative thoughts during the race. Finally, Tammen (1996) asked runners to rate on a 10-cm bipolar line whether their thoughts were more associative or dissociative in nature. Tammen concluded that as running pace increased that the participants employed more associative than dissociative thoughts.

Schomer (1986) took a novel approach to attention association-dissociation research in a study involving marathon runners. In response to the criticisms placed on other methods, the purpose of this study was to avoid “retrospective falsification” (Schomer, 1986). The marathon runners were issued microcassette recorders and asked to their thoughts during the run. The recordings were then classified into associative or dissociative categories. Schomer (1986) may be credited with the development of the Subjective Appraisal of Cognitive Strategies (SACS). The SACS contained 10 categories of cognitive thoughts, which in turn indicate an attentional preference. SACS has demonstrated adequate reliability and construct validity.

Silva and Applebaum (1989) developed the Running Style Questionnaire (RSQ) to assess attentional focus. Silva and Applebaum tested the instrument on 32 United States Olympic marathon trial contestants. The self-report instrument is comprised of 12 multiple-choice and 6 free-response questions aimed at capturing thought content and duration. The multiple-choice questions required the runners to identify the percentage of time that they devote to portions of the race. The free-response questions are aimed at providing specific thought content and emotions. The RSQ was administered the night prior to the Olympic trial. Results indicated that top placers could be discriminated from lower finishers based upon RSQ scores. Specifically, lower finishers tended to adopt a dissociative strategy and maintain it throughout the run. The higher finishers, however, shifted from associative to dissociative strategies at the earlier stages and throughout the race. The RSQ demonstrated adequate validity and reliability.

Another instrument created to assess attentional focus preferences is the Attentional Focusing Questionnaire (AFQ). Brewer, Van Raalte, and Linder (1996)

developed this instrument and tested it on 9 collegiate cross country student-athletes and 35 college students. Based primarily on Schomer's (1986) categorization design, the AFQ requires participants to rate the extent they engage in associative, dissociative and distressing activities during an endurance exercise on a 7-point scale. The response scale ranges from: 1 (would not do at all) to 7 (would do a lot). The cross country runners proved to employ more associative strategies than the psychology students. The AFQ has demonstrated adequate validity and reliability in a study on marathon runners (Masters, Ogles, & Jolton, 1996).

In summary, various methods and instrumentation have been utilized to assess association and dissociation. Although interviews conducted by some researchers (Morgan & Pollack, 1977; Morgan et al, 1988) provide valuable information. Paper and pencil assessments are based on data collected *after* the run. The major criticism that has followed these methods is the possibility of recall bias, i.e., runners may not remember their thoughts after an intense run. Schomer's (1986) study attempted to account for such bias – his study captured runners' thoughts during performance, but nonetheless has also received criticism. Although microcassette recorders used in his study were small, the runners typically did not wear them. Additionally, runners were asked to verbalize cognitions periodically throughout the run. Such “unnatural circumstances” may alter natural cognitive processes. This section has highlighted the major areas of concern regarding attention and its assessment, including: temporal proximity to the event, presence or absence of another person, invasiveness, instructional set, and method of recording thoughts (Masters & Ogles, 1998). Questionnaires developed in this area (SACS, RSQ, AFQ) have demonstrated adequate validity and reliability.

#### *Purpose of the Study*

This present study examined the effectiveness of four coping strategies in female cyclists. More specifically, the study examined compared the four types of coping strategies offered by Stevinson and Biddle (1999), i.e. internal association, external association, internal dissociation, and external dissociation, upon perceived exertion. The study built upon the work of Connolly and Janelle (2003), who provided the first empirical investigation of this model. An important consideration in this study is that the physical load will be standardized, which is not addressed in adequately in Padgett and

Hill's (1989) and Connolly and Janelle's (2003) studies. This study attempted to confirm the findings of Connolly and Janelle, yet employ more advance physical load standardization procedures.

*Hypotheses*

- 1) Participants in the internal and external dissociation conditions will report lower RPE than participants in the internal and external associative conditions.
- 2) There will be no difference between the internal and external associative conditions.
- 3) There will be no difference between the internal and external dissociative conditions.

## CHAPTER 3: METHOD

### *Participants*

Female undergraduate and graduate students (n =13, 18 - 24 years of age) from Florida State University served as participants for the study. The participants were recruited from on-campus spinning classes to help ensure that they have some cycling experience. Spinning classes at Florida State University typically require the participant to cycle at a high intensity (80% HR<sub>max</sub>) for 35-40 minutes.

### *Instrumentation*

*Rating of Perceived Exertion* (Appendix A). The Rating of Perceived Exertion (RPE; Borg, 1982) scale was placed in front of the bike, so that participants could easily rate their effort at 60-second intervals. The 15-grade scale ranges from 6 (very, very light) to 20 (very very hard). Borg (1982) has demonstrated that the RPE scale correlates strongly with heart rate (0.80-0.90). Russell and Weeks (1994) and Schomer (1987) have demonstrated that the scale has adequate validity and reliability.

*Informed consent* (Appendix B). An informed consent form was used to obtain written permission from the participants to perform the experiment. The form outlined the purpose of the study; a full description of the study, potential risks and benefits of participation, confidentiality measures taken by the researcher, the right to withdraw at any time, and contact information should any questions arise regarding the study.

*Demographic Information* (Appendix C). The demographics form was used to obtain demographic information about the participants. The form required the following information: name, age, year in school, amount of time involved with cycling, amount of time involved with spinning, number of hours spent per week cycling or spinning, and their perceived skill-level (low, medium, high).

*Post exercise evaluations* (Appendices D, E, F, and G). Participants were asked to indicate the percentage (0-100) they feel was devoted to the assigned strategy. In addition, internal associative treatment were asked to identify what portions of their bodies they attended to the most during the procedure. The internal dissociative treatment were asked questions regarding a video after the session (Appendix E). The external

associative treatment provided the final values of distance completed, and calories burned (Appendix F). The external dissociative treatment asked participants to keep track of the number of males and females that entered and exited the gym during the exercise (Appendix G).

#### *Apparatus and Materials*

The experiment required each participant to ride a Life-Fitness HR9500 stationary bike. Heart rate will be measured by a Polar chest heart rate monitor. The monitor provides an up-to-the-second heart rate of the wearer. Its values are easily legible to the participant and researcher via a digital watch face.

#### *Physical Task*

Participants rode an exercise bike for a total of 20-minutes. The task was comprised of a five-minute warm-up, a 10-minute physical task, and a five-minute cool down. Participants were asked to maintain 75%  $HR_{max}$  value throughout the 10-minute cycling task. This value is within the training sensitive zone, 70%  $HR_{max}$  to 90%  $HR_{max}$  that represents the upper and lower bounds of the heart rate threshold that will stimulate an aerobic response (McArdle, Katch, & Katch, 2000). Participants were instructed to begin a five-minute warm-up – not to eclipse their 75%  $HR_{max}$ . At the cessation of the warm-up, the 10-minute biking task I promptly began. Participants will maintain the assigned HR during the 10-minute physical task. After having completed the 10-minute biking task, participants will be instructed to cool down at a lower HR for the remaining five minutes.

#### *Attention Manipulation*

*Internal association.* Participants were asked to focus on their form, breathing, perspiration, and how their muscles feel. They were asked to pay close attention to their bodies. The participants will be asked to describe what, in particular, they thought about during the exercise (Appendix D). The purpose of this treatment is to create an internal associative condition for the participants to attend to during exercise.

*Internal dissociation.* Participants watched a video of their choice while riding the bike. Choices included an episode of a situation comedy, or an excerpt from a college football game. They were asked questions regarding the video after the session

(Appendix E). The purpose of this treatment was to create an inward distraction for the participants to attend to during exercise.

*External association.* Participants were asked to pay close attention to the digital reading on the screen in front of them. The screen displays values of time, i.e., duration of the exercise, distance completed for the exercise, calories burned, etc. They were asked to pay close attention to the distance completed (Appendix F). The purpose of this treatment was to create an external associative condition for the participants to attend to during exercise.

*External dissociation.* Participants were asked to pay close attention to the environment (The Leach Center). They were asked to keep track of the number of males and females that entered and exited the gym during the exercise. The bike location overlooks the entrance to the gym (Appendix G). The purpose of this treatment was to create an outward distraction for the participants to attend to during exercise.

#### *Procedure*

In order to recruit participants for the study, spinning instructors at the Leach Center at Florida State University were contacted. After having been issued a brief overview of the experiment prior to the spinning session, the potential participants were requested to volunteer by registering on a sign-up sheet outside the spin room. A day and time was scheduled for all 5 sessions. Each week, participants reported to the Leach Center. After having received, read and signed the informed consent to participate, the experiment was described to the participant.

#### *Submaximal $VO_{2max}$ test procedure*

The first session was the same for all participants, consisting of a submaximal multiple-stage test aimed at assessing the participants  $VO_{2max}$  and corresponding heart rates. Golding, Myers and Sinning (1989) developed the multistage YMCA protocol, which consists of 3 to 4 consecutive 3-minute stages. A pedal frequency of 50 revolutions per minute (rpm) is required for this procedure, and the warm-up consists of pedaling for one minute at 50 rpm and 25 Watts of resistance. Heart rate was assessed during the last half of minutes 2 and 3 of each stage. If the heart rate values were within 5 beats per minute (bpm) of one another, then a steady state has been achieved, and the participant may proceed to the next stage. Each stage followed the same procedure until

a heart rate between two successive stages is between 110 bpm and 150 bpm. The stages may differ for each participant as the level of resistance, measured in Watts, will be increased at variable increments according to the heart rate response from the last stage. The protocol outlines a flowchart (see Figure 2) in which higher heart rate values are matched to lower levels of resistance. Once the test was complete, participants were required to cool down for 2 minutes.

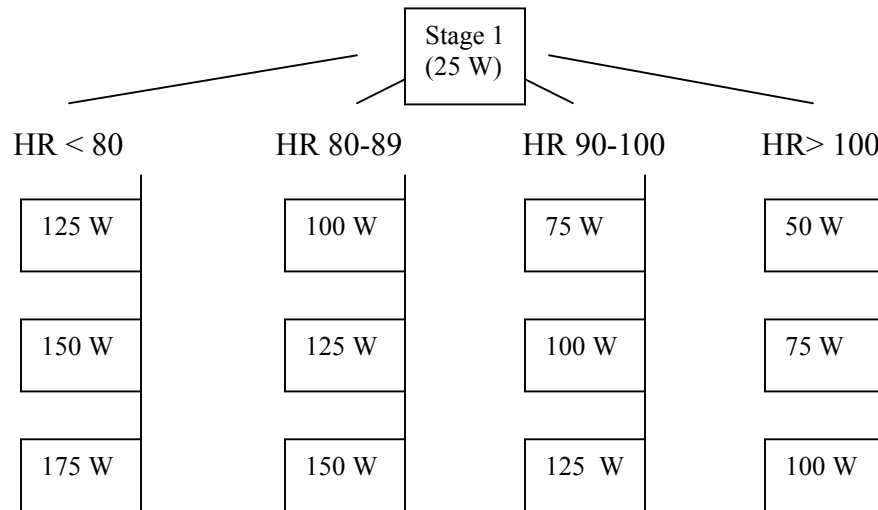


Figure 2. The cycle ergometer protocol offered by Golding, Myers, and Sinning (1989).

Heart rate maximal values were calculated by subtracting the participant's age from 220. The workload-heart rate data points may then be plotted on the cycle ergometer data graph (Appendix H). A horizontal line was drawn across the graph at the  $HR_{max}$  value. The point of intersection between the plotted workload-heart rate line and the  $HR_{max}$  line will allowed the researcher to predict the  $VO_{2max}$  by dropping a vertical line from the point of intersection down to the X-axis. Seventy-five percent of this value was then be taken and paired with its corresponding heart rate along the plotted line. This information was used to standardize the physical load in all four sessions that follow.

### *Primary task procedure*

To account for treatment order effects, the remaining four sessions were varied in the order in which they were administered. After having received the attention manipulation instructional set, the participants were instructed to commence the cycling task by adjusting the bike to a moderate level of resistance, approximately 80 Watts. Participants were asked to maintain the 75%  $HR_{max}$  value throughout the 12-minute cycling task. Measures of HR and RPE will be taken after the five-minute warm-up, and at one-minute intervals throughout the 12-minute cycle. The participants were then be asked to cool-down, and then dismount the bikes to fill out the post-exercise evaluation forms. All participants were debriefed following the experiment and received \$20.00 for their participation.

### *Statistical Analysis*

To test the three hypotheses, a repeated measures ANOVA with time ( $k = 10$ ) and treatment ( $k = 4$ ) as within subject factors was used to analyze the RPE in the four treatment conditions. Descriptive statistics (M, SD) were computed to describe any main and/or interaction effects that emerged.

## CHAPTER 4: RESULTS

### *Effect for Treatment on Heart Rate: Manipulation Check*

To enable generalizations of the RPE results, it was expected that HR data be similar in all four testing procedures. To ensure equality of metabolic rate among the four treatment conditions, HR was collected during each minute of the cycling task. An RM ANOVA was performed using treatment condition and time (minutes) as a within repeated subject factors. Results are shown in Table 2.

Table 2

*RM ANOVA results for Heart Rate using treatment condition and time as WS factors*

Effect	<i>df</i>	HF-value	<i>p</i>
Treatment	3, 36	1.72	.187
Time	9, 108	1.49	.226
Treatment by time	27, 324	1.26	.247

Neither main nor interaction effects approached significance ( $p > .05$ ). The descriptive statistics for HR by treatment and treatment by time are shown in Figures 3 and 4.

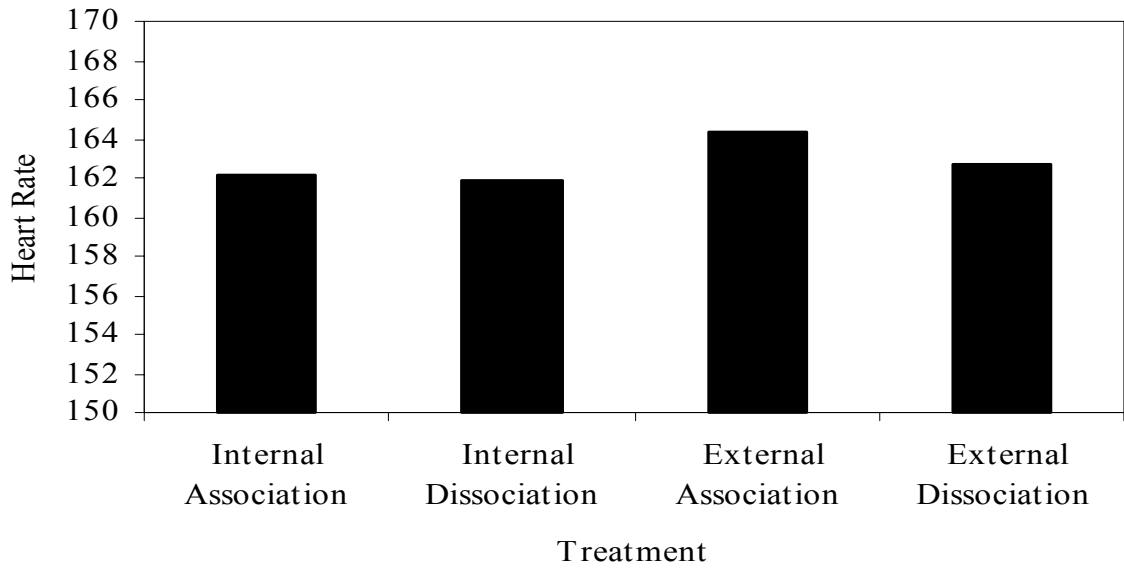


Figure 3: Mean HR under four treatment conditions across the 10 minute values.

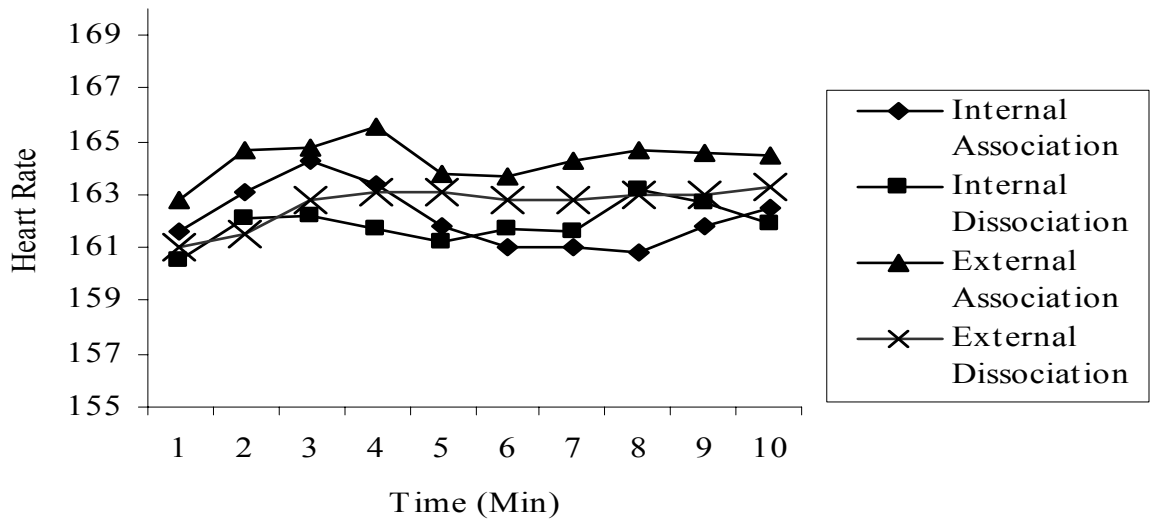


Figure 4: Mean HR values for the four treatments during the 10-minute cycling task.

*Qualitative Analysis: Manipulation Check*

The participants in the associative treatments were asked to verbally express what they thought about during exercise. Table 3 provides a summary of the reported thoughts that occurred during the cycling task.

Table 3

*Frequency table for reported thoughts during associative treatments*

---

Reported Thoughts	Frequency
Heart rate	13
Perspiration levels	11
Burning sensation in legs (i.e. quadriceps, calves)	11
Breathing rate	8
How many miles were traveled	5
Time elapsed	3
Not feeling well	3
Lack of music	1
Thirst	1
Don't want to attend class after session	1
Drinks ingested the previous night	1
Task completion thoughts	1
High humidity levels in gymnasium	1

---

The responses centered around heart rate; burning in the calves and thighs; breathing heavily; and rising perspiration levels. These responses were more consistent with the internal association instructional set, which asked participants to focus on internal sensations, than the external associative treatment instructional set, which asked participants to pay close attention to the digital bike monitor in front of them. The dissociative groups were asked to pay close attention to the immediate environment. Specifically, participants in the external dissociative treatment kept track of the number of males and females that entered and exited the gym during exercise. The totals that participants reported approximated the totals that the experimenter observed. Participants in the internal dissociative treatment answered questions regarding a video excerpt. The responses were consistent with the video, as there were no erroneous responses that suggested a lack of attention on the part of the participants.

*Effects for Treatment on Perceived Exertion*

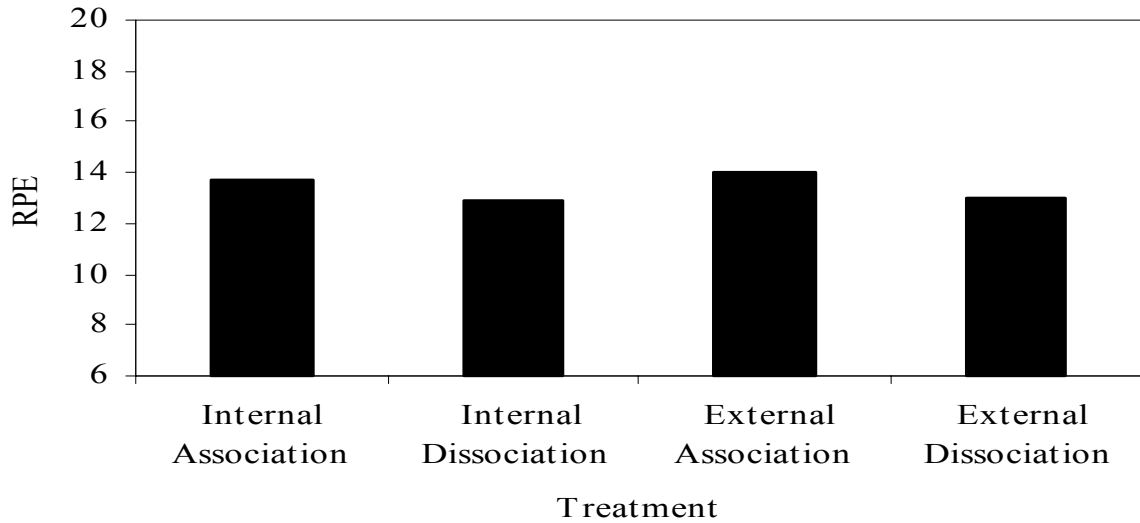
The first hypothesis stated that the participants in the internal and external dissociative conditions would report lower RPE than the participants in the internal and external associative conditions. To test this hypothesis, a RM ANOVA was employed. Prior to testing the hypothesis, the sphericity assumption was examined. All repeated within-subject factors yielded significant ( $p < .000$ ) values, suggesting a violation of this assumption. Due to these results and a small sample size ( $n = 13$ ), the Huynh-Feldt procedure was employed. The main and interaction effects for RPE are shown in Table 4.

Table 4

*RM ANOVA results for RPE using treatment condition and time as WS factors*

Effect	<i>df</i>	HF-value	<i>p</i>
Treatment	3, 36	8.72	.000
Time	9, 108	10.94	.000
Treatment by time	27, 324	1.39	.16

Significant ( $p < .001$ ) main effects for treatment and time were obtained. The treatment by time interaction effect was not significant ( $p = .16$ ). The main effect of treatment on RPE is presented in Figure 5, and the nonsignificant interaction effect is presented in Figure 6.



*Figure 5:* Mean RPE under four treatment conditions

On average, the participants perceived greater exertion in the internal ( $M = 13.74$ ,  $SD = 1.25$ ) and external associative ( $M = 14.03$ ,  $SD = 1.01$ ) conditions than in the internal ( $M = 12.95$ ,  $SD = 1.46$ ) and external dissociative ( $M = 12.95$ ,  $SD = .91$ ) conditions.

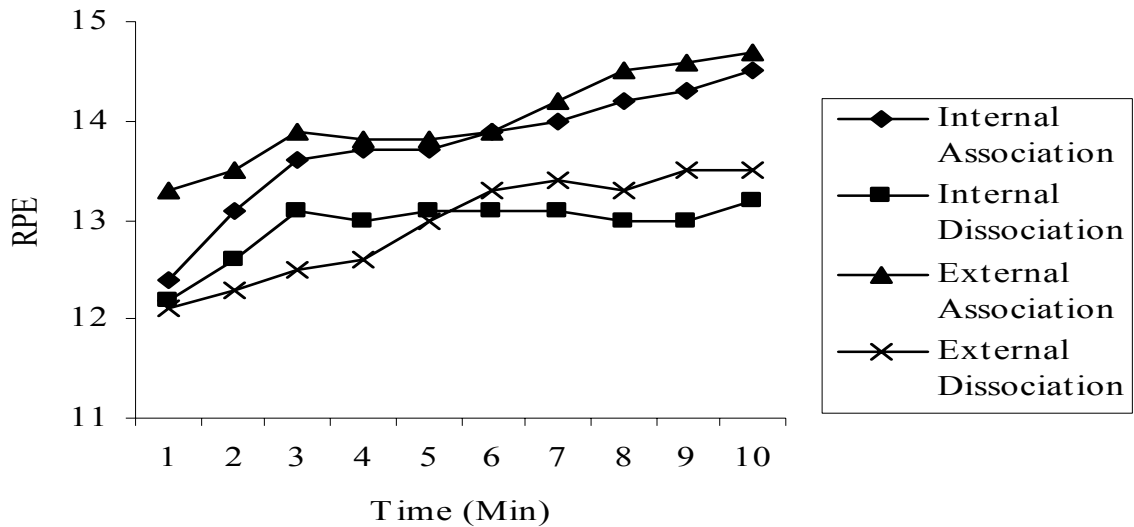


Figure 6: Means for the four treatments during the 10 minutes of cycling.

Figure 6 illustrates that the associative treatment groups elicited higher mean RPE values than the dissociative groups nearly throughout the entire task. The difference in RPE between the associative and dissociative groups may be more salient as the task approaches completion. The RPE reported at the first minute of the cycling task for all groups was: internal association ( $M = 12.39$ ,  $SD = 1.39$ ), external association ( $M = 13.3$ ,  $SD = .94$ ), internal dissociation ( $M = 12.16$ ,  $SD = 1.28$ ) and external dissociation treatment ( $M = 12.1$ ,  $SD = .86$ ). The RPE reported at the end of the cycling task for all groups was: internal association ( $M = 14.5$ ,  $SD = 1.6$ ), external association ( $M = 14.7$ ,  $SD = 1.4$ ), internal dissociation ( $M = 13.2$ ,  $SD = 1.9$ ) and external dissociation treatment ( $M = 13.5$ ,  $SD = 1.1$ ). The mean differences of RPE between the first minute and the last minutes suggest that the dissociative treatments elicited lower RPE throughout the task.

Table 5

*t*-test results for RPE of associative and dissociative treatments

Paired Comparison	<i>df</i>	ES	<i>t</i>	<i>p</i>
Internal Association - Internal Dissociation	9	.54	10.30	.000
Internal Association - External Dissociation	9	.87	6.31	.000
External Association - Internal Dissociation	9	.74	13.63	.000
External Association - External Dissociation	9	1.19	9.32	.000

Table 5 illustrates that medium to strong effect sizes were demonstrated by the internal associative treatment when compared to the internal (.54) and external dissociative (.87) treatment contrasts, respectively. Strong effects sizes were also found by the external associative treatment when compared to the internal (.74) and external (1.19) dissociative treatment contrasts, respectively. All paired comparisons reach significance ( $p = .000$ ). These findings are consistent with the first hypothesis.

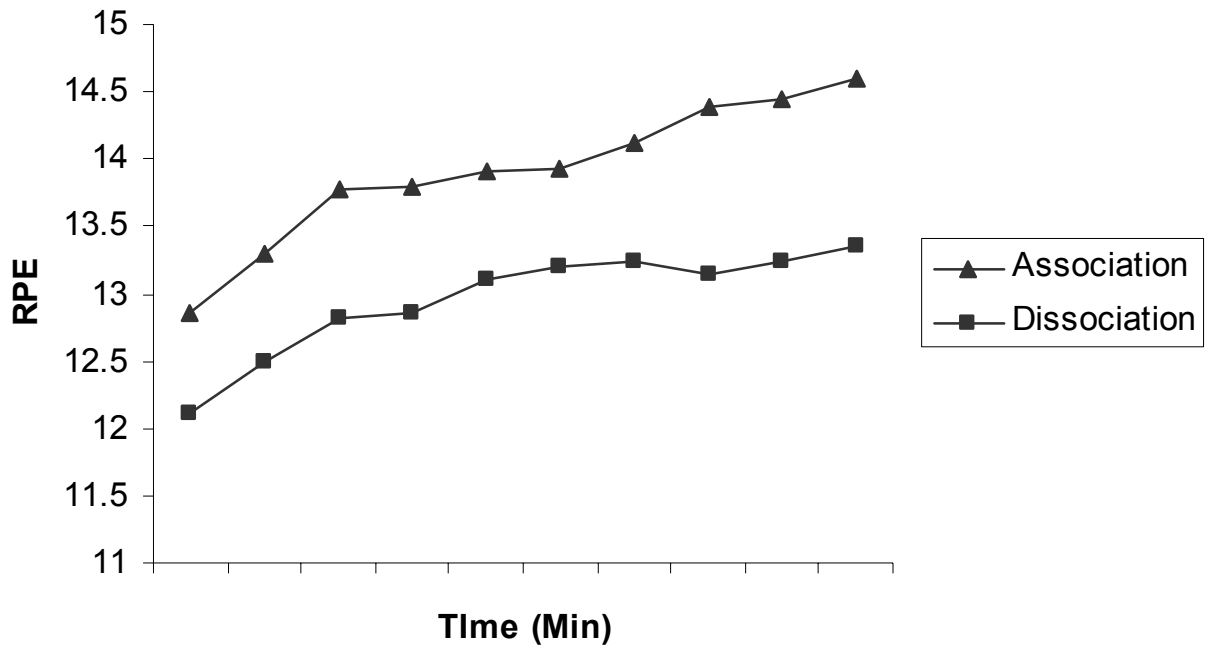
The associative and dissociative treatments were combined to further examine the first hypothesis, which stated that participants in the dissociative conditions would report lower RPE than the participants in the associative conditions. Therefore, the internal and external associative treatments were combined to form one treatment, and the internal and external dissociative treatments were combined to form one treatment. An RM ANOVA procedure was employed utilizing RPE as a dependent measure. The main and interaction effects for RPE are shown in Table 6.

Table 6

*RM ANOVA results for RPE of combined associative dissociative treatments*

Effect	<i>df</i>	HF-value	<i>p</i>
Treatment	1, 12	21.45	.001
Time	9, 108	10.94	.000
Treatment by time	9, 108	1.31	.279

Significant ( $p < .001$ ) main effects for treatment and time were obtained. The treatment by time interaction effects was not significant ( $p = .28$ ). The non-significant interaction effect is presented in Figure 7.



*Figure 7:* Interaction Effect of Treatment and Time on RPE for Combined Treatments

Visual inspection of Figure 7 shows that the average RPE's for the two treatments appear somewhat closer at the onset of the task, and slowly diverge as the task progresses. To verify minute-by-minute differences, a paired samples t-test was employed. Paired differences and effect sizes of each minute were examined. The results are presented in Table 6.

### *Differences Between Associative and Dissociative Treatments*

The RM-ANOVA pertaining to the four treatment conditions resulted in significant ( $p < .05$ ) differences among the four treatments. Specifically, the associative conditions yielded higher RPE than the dissociative conditions. To test the hypotheses that (1) there would be no difference between the internal and external associative treatments, and similarly, (2) there would be no difference between the internal and external dissociative treatments, two separate RM ANOVA's were performed. The WS repeated factors were treatment condition and time (minutes) for participants RPE. The four treatment conditions collapsed into two treatment conditions in each analysis. The main and interaction effects for RPE contrasting the internal and external associative treatment groups are shown in Table 7.

Table 7

#### *RM ANOVA results for RPE of Associative Treatments*

Effect	<i>df</i>	HF-value	<i>p</i>
Treatment	1, 12	1.69	.219
Time	9, 108	7.27	.000
Treatment by time	9, 108	0.96	.439

Neither treatment not treatment by time effects reached significance ( $p > .05$ ). The significant ( $p = .00$ ) time effect resulted from a gradual increase in RPE as the task progressed.

The main and interaction effects for RPE resulting from the RM-ANOVA of the internal and external dissociative treatment groups are shown in Table 8.

Table 8

*RM ANOVA results for RPE of Dissociative Treatments*

Effect	<i>df</i>	HF-value	<i>p</i>
Treatment	1, 12	.001	.978
Time	9, 108	8.71	.000
Treatment by time	9, 108	1.96	.138

The main effect for treatment failed to reach significance ( $p = .98$ ). The internal ( $M = 12.95$ ,  $SD = 1.46$ ) and external dissociative ( $M = 12.95$ ,  $SD = .91$ ) conditions displayed very similar means. The time main effect was again significant, as RPE increased steadily from the outset until the end of the cycling task.

## CHAPTER 5: DISCUSSION

The purpose of this study was to compare the effects of associative and dissociative coping strategies upon perceived exertion in undergraduate and graduate female students exercising on stationary bicycles, and to emend the limitations of Padgett and Hill's (1989) and Connolly and Janelle's (2003) studies.

Traditionally, coping strategies have been dichotomized into internal (associative) and external (dissociative) categories. Published research findings consistently report that associative coping strategies elicited higher RPE than dissociative strategies (Connolly & Janelle, 2003; Fillingham & Fine, 1986; Gill & Strom, 1985; Morgan & Pollack, 1977; Pennebaker & Lightner, 1980; Russell & Weeks, 1994; Schomer, 1986). Briefly, association is characteristic of higher exercise intensities in elite athletes. In addition, dissociative and associative coping strategies have been linked to endurance performance gains in novice athletes (Morgan et al., 1983; Okwumbua et al., 1983; Saintsing et al., 1988; Schomer, 1987). Thus, athletic status was viewed as the major factor in coping strategy use among exercisers. Elite athletes were thought to be associative during practice and performance, while their novice counterparts tend to shift between associative and dissociative coping strategies to endure physical tasks.

More recently, Tenenbaum (2001) provided an alternative explanation of the coping strategy use in endurance performance with a social cognitive model of perceived exertion. The model considers intensity of physical load, and not athletic status, as a primary determinant of coping strategy preference. Briefly, the social-cognitive model postulates that individuals that train at high levels of intensity, e.g. elite athletes, are unable to ignore the physiological sensations that accompany this training intensity, making associative strategies inevitable. Novice and recreational athletes may shift between associative and dissociative strategies due to physical load that carries less severe physiological symptoms.

Recent interpretations and clarifications of attention in sport have also advanced the understanding of coping strategies. Stevinson and Biddle (1999) proposed that

coping strategies may be viewed as having four dimensions, rather than two. The first dimension, task relevance, is comprised of associative (e.g. bodily sensations, pace) and dissociative (e.g. daydreams, environmental distractions) processes. The second dimension, direction, consists of internal and external mechanisms. The present study compared the effects of the resulting four coping types (internal association, internal dissociation, external association, and external dissociation) effects upon the RPE of female cyclists.

Padgett and Hill (1989) had dichotomized and examined the directional dimension of dissociative coping strategies before Stevinson and Biddle's emendation. Padgett and Hill examined the RPE of cyclists under external focus and internal associative conditions. The external focus group resembles the internal dissociative treatment of the current study. The external focus group reported less perceived effort than the associative condition. In the second of two experiments, runners were exposed to external dissociative, external focus, and control groups. The external focused runners ran faster mile times than the other two conditions. Padgett and Hill thereby concluded that external focus is linked to better performance gains in novice athletes. The researchers based their conclusions on the notion that it takes little or no effort to pay attention to the environment, whereas the external focus strategy required a cognitive effort on the part of the participants. The researcher suggested that the external focus strategy maintains higher distraction properties, and allows the performers to dissociate further from the task at hand, resulting in better performances.

Although Padgett and Hill's work was innovative, limitations plagued the study. As in previously reported research in this area, the study did not standardize the physical load. Although the researchers ensured individual consistency in work load, failure to standardize amongst all participants results in variable exertion on the part of the participants. Subsequently, results may have been misleading. According to the social cognitive model, as long as the intensity level remains moderate, only effort symptoms such as perspiration, breathing and local pain are felt. Conversely, high intensities are characterized by more extreme physiological signals such as exhaustion, total body pain, and labored breathing. Any lack in standardization of physical load results in variable intensities, which provides variable perceptions of exertion. The present study would

standardize physical load by performing a sub-maximal VO<sub>2</sub> test prior to all treatments. The test yielded a 75% VO<sub>2</sub> max and the corresponding heart rate ranges. Participants were required to maintain a heart rate within the range to ensure that they were at about 75% of maximum capacity.

A second limitation of the Padgett and Hill (1989) study is that cyclists were examined only in the first experiment, which employed two conditions, namely association and external focus. The design accounts for the traditional dichotomous conceptualization of coping strategies. The present study examined cyclists while incorporating the four coping strategies of the Stevinson and Biddle (1999) model.

Connolly and Janelle (2003) investigated the effectiveness of the Stevinson and Biddle model on male and female collegiate rowers. In the second of two experiments, results demonstrated that the rowers in the associative conditions yielded significantly higher means for performance (i.e. meters erged), heart rate, and RPE than rowers in the dissociative conditions. No performance differences were noted between either of the two associative dimensions or between the two dissociative dimensions (Connolly & Janelle, 2003).

A limitation of the Connolly and Janelle study is that heart rate was employed as the primary indicator of aerobic output. Although heart rate is a practical and convenient method of ascertaining approximate physical load, procedures employed in the present study provide more exact indicators of aerobic output. The present study employed a submaximal VO<sub>2</sub> test and corresponding heart rate resulting in less variability in physical work load. This limited variability in perceived exertion, and allowed comparatively more robust data to be collected than in the Connolly and Janelle study.

The present study hypothesized that the participants in the two dissociative conditions would report lower RPE than the participants in the two associative conditions. Additional hypotheses postulated that (1) there would be no difference between the two associative treatments, (2) there would be no difference between the two dissociative treatments. To test these hypotheses, RM ANOVA's were performed.

This study assigned participants to each one of the four treatment conditions: internal association, external association, internal dissociation, and external dissociation. The heart rate of the participants was closely monitored to ensure that they were

performing at about 75% of their VO<sub>2</sub> max. A RM ANOVA showed that physical load was approximately equivalent for all participants.

Results gave support to all three of the hypotheses, and corroborate Connolly and Janelle's (2003) findings. For instance, results showed that participants in the dissociative conditions experienced significantly lower exertion than participants in the associative conditions. Significant differences did not exist when the two dissociative conditions and the two associative conditions were compared to one another.

#### *Limitations and Future Directions*

Although the design of the present study attempted account for factors that might lead to undesirable results, some limitations prevail nonetheless. First and foremost, the small sample size limits the power of the statistical analysis. Although there was a low attrition rate, the recruitment procedures employed in the study still yielded only thirteen participants. The homogeneity of the participants, i.e. female college students, also limits the generalizability of the results. Further, the environment in which the study was performed lacked complete privacy. The exercise bike was placed in an area of relative isolation, yet extraneous stimuli may have prevailed. On a few occasions during the experiment, friends of participants or gym staff members interrupted the session. Although all of the participants used for the analysis reported adhering to the instructions for an appreciable portion of time, such disturbances limited control over the attention manipulation. Scheduling issues may have provided further problems. When given the opportunity to specify thought processes during the cycling session, the responses were more consistent with the internal association instructional set than the external association instructional set. Therefore, the attention manipulation for external associative condition may have been limited. Scheduling issues may have provided further problems. Although the individuals returned at the same time each week, some of the sessions were early in the morning while some were in the late afternoon. The peak gym hours are in the late afternoon. Thus, diurnal variation may have confounded the reported findings of this study.

Although Stevinson and Biddle (1999) provided a model that seems to adequately describe coping strategy types, task relevance may be the most pertinent construct in relation to perceived exertion. Results in the present study suggest that task relevance

affects perceived exertion more so than direction of attention. That is, associative strategies elicited higher RPE than dissociative strategies, but internally directed strategies did not elicit different RPE from external directed strategies. Future research may examine the dimensions of task relevance and direction more closely, perhaps by employing novel attentional manipulations that have not yet been employed in research settings. It is also important to understand the circumstances under which coping strategy type may vary. The present study examined young females in a cycling task, but future research may explore other endurance athlete types and tasks. Some populations worthy of consideration include water sport athletes (e.g. wake-boarders), cross country skiers, and tri-athletes. Future research may examine the effectiveness of associative and dissociative strategies implemented throughout a training cycle for endurance athletes. Research may also examine the effectiveness of associative and dissociative mental training programs on exercise adherence in beginning exercisers.

Additionally, more advanced methods of determining an individual's cardiovascular output are constantly being developed by exercise physiologists. The present study employed a submaximal  $\text{VO}_2$  test to determine gross cardiovascular potentials. More exact methods may be utilized to ensure that physical load does indeed remain the same for all participants. Some possibilities include maximal  $\text{VO}_2$  tests, and blood lactate tests.

These findings have practical implications for exerciser and program directors alike. Connolly and Janelle (2003) showed that rowers using an associative strategy performed better than rowers using a dissociative strategy, while perceiving higher levels of exertion and experiencing higher heart rates. The results from the present study support Connolly and Janelle's work in that the two associative strategies of the Stevinson and Biddle model again yielded significantly higher RPE than the two dissociative strategies of the model. Athletes and coaches may design practice sessions that emphasize associative strategies in an attempt to achieve performance gains. Recreational exercisers and gym directors may benefit from encouraging and providing more "dissociative environments". With further empirical investigation of coping strategy in sport and exercise, more practical applications may be made to recreational and elite athletes, coaches, and the like.

In corroboration with Connolly and Janelle (2003), it may be concluded from the present that association elicits higher RPE than dissociation in endurance tasks. Finally, although the Stevinson and Biddle (1999) model outlines pragmatic descriptions of associative and dissociative coping strategies, only the task relevant dimension appears to affect perceived exertion.

## APPENDIX A

### RATING OF PERCEIVED EXERTION

6	
7	very, very light
8	
9	very light
10	
11	fairly light
12	
13	somewhat hard
14	
15	hard
16	
17	very hard
18	
19	very, very hard
20	

## APPENDIX B

Please read this informed consent form before deciding to participate in this study.

### TITLE:

A Comparison of Coping Strategies: Effects Upon Perceived Exertion.

### DESCRIPTION OF PARTICIPANT INVOLVEMENT

This experiment will take place at the Leach Center. The procedure consists of 1 submaximal  $\dot{V}O_{2\max}$  test and 4 twenty-two minute cycling tasks. The  $\dot{V}O_{2\max}$  test require you to bike at moderate levels for approximately 15 minutes. After this test, your  $\dot{V}O_{2\max}$  and corresponding heart rate max will be predicted for use in further sessions. You will need to maintain a 75%  $HR_{\max}$  throughout the 12-minute cycling tasks. After having received the instructional set, you will be instructed to begin a 5-minute warm-up. You will also be fitted with silicone ear-plugs to reduce distraction. During this warm-up, you will adjust the bike's resistance to a moderate level. At the cessation of the 5-minute warm-up, measures of heart rate and perceived exertion will be taken. The 12-minute biking task will consist of these readings every minute. After having completed the 12-minute biking task, you will be instructed to cool down for the remaining 5 minutes. Lastly, you will be asked to fill out some short forms following the cycling task. Total time for these experiments is approximately 30 minutes.

### POTENTIAL RISKS AND BENEFITS

No more than minimal risk is involved in this study. You may experience dizziness, fatigue, nausea, or other related symptoms due to exercise. Leach Center Staff are properly trained to handle exercise-related emergencies. Potential benefits include personal insight into effectiveness of attentional strategies.

### NOTICE

To reduce the risk of the symptoms described in the last section, please inform the researcher if you have eaten anything within the last two hours. Describe the quantity and the quality of the food. If food has been ingested in the last two hours, the researcher may request to reschedule. Additionally, the Leach Center is an air-conditioned facility, which shall reduce the likelihood of negative symptoms.

### CONFIDENTIALITY

Your identity will be kept confidential to the extent provided by the law. The researcher assumes responsibility for this confidentiality. Findings will be reported in a private group setting. All data from this experiment will be destroyed on April 30<sup>th</sup>, 2004.

### WITHDRAWAL

You have the right to withdraw from participation at anytime without prejudice, penalty, or loss of benefits to which otherwise entitled.

### CONTACT INFORMATION

You may contact Christopher Stanley, Dr. David Pargman, or the Institutional Review Board at Florida State at any time to discuss research results and participant rights. Please see contact information below.

#### RESEARCHER:

Christopher T. Stanley, B.A.  
[cts1568@garnet.acns.fsu.edu](mailto:cts1568@garnet.acns.fsu.edu) (e-mail)  
850-339-4566 (phone)

#### MAJOR ADVISOR:

Dr. David Pargman  
[pargman@mailers.fsu.edu](mailto:pargman@mailers.fsu.edu)  
850-644-8793 (phone)

#### FSU INSTITUTIONAL REVIEW BOARD RESEARCH COORDINATOR:

Heidi Hodges  
[hhodges@mailers.fsu.edu](mailto:hhodges@mailers.fsu.edu) (e-mail)  
850-644-8633 (phone)

I have read and understand this consent form.

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date



APPENDIX C  
DEMOGRAPHIC INFORMATION

Name: \_\_\_\_\_

Date of Birth: \_\_\_\_\_

Year in school: \_\_\_\_\_

How long have you been involved in cycling (road biking, stationary, etc.)? : \_\_\_\_\_

How long have you been involved in spinning? \_\_\_\_\_

How many hours per weekn, on average, do you spend spinning? \_\_\_\_\_

Please circle the word below that best describes you as a cyclist/spinner:

Low-skilled

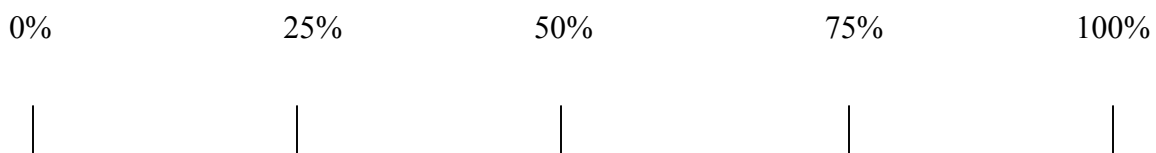
Moderately-skilled

High-skilled

APPENDIX D

INTERNAL ASSOCIATION QUESTIONNAIRE

Please mark on the line and write in the blank the percentage that you feel you devoted to the assigned strategy while cycling: \_\_\_\_\_

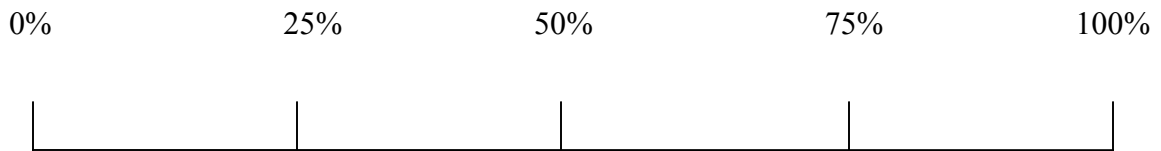


What, specifically, did you think about during the exercise? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

APPENDIX E

INTERNAL DISSOCIATION QUESTIONNAIRE

Please mark on the line and write in the blank the percentage that you feel devoted to the assigned strategy while cycling: \_\_\_\_\_



What was the name of the video?

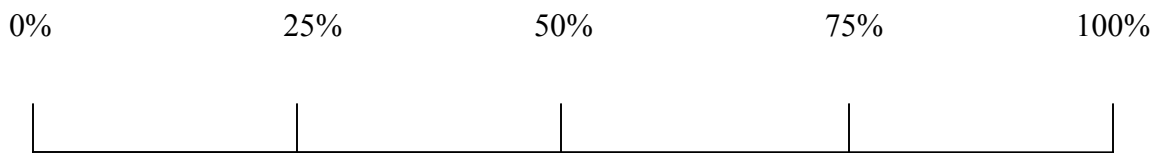
Describe the main characters/players?

Briefly, what occurred during the portion of the video that you watched?

What part was most memorable?

APPENDIX F  
EXTERNAL ASSOCIATION QUESTIONNAIRE

Please mark on the line and write in the blank the percentage that you feel you devoted to the assigned strategy while cycling: \_\_\_\_\_



What was the final distance, in miles, that you biked today?

How many levels of red dots were highlighted on the resistance portion of the screen?

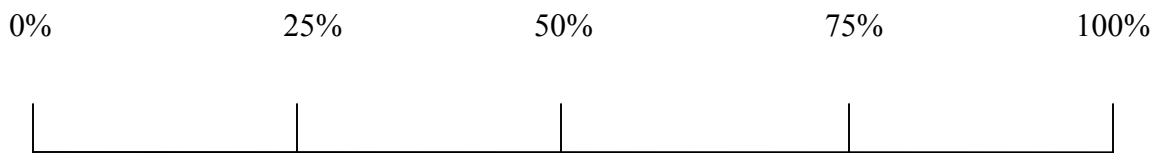
How many calories did you burn during this workout?

What specifically did you think about during this workout?

APPENDIX G

EXTERNAL DISSOCIATION QUESTIONNAIRE

Please mark on the line and write in the blank the percentage that you feel you devoted to the assigned strategy while cycling: \_\_\_\_\_



How many males entered the gym during the exercise?

How many females entered the gym during the exercise?

How many males exited the gym during the exercise?

How many females exited the gym during the exercise?



## APPENDIX I



Office of the Vice President  
for Research  
Tallahassee, Florida 32306-2763  
(850) 644-5260 • FAX (850) 644-4392

### APPROVAL MEMORANDUM

from the Human Subjects Committee

**Date:** August 25, 2003

**From:** David Quadagno, Chair *DQ/HH*

**To:** Christopher T. Stanley  
1631 Sharkey Street  
Tallahassee, FL 32304

**Dept:** Educational Psychology & Learning Systems

**Re:** Use of Human subjects in Research

**Project entitled: A Comparison of Dissociative Strategies: Effects Upon Perceived Exertion, Boredom and Symptoms of Fatigue**

---

The forms that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Human Subjects Committee at its meeting on **August 13, 2003**. Your project was approved by the Committee.

**The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals which may be required.**

If the project has not been completed by **August 12, 2004**, you must request renewed approval for continuation of the project.

You are advised that any change in protocol in this project must be approved by resubmission of the project to the Committee for approval. Also, the principal investigator must promptly report, in writing, any unexpected problems causing risks to research subjects or others.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols of such investigations as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Protection from Research Risks. The Assurance Number is IRB00000446.

APPLICATION NO. 03.410  
Cc: D. Pargman

APPENDIX J  
DEFENSE ANNOUNCEMENT

Thesis    Treatise    Dissertation

Name: Christopher Stanley      Phone #: (850) 504-1401

Department: Educational Psychology and Learning Systems

Major Professor: David Pargman

Defense Day: Thursday      Date: 03/25/2004      Time: 9:30 – 10:30

Location (room and building): Stone Building 206

Title: A Comparison of Coping Strategies: Effects Upon Perceived Exertion in a Cycling Task

## REFERENCES

- Abernethy, B. (1993). Attention. In R.N. Singer, M. Murphey, & L.K. Tennant (Eds.), *Handbook of Research on Sport Psychology* (pp. 127-170). New York: Macmillan
- Abernethy, B., Summers, J.J., & Ford, S. (2001). Issues in the measurement of attention. In (Ed.) *Advances In Sport and Exercise Psychology Measurement* (p. 173-193). Champaign, IL: Human Kinetics Publishers.
- Borg, G.A.V. (1962). Physical performance and perceived exertion. *Studia psychologia et pedagogia, 11*, 1-35.
- Borg, G.A.V. (1982). Psychophysical bases of perceived exertion. *Medicine and Science in Sport and Exercise, 14*, 377-381.
- Boutcher, S.H. (1992). Attention and athletic performance: An integrated approach. In T.S. Horn (Ed.), *Advances in Sport Psychology* (pp.251-266). Champaign, IL: Human Kinetics Publishers.
- Boutcher, S.H., & Zinsser, N. (1990). Cardiac deceleration of elite and beginning golfers during putting. *Journal of Sport & Exercise Psychology, 12*, 37-47.
- Broadbent, D.E. (1958). *Perception and communication*. New York: Pergamon Press
- Brewer, B.W., Van Raalte, J.L., & Linder, D.E. (1996). Attentional focus and endurance Performance. *Applied Research in Coaching and Athletics Annual, 11*, 1-14.
- Connolly, C. T. & Janelle, C.M. (2003). Attentional strategies in rowing: Performance, perceived exertion, and gender comparisons. *Journal of Applied Sport Psychology, 15*, 195-212.
- Easterbrook, J.A. (1959). The effect of emotion on cue utilization and the organization of behavior. *Psychological Review, 66*, 183-201.
- Eysenck M.W., & Keane, M.T. (1990). *Cognitive psychology: A student's handbook*. London: Lawrence Erlbaum Associates.
- Fillingim, R.B., & Fine, M.A. (1986). The effects of internal versus external information Processing on symptom perception in an exercise setting. *Health Psychology, 5*, 115-123.

- Gill, D.L., & Strom, E.H. (1985). The effect of attentional focus on performance of an endurance task. *International Journal of Sport Psychology*, *16*, 217-223.
- Hatfield, B.D., & Landers, D.M. (1987). Psychophysiology in exercise and sport research: An overview. *Exercise and Sport Sciences Review*, *15*, 351-388.
- James, W. (1890). *Principles of psychology*. New York: Henry Holt and Company.
- Kahneman, D. (1973). *Attention and effort*. Englewood Cliffs, NJ: Prentice-Hall.
- Masters, K.S., & Lambert, M.J. (1989). The relations between cognitive coping strategies, reasons for running, injury, and performance of marathon runners. *Journal of Sport and Exercise Psychology*, *11*, 161-170.
- Masters, K.S., & Lambert, M.J. (1989). The relations between cognitive coping strategies, reasons for running, injury, and performance of marathon runners. *Journal of Sport & Exercise Psychology*, *11*, 161-170.
- Masters, K.S., & Ogles, B.M. (1998). Associative and dissociative cognitive strategies exercise and running: 20 years later, what do we know? *The Sport Psychologist*, *12*, 253-270.
- Moran, A.P (1996). *The psychology on concentration in sport performers: A cognitive analysis*. London: Psychology Press.
- Morgan, W.P., Horstman, D.H., Cymerman, A., & Stokes, J. (1983). Facilitation of physical performance by means of a cognitive strategy. *Cognitive Therapy and Research*, *7*, 251-264.
- Morgan, W.P., O'Connor, P.J., Ellickson, K.A., & Bradley, P.W. (1988). Personality structure, mood states, and performance in elite male distance runners. *International Journal of Sport Psychology*, *19*, 247-263.
- Morgan, W.P. & Pollack, M.I. (1977). Psychological characteristics of the elite distance Runner. In P. Milvy (Ed), *Annals of the New York Academy of Sciences*, *301*, 382-403.
- Nideffer, R.N. (1976). Test of attentional and interpersonal style (TAIS) in sport. *The Sport Psychologist*, *4*, 285-300.
- Noble, B.J., & Robertson, J.M. (1996). *Perceived exertion*. Champaign, IL: Human Kinetics
- Okwumabua, T.M., Meyers, A.W., Schleser, R., & Cooke, C.J. (1983). Cognitive

- strategies and running performance: An exploratory study. *Cognitive Therapy and Research*, 7, 363-370.
- Padgett, V.R., & Hill, A.K. (1989). Maximizing athletic performance in endurance events: A comparison of cognitive strategies. *Journal of Applied Social Psychology*, 19, 331-340.
- Pennebaker, J.W., & Lightner, J.M. (1980). Competition of internal and external information in an exercise setting. *Journal of Personality and Social Psychology*, 39, 165-174.
- Posner, M.I., & Boies, S.J. (1971). Components of attention. *Psychological Review*, 78, 391-408.
- Robertson, R.J., Goss, F.L., & Metz, K.F. (1998). Perception of physical exertion during Dynamic exercise: A tribute to Gunnar A.V. Borg. *Perceptual and Motor Skills*, 86, 186-191.
- Russell, W.D., & Weeks, D.L. (1994). Attentional style in ratings of perceived exertion during physical exercise. *Perceptual and Motor Skills*, 78, 779-783.
- Sainsting, D.E., Richman, C.L., & Bergey, D.B. (1988). Effects of three cognitive Strategies on long-distance running. *Bulletin of the Psychonomic Society*, 26, 34-36.
- Schomer, H.H. (1986). Mental strategy and the perception of effort of marathon runners. *International Journal of Sport Psychology*, 17, 41-59.
- Schomer, H.H. (1987). Mental strategy training programme for marathon runners. *International Journal of Sport Psychology*, 17, 41-59.
- Silva, J.M., & Applebaum, M.I., (1989). Association-dissociation patterns of United States olympic marathon trial contestants. *Cognitive Therapy and Research*, 13, 185-192.
- Smith, A.L., Gill, D.L., Crews, D.J., Hopewell, R., & Morgan, D.W. (1995). Attentional strategy use by experienced distance runners: Physiological and psychological effects. *Research Quarterly for Exercise and Sport*, 66, 142-150.
- Stevinson, C.D., & Biddle, S.J.H., (1999). Cognitive strategies in running: A response to Masters and Ogles (1998). *The Sport Psychologist*, 13, 235-236.
- Tammen, V.V. (1996). Elite middle and long distance runners associative/dissociative coping. *Journal of Applied Sport psychology*, 8, 1-8.

- Tenenbaum, G. (2001). A social-cognitive perspective of perceived exertion and exertion tolerance. In R.N. Singer, H. Hausenblaus, & Janelle (Eds.), *Handbook of Sport Psychology* (pp. 810-820). New York, NY: Wiley & Sons.
- Tenenbaum, G., Fogarty, G., Stewart, E., Calcagnini, N., Kirker, B., Thorne, G., & Chirstensen, S. (1999). Perceived discomfort in running: Scale development and theoretical considerations. *Journal of Sport Sciences, 17*, 183-196.
- Ungerleider, S., Golding, J., Porter, K., & Foster, J. (1989). An exploratory examination cognitive strategies used by masters track and field athletes. *The Sport Psychologist, 3*, 245-253.
- Wachtel, P. (1967). Conceptions of broad and narrow attention. *Psychological Bulletin, 68*, 417-429.
- Wrisberg, C., & Pein, R. (1990). Past running experience as a mediator of the attentional focus of male and female recreational runners. *Perceptual and Motor Skill, 70*, 427-432.

## BIOGRAPHICAL SKETCH

Christopher Stanley was born and raised in LaGrange, Illinois, and graduated from Lyons Township High School. While at Lyons, he attained All-American status as a track and field athlete. He was originally recruited to the University of Mississippi to compete before transferring to the University of Illinois at Chicago (UIC). There, he was captain of the track team and a six-time All-Midwestern-Collegiate-Conference selection in the 800-meter event. He graduated from UIC with his Bachelor of Arts in Psychology in the Spring of 2001. He earned his Master of Science in Sport and Exercise Psychology at Florida State University while serving as an assistant track and field coach at Florida A & M University. Also while at FSU, he finished his first triathlon and marathon.